

SARS State Warehouse
TENDER DOCUMENT (ADDENDUM 1)
For
SARS (South African Revenue Service)
September 2015

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PART C1:
AGREEMENTS AND CONTRACT DATA

C1.1

CONTRACT DATA (JBCC PBA CONTRACT DATA)



PRINCIPAL BUILDING AGREEMENT: CONTRACT DATA

Project	SARS STATE WAREHOUSE, CAPE TOWN
Employer	SARS (SOUTH AFRICAN REVENUE SERVICES)
Contractor	
Contract Date	SEPTEMBER 2015
File Code	14.042-20.02

CONTRACT DATA

used in conjunction with the

JBCC® Principal Building Agreement

Edition 6.1 - published March 2014

Preface

JBCC® Constituents

The Joint Building Contracts Committee® NPC (JBCC®) is representative of building owners and developers, professional consultants and general and specialist contractors who contribute their knowledge and experiences to the compilation of JBCC® documents. JBCC® documents portray the consensus view of the constituent members and are published in the interests of standardisation and good practice with an equitable distribution of contractual risk. The constituents are:

Association of Construction Project Managers
Association of South African Quantity Surveyors
Consulting Engineers South Africa
Master Builders South Africa
South African Black Technical and Allied Careers Organisation
South African Institute of Architects
South African Property Owners Association
Specialist Engineering Contractors Committee

Application of JBCC® Contract Documents

The definitions contained in the JBCC® Principal Building Agreement apply to this document. A word or phrase in bold type in the text shall bear the meaning assigned to it in the definitions of such Agreement. Where a word or phrase is not in bold type it shall bear the meaning consistent with the context of its use

This contract data contains unique requirements applicable to the project and variables referred to in the JBCC® Principal Building Agreement. The information provided in this document by the principal agent is complete and accurate at the time of calling for tenders. Where additional information becomes available, all tenderers will be informed in writing. Reference to clause numbers in the JBCC® Principal Building Agreement are shown in [square brackets] in this contract data eg [3.2.1]. Spaces requiring information must be filled in, or marked as 'not applicable' but not left blank. This contract data, when completed and submitted by the contractor, becomes the form of tender. Where the contractor is appointed, the contract documents comprise the signed JBCC® Principal Building Agreement, this completed contract data, the priced document, drawings and other listed documents

Warning

The JBCC® Principal Building Agreement, the JBCC® Nominated / Selected Subcontract Agreement and respective Contract Data Edition 6.1 have been coordinated with JBCC® Certificates and other support documents. Forms from previous editions are not compatible with Edition 6.1

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A TENDER INFORMATION**A1 Project name**

SARS State Warehouse, Cape Town

A 2 Works description

As a general description only, the works comprises the alterations and additions to the existing State Warehouse

A 3 Site description

Erf No /Township	
Local authority	Cape Town
Street address	Customs House, nr 9 FW De Klerk Drive, Cape Town

A 4 Employer

Name	SARS (South African Revenue Services)		
Business-eg: public company	Semi-autonomous		
Business registration number		VAT/GST number	
Contact person	Marius Mundt		
Personal ID number		Mobile	083 448 9620
E-mail	mmundt@sars.gov.za		
Registered street address	Sable Centre, C/O Durban & Voortrekker Road, Bellville		
Postal address	Sable Centre, C/O Durban & Voortrekker Road, Bellville	Code	8000
Telephone	021 943 7775	Fax	

A 5 Principal agent

Name	BNM Architects		
Practice registration number		VAT/GST number	
Contact person	Francois Nortje		
Personal ID number		Mobile	
E-mail	fgnortje@avna.co.za		
Registered street address	Suite 1 Lyndon, 114 Park Drive, Central, Port Elizabeth		
Postal address	PO Box 12576, Central Hill, Port Elizabeth	Code	6006
Telephone	041 585 2125	Fax	041 585 2127

A 6	Specialist agent:	Quantity Surveyor	
	Name	Du Toit Pienaar Quantity Surveyors (Pty) Ltd	
	Practice registration number		VAT/GST number 416 026 6435
	Contact person	Francois du Toit	
	Personal ID number		Mobile 082 298 3030
	E-mail	info@dtpps.co.za	
	Registered street address	Office Nr. 210; Hibernian Towers; Beach Road; Strand; 7140	
	Postal address	PostNet Suite no. 460; X5061; Stellenbosch	Code 7599
	Telephone	021 200 7670	Fax

A 7	Specialist agent:	Electrical Engineer	
	Practice registration number		VAT/GST number
	Name	Clinkscapes Maughan-Brown	
	Contact person	Ruan Lamprecht	Mobile 084 575 9947
	Personal ID number		
	E-mail	alamprecht@cmbct.co.za	
	Registered street address	De Tijger Office Park, Hannes Louw Drive, Parow	
	Postal address	P.O. Box 271, Parow	Code 7499
	Telephone	021 911 5094	Fax 021 413 0428

A 8	Specialist agent:	Structural & Mechanical Engineer	
	Practice registration number		VAT/GST number
	Name	STAC Consulting Engineers	
	Contact person	Gus Venter	Mobile
	Personal ID number		
	E-mail	gventer@stac.co.za	
	Registered street address	The Vineyard Office Park, Vineyard Square North, 99 Jip de Jager Ave, Bellville	
	Postal address	PO Box 6229, Welgemoed	Code 7538
	Telephone	021 913 0616	Fax

A 9	Specialist agent:	Not Applicable	
	Name		
	Practice registration number		VAT/GST number
	Contact person		
	Personal ID number		Mobile
	E-mail		
	Registered street address		
	Postal address	Code	
	Telephone		Fax

A 10	Specialist agent:	Not Applicable	
	Name		
	Practice registration number		VAT/GST number
	Contact person		
	Personal ID number		Mobile
	E-mail		
	Registered street address		
	Postal address	Code	
	Telephone		Fax

A 11	Specialist agent:	Not Applicable	
	Name		
	Practice registration number		VAT/GST number
	Contact person		
	Personal ID number		Mobile
	E-mail		
	Registered street address		
	Postal address	Code	
	Telephone		Fax

B CONTRACT DATA

Clause references apply to the JBCC® Principal Building Agreement Edition 6.1 (PBA) published March 2014
Only clauses in the PBA requiring the provision of information [CD] are quoted below

2.0 Law, regulations and notices

2.1/25.15 Law of the country applicable to the project

South Africa

5.0 Contract documents

5.1 Signed **contract documents** held by the **principal agent**, or

Employer

5.5 Number of copies of documents issued free to the **contractor**

3

copies

Priced document

Lump sum priced document

Priced **bills of quantities** (BoQ)

System/method of measurement

yes / no?

No

yes / no?

Yes

Revised Sixth Edition of the Standard System of Measuring Builder's Work, issued by the ASAQS

Contract documents comprising ...

Description

Marked ?

Notes

JBCC® Principal Building Agreement Ed 6.1 - March 2014	Sec. C1.2	
JBCC® PBA Contract Data Ed 6.1 - March 2014	Sec. C1.1	
ASAQS Preliminaries - September 2013	Sec. C1.3	

NOTE

If insufficient space, please see annexure:-

Contract drawings - description

Date

Marked

Number

Revision

See section C3				

NOTE

If insufficient space, please see annexure:-

C3.1

6.0 Employer's agents

6.3

Description of interests of agents in the project other than professional services, if applicable	Not Applicable
--	----------------

10.0 Insurances

By the **employer**, yes/no ?

No

Obligation Currency Insured amount

Contract Works Insurance (CWI) (including **materials and goods**, temporary works)

contract sum

Allowance for professional fees and escalation of the insured value at 25% pa, or ? %

%

Free issue material at new replacement value, added to CWI, where applicable

R

Employer owned surrounding property (care, custody, control or worked on)

R

Public Liability Insurance (each and every claim OR unlimited / value ?)

Supplementary Insurance (incl CWI extensions)

per CWI

Removal of Lateral Support Insurance

employer

R

Other:

R

Policy deductibles

Currency Amount

- **Works / free issue**

contractor

R

- **Employer** owned surrounding properties

contractor

R

- Public Liability

contractor

R

- Supplementary Insurance

contractor

R

- Removal of Lateral Support

contractor

R

- Other:

contractor

R

or...

By the **contractor**, yes/no ?

Yes

Currency Insured amount

Contract Works Insurance (CWI) (including **materials and goods**, temporary works)

contract sum

Allowance for professional fees and escalation of the insured value at 25% pa, or ? %

30%

Free issue material at new replacement value

R

Public Liability Insurance (each and every claim OR unlimited for the period)

every claim R10 million and more

Supplementary Insurance (incl CWI extensions)

per CWI

Policy deductibles

R 20 000

Other:

R N/A

12.0 Duties of the parties

12.1.11

Description of **free issue** by **employer**

(Attach separate page for multiple items)

Not Applicable

12/13 Site information

9.2.6/9.2.7

Alterations & additions to existing premises?

Yes

12.1.2

Premises occupied - yes/no? identify area?

The building will be occupied , but the area of works will be vacated.

12.1.3

Relevant natural features to be retained / relocated / removed

None Currently Specified

12.1.3 Known services to be retained / relocated / terminated

Yes

12.1.4 Utilities connections provided?

Yes

12.1.5 Areas the **contractor** may not occupy?

Contractor to occupy area within designated construction area only

NOTE	If insufficient space, please see annexure:-	
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14.0 Nominated subcontractors

14.1.4	Specialisation:	
14.1.4	Specialisation:	
14.1.4	Specialisation:	
14.1.4	Specialisation:	
14.1.4	Specialisation:	

NOTE	If insufficient space, please see annexure:-	
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16.0 Direct contractors

12.1.12 **Employer** to define extent of work by a **direct contractor**

16.1	Specialisation:	Racking and in-rack sprinklers
16.1	Specialisation:	Signage
16.1	Specialisation:	Furniture and Fittings

NOTE	If insufficient space, please see annexure:-	
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12.0 Site ... possession of:-

12.1.6 Possession of the **site** - intended date

90 Calander Days from tender submission

12.2.17 Start work within ? **working days** after being given possession of the **site**

Due date / yyyy/mm/dd	
5	working days

19/20/24 Practical completion / penalty for late completion

19.0 **Practical completion** of the **works** as a whole
OR ...only one option can apply !

Inspection = working days	Date for practical completion yyyymmdd	Penalty Currency	Penalty amount per calendar day
10	126 Working Days from site possession	R	10,000

19/20/24 **Practical completion** of the **works** in **sections: 1**

19/20/24 **Practical completion** of the **works** in **sections: 2**

19/20/24 **Practical completion** of the **works** in **sections: 3**

19/20/24 **Practical completion** of the **works** in **sections: 4**

19/20/24 **Practical completion** of the **works** in **sections: 5**

		R	
		R	
		R	
		R	
		R	

NOTE	If insufficient space, please see annexure:-	
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19.0 Practical completion

19.1.1 Items that do not have to be complete to achieve **practical completion**

Direct Contracts

NOTE	If insufficient space, please see annexure ...	
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19.1.1 Criteria to achieve **practical completion** (the BoQ may contain a more detailed description)

All work relating to the project as designed by the design consultants

NOTE	If insufficient space, please see annexure ...	
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25.0 Payment

25.0 Currency:

25.2 Issue of regular payment certificates on

25.3.2 **Materials and goods off site** - paid subject to ...

25.3.4/26.9.5 Contract price adjustment provisions

R			
date@month	7th	or... day of week	
Security for Advance Payment provided ?			Yes
Method?	Fixed - not adjusted		

NOTE	If insufficient space, please see annexure ...	
------	--	--

30.0 Dispute resolution

30.7.4(a) Alternative dispute resolution organisation

Option B

Changes made to JBCC® documentation

Refer to Section C1.2.2

NOTE If insufficient space, please see annexure:-

C TENDER CLOSING

Tender closing: date	Refer notes to bidders	Tender closing: time	
Tender closing: place	Refer notes to bidders		
SUBMISSION ADDRESS	Refer notes to bidders		
Delivered in electronic format?	Refer notes to bidders	E-mail address	
Alternate offer considered ?	Only if original tender submitted	yes / no?	

D TENDERER'S SELECTION (to be completed by the tenderer)

11.0 Securities

11.1.2 **Security for Construction** (variable)

Obligation

If specified, **contractor's** choice

yes/no ?

11.1.3 or **Security for Construction** (fixed)

If specified, **contractor's** choice

yes/no ?

11.1.4 **Security for Advance Payment**

Provided by the **contractor**

yes/no ?

(where the **contractor** requests the **employer** to pay an advance for **materials and goods**)

Purpose

Currency

R

Amount

11.4 **Security for Payment**

To be provided by the **employer**

yes/no ? Yes

19.0 Date for Practical completion ... contractor's holiday periods ?

Contractor's annual holiday period - year 1	from ...		until	
Contractor's 'other' holiday period - year 1	from ...		until	
Contractor's annual holiday period - year 2	from ...		until	
Contractor's 'other' holiday period - year 2	from ...		until	
Contractor's annual holiday period - year 3	from ...		until	
Contractor's 'other' holiday period - year 3	from ...		until	

NOTE If insufficient space, please see annexure:-

26.0 Payment / Adjustment of Preliminaries

Payment of preliminaries

- Option A Assessed by **principal agent**, an amount pro rated to the value of the **works** executed in the same ratio as the **preliminaries** to the **contract sum**, (including **tax**); shall exclude the amount of **preliminaries**, all contingency sum(s) and any allowance for CPAP

Or ...

Or ...

- Option B An amount agreed by the **principal agent** and the **contractor** in terms of the **Bills of Quantities** or the **priced document** to identify an initial establishment charge / a monthly charge / and a final disestablishment charge

Where the **contractor** does not indicate option 'A' or option 'B' - option 'A' shall apply

Adjustment of preliminaries [26.9.4]

- Option A For the adjustment of **preliminaries** both the **contract sum** and the **contract value** (including **tax**) shall exclude the amount of **preliminaries**, all contingency sum(s) and any provision for Cost Price Adjustment Provisions:-

- An amount which shall not be varied
- An amount varied in proportion to the **contract value** as compared to the **contract sum**
- An amount varied in proportion to the **construction period** as compared to the initial **construction period** (excluding revisions to the **construction period** to which the **contractor** is not entitled) to adjustment of the **contract value** in terms of the **agreement**

The **contractor** shall provide a breakdown of charges (including **tax**) within 15 **working days** of the date of acceptance of tender and, where applicable, an apportionment of preliminaries per section

Where such information is not provided the following subdivision shall be deemed to apply:

- 10% of the amount shall not be varied
- 15% varied in proportion of the **contract value** to the **contract sum**
- 75% varied in proportion to the revised **construction period** compared to the initial **construction period** ...

Or ...

Or ...

- Option B The **contractor** shall within 15 **working days** of the date of possession of the **site** provide the **principal agent** with a detailed breakdown of **preliminaries** amounts for the **works** as a whole, or per **section** where applicable, including administrative and supervisory staff charges and for the use of **construction equipment** in terms of the **programme**.

Where the **contractor** does not indicate option 'A' or option 'B' - option 'A' shall apply

Notes

- 1 By submission of this tender to the **employer** the tenderer offers and agrees to execute and complete the **works** and remedy any **defects** in conformity with the specification for the tender sum stated - to be paid in instalments as work is completed
- 2 The tender shall remain in full legal force for forty five (45) **calendar days** from the closing date of the tender. The tenderer accepts liability for **damages** that may be suffered by the **employer** should the tender validity period not be honoured
- 3 The lowest or any offer will not necessarily be accepted by the **employer** - nor need reasons be given for such a decision
- 4 Any provision in this agreement that may confer any benefit or right in favour of any **subcontractor** shall be binding on the **parties** and be capable of acceptance by such **subcontractor** at any time
- 5 Annexures ... marked

A	
B	
C	

TENDER SUM COMPILATION

Tenderer's work excluding tax	Currency R	amount	<input type="text"/>
Tax ... at percentage <input type="text" value="14.00%"/>	R	amount	<input type="text"/>
Total TENDER SUM inclusive of tax	R	amount	<input type="text"/>
Tender sum in words			
<input type="text"/>			

(print) TENDERER	Capacity	who, by its SIGNATURE warrants authority thereto	Date	Location
------------------	----------	--	------	----------

WITNESS print name	Capacity	SIGNATURE	Date	Location
--------------------	----------	-----------	------	----------

TENDERER'S DETAILS

Name	<input type="text"/>		
Business-eg: public company	<input type="text"/>		
Business registration number	<input type="text"/>	VAT/GST number	<input type="text"/>
Contact person	<input type="text"/>		
Personal ID number	<input type="text"/>	Mobile	<input type="text"/>
E-mail	<input type="text"/>		
Registered street address	<input type="text"/>		
Postal address	<input type="text"/>	Code	<input type="text"/>
Telephone	<input type="text"/>	Fax	<input type="text"/>

C1.2

JBCC PRINCIPAL BUILDING AGREEMENT

C1.2.1

JBCC Principal Building Agreement

The conditions of contract which shall apply to this contract will be “*JBCC Principal Building Agreement Series 2000 Edition 6.1 March 2014*” including all supporting documentation as published by the JBCC.

The “*JBCC Principal Building Agreement Series 2000 Edition 6.1 March 2014*” are available for inspection at the offices of the quantity surveyor, or may be purchased from any of the abovementioned organizations.

Refer to section C1.2.2 for details on changes made to the standard JBCC Principal Building Agreement.

C1.2.2

Amendments to standard JBCC PBA

EXTENT OF CHANGES MADE TO THE STANDARD JBCC DOCUMENT

SECTION A:JBCC PRINCIPAL BUILDING AGREEMENT

INTERPRETATION

Law, Regulations and Notices.

Without limiting the generality of the provisions of clause 2.1 of the **agreement**, the **contractor's** attention is drawn to the provisions of the Construction Regulations, 2003 issued in terms of the Occupational Health and Safety Act, 1993. It is specifically stated that the **employer** shall prepare a documented health and safety specification for the **works** and that the **employer** shall ensure that the **contractor** has made provision for the cost of health and safety measures during the execution of the **works**. The **contractor** shall price opposite this item for compliance with the act and the regulations and the reasonable provisions of the aforementioned health and safety specifications.

INSURANCES AND SECURITY

Security.

Clause 11.4 and 11.5 is hereby deleted in its entirety. The Employer shall not provide a payment guarantee.

Clause 11.10 is hereby deleted in its entirety and replaced by: "The contractor shall waive his lien within 7 calendar days from the date of site handover"

EXECUTION

Setting Out.

The following new subclause is hereby added to this clause:

- 13.3 The **contractor** shall notify the **principal agent** if any encroachments of adjoining foundations, buildings, structures, pavements, boundaries, etc. exist in order that the necessary arrangements may be made for the rectification of any such encroachments.

Clause 18.0

PAYMENT

Interim payment.

Subclause 25.3.2 is hereby deleted and substituted by the following :
Notwithstanding this or any other clause, **materials and goods** stored off site shall not be included in the amount authorised for payment.

Subclause 25.7 is hereby amended by the substitution of the words "fourteen (14) **calendar days**" in the first line by the words "thirty (30) **calendar days**".

Clause 31.0

SECTION B: ASAQS PRELIMINARIES

4.0 SAMPLES, SHOP DRAWINGS AND MANUFACTURER'S INSTRUCTIONS

Samples of materials.

Clause 4.1 is hereby amended by the addition of the following:

The **principal agent** may reject any materials or colours not corresponding with the approved samples. The approved samples shall be kept on site until completion of the **works**.

Should any materials or items specified prove to be either unavailable, in poor supply or likely to cause delay to the **works**, the **contractor** shall notify the **principal agent** in sufficient time for suitable alternatives to be considered. Any claims for delays resulting from the **contractor** not conforming with the terms of this clause will not be entertained or allowed.

Clause 4.1

9.0 GENERAL

Security of the **works**.

The **contractor** shall provide and maintain twenty-four hour site security and loss control systems all to the satisfaction of the **principal agent**. It is envisaged that these procedures will incorporate, inter alia, gate control for personnel and vehicles, individual entry permits, regular security patrols and the like.

Clause 9.3

SECTION C : SPECIFIC PRELIMINARIES

SUPPLEMENTARY DOCUMENTATION

Site instructions.

Contract instructions issued on site are to be recorded in triplicate in an instruction book which is to be maintained on site by the **contractor**.

MATERIALS AND WORKMANSHIP

Testing of windows to ensure watertightness

As the windows are fixed they shall be glazed and prepared so that each window can be tested for watertightness with water sprayed on by means of a 20mm hosepipe using adequate pressure. If the pressure proves to be inadequate, in the opinion of the **principal agent**, then the pressure in the hosepipe shall be boosted by means of compressed air or other approved means. Each window section shall be tested under the supervision of the **principal agent** and approved before final acceptance of the fenestration.

Warranties for materials and workmanship

The **contractor** shall obtain written warranties where called for, addressed to the **employer**, from the firms supplying the materials or doing the work and deliver such guarantees to the **principal agent** on the certified completion of the **contract**.

The warranties shall state that workmanship, materials and installation are guaranteed for a specified period reckoned from the date of certified completion of the **works** and that any **defects** in the workmanship, materials and installation that may arise during that period shall be made good at the expense of the firm doing the work upon written notice from the **principal agent** or the **employer** to do so.

TEMPORARY WORKS AND PLANT

Propping of floors below

The **contractor** is advised that propping of floors below will be required if he wishes to use any areas of completed suspended reinforced concrete slabs for vehicle access, storage of materials and goods and location of plant, scaffolding, etc. The location of these areas and any necessary propping shall be approved by the **principal agent** and the cost thereof shall be borne by the **contractor**.

Main notice board.

One main notice boards shall be erected at the contractors cost, size to be approximately 2 500 x 2 700mm high overall, fixed approximately 2 500mm above ground level.

TEMPORARY SERVICES

Site parking

Wherever and whenever practicable five parking bays on site shall be made available and reserved for the sole use of the employer and the professional consultants.

Site establishment

The site are situated in the CBD, the contractor are to allow for organising with the local authority for temporary use of parking bays, walkways, etc.

FINANCIAL ASPECTS

Overtime

The additional costs of overtime work shall not be for the **employer's** account except when prior written agreement thereto is given by the principal agent.

GENERAL

Copyright

The ownership of the copyright in and to: all drawings, specifications, models and documents of any nature delivered to the **contractor** or produced by or on behalf of the **contractor** in connection with the **works**; and, the artistic character and/or artistic design of the **works**, shall remain vested in and/or is hereby assigned to the **employer** by the **contractor**.

Confidentiality

As the project is of a highly confidential nature, the **contractor** shall:

Treat all drawings, specifications, models and documents of any nature delivered to the **contractor** or produced by or on behalf of the **contractor** in connection with the **works** as being confidential;

Keep secret and not directly or indirectly disclose or divulge to any person (except insofar as may be necessary in connection with the project) any information contained in the **contract documents** without the previous written consent of the **principal agent**;

Not copy, photograph and/or repeat either wholly or in part any of the **contract documents** referred to above (except insofar as may be necessary in connection with the project); return to the **principal agent** all **contract documents** issued herewith upon submission of the tender; and, upon completion of the works deliver to the **principal agent** all **contract documents** of any nature pertaining to the project.

C1.3

ASAQS PRELIMINARIES



PRELIMINARIES

for use with the 2014 edition of the JBCC agreements
(PBA and NSSA Edition 6.1, MWA Edition 5.1)

Project SARS STATE WAREHOUSE, CAPE TOWN

Employer SARS (SOUTH AFRICAN REVENUE SERVICES)

Contractor

Agreement date SEPTEMBER 2015 ***File code*** 14.042-20.02

Disclaimer:

No responsibility for loss or damage to any person or entity as a result of the material contained in this document is accepted by the Association of South African Quantity Surveyors

MARCH 2014

EXPLANATORY NOTES AND INSTRUCTIONS

Introduction

The Association of South African Quantity Surveyors (ASAQS) has compiled the ASAQS Preliminaries in the interests of standardisation of documentation and good practice in the building industry. The document generally covers all aspects of preliminaries for most types of projects and should consequently simplify the tendering for and the administration of building agreements and produce economic advantages to all concerned. Users should note that the Preliminaries have been specifically formulated for use with the 2014 edition of the JBCC agreements (PBA and NSSA Edition 6.1, MWA Edition 5.1)

How the document is structured

The Preliminaries is part of the building agreement and subcontract documentation to be referred to in the priced document. It is intended that the Preliminaries could be used by reference only in the preparation of the priced document

The Preliminaries for any specific project will comprise the following:

Section A A recital of the headings of the individual clauses of the JBCC Principal Building Agreement (PBA), JBCC N/S Subcontract Agreement (NSSA) or JBCC Minor Works Agreement (MWA). Modifications to the standard clauses should be avoided. Any modifications identified in the contract data of the relevant agreement must be recorded against the relevant clause numbers

Section B A recital of the headings of the clauses in the ASAQS Preliminaries. Modifications to the standard clauses should be avoided. Any modifications identified in the Preliminaries schedule must be recorded against the relevant clause numbers

Section C Any special clauses to meet the particular circumstances of a specific project are embodied in this section

The JBCC has designed the agreements for use with or without bills of quantities. This brings a consistency in the contractual language used and the administrative procedures required in building agreements

Preface to the Preliminaries

1 The Preliminaries of the priced document should contain the following introduction:

"The ASAQS Preliminaries (March 2014 edition) published by the Association of South African Quantity Surveyors for use with the JBCC Principal Building Agreement Edition 6.1 / JBCC N/S Subcontract Agreement Edition 6.1 / JBCC Minor Works Agreement Edition 5.1 shall be deemed to be incorporated in these **bills of quantities** / this lump sum document. The **contractor** is deemed to have referred to such document for the full intent and meaning of each clause. These clauses are hereinafter referred to by clause number and heading only. Where standard clauses or alternatives are not entirely applicable to the **agreement** such modifications, corrections or supplements shall take precedence notwithstanding anything to the contrary contained in such document"

2 Clauses marked with an asterisk are optional clauses or clauses requiring information relating to the specific project, selection and details of which are to be included in the Preliminaries schedule. The relevant option applicable to the specific project should be shown against the clause number and heading

3 Where clauses are not used for the specific project these should nevertheless be listed in the bills of quantities / lump sum document but marked NOT APPLICABLE or N/A

4 When exceptional circumstances exist where the standard wording of clauses or options contained in the Preliminaries would not be applicable then clauses may be drafted specifically to meet these exceptional circumstances. Such clauses should be inserted in the Preliminaries under the relevant heading where appropriate

Should it not be appropriate to place such exceptional clauses under an existing heading, then such clauses should be included under a separate heading in Section C of the Preliminaries

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PRELIMINARIES

1.0 INTERPRETATION

1.1 Definitions

A word or phrase in bold type in these **preliminaries** shall have the meaning assigned to it in the definitions listed in the JBCC Principal Building Agreement, The JBCC N/S Subcontract Agreement or the JBCC Minor Works Agreement as the case may be. A word or phrase not in bold type shall be interpreted in the context of its usage

Where the **preliminaries** are applicable to a N/S Subcontract Agreement, in interpreting the document, “**contractor**” is to be substituted for “**principal agent**” and likewise “**subcontractor**” for “**contractor**” where necessary and other terms substituted as are consistent with the context of the **agreement** being addressed

The listed defined word or phrase does not qualify as a definition where information, required to be stated in the **preliminaries** schedule, has not been provided

1.2 Interpretation

- 1.2.1 In this document, unless inconsistent with the context, the words ‘accept, allow, appoint, approve, authorise, certify, decide, demand, designate, grant, instruct, issue, list, **notice**, notify, object, record, reduce, refuse, request, state’ and their derivatives, require such acts to be in writing
- 1.2.2 The masculine gender includes the feminine and neuter genders and *vice versa*, the singular includes the plural and *vice versa* and a person includes juristic or artificial persons
- 1.2.3 The headings of clauses are for reference purposes only and shall not be used in interpretation
- 1.2.4 Reference to a clause number written as [6.2.1] means that specific clause; clause [6.2.1-3] means the sub-clauses 1 to 3 inclusively; clause [6.2.1 & 3] means the subclauses 1 and 3 only
- 1.2.5 Documents and legislation referred to in the **preliminaries** shall mean the current edition thereof with all amendments thereto at the date of submission of the tender unless otherwise stated
- 1.2.6 The word ‘deemed’ shall be conclusive that something is fact, regardless of the objective truth
- 1.2.7 Clauses marked with an asterisk are optional clauses or clauses requiring information relating to the specific project, selection and details of which are to be included in the **preliminaries** schedule

2.0 DOCUMENTS

2.1 *Checking of documents*

The tenderer shall check the numbers of the pages of the tender documents and should any be missing or duplicated, or the reproduction is indistinct, or if any doubt exists as to the intent or meaning of any description, or where the **contract documents** contain any obvious errors, the tenderer shall notify the **principal agent** forthwith thereof and the **principal agent** shall promptly give a written directive

2.2 *★Provisional bills of quantities*

The quantities in provisional **bills of quantities** are an indication of the **works** to be executed and are subject to remeasurement

2.3 **★Availability of construction information**

Where the **construction information** for the **works** is not complete and will only be completed during the **construction period** the **contractor** and **principal agent** shall work together to identify the requirements for the provision of **construction information**. The **contractor** and **principal agent** shall agree the dates that are reasonable by when the **contractor** is to be provided with each outstanding item of the **construction information**

The **contractor** and **subcontractor** shall agree dates by when the **subcontractor** is to be provided with each item of the outstanding information in terms of the **programme**

3.0 **PREVIOUS WORK AND ADJOINING PROPERTIES**

3.1 **★Previous work - dimensional accuracy**

In consecutive contracts the **contractor** shall, within a reasonable period after taking possession of the **site**, but not exceeding ten (10) per cent of the **construction period** or twenty (20) **working days** whichever is the lesser, check the existing levels, lines, profiles and the like affecting the **works** and satisfy himself as to the dimensional accuracy of work previously executed. The **contractor** shall forthwith notify the **principal agent** and request a **contract instruction** regarding any dimensional inaccuracy found in work previously executed

3.2 **★Previous work - defects**

The **contractor** on becoming aware of a **defect** in work previously executed shall forthwith notify the **principal agent** requesting a **contract instruction** regarding such a **defect**

3.3 **★Inspection of adjoining properties**

Before commencing the **works** the **principal agent** and **contractor** shall arrange with the owners of adjacent buildings and properties and representatives of local authorities to inspect, amongst others, the buildings, structures, pavings, kerbs, channels and fences. The **contractor** shall record all conditions that the **works** could affect and copy the **principal agent** accordingly. The **contractor** shall pay particular attention to cracks, defects and existing levels related to structures, pavings, kerbs, channels and fences, which later could be claimed to have been caused or disturbed by the **works**

Where instructed by the **principal agent**, levels and photographs shall be taken by the **contractor** and the cost thereof shall be for the **employer's** account. Certified copies shall be lodged with the **principal agent**

4.0 **SAMPLES, SHOP DRAWINGS AND MANUFACTURER'S INSTRUCTIONS**

4.1 **Samples of materials**

The **contractor** shall furnish at his cost samples of materials and specimens of finishes as may be called for by the **principal agent** for his approval

4.2 **Workmanship samples**

The **principal agent** may instruct the **contractor** to furnish samples of workmanship for his approval. Where the **principal agent** requires an assembly of various elements of the building or installation which is not incorporated in the **works**, the **contractor** shall arrange such an assembly at the **employer's** expense and the **contract value** shall be adjusted accordingly

4.3 **Shop drawings**

Shop drawings are drawings, diagrams, designs, illustrations, schedules, performance charts, brochures, setting out drawings, shop details and other data which are prepared by the **contractor**, **subcontractor**, manufacturer, supplier or distributor which illustrate manufacturing details and methods of execution of work

Only shop drawings and samples submitted for approval by the **contractor** shall be considered by the **principal agent**. The **principal agent's** approval of shop drawings or samples shall be limited to checking

for general conformity with design and specification and shall not alter the design responsibilities in terms of the **agreement**. Where shop drawings are called for:

4.3.1 The **contractor** shall:

- Prepare or ensure that a **subcontractor**, manufacturer, supplier or distributor prepares shop drawings at their own expense
- Submit sufficient copies of shop drawings to the **principal agent** for approval
- Allow the **principal agent** reasonable time to approve shop drawings
- Keep a record of all shop drawings submitted to the **principal agent**
- Ensure that shop drawings conform to the dimensions of built work
- Submit sufficient copies of the approved shop drawings to the **principal agent** for his use and for use in the **works**
- Ensure that work is not executed from shop drawings that have not been approved by the **principal agent**

4.3.2 The **principal agent** shall:

- Check timeously the shop drawings submitted by the **contractor**
- Advise the **contractor** where shop drawings are approved or are to be resubmitted

4.4 **Compliance with manufacturer's instructions**

The **contractor** shall take delivery of, handle, store, use, apply and fix all products in strict accordance with the manufacturer's instructions

5.0 DEPOSITS AND FEES

5.1 **Deposits and fees**

The **contractor** shall arrange for and pay all deposits, fees and charges according to **law**, regulation or bylaw of any local or other authorities that relate to hoardings, the use of pavements, street encroachment or crossings, permission for the suspension of parking facilities and the like

6.0 TEMPORARY SERVICES

6.1 **★ Water**

The **employer** does not warrant that any water supply that may exist is adequate for the proper execution of the **works**. Where such supply is inadequate, the **contractor** shall provide an adequate supply at his own expense. Water for the **works** as stated in the **preliminaries** schedule shall be provided by:

6.1.1 **Option A**

The **contractor** including necessary temporary plumbing

6.1.2 **Option B**

The **employer** free of charge to the **contractor**. The **contractor** shall connect to the existing water supply at approved points and execute any necessary temporary plumbing

6.1.3 Option C

The **employer** to the **contractor**. The **contractor** shall connect to the existing water supply at approved points, supply and install meters and execute any necessary temporary work. The **employer** shall meter the consumption for which the **contractor** shall be responsible

6.2 ★ *Electricity*

The **employer** does not warrant that any electricity supply that may exist is adequate for the proper execution of the **works**. Where such supply is inadequate, the **contractor** shall provide an adequate supply at his own expense. Electricity and lighting for the **works** as stated in the **preliminaries** schedule shall be provided by:

6.2.1 Option A

The **contractor** including necessary temporary installation work

6.2.2 Option B

The **employer** free of charge to the **contractor**. The **contractor** shall connect to the existing electricity supply at approved points and execute the necessary temporary installation

6.2.3 Option C

The **employer** to the **contractor**. The **contractor** shall connect to the existing electricity supply at approved points, supply and install meters and execute necessary temporary work. The **employer** shall meter the consumption for which the **contractor** shall be responsible

6.3 ★ *Ablution and welfare facilities*

Ablution and welfare facilities as stated in the **preliminaries** schedule shall be provided for the use of all persons on the **site** by:

6.3.1 Option A

The **contractor** who shall maintain such facilities in a thoroughly clean and tidy condition

6.3.2 Option B

The **employer** who shall permit the use of existing facilities. The **contractor** shall maintain such facilities in a thoroughly clean and tidy condition and make good any damage thereto at his own expense

6.4 ★ *Communication facilities*

The **contractor** shall provide communication facilities as stated in the **preliminaries** schedule and shall be entitled to recover usage costs from the users thereof

7.0 PRIME COST AMOUNTS

7.1 *Responsibility for prime cost amounts*

All **prime cost amounts** are for **materials and goods** delivered to the **site**. The **priced document** shall make provision for the **contractor** to separately price for overheads and profit and for taking delivery, unloading, checking against invoices and/or delivery notes, getting in, unpacking, storing, hoisting and fixing of such **materials and goods**. The **contractor** shall check the quantity and condition of all **materials and goods** on taking delivery as any **materials and goods** subsequently found missing or damaged shall be replaced at the **contractor's** expense

8.0 ATTENDANCE ON SUBCONTRACTORS

8.1 *General attendance*

General attendance is defined as being the duties of the **contractor** as described in clause 12.2 of the **JBCC N/S Subcontract Agreement**

8.2 *Special attendance*

The **priced document** shall make provision for the **contractor** to separately price for special attendance on each **subcontractor**. Special attendance such as unloading, storing, placing in position, providing special power supplies, specific hoisting, craneage and scaffolding requirements, provision of temporary casing and/or other specific protection of the **works**, special security and clearing away rubbish are described in detail in the **contract documents**

9.0 GENERAL

9.1 *★Protection of the works*

Specific protection measures required by the **employer** are described in detail in the **preliminaries** schedule

9.2 *★Protection/isolation of existing/sectionally occupied works*

The **contractor** shall provide all reasonable temporary measures to protect/isolate the existing and/or **sections** of the occupied **works** and remove such measures on completion

9.3 *Security of the works*

The **contractor** shall take all appropriate measures for general security of the **works**

9.4 *Notice before covering work*

The **contractor** shall give adequate notice to the **principal agent** whenever any work or material which is subject to inspection or remeasurement is to be covered or concealed in any way. In default of such a notice being received timeously by the **principal agent** such work shall be exposed and later made good at the **contractor's** expense

9.5 *★Disturbance*

The **contractor** shall execute the **works** with a minimum of disturbance to adjoining premises, any parts of the **works** already handed over and the occupants of those premises and/or parts. Any specific requirements are stated in the **preliminaries** schedule

9.6 *★Environmental disturbance*

The **contractor** shall execute the **works** without any unreasonable adverse effect on the environment. Any specific requirements are stated in the **preliminaries** schedule

9.7 *Works cleaning and clearing*

The **contractor** shall regularly clean and clear away all rubbish and excess materials as the **works** proceed and leave the **works** in a clean and satisfactory state for use and occupation in terms of the **agreement**

9.8 *Vermin*

The **contractor** shall take all necessary precautions to keep the **works** and the **site** free from vermin and shall leave the **works** vermin-free on completion

9.9 *Overhand work*

No provision has been made for overhand work. Where necessary, the **contractor** shall make his own arrangements with the owners of adjoining properties to execute such work

10.0 SCHEDULE

The **preliminaries** schedule contains all pre-tender variables referred to in this document and must be completed in full and included in the tender documents

Spaces requiring information must be filled in, shown as 'not applicable' or deleted and not left blank. Where choices are offered, the non-applicable items are to be deleted. Where insufficient space is provided the information should be annexed hereto and cross referenced to the applicable clause of the **preliminaries** schedule. Key cross reference clauses are italicised in [] brackets

10.1 ***Provisional bills of quantities***

[2.2]	The quantities are provisional	(yes/no)	Yes
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10.2 ***Availability of construction information***

[2.3]	Construction documentation is complete	(yes/no)	No
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10.3 ***Previous work – dimensional accuracy***

[3.1]	Details		
<hr/>			
No additional requirements			
<hr/>			
<hr/>			

10.4 ***Previous work – defects***

[3.2]	Details		
<hr/>			
No additional requirements			
<hr/>			
<hr/>			

10.5 ***Inspection of adjoining properties***

[3.3]	Specific requirements		
<hr/>			
No additional requirements			
<hr/>			
<hr/>			

10.6 ***Water***

[6.1]	Option A (by contractor)	(yes/no)	No
	Option B (by employer – free of charge)	(yes/no)	Yes

	Option C (by employer - metered)	(yes/no)	<div>No</div>
10.7	Electricity		
[6.2]	Option A (by contractor)	(yes/no)	<div>Yes</div>
	Option B (by employer – free of charge)	(yes/no)	<div>Yes</div>
	Option C (by employer - metered)	(yes/no)	<div>Yes</div>
10.8	Ablution and welfare facilities		
[6.3]	Option A (by contractor)	(yes/no)	<div>Yes</div>
	Option B (by employer)	(yes/no)	<div>No</div>
10.9	Communication facilities		
[6.4]	Specific requirements		
	No additional requirements		
10.10	Protection of the works		
[9.1]	Specific requirements		
	No additional requirements		
10.11	Protection/isolation of existing/sectionally occupied works		
[9.2]	Protection is required	(yes/no)	<div>Yes</div>
10.12	Disturbance		
[9.5]	Specific requirements		
	No additional requirements		

10.13 ***Environmental disturbance***

[9.6] Specific requirements

C1.4

Form of Guarantee



Guarantee for Construction

For use with the JBCC® Principal Building Agreement state edition /date

GUARANTOR DETAILS

Guarantor:	<input type="text"/>		
Physical address:	<input type="text"/>		
Guarantor's signatory 1:	<input type="text"/>	Capacity	<input type="text"/>
Guarantor's signatory 2:	<input type="text"/>	Capacity	<input type="text"/>
Employer:	<input type="text"/>		
Contractor:	<input type="text"/>		
Principal Agent:	<input type="text"/>		
Works:	<input type="text"/>		
Site:	<input type="text"/>		
Name of Signatory:	<input type="text"/>		
Contract Sum:	Accepted amount inclusive of tax	Currency	<input type="text"/> <input type="text"/>
... amount in words:	<input type="text"/>		
Guaranteed Sum:	The maximum aggregate amount	Currency	<input type="text"/> <input type="text"/>
... amount in words:	<input type="text"/>		
Security for Construction	(insert variable or fixed)	<input type="text"/>	Expiry date <input type="text"/>

AGREEMENT DETAILS

Sections	Total number / not applicable	<input type="text"/>	Last section	<input type="text"/>
Principal Agent issues	'JBCC® format Interim Payment Certificates, the Final Payment Certificate, the Certificate of Practical Completion and the Certificate of Final Completion			

1.0 GUARANTEE for CONSTRUCTION (Variable)

1.1 Where a Guarantee for Construction (Variable) in terms of the Agreement has been selected this clause 1.0 and 3.0 to 13.0 shall apply. The Guarantor's liability shall be limited to the diminishing amounts of the Guaranteed Sum as follows:-

GUARANTOR'S LIABILITY

PERIOD OF LIABILITY

1.1.1 Maximum Guaranteed Sum (not exceeding 10.0% of the contract sum) in the amount of:

From and including the date of issue of this Guarantee for Construction and up to and including the date of issue of the interim payment certificate certifying in excess of 50% of the contract sum

Amount in words:

1.1.2 Reducing to the Guaranteed Sum (not exceeding 6.0 % of the contract sum) in the amount of:

From and including the day after the date of the aforesaid interim payment certificate and up to and including the date of issue of the only Certificate of Practical Completion or last Certificate of Practical Completion where there are sections

Amount in words:

1.1.3 Reducing to the Guaranteed Sum (not exceeding 4.0% of the contract sum) in the amount of:

From and including the day after the date of the applicable Certificate of Practical Completion and up to and including the date of issue of the only Certificate of Final Completion or the last Certificate of Final Completion where there are sections

Amount in words:

1.1.4 Reducing to the Guaranteed Sum (not exceeding 2.0% of the contract sum) in the amount of:

From and including the day after the date of the applicable Certificate of Final Completion and up to and including the date of issue of the Final Payment Certificate where payment is due to the Contractor, whereafter this Guarantee for Construction shall expire. Where the Final Payment Certificate reflects payment due to the Employer this Guarantee for Construction shall expire upon payment of the full amount certified

Amount in words:

1.2 The Guarantor's liability limits set out in 1.1.1 to 1.1.4 shall apply in respect of any claim received by the Guarantor during the Security validity

2.0 GUARANTEE for CONSTRUCTION (Fixed)

2.1 Where a Guarantee for Construction (Fixed) in terms of the Agreement has been selected this clause 2.0 and 3.0 to 13.0 shall apply. The Guarantor's liability shall be limited to the amount of the Guaranteed Sum as follows:-

GUARANTOR'S LIABILITY

Maximum Guaranteed Sum (not exceeding 5.0% of the contract sum) in the amount of:

Amount in words:

PERIOD OF LIABILITY

From and including the date of issue of this Guarantee for Construction and up to and including the date of the only Certificate of Practical Completion or the last Certificate of Practical Completion where there are sections, whereafter this Guarantee for Construction shall expire

3.0 The Guarantor acknowledges that:-

- 3.1 Any reference in this Guarantee for Construction to the Agreement is made for the purpose of convenience and shall not be construed as any intention to create an accessory obligation or any intention to create a suretyship
- 3.2 Its obligation under this Guarantee for Construction is restricted to the payment of money
- 3.3 Reference to a recovery statement or an Interim or Final Payment Certificate, or a Certificate(s) of Practical or Final Completion shall mean such certificate issued by the Principal Agent
- 4.0 Subject to the Guarantor's maximum liability referred to in clauses 1.0 or 2.0 , the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 4.1 to 4.3:-
- 4.1 A copy of a first written demand notice issued by the Employer to the Contractor stating that payment of a sum certified by the Principal Agent in an interim or Final Payment Certificate has not been made in terms of the Agreement and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 4.2
- 4.2 A first written demand notice issued by the Employer to the Guarantor at the Guarantor's physical address with a copy to the Contractor stating that a period of seven (7) calendar days has elapsed since the issue of the first written demand notice in terms of 4.1 and that the sum certified has not been paid to date. The Employer herewith calls up this Guarantee for Construction and demands payment of the sum certified from the Guarantor
- 4.3 A copy of the applicable payment certificate which entitles the Employer to receive payment in terms of the Agreement of the sum certified in 4.0
- 5.0 Subject to the Guarantor's maximum liability referred to in 1.0 or 2.0 , the Guarantor undertakes to pay the Employer the Guaranteed Sum or the full outstanding balance upon receipt of a first written demand notice from the Employer to the Guarantor at the Guarantor's physical address calling up this Guarantee for Construction stating that:-
- 5.1 The Agreement has been terminated due to the Contractor's default and that the Security for Construction is called up in terms of 5.0. The demand notice shall enclose a copy of the notice of termination; or
- 5.2 A provisional sequestration or liquidation court order has been granted against the Contractor and that the Guarantee for Construction is called up in terms of 5.0. The demand notice shall enclose a copy of the court order
- 6.0 The aggregate amount of payment to be made by the Guarantor in terms of 4.0 and 5.0 shall not exceed the Guarantor's maximum liability in terms of 1.0 or 2.0
- 7.0 Where the Guarantor is a registered insurer and has made payment in terms of 5.0, the Employer shall within one hundred and eighty (180) calendar days of receipt of payment submit an expense account to the Guarantor showing how all monies received in terms of the Guarantee for Construction have been expended, or will be expended, and shall refund to the Guarantor any surplus amount. All monies refunded to the Guarantor in terms of this Guarantee for Construction shall bear interest at the prime overdraft rate of the Employer's bank compounded monthly and calculated from the date of payment by the Guarantor to the Employer until the date of refund

- 8.0 Payment by the Guarantor in terms of 4.0 or 5.0 shall be made within seven (7) calendar days upon receipt of the first written demand notice to the Guarantor
- 9.0 The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer deems fit and the Guarantor shall not have the right to claim his release from this Guarantee for Construction on account of any conduct alleged to be prejudicial to the
- 10.0 The Guarantor chooses the physical address-stated above for all transactions in relation to this security
- 11.0 This Guarantee for Construction is neither negotiable nor transferable and shall expire in terms of either 1.1.4 or 2.1, or on payment in full of the Guaranteed Sum or on the Security expiry date, whichever is the earlier, where after no claims will be considered by the Guarantor. The original Guarantee for Construction form shall be returned to the Guarantor after it has expired
- 12.0 This Guarantee for Construction, with the required demand notices in terms of 4.0 or 5.0, shall be regarded as a liquid document for the purpose of obtaining a court order
- 13.0 Where this Guarantee for Construction is issued in the Republic of South Africa the Guarantor hereby consents to the jurisdiction of a court in the area where the project is located

Signed at

Date

Guarantor's Signatory 1

Guarantor's Signatory 2

Witness

Witness

Guarantor's seal or stamp

PART C2
PRICING DOCUMENT

Pricing Instructions:

1. The pricing documentation comprises the following:

C2.2 Main Contractor's Bills of Quantities
2. The JBCC Principal Building Agreement Series 2000 Edition 6.1 March 2014, the Contract Data contained in the Principal Building Agreement Contract Data, the Specifications and the Drawings shall be read in conjunction with the Bill of Quantities.
3. Tenderers are to allow against the items the full inclusive cost for the works as described in this document inclusive of all drawings, schedules, specifications, etc as issued with this document.
4. The amounts and rates to be inserted in the Bill of Quantities shall be the full inclusive amounts to the Employer for the work described under the several items. Such amounts shall cover all the costs and expenses that may be required in and for the construction of the work described, and shall cover the costs of all general risks, profits, taxes (but excluding value-added tax), liabilities and obligations set forth or implied in the documents on which the Tender is based.
5. An amount or rate shall be entered against each item in the Bill of Quantities, whether or not quantities are stated. An item against which no amount or rate is entered will be considered to be covered by the other amounts or rates in the Bill.
6. The Tenderer shall also fill in a rate against the items where the words "rate only" appear in the amount column. Although no work is foreseen under these items and no quantities are consequently given in the quantity column, the tendered rates shall apply should work under these items actually be required.
7. Should the Tenderer group a number of items together and tender one sum for such group of items, the single tendered sum shall apply to that group of items and not to each individual item, or should he indicate against any item that full compensation for such item has been included in another item, the rate for the item included in another item shall be deemed to be nil.
8. The tendered rates, prices and sums shall, subject only to the provisions of the Conditions of Contract, remain valid irrespective of any change in the quantities during the execution of the Contract.
9. The quantities of work as measured and accepted and certified for payment in accordance with the Conditions of Contract, and not the quantities stated in the Bill of Quantities, will be used to determine payments to the Contractor. The validity of the Contract shall in no way be affected by differences between the quantities in the Bill of Quantities and the quantities certified for payment.
10. **Ordering of materials** are not to be based on the Bill of Quantities, but only on information issued for construction purposes.
11. The tenderer is referred to the general specification document as included within this tender document. Where the specification and bills of quantities are in contradiction, the bills of quantities will apply.
12. Where trade names are references, it is deemed to include the wording "*Similar or exceeding equal, as approved by the principal agent*"

12. For the purposes of this Bill of Quantities, the following words shall have the meanings hereby assigned to them:

- Unit : The unit of measurement for each item of work as defined in the Standardized, Project or Particular Specifications
- Quantity : The number of units of work for each item
- Rate : The payment per unit of work at which the Tenderer tenders to do the work
- Amount : The quantity of an item multiplied by the tendered rate of the (same) item
- Sum : An amount tendered for an item, the extent of which is described in the Bill of Quantities, the Specifications or elsewhere, but of which the quantity of work is not measured in units

C2.2

Main Contractor's Bills of Quantities

Item No	Quantity	Rate	Amount
<u>BILL No. 1</u>			
<u>BILL NO. 1</u>			
<u>PRELIMINARIES</u>			
<u>BUILDING AGREEMENT AND PRELIMINARIES</u>			
<p>The JBCC Principal Building Agreement (March 2014 Edition 6.1) prepared by the Joint Building Contracts Committee shall be the applicable building agreement, amended as hereinafter described</p> <p>The JBCC Principal Building Agreement contract data form an integral part of this agreement</p> <p>The ASACS Preliminaries (March 2014 edition) published by the Association of South African Quantity Surveyors for use with the JBCC Principal Building Agreement shall be deemed to be incorporated in these bills of quantities</p> <p>The contractor is deemed to have referred to the abovementioned documents for the full intent and meaning of each clause</p> <p>The clauses in the abovementioned documents are hereinafter referred to by clause number and heading only.</p> <p>Where any item is not relevant to this agreement such item is marked N/A (signifying "not applicable")</p>			
<u>PREAMBLES FOR TRADES</u>			
<p>The Model Preambles for Trades (2008 edition) as published by the Association of South African Quantity Surveyors shall be deemed to be incorporated in these bills of quantities and no claims arising from brevity of description of items fully described in the said Model Preambles will be entertained</p> <p>Supplementary preambles are incorporated in these bills of quantities to satisfy the requirements of this project. Such supplementary preambles shall take precedence over the provisions of the Model Preambles</p> <p>The contractor's prices for all items throughout these bills of quantities shall take account of and include for all of the obligations, requirements and specifications given in the Model Preambles and in any supplementary preambles</p>			
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PRICING OF PRELIMINARIES

Should the **contractor** select Option A in terms of clause 26.9.4 of the **contract data** for the purpose of adjustment of these **preliminaries**, the amount entered into the amount column in these **preliminaries** is to be divided into one or more of the three categories provided namely fixed (F), value related (V) and time related (T)

SECTION A: PRINCIPAL BUILDING AGREEMENT

Interpretation (A1-A7)

A	Clause 1.0 - Definitions and interpretation	Item
B	Clause 2.0 - Law, regulations and notices	Item
C	Clause 3.0 - Offer and acceptance	Item
D	Clause 4.0 - Assignment and cession	Item
E	Clause 5.0 - Contract documents	Item
F	Clause 6.0 - Employer's agents	Item
G	Clause 7.0 - Design responsibility	Item

Insurance and security (A8-A11)

H	Clause 8.0 - Works risk	Item
J	Clause 9.0 - Indemnities	Item
K	Clause 10.0 - Insurances	Item
L	Clause 11.0 - Security	Item

Execution (A12 - A17)

M	Clause 12.0 - Duties of the parties	Item
N	Clause 13.0 - Setting out	Item
P	Clause 14.0 - Nominated subcontractors	Item
Q	Clause 15.0 - Selected subcontractors	Item
R	Clause 16.0 - Direct contractors	Item
S	Clause 17.0 - Contract instructions	Item

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Completion (A18 - A24)

A	Clause 18.0 - Interim completion	Item
B	Clause 19.0 - Practical completion	Item
C	Clause 20.0 - Sectional completion	Item
D	Clause 21.0 - Defects liability period and final completion	Item
E	Clause 22.0 - Latent defects liability period	Item
F	Clause 23.0 - Revision of date for practical completion	Item
G	Clause 24.0 - Penalty for late or non-completion	Item

Payment (A25 - A27)

H	Clause 25.0 - Payment	Item
J	Clause 26.0 - Adjustment of the contract value and final account	Item
K	Clause 27.0 - Recovery of expense and/or loss	Item

Suspension and termination (A28 - A29)

L	Clause 28.0 - Suspension by the contractor	Item
M	Clause 29.0 - Termination	Item

Dispute resolution (A30)

N	Clause 30.0 - Dispute resolution	Item
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Contract data

Before submission of his tender the **contractor** is to complete the tenderer's selection in the **contract data**

SECTION B: ASAQS PRELIMINARIES
1.0 DEFINITIONS AND INTERPRETATION

P	Definitions	Clause 1.1	Item
Q	Interpretation.	Clause 1.2	Item

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2.0 DOCUMENTS

A	Checking of documents.	Clause 2.1	Item
B	Provisional bills of quantities.	Clause 2.2	Item
C	Availability of construction documentation.	Clause 2.3	Item

3.0 PREVIOUS WORK AND ADJOINING PROPERTIES:

D	Previous work - dimensional accuracy.	Clause 3.1	Item
E	Previous work - defects .	Clause 3.2	Item
F	Inspection of adjoining properties.	Clause 3.3	Item

4.0 SAMPLES, SHOP DRAWINGS AND MANUFACTURER'S INSTRUCTIONS

G	Samples of materials.	Clause 4.1	Item
H	Workmanship samples.	Clause 4.2	Item
J	Shop drawings	Clause 4.3	Item
K	Compliance with manufacturers' instructions.	Clause 4.4	Item

5.0 DEPOSITS AND FEES

L	Deposits and fees.	Clause 5.1	Item
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6.0 TEMPORARY SERVICES

M	Water.	Clause 6.1	Item
N	Electricity.	Clause 6.2	Item

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A	Telecommunication facilities.	Clause 6.3	Item
B	Ablution facilities.	Clause 6.4	Item
7.0 PRIME COST AMOUNTS			
C	Responsibility for prime cost amounts .	Clause 7.1	Item
8.0 SPECIAL ATTENDANCE ON N/S SUBCONTRACTORS			
D	General attendance.	Clause 8.1	Item
E	Special attendance.	Clause 8.2	Item
9.0 GENERAL			
F	Protection of the works .	Clause 9.1	Item
G	Protection/isolation of existing/sectionally occupied works .	Clause 9.2	Item
H	Security of the works .	Clause 9.3	Item
J	Notice before covering work.	Clause 9.4	Item
K	Disturbance.	Clause 9.5	Item
L	Environmental disturbance.	Clause 9.6	Item
M	Works cleaning and clearing.	Clause 9.7	Item
N	Vermin.	Clause 9.8	Item
P	Overhand work.	Clause 9.9	Item

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SECTION C : SPECIFIC PRELIMINARIES

A The contractor to price against this item all costs deemed to be incurred to in complying with specific preliminaries as per section C1.2.2

SUMMARY OF CATEGORIES

Category "F": Fixed R _____

Category "V": Value R _____

Category "T": Time R _____

Item

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Handing over of materials

Where certain materials or articles from demolitions or articles are described as to be handed over by the contractor to the Regional Representative or Representative/Agent, such as materials or articles shall be properly stored by the contractor, until handing over thereof. The contractor must obtain an official receipt listing the materials or articles and dates of handing over. If the contractor fails to submit the receipt when requested, it shall be deemed that the materials or articles are still in his possession and he will be held liable to the Department for the full replacement value thereof, which amount will be deducted from any monies due to the contractor.

Building up of brickwork

All items for building up brickwork are deemed to include the necessary brickwork reinforcement

REMOVAL OF EXISTING WORK
Breaking up and removing unreinforced concrete including all necessary cutting

A	250mm Thick surface beds, etc	m2	7
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Breaking up and removing reinforced concrete including all necessary cutting and retain existing reinforcement

B	Slabs	m3	1
---	-------	----	---

Breaking up and removing reinforced concrete including reinforcement with and including all necessary concrete and steel cutting

C	Slabs	m3	3
---	-------	----	---

Breaking down and removing brickwork etc

D	230mm One brick walls	m2	25
---	-----------------------	----	----

E	230mm Brick grille with vent slots	m2	26
---	------------------------------------	----	----

Taking up / off and removing finishes from walls, floor, ceilings, etc.

F	Vinyl tiles fixed to floors	m2	145
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Alterations

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Taking out and removing external timber doors

A Existing timber doors complete, with size 1 664 x 2 064mm high

No

1

Taking out and removing roller shutter doors and handing to employer

B Existing Roller shutter doors complete with size 5 400 x 2 490mm high

No

2

C Existing Roller shutter doors complete with size 5 400 x 3 400mm high

No

4

D Existing Roller shutter doors complete with size 6 670 x 3 400mm high

No

1

Taking out and removing lift door and architrave

E Existing lift door including architrave with size 1 800 x 1 900mm high complete

No

1

Taking out and removing external windows

F Existing window complete, approximately 8.0m² each

m2

11

Taking out and removing internal windows

G Existing window complete, approximately 14.0m² each

m2

34

Taking out and removing internal partitions, doors etc

H Timber Partitioning wall

m2

50

Take out/off and remove sundry metalwork

J 1 200mm High Steel Mesh security dividing screen

m

16

K 2 000mm High Steel Mesh security dividing screen

m

42

L 400 x 200mm High steel burglar bar

No

24

M Steel "shute", 6 640 x 1 610mm wide overall on plan and rising 3 400mm, including 800mm high sides, etc

No

1

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Alterations

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<u>Take out/off and remove existing fences, inclusive of gates, etc and handing to employer</u>		
A	1 800mm High fencing	m 28
B	2 100mm High fencing	m 18
<u>Take out/off and remove existing Precast concrete coping to slab edge and set aside for re-use and later refix in similar new position</u>		
C	Precast concrete coping to slab edge	m 9
<u>Hacking up/off and removing granolithic, screeds, plaster, etc from concrete or brickwork and preparing surfaces for new screed, plaster, tile finishes, etc</u>		
D	25mm Thick average screed from floors	m2 4 601
E	75mm Thick average screed from floors	m2 97
<u>Taking out and removing piping, sanitary fittings, etc setting aside for re-use and later refixing in similar new position</u>		
F	Floor drain	No 34
<u>Block Off Unused Services</u>		
G	Floor drain complete	No 2
<u>CUTTING THROUGH FLOORS, WALLS, CEILINGS, ETC</u>		
<u>Concrete Floors</u>		
H	Cutting through 250mm thick reinforced concrete slab for opening 350 x 350mm including making good concrete	No 1
<u>Metal glazed windows</u>		
J	Altering existing metal glazed window to suit 1 770 x 1 620mm high mechanical ventilation duct and fan (duct and fan elsewhere measured)	No 7
<u>Cutting through for and forming plain openings through 230mm brick walls including prestressed concrete lintels, making good plaster on both sides and into reveals and with unreinforced concrete thresholds with steel trowelled finish</u>		
K	Opening Size 400 x 400mm high through 230mm brick wall	No 4
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Bill No. 2 Alterations SARS State Warehouse, Cape Town 14042-20-03-4 - Tender Document Add 1		

R

BUILDING-UP OPENINGS

Brickwork in NFP bricks in class II mortar in building up openings, including bonding new to existing and making good cement plaster on both sides (making good paintwork elsewhere)

A	Opening 400 x 200m high overall in 230mm brick wall	No	24
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MAKING GOOD EXISTING

Making good cement plaster

B	Walls where 230mm brick walls removed	m	17
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GENERAL ALLOWANCE

NOTE: Where appropriate the rates contained in the bills of quantities will be used in determining the value of the budget allowance below

General allowances

C	Allow the budgetary amount of R 250,000.00 (Two Hundred and Fifty Thousand Rand) for unforeseen builders work and alterations to be used as directed by the Principal Agent and deducted in whole or in part if not required	Item	250 000 00
D	Allow the budgetary amount of R 50,000.00 (Fifty Thousand Rand) for crack repairs to be used as directed by the Principal Agent and deducted in whole or in part if not required	Item	50 000 00

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Alterations

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Alterations
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EXCAVATION, FILLING, ETC
Excavation in earth not exceeding 2m deep

A To reduce levels to final levels under floors, etc

m3

161

Extra over excavations for excavations in

B Soft Rock

m3

16

C Hard Rock

m3

8

Extra over all excavations for carting away

D Surplus material from excavations and/or stock piles on site and/or within the building to a dumping site to be located by the Contractor

m3

161

Risk of collapse of excavations

E Sides of trench and hole excavations not exceeding 1.5m deep

m2

61

Keeping excavations free of water

F Keeping excavations free of water

Item

Soilcrete filling in accordance with engineers general notes drawing S-00 rev A

G Under floors, steps, pavings, etc

m3

161

H Extra over for cement stabilise

m3

8

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Bill No. 3

Earthworks

SARS State Warehouse, Cape Town

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**G7 Earth filling in accordance with SABS 1200 DM
supplied by the contractor compacted to 98% Mod
AASHTO density**

A Under floors, steps, pavings, etc

m3

7

Compaction of surfaces

B Compaction of ground surface in service trenches, etc by
wetting and compacting with plate compactor

m2

136

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Bill No. 3

Earthworks

SARS State Warehouse, Cape Town

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Bill No. 3
Earthworks
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Item No		Unit	Quantity	Rate	Amount
	<u>BILL No. 4</u>				
	<u>CONCRETE, FORMWORK AND REINFORCEMENT</u>				
	NOTE: Tenderers are advised to study the Model Preambles for Trades before pricing this bill				
	<u>SUPPLEMENTARY PREAMBLES</u>				
	<u>Cost of tests</u>				
	The costs of making, storing and testing of concrete test cubes as required under Clause 7 "Tests" of SABS 1200 G shall include the cost of providing cube moulds necessary for the purpose, for testing costs and for submitting reports on the tests to the Architect. The testing shall be undertaken by an independent firm or institution nominated by the Contractor to the approval of the Architect (Test cubes are measured separately)				
	<u>Formwork</u>				
	Descriptions of formwork shall be deemed to include use and waste only (except where described as "left in" or "permanent"), for fitting together in the required forms, wedging, plumbing and fixing to true angles and surfaces as necessary to ensure easy release during stripping and for reconditioning as necessary before re-use. The vertical strutting shall be carried down to such construction as is sufficiently strong to afford the required support without damage and shall remain in position until the newly constructed work is able to support itself				
	Formwork to soffits of solid slabs, etc shall be deemed to be to slabs not exceeding 250mm thick unless otherwise described				
	Formwork has been measured to the sides of all reinforced concrete in foundations and will be remeasured according to actual usage. However, formwork necessitated by irregularity or collapse of excavated faces will not be measured and the cost thereof shall be deemed to be included in the allowance for taking the risk of collapse of the sides of the excavations, provision for which is made in "Earthworks"				
	Carried to Collection			R	
	Bill No. 4				
	Concrete, Formwork and Reinforcement				
	SARS State Warehouse, Cape Town				
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UNREINFORCED CONCRETE
20MPa/19mm concrete

A Filling to cavity of hollow walls

m3

1

REINFORCED CONCRETE
25MPa/19mm concrete

B Surface beds cast in panels on waterproofing

m3

24

30MPa/19mm concrete

C Slabs including beams and inverted beams

m3

32

D Structural topping 75mm thick on existing slabs

m3

346

E Stairs including landings, beams and inverted beams

m3

2

F Ramps

m3

1

G Columns

m3

2

H Isolated Beams

m3

2

TEST BLOCKS
Test blocks

J Making and testing set of three 150 x 150 x 150mm concrete strength test cubes

No

25

CONCRETE SUNDRIES
Curing surfaces of concrete with "Sikafloor - CureHard-24" curing compound applied as per manufacturer's instructions

K On power floated concrete surfaces

m2

4 319

Finishing top surfaces of concrete smooth with a power float

L Surface beds, slabs, etc

m2

4 811

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Concrete, Formwork and Reinforcement

SARS State Warehouse, Cape Town

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FORMWORK
SMOOTH FORMWORK (DEGREE OF ACCURACY II)
Smooth formwork to sides

A	Rectangular columns with total height not exceeding 3.5m above bearing level	m2	12
B	Tapered columns with total height not exceeding 3.5m above bearing level	m2	12
C	Beams	m2	36
D	Inverted beams	m2	15
E	Edges, risers, ends and reveals not exceeding 300mm high or wide	m	12
F	Sloping and stepped outer edges of stairs 350mm high extreme	m	2

Smooth formwork to soffits

G	Slabs not exceeding 250mm thick propped up exceeding 1.5m and not exceeding 3.5m high	m2	5
H	Slabs exceeding 250mm not exceeding 500mm thick propped up exceeding 1.5m and not exceeding 3.5m high	m2	32
J	Slabs with sloping soffit exceeding 250mm not exceeding 500mm thick propped up exceeding 1.5m and not exceeding 3.5m high	m2	39
K	Landings propped up exceeding 1.5m and not exceeding 3.5m high	m2	8
L	Stairs with sloping soffits	m2	8

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Concrete, Formwork and Reinforcement

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Formwork to sloping top surfaces

A	Beams, walls, etc exceeding 300mm wide	m2	7
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Boxing in rough formwork to form

B	25 x 25mm Chamfers along top or bottom edges	m	200
---	--	---	-----

C	Boxing in smooth formwork to form 200 x 100mm horizontal rainwater drainage channel to falls	m	9
---	--	---	---

D	Boxing in smooth formwork to form 200 x 100 x 500mm penetration through edge beam	No	1
---	---	----	---

PRECAST CONCRETE

Exposed aggregate concrete coping to match existing coping size as per 'Lovric tiles' Please contact Gary at Lovric Tiles enviromi@mweb.co.za

E	Precast concrete coping to slab edge	m	17
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SLEEVES AND HOLES
Core drill holes

F	50mm Diameter hole through reinforced concrete exceeding 200mm and not exceeding 300mm thick	No	18
---	--	----	----

G	100mm Diameter hole through reinforced concrete exceeding 200mm and not exceeding 300mm thick	No	12
---	---	----	----

H	150mm Diameter hole through reinforced concrete exceeding 200mm and not exceeding 300mm thick	No	15
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MOVEMENT JOINTS, ETC
Saw cut joints

A	3 x 50mm Saw cut joints in top of concrete	m	203
---	--	---	-----

Construction joints through concrete, cast at 15 degrees as per drawing S-02 rev C

B	Surface beds not exceeding 300mmm thick	m	270
---	---	---	-----

Movement joints

C	"Migua" Type FP60/6500 movement joint, including all sealants, gaskets, etc. fixed to concrete complete	m	79
---	---	---	----

Expansion joints

D	"M-trim" Type ASCF 106 expansion joint, including all sealants, gaskets, etc. fixed to concrete complete	m	203
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 Concrete, Formwork and Reinforcement
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REINFORCEMENT
Mild steel reinforcement to structural concrete work

A	16mm Diameter bars	to	0.03
B	12mm Diameter bars	to	0.03
C	10mm Diameter bars	to	0.15
D	8mm Diameter bars	to	0.15

High tensile steel reinforcement to structural concrete work

E	32mm Diameter bars	to	0.18
F	25mm Diameter bars	to	0.18
G	20mm Diameter bars	to	0.30
H	16mm Diameter bars	to	1.60
J	12mm Diameter bars	to	1.65
K	10mm Diameter bars	to	2.37

Fabric reinforcement

L	Type 193 fabric reinforcement in concrete surface beds, slabs, etc	m2	4 222
M	Type 395 fabric reinforcement in concrete surface beds, slabs, etc	m2	105

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Mild steel dowel bars

A 1 000mm long Y16 dowels bars grouted into and including
200mm deep x 18mm diameter holes with HILTI HIT-HY
150 resin with section in existing slab to be bitumen painted

No

31

B 1 000mm long Y20 dowels bars grouted into and including
200mm deep x 22mm diameter holes with HILTI HIT-HY
150 resin with section in existing slab to be bitumen painted

No

119

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Concrete, Formwork and Reinforcement

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BRICKWORK IN FOUNDATIONS
Brickwork of NFP clay bricks (14 MPa nominal compressive strength) in Class II mortar

A	270mm Brick walls in foundations	m2	14
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SUPERSTRUCTURE BRICKWORK
Brickwork of NFP clay bricks (14 MPa nominal compressive strength) in Class II mortar

B	Half brick walls	m2	9
C	One brick walls	m2	567
D	One brick walls in beamfilling	m2	4
E	One brick walls in bund wall	m2	11
F	270mm Cavity wall of two half brick skins including wire ties	m2	110

BRICKWORK SUNDRIES

G	Splayed mortar fillet one course high in 50mm cavity	m	12
H	Closing 50mm cavity of hollow walls vertically with brickwork half brick wide	m	19
J	Closing 50mm cavity of hollow walls horizontally with one course of brickwork	m	14

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 Masonry
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"Corobrick Cape Stormberg Rustic FBS", clay face brick, bedded and jointed in Class I mortar and pointed with recessed horizontal and vertical joints

A	Extra over for face brick work	m2	160
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Movement joints with "Jointex" between concrete and brick surfaces

B	10mm Joints vertical not exceeding 300mm wide	m	118
---	---	---	-----

C	10mm Joints horizontal not exceeding 300mm wide	m	182
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Masonry
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Brickwork reinforcement

A	75mm Wide reinforcement built in horizontally	m	2 316
B	150mm Wide reinforcement built in horizontally	m	2 320

Galvanised hoop iron cramps, ties, etc

C	40 x 1.6mm "Eco tibond" wall tie with one end shot pinned to concrete, masonry or steel and other end built into masonry	No	473
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"Stresso" pre-stressed fabricated lintels

D	90 x 75mm Lintels in lengths not exceeding 3m	m	22
E	190 x 75mm Lintels in lengths not exceeding 3m	m	9
F	280 x 75mm Lintels in lengths exceeding 3m and not exceeding 4.5m	m	11

FIBRE-CEMENT WINDOW SILLS
Natural grey sills in single lengths bedded in class 1 mortar including metal fixing lugs etc

G	15 x 150mm Wide sills set sloping and slightly projecting	m	9
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 Masonry
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Masonry

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Item No		Unit	Quantity	Rate	Amount
	<u>BILL No. 6</u>				
	<u>WATERPROOFING</u>				
	NOTE: Tenderers are advised to study the Model Preambles for Trades before pricing this bill				
	<u>SUPPLEMENTARY PREAMBLES</u>				
	<u>Waterproofing</u>				
	Waterproofing of roofs, basements, etc shall be laid under a ten year guarantee. Waterproofing to roofs shall be laid to even falls to outlets, etc with necessary ridges, hips and valleys. Descriptions of sheet or membrane waterproofing shall be deemed to include additional labour to turn-ups and turn-downs				
	<u>DAMPPROOFING OF WALLS AND FLOORS</u>				
	<u>One layer of 250 micron "Consol Plastics Gunplas USB Green" waterproof sheeting sealed at laps with "Gunplas Pressure Sensitive Tape"</u>				
A	Under surface beds	m2	115		
	<u>Two coats "Flintkote Type 5" bitumen emulsion waterproof coating to</u>				
B	Masonry walls	m2	123		
	<u>WATERPROOFING TO ROOFS, BASEMENTS, ETC</u>				
	<u>"ABE Index Unigum" 4mm torchon waterproofing system 1 layer, applied by 'torchfusion' with 100mm side laps and 150mm end laps, including primer, flashings, gussets. Laid under a ten-year material warranty, to receive paint or stone protection (elsewhere), applied as per manufacturer's specification</u>				
C	On roofs	m2	76		
D	On tops and sides of parapet walls	m2	69		
E	Additional membranes, gussets, collars, etc around pipes and into outlets, etc	No	1		
	Carried to Collection			R	
	Bill No. 6				
	Waterproofing				
	SARS State Warehouse, Cape Town				
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WATERPROOFING PROTECTION
19mm Washed crushed stone dressing evenly spread with larger stones around outlets on waterproofing

A	50mm Thick to flat roofs	m2	76
---	--------------------------	----	----

PROTECTIVE ROOFING PAINT
Two coats bituminous aluminium paint

B	On waterproofing to roofs	m2	69
---	---------------------------	----	----

JOINT SEALANTS, ETC
"Sikaflex pro 2HP" two-part polyurethane joint sealing compound including backing cord, bond breaker, "Sika primer-3", etc

C	3mm In saw cut joints in floors	m	203
---	---------------------------------	---	-----

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Bill No. 6
 Waterproofing
 SARS State Warehouse, Cape Town
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BUDGETARY ALLOWANCES

Waterproofing in patches

NOTE: Where appropriate the rates contained in the bills of quantities will be used in determining the value of the budget allowance below

A Allow the budgetary amount of R 35,000 (Thirty Five Thousand Rand) for Waterproofing in patches, to be used as directed by the Principal Agent and deducted in whole or in part if not required

Item

35 000 00

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Bill No. 6
Waterproofing
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Section No. 1

Bill No. 6

Waterproofing

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Waterproofing
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Bill No. 7
Carpentry and Joinery
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Decorative thermosetting plastic laminate covering

Laminate covering shall be glued under pressure and edge strips of same shall be butt jointed at junctions with adjacent similar finish

The following joinery fittings have been measured as complete units i.e. the components of the units have not been separately measured. The descriptions, therefore, of such units shall be deemed to include all components, assembling, housing, notching, glueing, blocking, planting on and screwing with countersunk screws, edge strips, skirtings, trims, framework, decorative plastics finish, glass, ironmongery, metalwork, paint or varnish finishes, etc

Prices are to include for all ironmongery, finishes, etc unless otherwise described

Prices are to include for the making of holes, etc to accommodate lighting, conduiting, pipes, fittings, etc

Prices are to include for approved silicon sealant at all junctions of work tops, sides, panels, etc. with walls

DOORS, ETC
Heavy duty solid core hardwood doors with hardboard horizontal grooves, hung to timber/aluminium frame

A	40mm Single door 813 x 2 032mm high (Type D2)	No	1
B	40mm Single door 813 x 2 032mm high (Type D2) including door grille	No	4
C	44mm Double door 1 612 x 2 030mm high (Type D3)	No	1

FIRE DOORS
Purpose made Class D fire door, with and including "BITCON INDUSTRIES" Class B single rebated grade 316 stainless steel frame

D	40mm Door 850 x 2 032mm high (Type D1)	No	3
E	40mm Door 1 612 x 2 032mm high (Type D3)	No	5

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Bill No. 7
 Carpentry and Joinery
 SARS State Warehouse, Cape Town
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FRAMED FRAMES ETC
Wrought meranti

- A 70 x 104mm Rebated wrot frames plugged with 19mm timber quadrant each side

m

11

SKIRTINGS
Wrought meranti

- B 64 x 19mm Skirtings including 19mm quadrant bead, plugged to wall, partitioning, etc

m

59

- C 69 x 19mm Skirtings including 19mm quadrant bead, plugged to wall, partitioning, etc

m

16

JOINERY FITTINGS
Joinery units complete as per architect's joinery schedule: Cash Office joinery - 3062/801 Rev 1

- D Writing counter as per Detail 001, with 300 x 32mm "Life seal FORMICA" finish post formed worktop with 90 degrees bullnose edging, 32mm Life seal post formed "FORMICA" board fixed to support rails, 16mm melamine infill and 12 x 9mm aluminium angle shadowline, with overall size 1 190 x 300mm high, complete in its entirety as per architect's Joinery Details No. 3062-801 Rev. 1

No

1

- E Worktop counter as per Detail 004 and 005, with and including three drawer cupboards with 600 x 32mm "Life seal FORMICA" finish post formed worktop with 90 degrees bullnose edging, 94 x 32mm SA Pine bearers, 19mm meranti quadrant, 44 x 32mm H/W support rails, 16mm Melamine faced board cover strip, 16mm Melamine faced board support divisions and silicon sealant, with and including drawers with 6mm masonite tempered hardboard bottom, 16mm Melamine faced board faced drawing and 100 x 16mm Melamine faced board stop rail complete with all stainless steel T-handels, with size 600 x 760mm high, complete in its entirety as per architect's Joinery Details No. 3062-804 Rev. 1 & 3062-805 Rev. 1

m

10

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Bill No. 7

Carpentry and Joinery

SARS State Warehouse, Cape Town

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**Joinery units complete as per architect's joinery
 schedule: Lower Office Tea Area joinery - 3062/802 Rev
 1**

- A Sink cupboard as per Detail 002 and 003, with size 1 965 x 535 x 900mm high with top, sides, bottom, division, shelf, back and piano double hinged doors, complete in its entirety as per architect's Joinery Details No. 3062-802 Rev. 1 & 3062-803 Rev. 1 (sink elsewhere)
- B Wall cupboard as per Detail 002 and 003, size 1 965 x 300 x 750mm high with top, sides, bottom, division, shelf, back and piano double hinged doors, complete in its entirety as per architect's Joinery Details No. 3062-802 Rev. 1 & 3062-803 Rev. 1

No

1

No

1

**Joinery units complete as per architect's joinery
 schedule: Reception Counter joinery - 3062/803 Rev 1**

- C Floor cupboard as per Detail 007, with 600 x 32mm "Life seal FORMICA" finished post formed worktop with 90 degrees bullnose edging, 150 x 32mm SA Pine bearers as 500mm c/c, 19mm meranti quadrant, silicon sealant, 16mm Melamine faced board rear lining, 16mm "Bisonlam" Super White mid self, 16mm Bisonlam Super White on "Bisonbord" V313 bottom self, stainless steel T-handles, with overall size 2 955 x 535 x 900mm high, complete in its entirety s per architect's Joinery Details No. 3062-807 Rev. 1
- D Worktop counter as per Detail 008, with 600 x 32mm "Life seal FORMICA" finished post formed worktop with 90 degrees bullnose edging, 150 x 32mm SA Pine bearers as 500mm c/c, 19mm meranti quadrant, silicon sealant, 16mm Melamine faced board rear lining, 16mm Bisonlam Super White on Bisonbord V313 bottom self, with size 750 x 900mm high, complete in its entirety as per architect's Joinery Details No. 3062-808 Rev. 1

m

3

m

4

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 Carpentry and Joinery
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Joinery units complete as per architect's joinery schedule: Security Office joinery - 3062/804 Rev 1

A	Sink cupboard as per Detail 002 and 003, with size 1 965 x 535 x 900mm high with top, sides, bottom, division, shelf, back and piano double hinged doors, complete in its entirety as per architect's Joinery Details No. 3062-802 Rev. 1 & 3062-803 Rev. 1 (sink elsewhere)	No	1
B	Wall cupboard as per Detail 002 and 003, size 300 x 1 965 x 750mm high with top, sides, bottom, division, shelf, back and piano double hinged doors, complete in its entirety as per architect's Joinery Details No. 3062-802 Rev. 1 & 3062-803 Rev. 1	No	1
C	Worktop counter as per Detail 005, with 600 x 32mm "Life seal FORMICA" finish post formed worktop with 90 degrees bullnose edging, 64 x 19mm meranti skirting with 19mm meranti quadrant, 44 x 32mm H/W support rails, 16mm Melamine faced board cover strip, 32mm Melamine faced board support divisions and silicon sealant, with size 600 x 760mm high, complete in its entirety s per architect's Joinery Details No. 3062-805 Rev. 1	m	9
D	Floor cupboard as per Detail 007 and 010, with 600 x 32mm "Life seal FORMICA" finished post formed worktop with 90 degrees bullnose edging, 150 x 32mm SA Pine bearers as 500mm c/c, 19mm meranti quadrant, silicon sealant, 16mm Melamine faced board rear lining, 16mm Bisonlam Super White mid self, 16mm Bisonlam Super White on Bisonbord V313 bottom self, stainless steel T-handles, with overall size 535 x 900mm high, complete in its entirety s per architect's Joinery Details No. 3062-807 Rev. 1 & 3062-810 Rev. 1	m	4

BUMPER RAILS

Wrot Meranti

E	108 x 22mm Hardwood timber chair rail plugged to wall	m	159
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Carpentry and Joinery

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Carpentry and Joinery

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Carpentry and Joinery
SARS State Warehouse, Cape Town
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User note

Circular bulkheads shall be given separately

SUSPENDED CEILINGS

25mm thick "Soundlite" exposed acoustic grid ceiling 1 200mm x 600mm tile into "Donn" ceiling grid. Ceiling grid consisting of Donn Wall Angle (SM26/M6) fixed to the perimeter wall using fixing at 300mm centres. Space Donn Main Tees (T38V/T37V) at 1200mm centres. Suspend main tees using Donn Pre-Stretched Galvanised Hanger wire 2.5mm thick or Donn Hanger strap 19mm wide at 1200mm centres. Main tee should be fixed to the wall using angle cleats, installed to manufacturer's instructions

A	Horizontal ceilings suspended not exceeding 1m below concrete soffits	m2	225
---	---	----	-----

BULKHEADS, ETC

9,5mm "Rhino" gypsum plasterboard with 63mm wide strips of mesh scrim nailed over joints and the whole finished with gypsum skim plaster trowelled to a smooth polished surface to the thickness recommended by the manufacturer on a concealed tee suspension system including main and cross tees, necessary hangers, grids, etc

B	Horizontal portion of bulkheads 400mm wide, suspended not exceeding 1m below concrete soffits	m	31
---	---	---	----

C	Horizontal portion of bulkheads 700mm wide, suspended not exceeding 1m below concrete soffits	m	5
---	---	---	---

D	Vertical portion of bulkheads 300mm high, suspended not exceeding 1m below concrete soffits	m	73
---	---	---	----

Sundries

E	Extra over bulkhead for opening for 150 x 150mm vent	No	16
---	--	----	----

Cornices to ceilings

F	"Donn" wall angle SM25	m	69
---	------------------------	---	----

G	"Donn" wall angle M6	m	46
---	----------------------	---	----

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Bill No. 8
 Ceilings, Partitions, etc
 SARS State Warehouse, Cape Town
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PARTITIONS ETC

Standard "Gyproc" drywall consisting of 63.5mm ultra steel drywall studs inserted at 400mm centres into 63.5mm drywall steel top track fixed to grid and bottom plugged to concrete, clad both sides with 12.5mm taper-edge "RhinoBoard" fixed with drywall screws at 220mm centres, stagger joints between boards, all joints are to be taped and jointed and "RhinoGlide" skim finish to exposed surfaces as per manufacturers specification, drywall to be complete with natural aluminium head channel and Donn Corner Bead to all external corners

A	Partitioning 2 150mm high	m	41
B	Extra over drywall partitions 2 150mm high for corner	No	2
C	Extra over drywall partitions 2 150mm high for T-intersections	No	3
D	Extra over drywall partitions 2 150mm high for vertical abutment	No	5
E	Extra over drywall partitions 2 150mm high for HVAC opening 200 x 100mm high, etc complete	No	1
F	Extra over drywall partitions 2 150mm high for door opening 900 x 2 040mm high, etc complete (door elsewhere measured) (Type D2)	No	3
G	Extra over drywall partitions 2 150mm high for window opening 1 000 x 1 200mm high, etc complete (window elsewhere measured) (Type W6)	No	1
H	Extra over drywall partitions 2 150mm high for window opening 1 500 x 1 200mm high, etc complete (window elsewhere measured) (Type W5)	No	1
J	Partitioning average 3 500mm high	m	7
K	Extra over drywall partitions average 3 500mm high for vertical abutment	No	2
L	Extra over drywall partitions average 3 500mm high for aluminium window, type W1 size 785 x 1 000mm high, etc complete (window elsewhere measured) (Type W1)	No	1

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Bill No. 8

Ceilings, Partitions, etc

SARS State Warehouse, Cape Town

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"Gyproc Moistyre Resistant" drywall consisting of 63.5mm ultra steel drywall studs inserted at 400mm centres into 63.5mm drywall steel top track fixed to grid and bottom plugged to concrete, clad both sides with 12.5mm taper-edge "Moistyre Resistant board" fixed with drywall screws at 220mm centres, stagger joints between boards, all joints are to be taped and jointed and "RhinoGlide" skim finish to exposed surfaces as per manufacturers specification, drywall to be complete with natural aluminium head channel and Donn Corner Bead to all external corners

A Partitioning 2 150mm high

m

4

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Bill No. 8
Ceilings, Partitions, etc
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Bill No. 8

Ceilings, Partitions, etc

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Bill No. 8
Ceilings, Partitions, etc
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Item No		Unit	Quantity	Rate	Amount
	BILL No. 9				
	FLOOR COVERINGS, WALL LININGS, ETC				
	NOTE: Tenderers are advised to study the Model Preambles for Trades before pricing this bill				
	SUPPLEMENTARY PREAMBLES				
	Fixing				
	Floor coverings, wall linings, etc shall, where applicable, be fixed with adhesive as recommended by the manufacturers of the flooring, linings, etc				
	Surface preparation, priming, curing, cleaning etc				
	Descriptions of the items below are deemed to include all necessary preparation, priming, mixing, curing, cleaning etc as prescribed by the manufacturers of the various products				
	FLOOR COVERINGS				
	<u>500 x 500 x 6mm "Basket weave" carpet tiles in "rope" colour, in tessellated laid pattern installed with plain backing fixed with approved acrylic emulsion adhesive to screed, laid in accordance with SABS 0186-2000 fitting code (screed elsewhere measured), all in accordance with manufacturer's specification</u>				
A	On floors	m2	116		
	EPOXY FLOORING				
	<u>"Hengro floor protect premium (HFP)" self priming, self sealing, Bisphenol A based two-part resin epoxy coating, colour "light grey" as per manufacturer's instructions</u>				
B	On floors	m2	124		
	CORNER PROTECTORS, DIVIDING STRIPS, ETC				
	<u>"Kirk Marketing"</u>				
C	Aluminium Wide carpet gripper edge trim (code: ACGRE100)	m	7		
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	Bill No. 9				
	Floor Covering, Wall Linings, etc				
	SARS State Warehouse, Cape Town				
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HINGES, BOLTS, ETC
Manufactured by "DORMA"

A	DBB-SS-009 102 x 75 x 3mm stainless steel two ball bearing butt hinge	Pairs	28
B	PHA 2000 series 2 point locking panic bolt with cross bar for leaf up to 1 000mm wide, double door 2 064mm high	No	10
C	DPH301C 150 x 19mm stainless steel "D" shaped straight bolted through pull handle	No	5
D	DFB-SC-180/150 150mm Satin Chrome flush bolt with heel	No	2

Manufactured by "HOWICK"

E	H090 100 x 44 sinkless centre leaf hinges	Pairs	3.0
F	H076 Stainless steel heavy duty spring clip (St/Steel)	No	2

LOCKS
Manufactured by "DORMA"

G	D036S euro-profile cylinder sash lock SS	No	9
H	DDC106501 nickel plated 65mm ten pin euro-profile grand master keyed double cylinder	No	5
J	DSC104201 nickel plated 65mm ten pin euro-profile grand master keyed single cylinder	No	5
K	DWC-005 stainless steel WC indicator and turn knob escutcheons with cylinder lock to fit	No	4
L	D038R Rebate conversion kit for euro-profile locks SS	No	1

HANDLES
Manufactured by "DORMA"

M	SH810 solid SS lever handle with Euro cylinder escutcheon to match	Pairs	9
N	PHT 3901 external fire escape access with lever handle	No	5

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Bill No. 10
 Ironmongery
 SARS State Warehouse, Cape Town
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DOOR CLOSERS
Manufactured by "DORMA"

A	TS73V EN 2-4 variable spring strength regular arm door closer	No	13
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SUNDRIES
Manufactured by "DJW"

B	Concealed fixing rubber doorstop, plugged to concrete floor	No	5
---	---	----	---

BATHROOM FITTINGS
Manufactured by "Kimberly Clarke"

C	"Reflex MK2" stainless steel hand towel dispenser (code: SA426125)	No	1
D	"MR2" stainless steel toilet roll holder (code: SA426130)	No	1
E	"AQUARIUS" stainless steel waste bin disposer (code: SA426135)	No	1
F	"Serra NOX 3" stainless steel soap dispenser (code: SD1226 Satin)	No	1

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Bill No. 10
 Ironmongery
 SARS State Warehouse, Cape Town
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SIGNAGE

NOTE: Where appropriate the rates contained in the bills of quantities will be used in determining the value of the budget allowance below

General allowances

A Allow the budgetary amount of R 50,000.00 (Fifty Thousand Rand) for statutory signageto be used as directed by the Principal Agent and deducted in whole or in part if not required

Item

50 000 00

Carried to Collection

R

Bill No. 10
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SARS State Warehouse, Cape Town
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Bill No. 10

Ironmongery

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Ironmongery

All ironmongery to be supplied by the Contractor unless otherwise specified. Contractors are to provide samples for approval by the Architect of these ironmongery on submission of their tenders. All ironmongery shall be approved by the Architect prior to installation

Sub Contractor to supply all relevant shopfronts with catches, handles, hinges etc. to match shop fronts and doors, all to the Architects approval

All sliding gear to sliding doors to be supplied by the contractor unless otherwise specified. Contractors are to provide samples for approval by the Architect of these sliding gear on submission of their tenders. All sliding gear shall be approved by the Architect prior to installation

Joints and Sealants

All joints in frames shall be made by mechanical means

An approved silicone sealant is to be provided for both sides of all internal and external shop fronts between the aluminium frames and brick wall or concrete column and between the aluminium frame and plaster finish

Powdercoating

Aluminium surfaces to receive 50-80µm Matt Charcoal powder coating to be applied by a certified markholder of SANS 1578 and SANS 1796

Wind Loading

The unfactored SABS Wind Loading for :

Terrain Category 2 Class A element at Sea Level 10m above ground level is 1.5 kPa/m²

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Bill No. 11
Metalwork
SARS State Warehouse, Cape Town
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ALUMINIUM WINDOWS, DOORS & SHOPFRONTS

Purpose made epoxy coated aluminium windows, doors & shopfronts colour: Matt Grey, in accordance with AAAMSA standards with and including glazing strictly according to SANS 613, 1578 and 1796 with matching glazing beads, friction stays and hinges by manufacturer, handles to clients approval plugged to brickwork/concrete/steel beams including polyurethane elastometric uv-resistant flexible joint sealant suitable for painting, aluminium/rubber gaskets, all in accordance with architect's drawings and specifications

A	Shopfront type SF1, overall size 2 655 x 2 555mm high including single door, fixed lights with 6,5mm laminated safety clear glazing and ironmongery complete in its entirety as per architect drawing 3062-Arc-SEC3 Rev 3	No	1
B	Shopfront type SF2, overall size 2 800 x 2 555mm high including fixed lights with 6,5mm laminated safety clear glazing and ironmongery complete in its entirety as per architect drawing 3062-Arc-SEC3	No	1
C	Single Door type D1, overall size 900 x 2 040mm high including frame, fixed light with 6mm clear float safety glass, door grille, hinges, handle, lock and door closer complete in its entirety as per architect drawing 3062-Arc-SEC3 Rev.3	No	1
D	Window type W1, overall size 1 930 x 1 150mm high extreme, including 6.5mm laminated safety clear glazing, complete in its entirety as per architect's drawing 3062-Arc-SEC3 Rev 3	No	1
E	Window, type W2, overall size 2 000 x 1 150mm high extreme, including 6.5mm laminated safety clear glazing, complete in its entirety as per architect's drawing 3062-Arc-SEC3 Rev 3	No	1
F	Window type W3, overall size 1 455 x 1 150mm high extreme, including 6.5mm laminated safety clear glazing, complete in its entirety as per architect's drawing 3062-Arc-SEC3 Rev 3	No	2

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 Bill No. 11
 Metalwork

 SARS State Warehouse, Cape Town
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FIREPROOF STEEL ROLLER SHUTTERS ETC

Fireproof steel roller shutter door with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support, fixed to brickwork or concrete

A	Crank operated slatted roller shutter door type D4, for opening with size 5 400 x 3 400mm high, complete its entirety as per architect's Door Schedule No. 404 Rev 1 (With option to be modify to motorized operated)	No	2
B	Crank operated slatted roller shutter door type D5, for opening with size 5 400 x 2 490mm high, complete its entirety as per architect's Door Schedule No. 405 Rev 1 (With option to be modify to motorized operated)	No	2
C	Crank operated slatted roller shutter door type D6, for opening with size 5 400 x 2 900mm high, complete its entirety as per architect's Door Schedule No. 406 Rev 1 (With option to be modify to motorized operated)	No	1
D	Crank operated slatted roller shutter door type D7, for opening with size 6 670 x 3 400mm high, complete its entirety as per architect's Door Schedule No. 407 Rev 1 (With option to be modify to motorized operated)	No	2
E	Crank operated slatted roller shutter door type D8, with and including hinged door size 900 x 2 100mm high for opening with size 6 670 x 3 400mm high, complete its entirety as per architect's Door Schedule No. 408 Rev 1 (With option to be modify to motorized operated)	No	1
F	Crank operated slatted roller shutter door type D9, for opening with size 3 000 x 2 490mm high, complete its entirety as per architect's Door Schedule No. 409 Rev 1 (With option to be modify to motorized operated)	No	1

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 Metalwork
 SARS State Warehouse, Cape Town
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STEEL GATES, SCREENS, ETC
Welded screens and gates to concrete slab

A	Gate type G1, with 50 x 50 x 3mm Galvanized steel frame with 100 x 50 x 3mm galvanized steel intermediate rail, double leaf gate, with and including "Betafence" or similar approved security mesh zinc-alu fence panel with 3mm diameter horizontal and vertical wire, with 72.2 x 12.7 inner apertures, all PVC coated, including barrel bolts, lock plates and hinges, with overall size 3 000 x 2 200mm high, complete in its entirety as per architect's Gate Schedule No. 601 Rev. 3	No	11
B	Gate type G2, with 50 x 50 x 3mm Galvanized steel frame with 100 x 50 x 3mm galvanized steel intermediate rail, with and including "Betafence", or similar approved security mesh zinc-alu fence panel with 3mm diameter horizontal and vertical wire, galvanized with 72.2 x 12.7mm inner apertures, all PVC coated, including barrel bolt, lock plate and hinges, with overall size 900 x 2 200mm high, complete in its entirety as per architect's Gate Schedule No. 602	No	3
C	Gate type G3, with 50 x 50 x 3mm Galvanized steel frame with 100 x 50 x 3mm galvanized steel intermediate rail & stiffener bars, with and including "Betafence", or similar approved security mesh zinc-alu fence panel with 3mm diameter horizontal and vertical wire, galvanized with 72.2 x 12.7 inner apertures, all PVC coated, with and including hook, lock plate and gate track, sliding gate with overall size 6 000 x 2 200mm high, complete in its entirety as per architect's Gate Schedule No. 603 Rev 3	No	3
D	Gate type G5, stainless steel "Turnstar Titan" turnstile with gate, over all size 1 430 x 2 123mm high, complete in its entirety as per architect's Gate Schedule No. 605 Rev 2	No	1

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 Metalwork

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A	"Betafence BETAVIEW 3510" or similarly approved security mesh zinc-alu fence panel in 2 200 x 3 050mm panels with 3mm diameter horizontal and vertical wire, with 72.2 x 12.7 inner apertures, all PVC coated, with and including galvanized tubular post size 70 x 44mm covered with post cap, all PVC coated and 5mm thick steel floor plate to underside of post bolted to concrete, complete as per architect's drawing 3062-Arc-001 Rev 5	m	274
B	"Chromadek DIAMOND DECK" or similarly approved profile sheeting with galvanized finish, fixed to frame with self-tapping screws including 100 x 50 x 20mm galvanized steel channel top, intermediate and bottom rail, bracket and bolted to IPE 120 x 64mm galvanized steel posts at 3 050mm c/c welded on 250 x 250 x 5mm steel plate bolted to concrete floor, complete as per architect's drawing 3062-Arc-001 Rev 5	m	35
<u>GALVANISED STEEL BALUSTRADES</u>			
<u>Galvanised mild steel "Valmatex" tube balustrade</u>			
C	Horizontal balustrades 1000mm high, of 35mm external diameter thick continuous pipe handrail, section continuous top and bottom rails, 35mm external diameter section posts at approximately 1000mm centres with 150 x 150 x 5mm footplates bolted to concrete (Drawing No 3062-Arc-SEC1 rev4)	m	20
D	Raking balustrades 1000mm high, of 35mm external diameter thick continuous pipe handrail, section continuous top and bottom rails, 35mm external diameter section posts at approximately 1000mm centres with 150 x 150 x 5mm footplates bolted to concrete (Drawing No 3062-Arc-SEC1 rev4)	m	2

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Bill No. 11
 Metalwork
 SARS State Warehouse, Cape Town
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SECURITY PAYROLL WINDOWS

Purpose made epoxy coated aluminium window colour: Matt Grey, in accordance with AAAMSA performance criteria A0, glazed in accordance with SANS 10160, 10137, 10400 (Part N of Section 3), fitted with clip-on glazed beads with gasket seals with lugs and screws to drywall frames, all in accordance with AAMSA selection guide of glazed aluminium architectural aluminium products - June 2004

- A Window type W1, with overall size 785 x 1000mm high including 8.6mm laminated safety clear glazing, complete its entirety as per architect's Window Diagram 3062-501

No

1

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Metalwork
SARS State Warehouse, Cape Town
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Metalwork

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Bill No. 11
Metalwork
SARS State Warehouse, Cape Town
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Item No		Unit	Quantity	Rate	Amount
	<u>BILL No. 12</u>				
	<u>PLASTERING</u>				
	NOTE: Tenderers are advised to study the Model Preambles for Trades before pricing this bill				
	<u>GRANOLITHIC</u>				
	<u>Method</u>				
	The method to be used shall be either the monolithic method or the bonded method				
	<u>Preparation</u>				
	For granolithic applied monolithically, the concrete floor shall be swept clean after bleeding of the concrete has ceased and the slab has begun to stiffen; any remaining bleed water shall be removed and the granolithic applied immediately thereafter. For granolithic to be bonded to the floor slab after it has hardened, the slab surface shall be hacked (preferably by mechanical means) until all laitance, dirt, oil, etc is dislodged and swept clean of all loose matter. The slab shall then be wetted and kept damp for at least six hours before applying the granolithic				
	<u>Mix</u>				
	Granolithic shall attain a compressive strength of at least 41MPa. The coarse aggregate shall comply with SANS 1083 and shall generally be capable of passing a 10mm mesh sieve. Where the thickness of the granolithic exceeds 25mm, the size of the coarse aggregate shall be increased to the maximum size compatible with the thickness of the granolithic				
	<u>Panels</u>				
	Granolithic shall be laid in panels not exceeding 14m ² for monolithic finishes, not exceeding 9,5m ² for bonded finishes and not exceeding 6m ² for all external granolithic. Wherever possible, panels shall be square but at no time should the length of the panel exceed 1,5 times its width				
	Where possible joints between panels shall be positioned over joints in the floor slab and shall be at least 3mm wide through the full thickness of the finish, separated by strips of wood or fibreboard and finished with V-joints				
	Carried to Collection			R	
	Bill No. 12				
	Plastering				
	SARS State Warehouse, Cape Town				
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Laying

Monolithic granolithic shall be applied to the partially set slab and thoroughly compacted and lightly wood floated to the required levels

Bonded granolithic shall be applied to the slab after applying a 1:1 sand-and-cement slurry brushed over the surface and allowed to partially set before applying the granolithic. The granolithic shall be thoroughly compacted and lightly wood floated to the required levels

After wood floating, the monolithic and bonded granolithic shall remain undisturbed until bleeding has ceased and the surface has stiffened. Any remaining bleed water and laitance shall then be removed and the surface steel trowelled or power floated

Curing, seasoning and protection

Granolithic shall be covered with clean hessian with waterproof building foil over and kept wet for at least seven days after laying

Colour

Coloured granolithic shall be tinted with an approved colouring pigment mixed into a true and even colour

SCREEDS & GRANOLITHIC SCREEDS

Screeds on concrete

A	30mm Thick on treads and risers of staircases	m2	3
B	65mm Thick average on roofs to falls and currents	m2	71
C	75mm Thick on floors and landings	m2	483
D	Coved skirtings 250mm high stepped over bund wall as per drawing 3062-Arc-004 Rev-	m	67

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Bill No. 12

Plastering

SARS State Warehouse, Cape Town

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GRANOLITHIC
Untinted granolithic on concrete (degree of accuracy grade I)

A	30mm Thick on treads and risers of stairs, including reedings	m2	12
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SPECIALIST PLASTER FLOOR FINISHES
Minimum 5mm "Polyflor Poly Levelmaster" on

B	Floors	m2	100
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INTERNAL PLASTER
Cement plaster on brickwork

C	On walls	m2	713
D	On walls in patches	m2	15
E	On narrow widths	m2	16
F	Forming of V grooves in plaster.	m	18

Cement plaster on concrete

G	On projecting and isolated columns	m2	64
H	On narrow widths	m2	3

EXTERNAL PLASTER
Cement plaster on brickwork

J	On walls	m2	23
K	Forming of V grooves in plaster.	m	18

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Bill No. 12
 Plastering
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Bill No. 12

Plastering

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Prime Cost (PC) Sums

Prime Cost (PC) Sums means an amount of money provided in the bills of quantities for material and goods to be obtained from a supplier nominated by the architect and to be fixed by the contractor (Clause 1.1 of Principal Building Agreement)

The prime cost amount shall be omitted from the contract sum and the amounts actually paid by the contractor in respect of the purchase of the nett quantity of such items including delivery to site shall be added to the contract sum

The contractor has to allow for labour, profit and waste in his rate over and above the PC amount

WALL TILING

200 x 200 x 8mm Ceramic tiles (PC Sum R 200/m² excluding VAT supply and delivered to site), fixed with "Gold Star 6" adhesive to walls flush pointed with "TAL Wall & Floor" grouting

A	On walls	m2	3
B	On narrow widths	m2	3
C	On walls in isolated panels, splashbacks, etc	m2	1

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Bill No. 13

Tiling

SARS State Warehouse, Cape Town

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FLOOR TILING

600 x 600mm Ceramic tiles (PC Sum R 200/m² excluding VAT supply and delivered to site), fixed with "Gold Star 6" adhesive to walls flush pointed with "TAL Wall & Floor" grouting

A	On floors and landings	m2	103
B	Ceramic tiles to treads and risers of staircases	m2	6
C	Skirting 600 x 100mm high	m	46

CORNER PROTECTORS, DIVIDING STRIPS, ETC

"Kirk Marketing"

D	Aluminium Wide Tile-in Ramp (code: AWTIR100)	m	4
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Carried to Collection

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Bill No. 13

Tiling

SARS State Warehouse, Cape Town

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Tiling

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Tiling
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Copper pipes

Pipes shall be hard drawn and half hard pipes of the class stated. Class 0 (thin walled hard drawn) pipes shall not be bent. Class 1 (thin walled half-hard), class 2 (half-hard) and class 3 (heavy walled half-hard) pipes shall only be bent with

benders with inner and outer formers on approval from the engineer.

Fittings to copper waste, vent and anti-syphon pipes and capillary solder fittings shall be "Cobra Watertech" type. Capillary solder fittings shall comply with ISO 2016.

Fixing of pipes

Unless specifically otherwise stated, descriptions of pipes shall be deemed to include fixing to walls etc, casting in, building in or suspending not exceeding 1m below suspension level

Reducing fittings

Where fittings have reducing ends or branches they are described as "reducing". In the case of pipes with diameters not exceeding 60mm only the largest end or branch size is given. Should the contractor wish to use other fittings and bushes or reducers he may do so on the understanding that no claim in this regard will be entertained. In the case of pipes with diameters exceeding 60mm all sizes are given and no claim for extra bushes, reducers, etc will be entertained

Wire gratings

Descriptions of gutter outlets, etc shall be deemed to include wire balloon gratings

Exposed concrete surfaces

Exposed surfaces of concrete stormwater channels, cover slabs, inspection eye marker slabs, gulley tops, cleaning eye

tops, catchpits, inspection chambers, etc shall be finished smooth with plaster

Carried to Collection

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Plumbing and drainage
SARS State Warehouse, Cape Town
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Laying, backfilling, bedding, etc of pipes

Pipes shall be laid and bedded and trenches shall be carefully backfilled in accordance with the manufacturer's instructions

Where no manufacturer's instructions exist pipes shall be laid in accordance with Clauses 5.1 and 5.2 of each of the following:

SABS 1200 L : Medium-pressure pipelines
 LD : Sewers
 LE : Stormwaterdrainage

Pipe trenches, etc shall be backfilled in accordance with Clauses 3, 5.5, 5.6, 5.7 and 7 of:

- Allow for backfilling of trenches with imported sand filling
- SABS 1200 DB : Earthworks (Pipe trenches)

Pipes shall be bedded in accordance with Clauses 3.1 to 3.4.1, 5.1 to 5.3 and 7 of:

- SABS 1200 LB : Bedding (Pipes)

Unless otherwise described bedding of rigid pipes shall be Class B bedding

Flush pans

Flush pans shall have straight or side outlets and "P" or "S" traps as necessary

Stainless steel basins, sinks, wash troughs, urinals, etc

Units shall have standard aprons on all exposed edges and tiling keys against walls where applicable

All stainless steel work to be grade 304 unless otherwise stated

Waste unions

Descriptions of waste unions shall be deemed to include rubber or vulcanite plugs and chains fixed to fittings

Scope of the work

The scope of work is described in the specification and on the drawings

Carried to Collection

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Plumbing and drainage
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Painting

Where applicable the Principal Building Contractor will be responsible for painting all exposed pipe work

Pricing

The tenderer must price each item in this section individually and no changes made by the tenderer shall be recognised

Where inclusive items are measured and priced, the contractor must on request, supply full details of the components and prices making up the inclusive items. If the

contractor does not supply such details and prices within fourteen days after having been requested to do so, the Quantity Surveyor will determine such at his own discretion

RAINWATER DISPOSAL

Nutec Fibre cement rainwater down pipe

A	100 x 76mm Rectangular rainwater down pipe	m	4
B	Extra over rainwater pipe for shoe	No	1
C	Extra over rainwater pipe for bend	No	1
D	476 x 234 x 267mm Deep rainwater head with outlet for 100 x 76mm diameter pipe (Code: 744-744)	No	1

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 Plumbing and drainage
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SANITARY FITTINGS

NOTE: Prices for sanitary fittings fixed to walls or abutting walls shall include for sealing against walls with silicone sealing compound. This shall apply to wash hand basins, sinks and drainers, WC cisterns, wash troughs, shower trays and the like.

"Vaal"

A	Vitreous china 455 x 290mm "Bantam" basin with one tap hole, integrated overflow and chainstay hole (code: 7030)	No	1
B	Vitreous china Charisma 90° outlet back inlet closed rim back-to-wall pan, with quality thermoset soft-close seat and floor brackets (code: 431900), including "Geberit" concealed cistern (code: 110.772.00.1) with "Bolero" matt chrome actuator plate (code: 115.777.46.1)	No	1

"Franke"

C	"Trendline" 711 stainless steel sink 1200 x 535 SEB single end bowl drop-on sink (code: 311850)	No	2
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WASTE UNIONS ETC
"Cobra"

D	32mm Chrome plated basin waste (code: 301) with 62mm diameter flange, 80mm shank, slotted with backnut, plug, chain and stay	No	1
E	40mm CP sink waste (Code: 316) with 70 diameter flange, 45mm shank, slotted with backnut, anti-theft plug, chain and stay	No	2

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TRAPS ETC
"Cobra"

- A 32 x 40mm P-bottle trap (code: 365/40) to suit 40mm PVC waste pipe

No 1

"PVC"

- B 40 x 40mm "S" trap

No 2

TAPS, MIXERS, VALVES, ETC TO SANITARY FITTINGS
"Hansgrohe"

- C "Focus 70" single lever basin mixer (code: 31730000)

No 1

- D "Focus E" single lever kitchen mixer (code: HG3178000)

No 2

SANITARY PLUMBING
Class 12 uPVC pipes

- E 40mm Pipes fixed to walls

m 5

- F 110mm Pipes suspended not exceeding 1m below concrete soffits

m 167

Class 4 uPVC pipes

- G 25mm Diameter pipe chased into wall

m 37

- H 25mm Diameter pipe

m 87

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Extra over uPVC pipes for fittings

A	25mm Bend	No	28
B	25mm Access bend	No	2
C	25mm Junction	No	1
D	40mm Bend	No	6
E	40mm Inspection Bend	No	3
F	110-40mm Reducer	No	3
G	110mm Bend	No	5
H	110mm Junction	No	1
J	110mm Inspection bend	No	1
K	110mm Pan connector	No	1
L	100mm ABC cleaning eye in end of pipe	No	3

"Grundfos MDG.09.3.2 " pumps

M	Submersible sewage pumping plant complete with two pumps, each to deliver 3.4 litres per second at 5m head, associated pipework, including duckfoot bends, two 110mm non-return valves, two isolation valves, manifold to connect to 110mm rising main and with controls housed in a wall mounted, indoor, steel panel which includes the level control switches and alarms for extra high level and motor trip	No	1
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Connections to main

N	Cut into 160mm external sewerage drain (by others) and connect to new	No	1
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WATER SUPPLY
**Class II hard drawn copper pipes in roofs, ceiling voids,
etc including supports**

A	22mm Pipes	m	37
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B	28mm Pipes	m	110
---	------------	---	-----

**Class II hard drawn copper pipes chased in walls, etc
including supports**

C	15mm Pipes	m	8
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**Extra over class II copper pipes for solvent welded
fittings**

D	15mm Fittings	No	18
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E	22mm Fittings	No	5
---	---------------	----	---

F	28mm Fittings	No	5
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TAPS, VALVES, ETC TO COPPER PIPES
Brass

G	15mm Stopcock	No	2
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ELECTRIC WATER HEATERS

"ZIP"

A 2.5 litre Hydroboil (code: 380001)

No

1

"Kwikot"

B 10 litre Prisma classique electrical water heaters (Code: FPRX-10-UB)

No

1

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Plumbing and drainage

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Previously painted plastered exterior surfaces

Prepare all surfaces including brushing down areas of mould, fungus and damp and treating with two coats of anti fungal wash. Rinse thoroughly to remove all traces of chemicals and allow to dry completely

Paint on plaster surfaces Wall & All to existing water based coated exterior cement plaster.

Remove loose and peeling paint back to a firm edge by scraping, sanding or other suitable means. Feather the edges with 100 grit sandpaper and ensure surface is dust free.

Remove surface contaminants using Sugar Soap solution - 500g Sugar Soap Powder dissolved in 5 litres water, or Sugar Soap Liquid. For stubborn contaminants use hot water in the above mix and a bristle broom or scrubbing brush. Rinse with tap water to remove all traces of sugar soap and allow to dry.

Ensure surfaces are clean, dry and sound. Moisture content not more than 8% measured on a Doser Hygrometer BD2 scale (or equivalent) before painting. Apply Plaster Primer (UC 56) or Professional Plaster Primer (PP 700) to bare and repaired areas. Allow 16 hours to dry. Finish with two coats of Wall & All (WAA) with 2 hours drying time between coats, for a maintenance cycle of 6 years in a C3 - industrial environment.

On existing external face brick surfaces

Water jet surfaces with high pressure low volume water jetting lance to remove all loose dirt, brush down and wash to remove surface contamination, brush down areas of mould, fungus and damp and treat with two coats of anti fungal wash

On existing unpainted sheet metal roof covering

Water jet surface with high pressure low volume water jetting lance to remove all dirt, brush down and wash to remove surface contamination, brush down areas of mould, fungus and damp and treating with two coats of anti fungal wash

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Paintwork

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Previously painted metal surfaces

Prepare surfaces and remove all loose material, dust, grease, salts and contamination with Degreaser, and rinse. Apply one coat Galvanised Iron Primer, one coat Universal Undercoat, two coats Super Universal Enamel paint on new exterior galvanised steel surfaces. Colour to later specification.

Previously painted or varnished wood surfaces

All surfaces shall be stripped of all old paint, old varnish, etc., using scrapers, wire wool, paint remover and sanding. bleach any blackening using oxalic solution scrubbed with wire wool. Rinse thoroughly to remove all traces of chemicals and allow to dry

Colours

Unless otherwise described all paintwork shall be deemed to have a colour value in excess of 7 on the Munsell system in accordance with SANS 1091

PAINTWORK, ETC TO NEW WORK

ON PLASTER, ETC

Prepare, stop and apply one coat Plascon Professional Plaster Primer and two coats Plascon Wall & All sheen paint, in accordance with the manufacturer's specifications, to

A External plastered walls and columns

m2

31

ON FLOATED PLASTER

Clean down, prepare and apply one coat "Plascon Acrylic Filler" primer, stop with "Mendall 90", sand and touch up with "Plascon Acrylic Filler" and two coats "Plascon Double Velvet" sheen paint as per manufacturer's specification

B On internal walls

m2

574

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Paintwork

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ON SMOOTH CONCRETE SURFACES

Prepare, stop and apply one coat Plascon Gehopon 7 Sealer (GW7) and two coats of Plascon Gehopon 3000 WB (GW3000), in accordance with the manufacturer's specifications, to

A	On floors and landings	m2	197
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Prepare, stop and apply one coat "Dulux Duracoat M371-2000" masonry paint and two coats "Dulux D175-Line" acrylic-pva paint, in accordance with the manufacturer's specifications, to

B	Ceilings and beams	m2	501
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C	Walls and columns	m2	56
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ON PLASTERBOARD

Prepare, stop and apply one coat "Dulux Duracoat M371-2000" masonry paint and two coats "Dulux D175-Line" acrylic-pva paint, in accordance with the manufacturer's specifications, to

D	On partitions	m2	225
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E	Ceilings and cornices	m2	38
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ON METAL

Prepare and apply one coat alkyd based universal undercoat and one coat superior quality universal enamel paint, on work in sound condition, in accordance with the manufacturer's specifications, to

F	Rails, bars, pipes, etc not exceeding 300mm girth	m	1 306
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G	Rails, bars, pipes, etc exceeding 300mm girth	m2	74
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Prepare and apply one coat universal undercoat and two coats eggshell enamel paint, on galvanised steel, on work in sound condition, in accordance with the manufacturer's specifications, to

H	On roof sheeting	m2	152
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 Paintwork
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ON WOOD

Prepare and apply one coat "Plascon Pink" wood primer, one coat "Dulux" universal undercoat and two coats "Plascon Velvagio Satin Enamel" paint, in accordance with the manufacturer's specifications, to

A	On doors	m2	27
B	On door frames, etc	m2	1

Prepare, stop and apply one coats "Woodcoat Suede Matt" wood varnish followed by two coats "Woodcoat Suede Matt" wood varnish, in accordance with the manufacturer's specifications, to

C	Skirtings, rails, etc not exceeding 300mm girth	m	75
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Prepare, stop and apply one coats "Dulux woodgard" timbasheen eggshel wood varnish diluted 10-15% with mineral turpentine, followed by two coats "Dulux woodgard" timbasheen matt wood varnish, in accordance with the manufacturer's specifications, to

D	Skirtings, rails, etc not exceeding 300mm girth	m	159
---	---	---	-----

ON FAIR FACED BRICKWORK

Prepare, stop and apply one coat appropriate primer and two coats "Plascon Professional Double Velvet" sheen paint, in accordance with the manufacturer's specifications, to

E	On internal walls	m2	2 260
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ON FIBRE CEMENT

Prepare, stop and apply one coat "Plascon Plaster Primer" and two coats "Plascon Velvagio Satin Enamel" paint, in accordance with the manufacturer's specifications, to

F	Window sills, etc	m2	1
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PAINTWORK ETC TO PREVIOUSLY PAINTED WORK
ON INTERNAL FLOATED PLASTER SURFACES

Clean down, prepare, stop and apply one coat appropriate Bonding liquid, two coats "Plascon VIP Plastic PVA" paint, in accordance with the manufacturer's specifications, to

A	Ceilings and beams	m2	5 850
B	On internal walls	m2	2 092

ON METAL

Clean down, prepare, stop and apply one coat "Galvogrip Calcium Plumbate" primer, one coat universal undercoat and two coats "Plascon Super Gloss" enamel paint, in accordance with the manufacturer's specifications, to

C	Windows with burglar bars	m2	327
D	Gates, grilles, burglar screens, balustrades, etc (Measured over the full flat area)	m2	113

ON WOOD

Clean down, prepare, stop and apply one coat "Plascon Pink" wood primer with stop touch up where necessary and apply one coat universal undercoat and two coats "Plascon Velvagio Satin" enamel paint, in accordance with the manufacturer's specifications, to

E	On doors	m2	15
F	On door frames, etc	m2	2

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 Paintwork
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SIGNWRITING

Clean down, prepare and apply one coat "Plascon Acrylic Filler" primer, stop with "Mendall 90", sand and touch up with "Plascon Acrylic Filler" and two coats "Plascon Double Velvet" sheen paint, in accordance with the manufacturer's specifications, to

A Numeral or letter 400 x 400mm high

No

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Paintwork
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Paintwork

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Paintwork
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PART C3:
SCOPE OF WORKS

C3.1

Drawing List

The following drawings have been issued with and form part of the Bills of Quantities. In order to obviate lengthy descriptions, references have been made in certain items within the Bills of Quantities to particular drawings by reference to the drawing number. In these cases the relevant drawing/s shall be taken and read in conjunction with the bill item/s concerned and the rates and prices shall include for providing all labour, materials, equipment, services and for performing all operations required for the complete installation of the item described and as shown on the

The following drawings are issued with and form part of this tender:

DRAWING NAME	DRAWING NO.	REVISION
1 - ARCHITECT'S DRAWINGS:		
Drawings		
Ground Storey Plan	3062-Arc-001	5
Demolition plan	3062-Arc-002	3
Long Elevational section	3062-Arc-003	1
Floor finish plan	3062-Arc-004	-
Plans / Elevation	3062-Arc-SEC1	4
Section / Details	3062-Arc-SEC2	4
Door / Window / Sanitary / Finish	3062-Arc-SEC3	3
Door Schedule	3062-Arc-401	1
Door Schedule	3062-Arc-402	1
Door Schedule	3062-Arc-403	1
Door Schedule	3062-Arc-404	1
Door Schedule	3062-Arc-405	1
Door Schedule	3062-Arc-406	1
Door Schedule	3062-Arc-407	1
Door Schedule	3062-Arc-408	1
Door Schedule	3062-Arc-409	1
Window Schedule	3062-Arc-501	-
Gate Schedule	3062-Arc-601	3
Gate Schedule	3062-Arc-602	3
Gate Schedule	3062-Arc-603	3
Gate Schedule	3062-Arc-605	2
Joinery Schedule	3062-Arc-801	1
Joinery Schedule	3062-Arc-802	1
Joinery Schedule	3062-Arc-803	1
Joinery Schedule	3062-Arc-804	1
Joinery Details	3062-Arc-JD/801	1
Joinery Details	3062-Arc-JD/802	1
Joinery Details	3062-Arc-JD/803	1
Joinery Details	3062-Arc-JD/804	1
Joinery Details	3062-Arc-JD/805	1
Joinery Details	3062-Arc-JD/806	1
Joinery Details	3062-Arc-JD/807	1
Joinery Details	3062-Arc-JD/808	1

Architects Drawings Continued		
Joinery Details	3062-Arc-JD/809	1
Joinery Details	3062-Arc-JD/810	1
Ground Storey Plan - Proposed Sewerage Route	3062-Arc-001	-
Typical System Including Stone Ballast	-	-
Architects Schedules		
Sanitary Schedule	-	-
Finishing Schedule - NEW SECURITY OFFICE / OFFICES RENOVATION	-	-
Finishing Schedule - EXISTING WAREHOUSE BUILDING	-	-

2 - STRUCTURAL ENGINEER'S DRAWINGS

General Notes	S-00	A
Security Office Details	S-01	A
Warehouse Floors & Ring Beams	S-02	C
Tank Base Details	S-03	B

3 - ELECTRICAL ENGINEER'S DRAWINGS

Lighting Layout	6352/E/01	-
Power Layout	6352/E/02	-
Fire Detection and Public Address Layout	6352/FD/01	-
Schematic Diagram	6352/E/SCH/01	-
Schematic Diagram	6352/E/SCH/02	-
Schematic Diagram	6352/E/SCH/03	-
SDB Network Diagram	6352/E/SCH/04	-

4 - MECHANICAL ENGINEER'S DRAWINGS

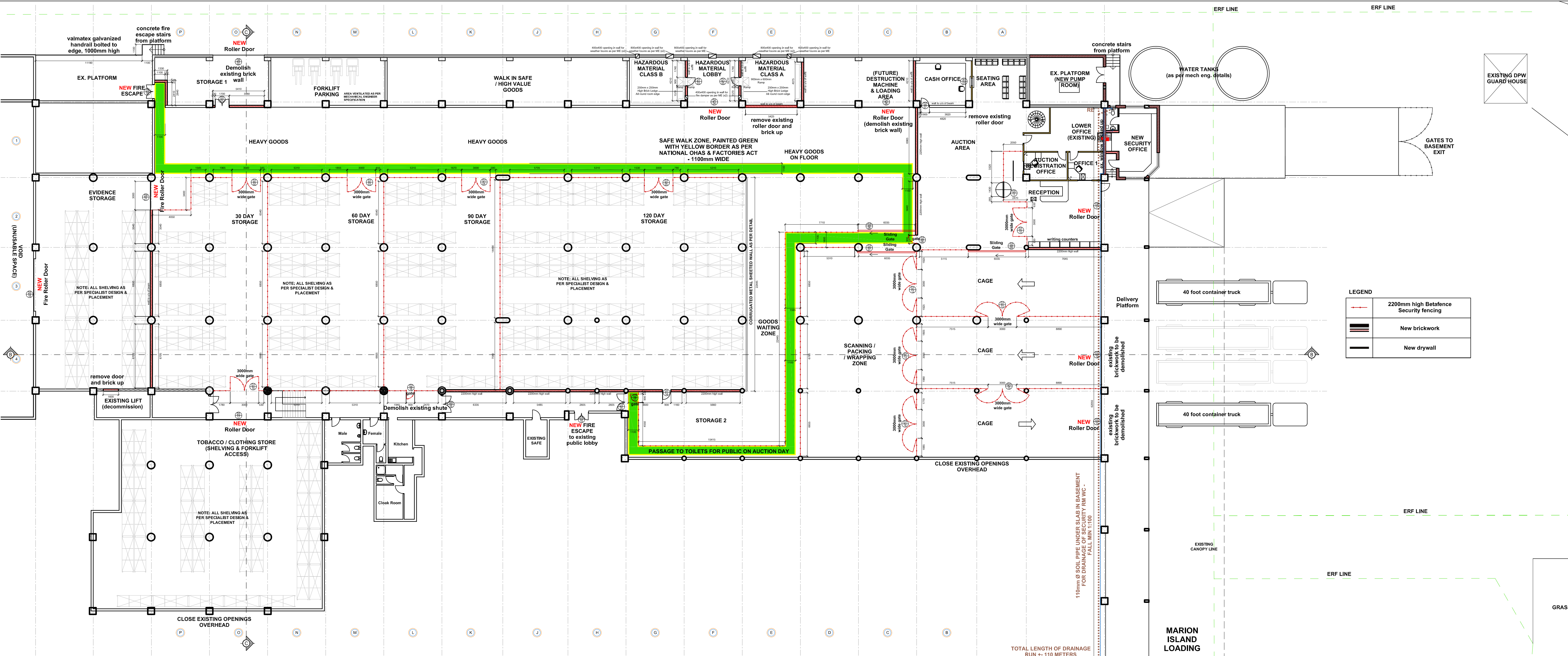
Ground Floor Warehouse Layout Smoke Ventilation Details	2190315-HVAC-02	1
Ground Floor Hazardous Material Storage Ventilation	2190315-HVAC-03	0
Ground Floor Office HVAC Layout & Sections	2190315-HVAC-04	0

5 - FIRE ENGINEER'S DRAWINGS

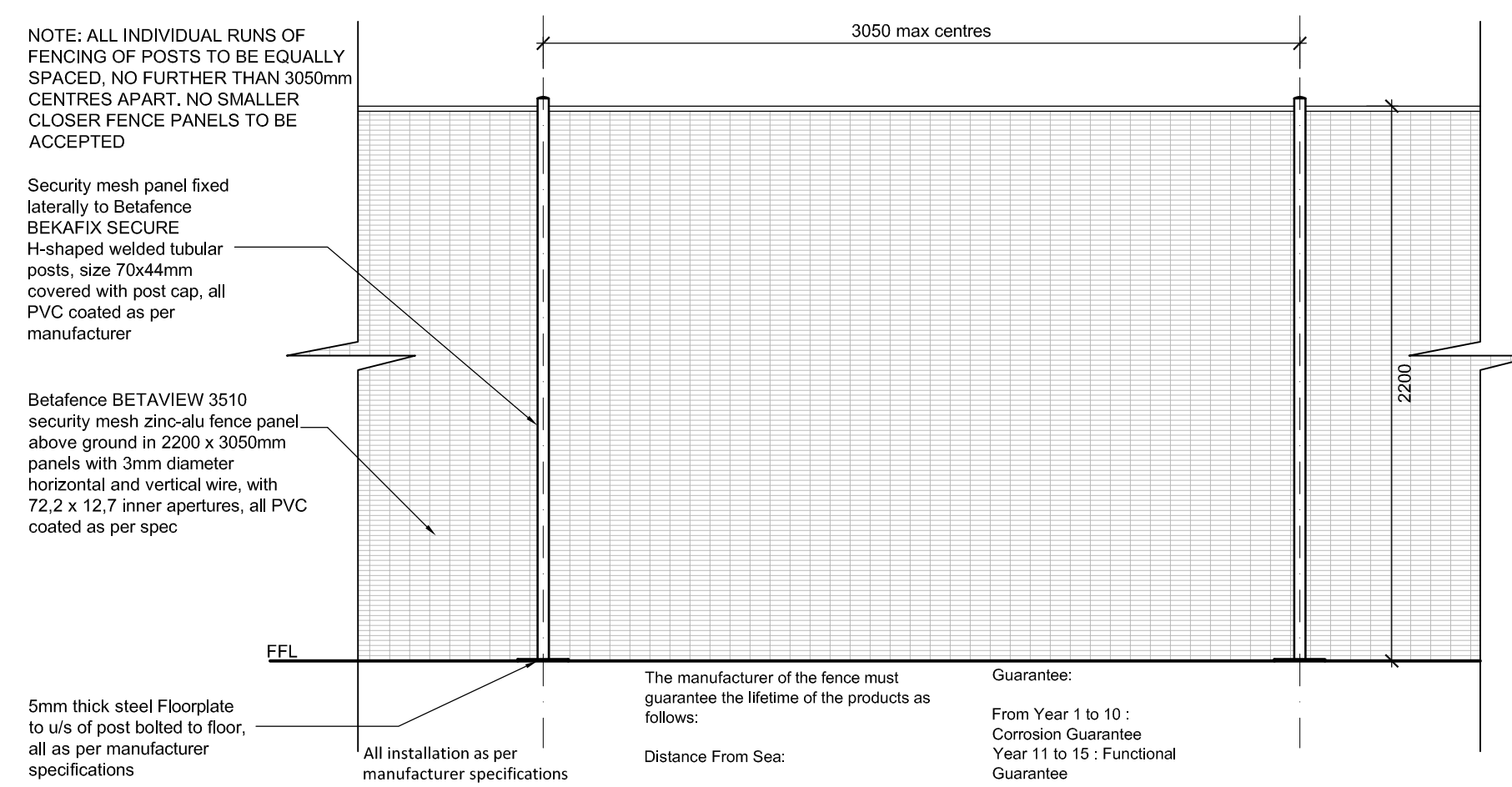
Fire Plan	6352/F/01	-
Roof Level & Ceiling Sprinkler Layout	6352/S/01	-
In-Rack Sprinkler Layout	6352/S/02	-

C3.2

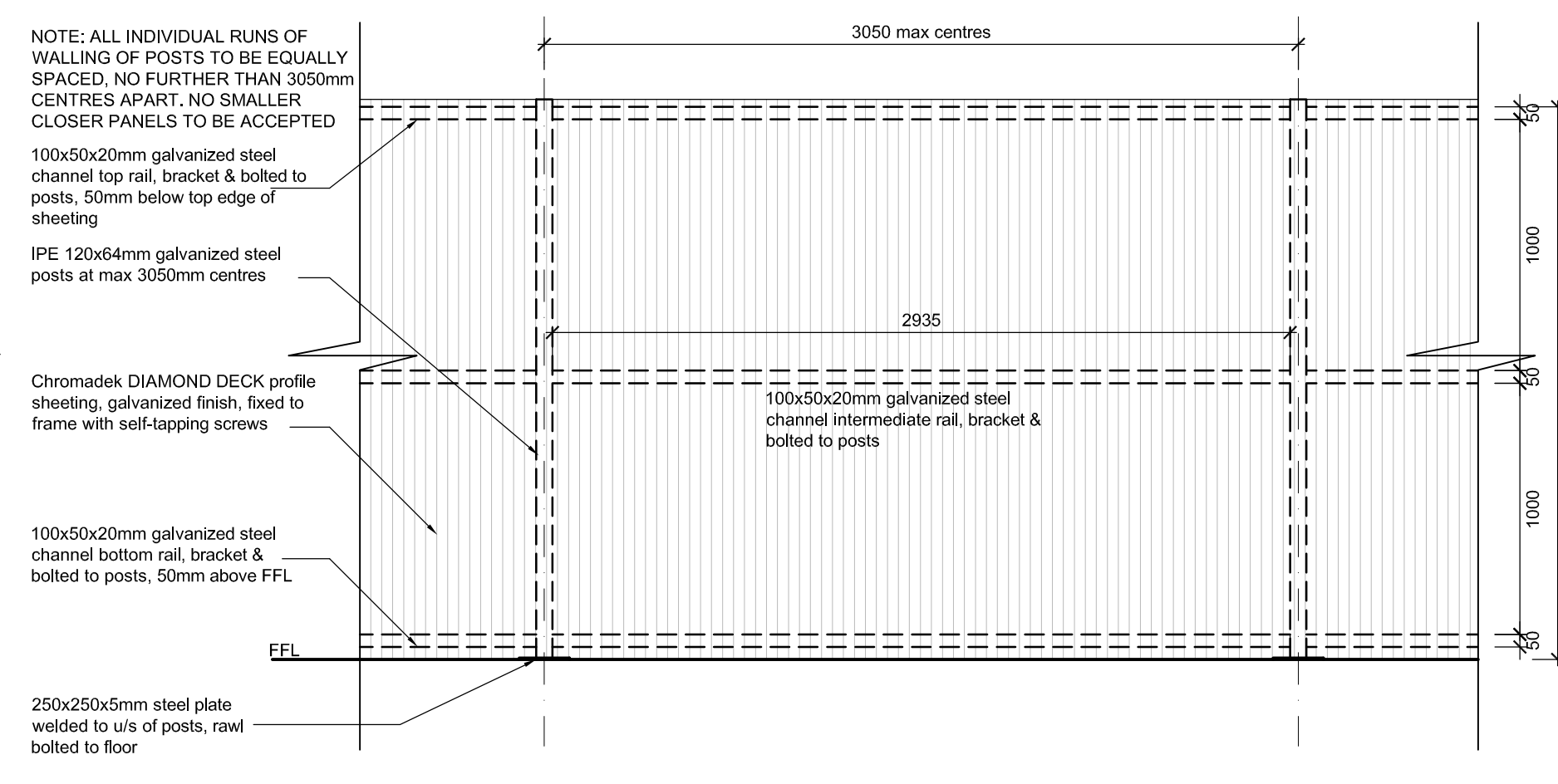
Architect's Drawings



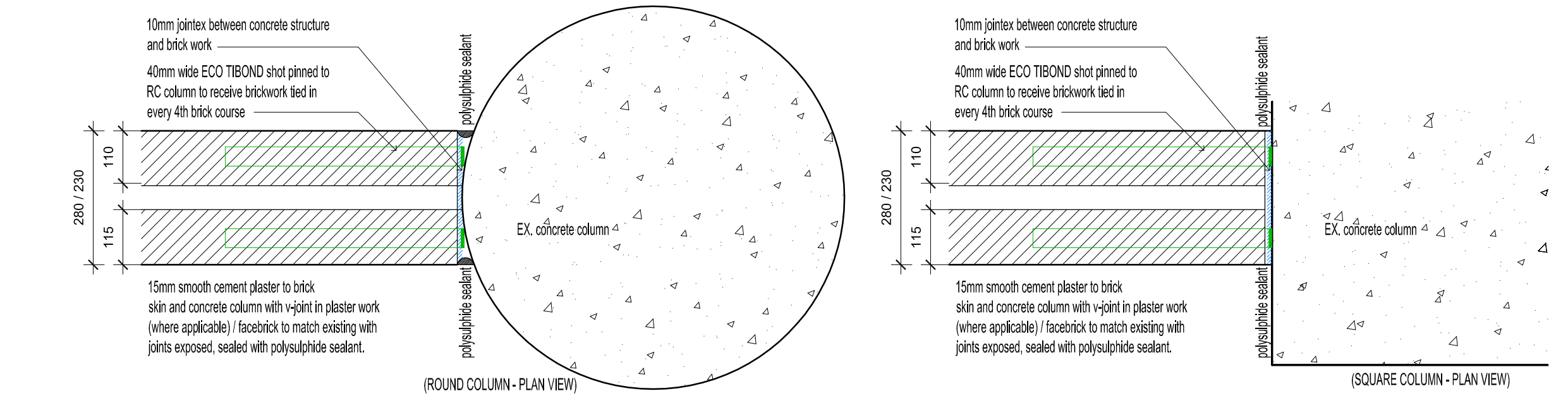
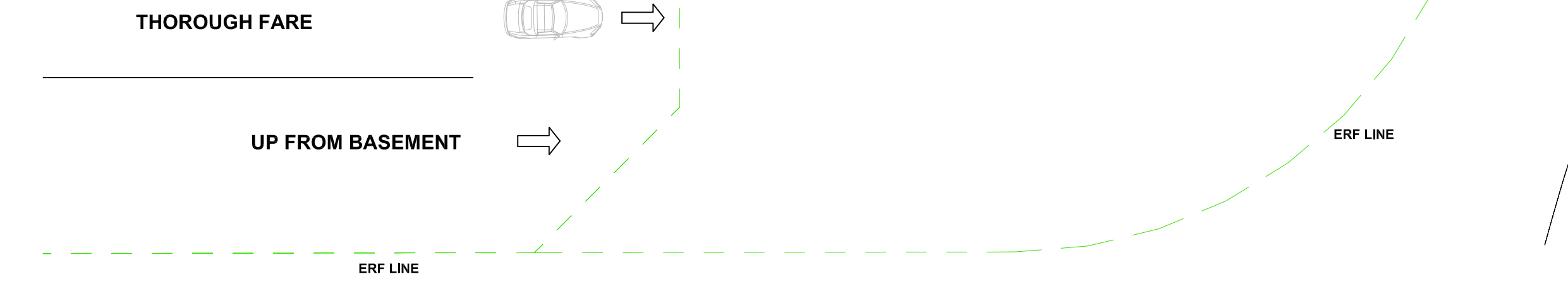
WAREHOUSE GROUND STOREY PLAN
SCALE 1:200



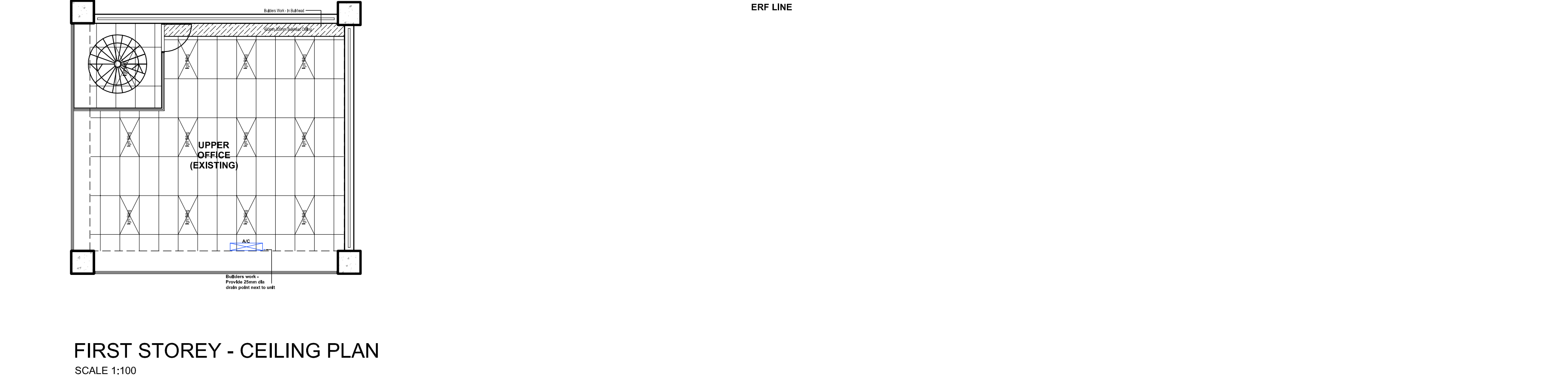
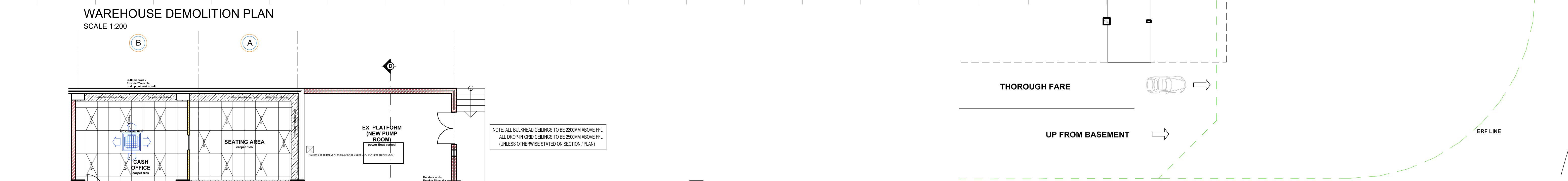
TYPICAL INTERNAL FENCE SECTIONAL ELEVATION
SCALE 1:25

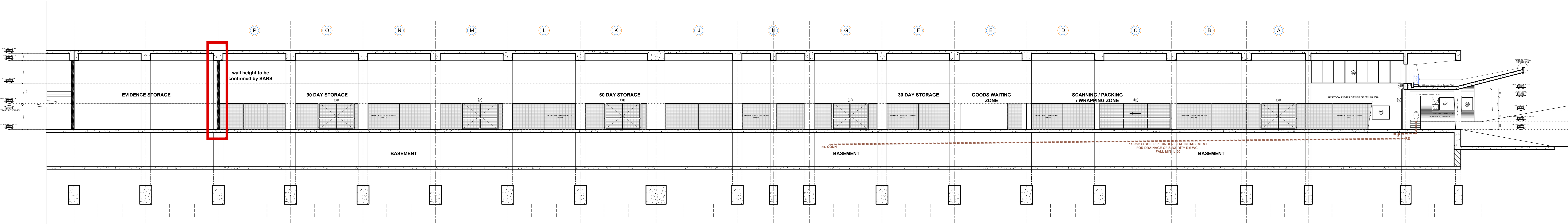


TYPICAL SHEETED WALL SECTIONAL ELEVATION
SCALE 1:25

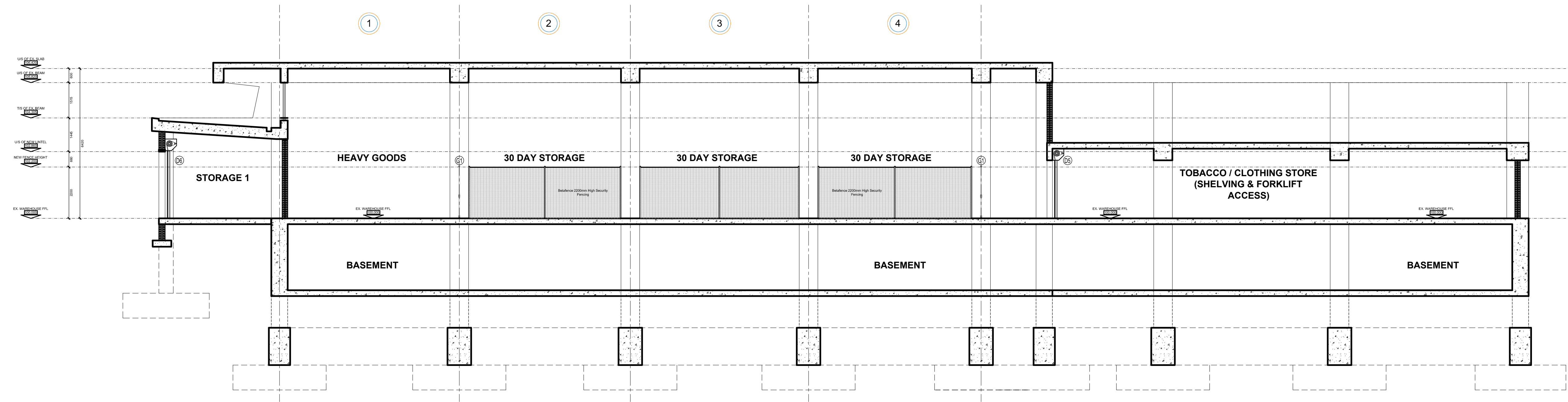


TYPICAL BRICKWORK TO COLUMN JOINT DETAIL
SCALE 1:10

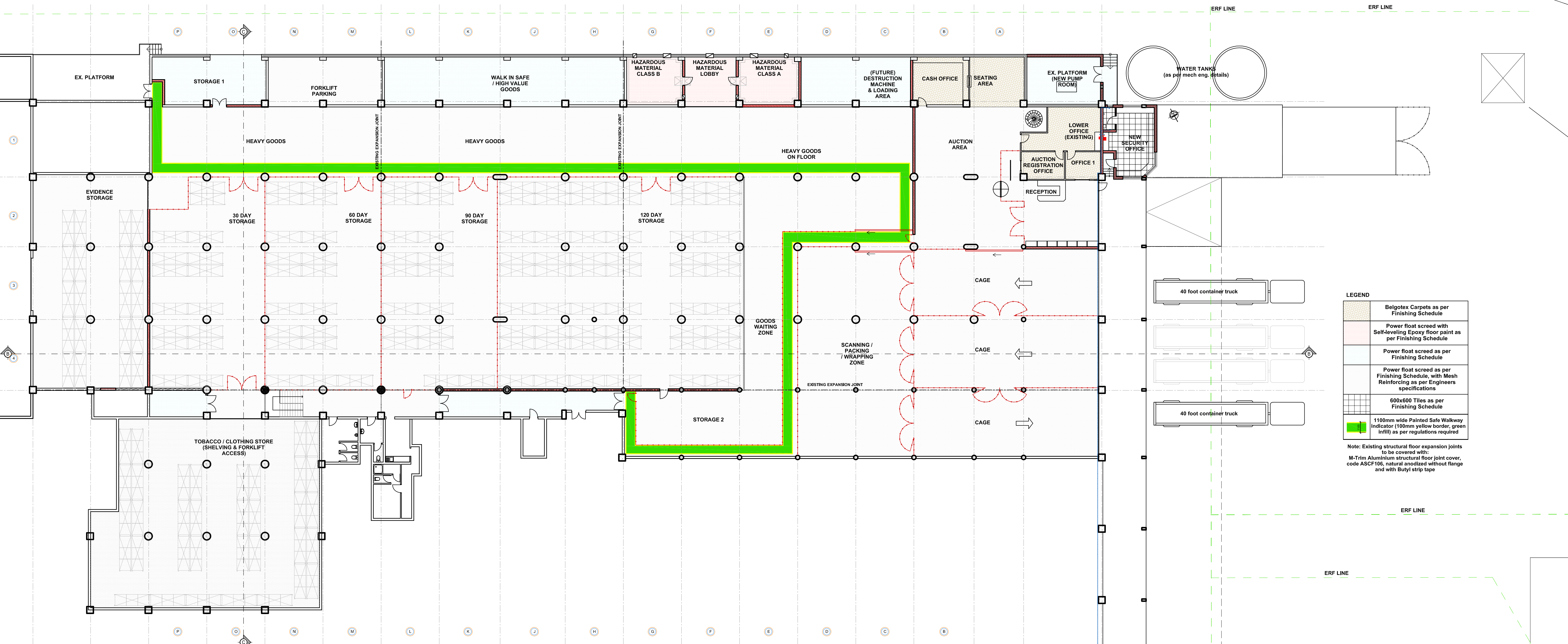




SECTION BB
SCALE 1:100



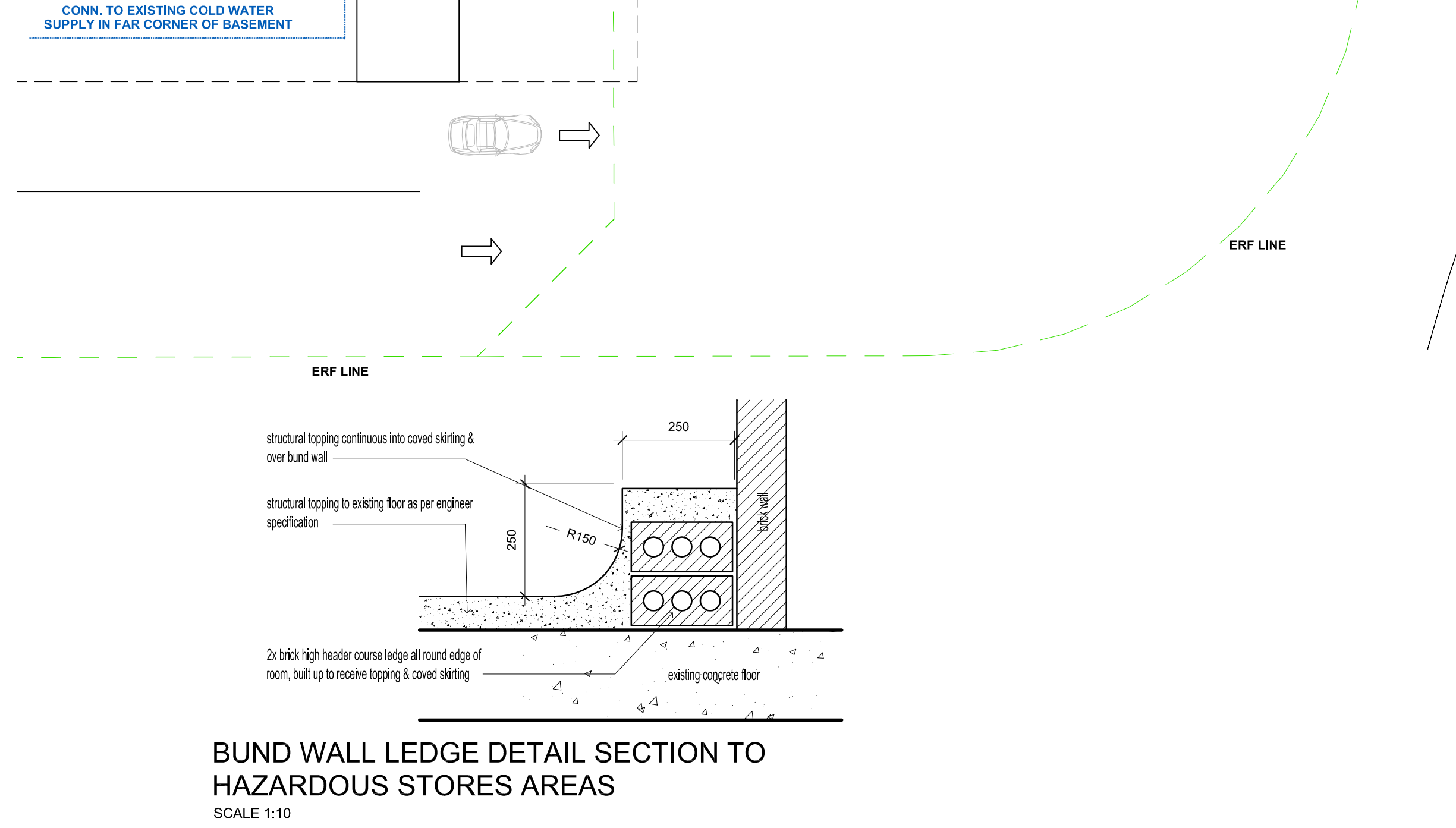
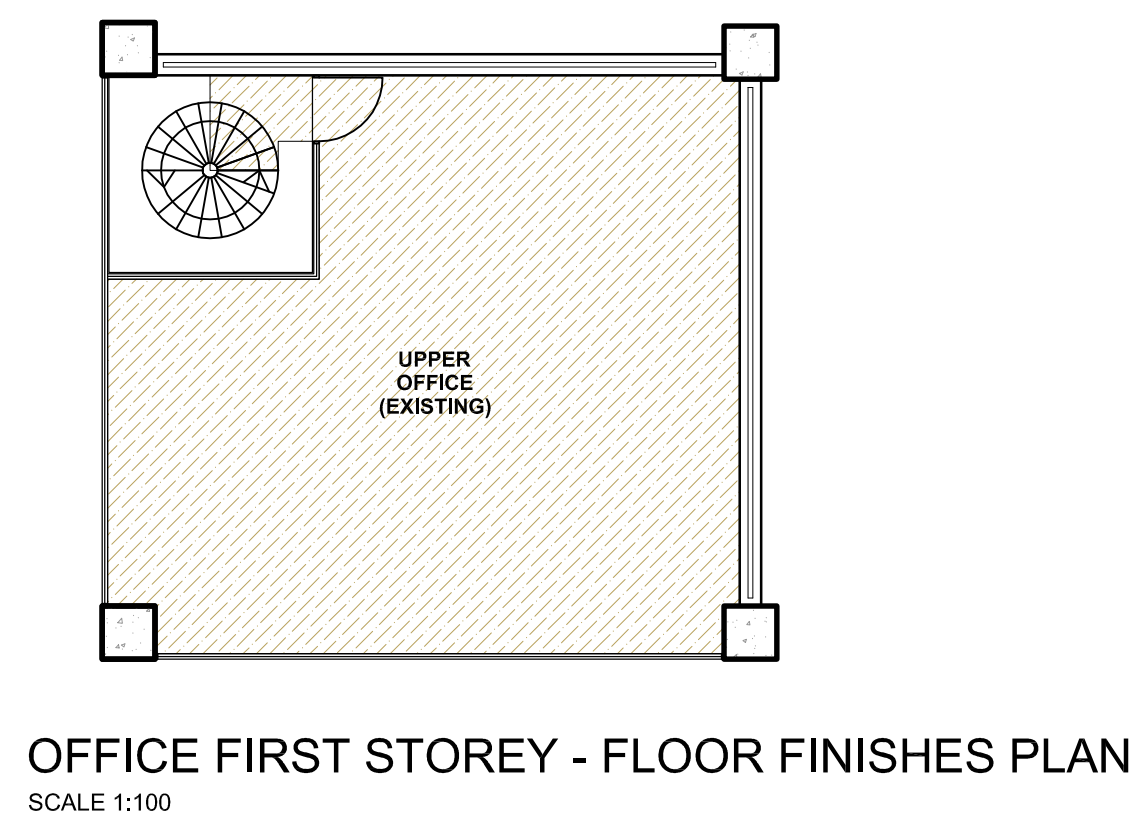
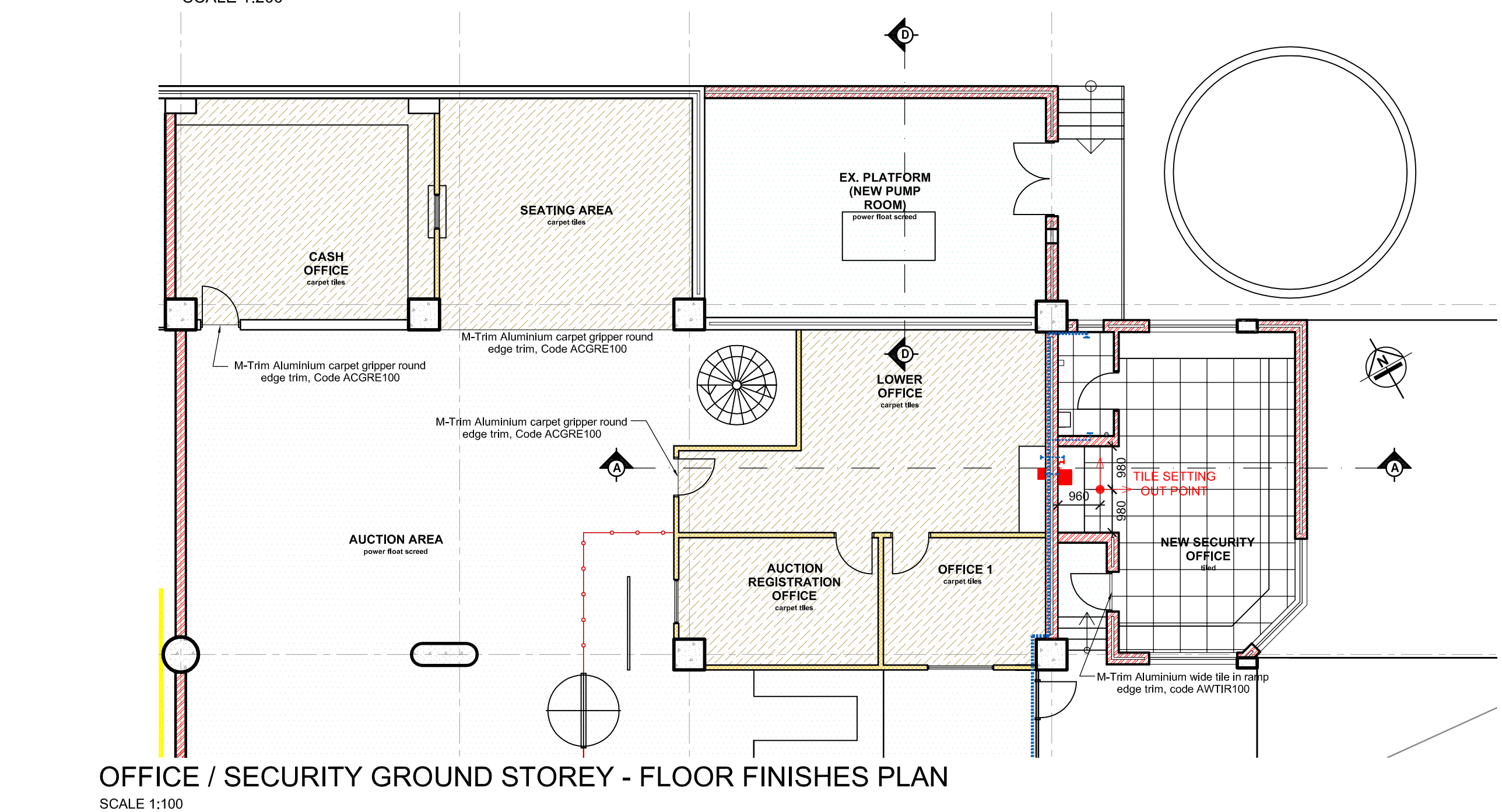
SECTION CC
SCALE 1:100

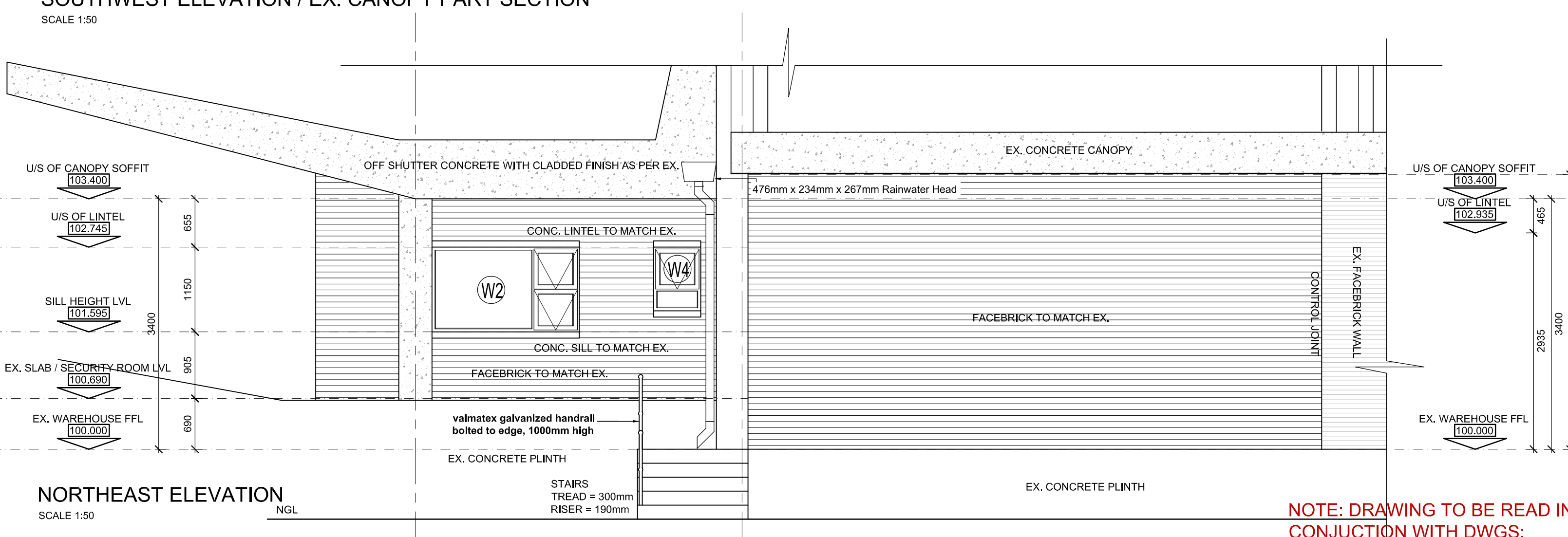
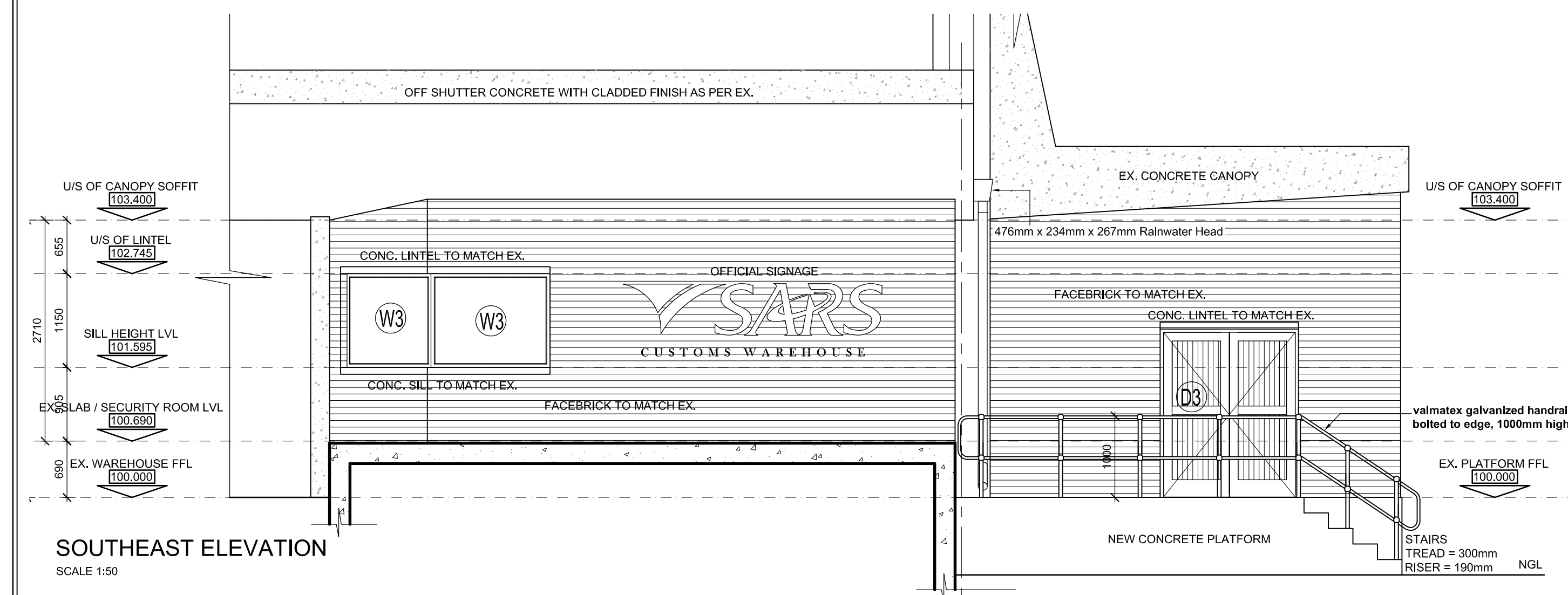
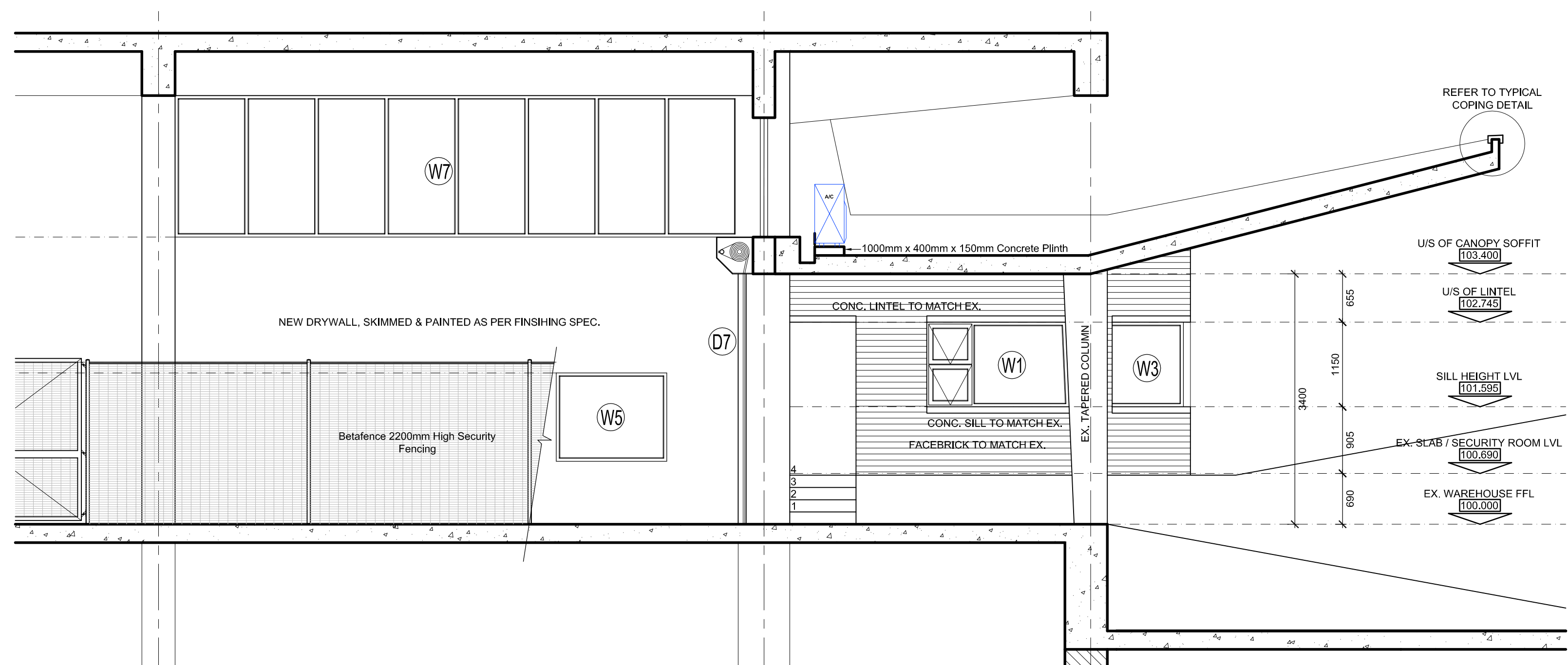
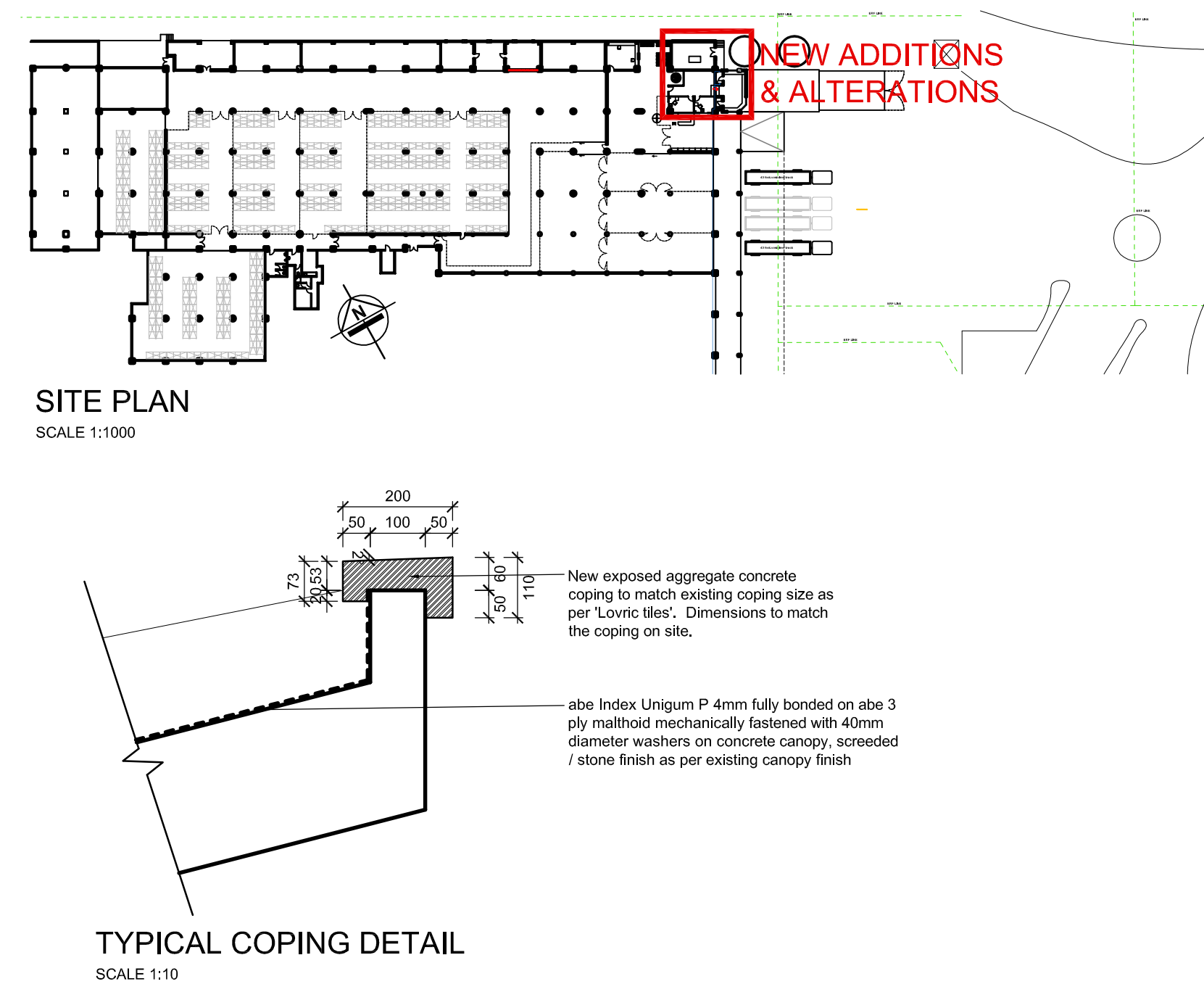
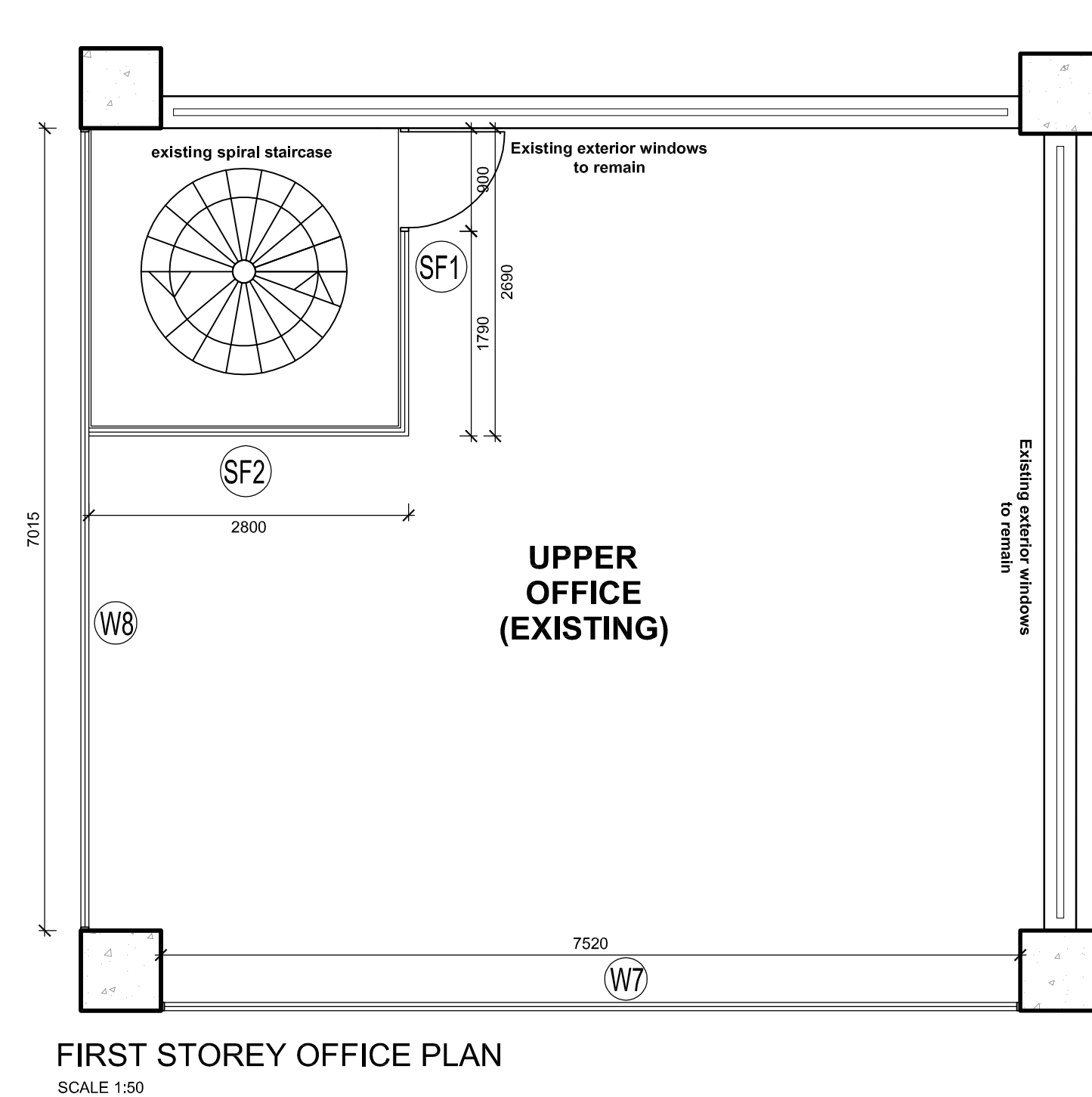
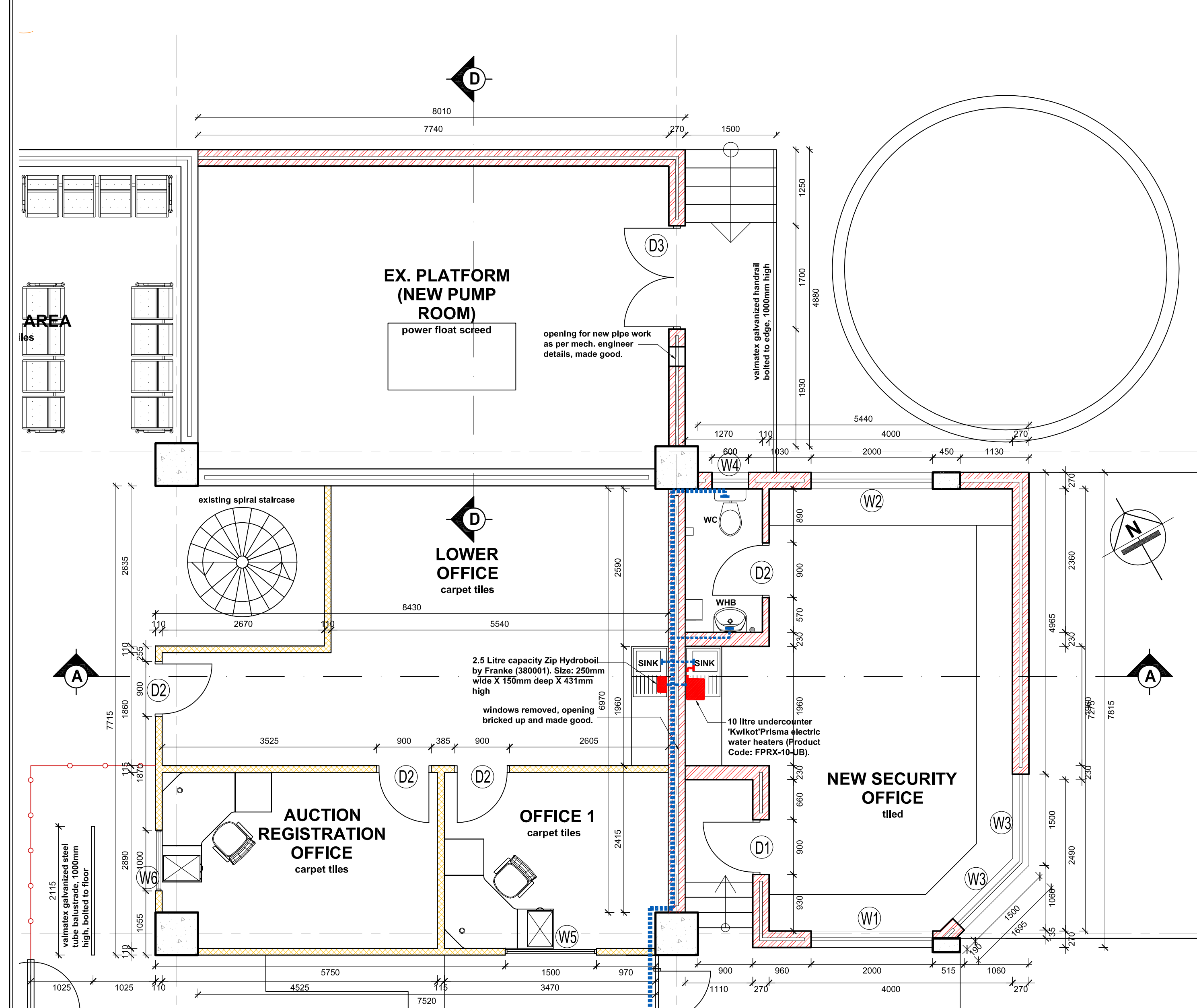


LEGEND

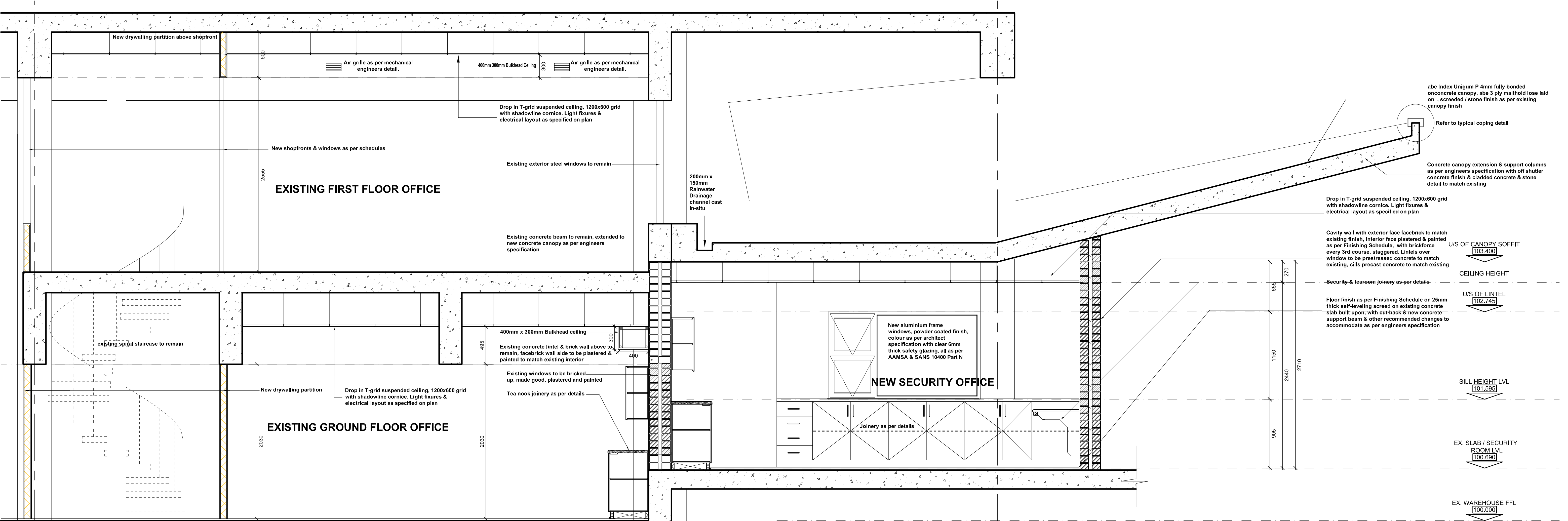
	Belgotex Carpets as per Finishing Schedule
	Power float screed with Self-leveling Epoxy floor paint as per Finishing Schedule
	Power float screed as per Finishing Schedule
	Power float screed as per Finishing Schedule, with Mesh Reinforcing as per Engineers specifications
	600x600 Tiles as per Finishing Schedule
	1100mm wide Painted Safe Walkway Indicator (100mm yellow border, green infill) as per regulations required

Note: Existing structural floor expansion joints to be covered with:
M-Trim Aluminium structural floor joint cover, code ASCF106, natural anodized without flange and with Butyl strip tape



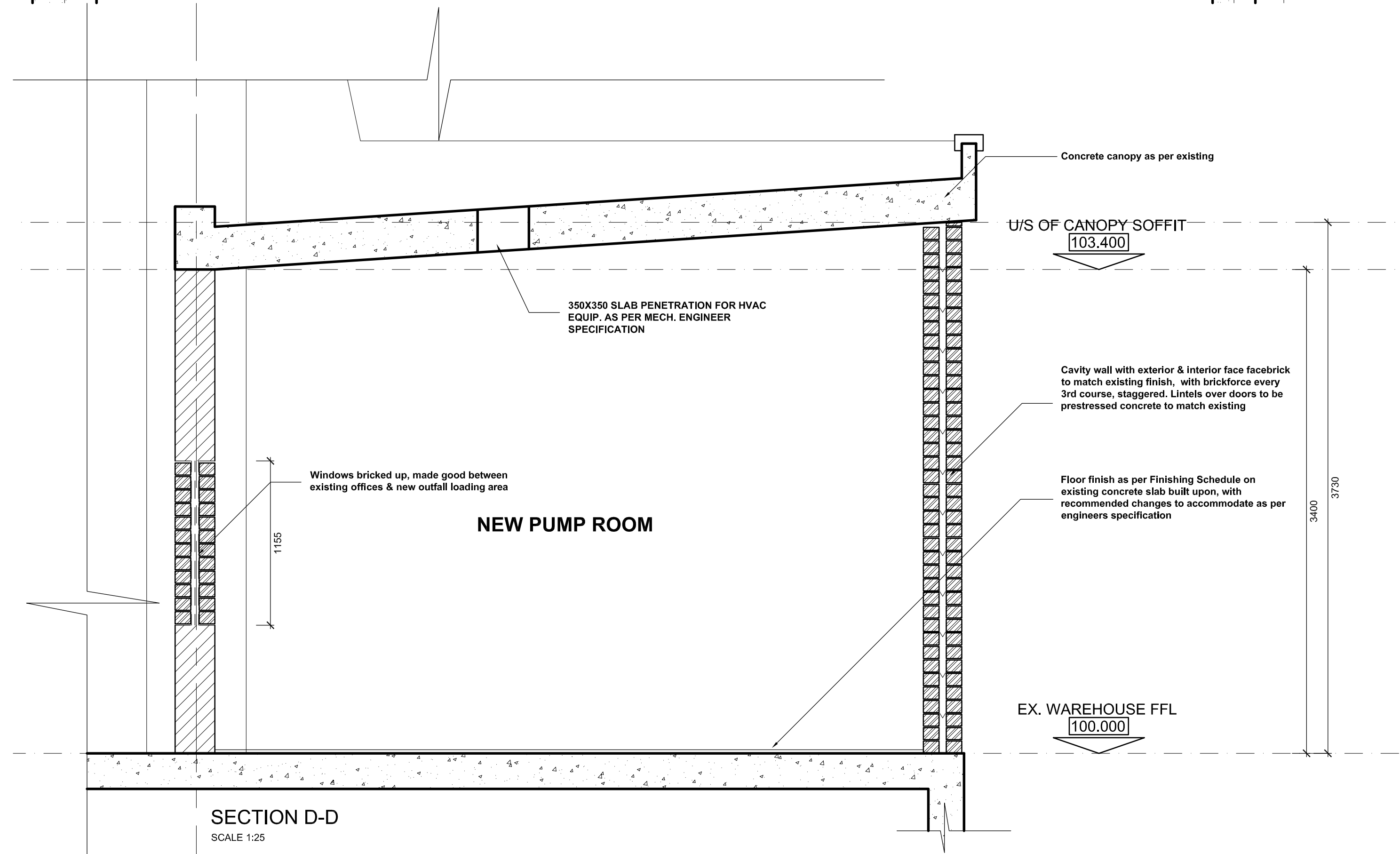


NOTE: DRAWING TO BE READ IN CONJUNCTION WITH DWGS: 3062-Arc-SEC2 & 3062-Arc-SEC3

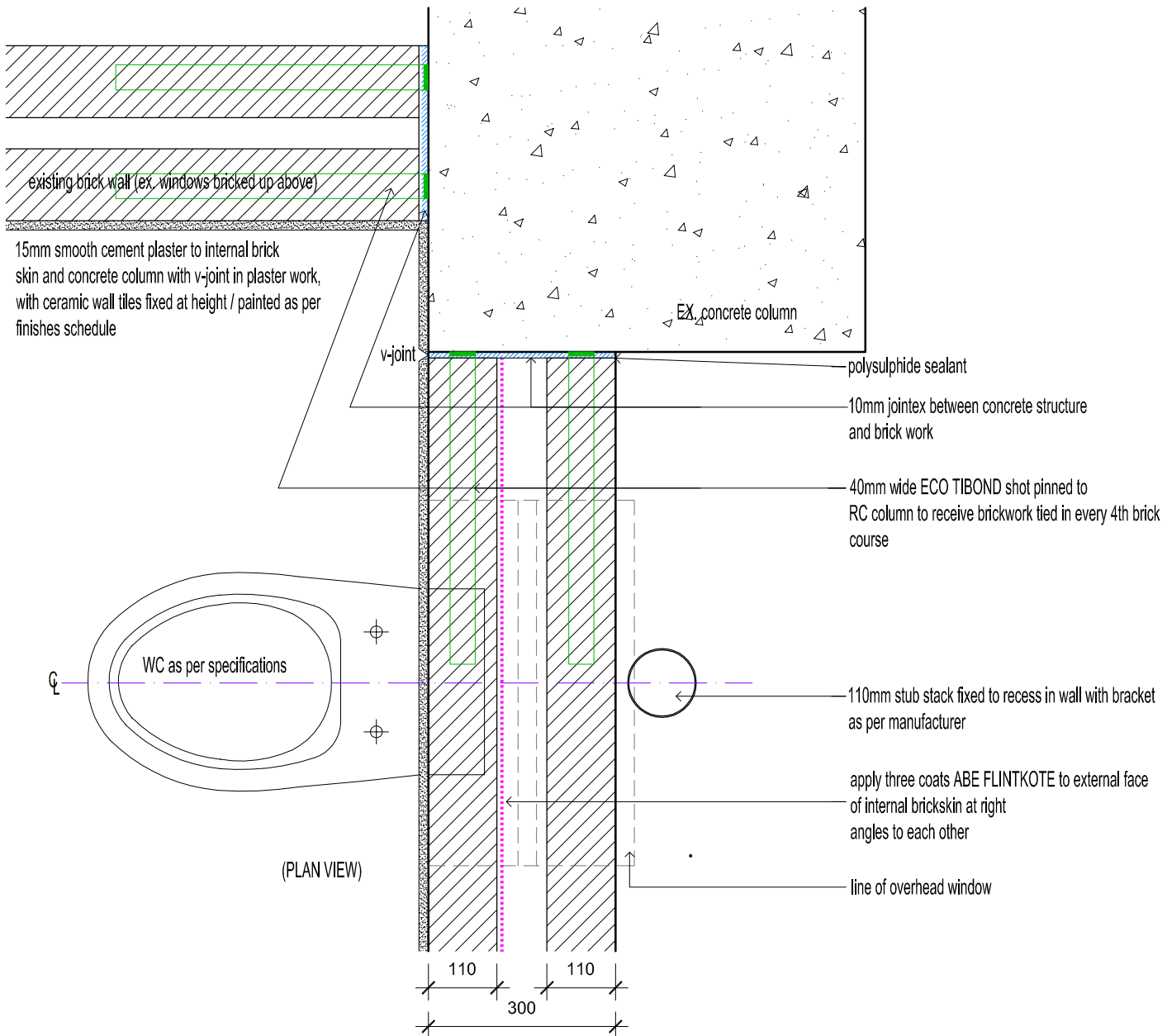


SECTION A-A
SCALE 1:25

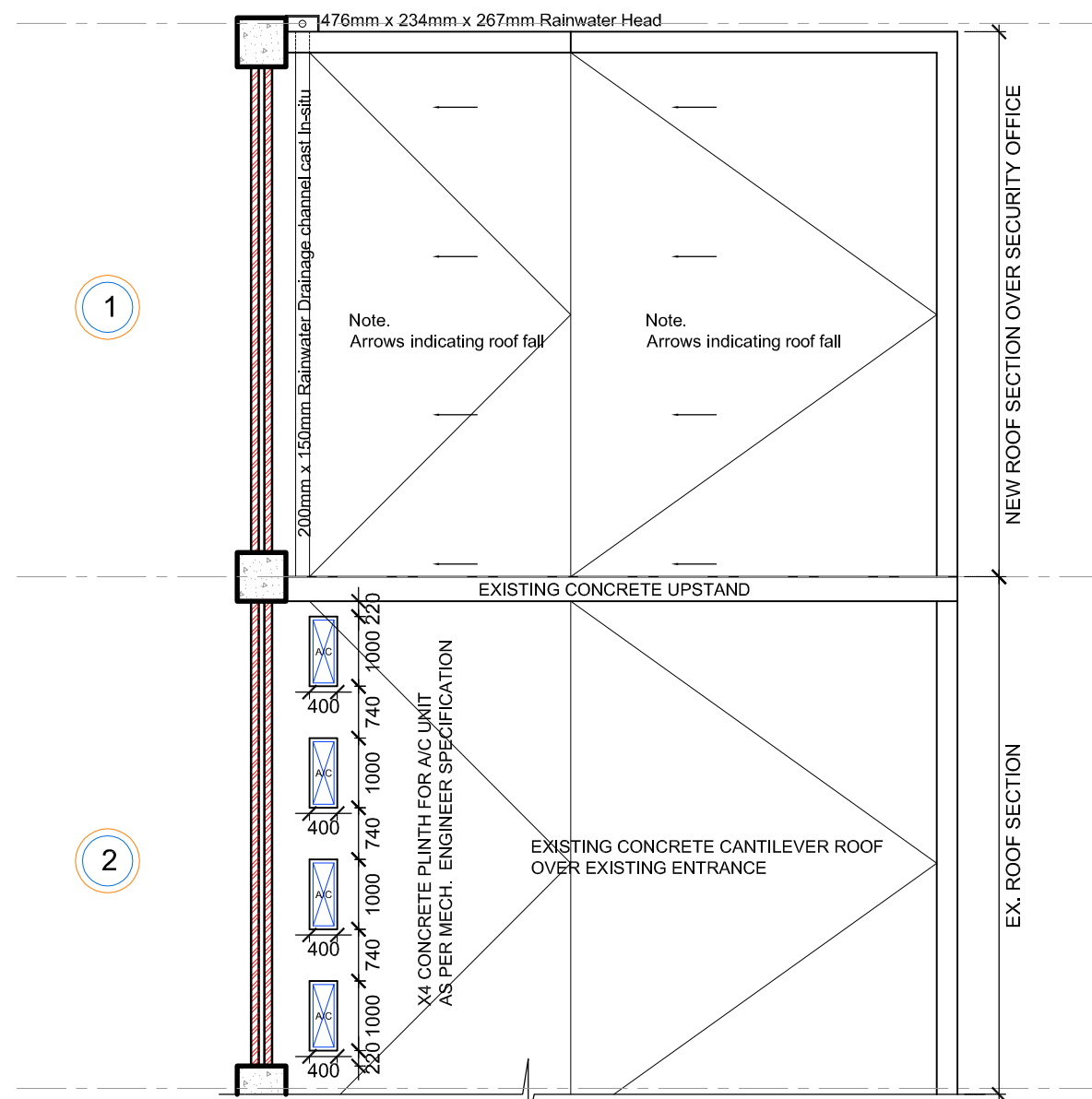
BASEMENT LEVEL - VEHICLE RAMP ENTRANCE



SECTION D-D
SCALE 1:25

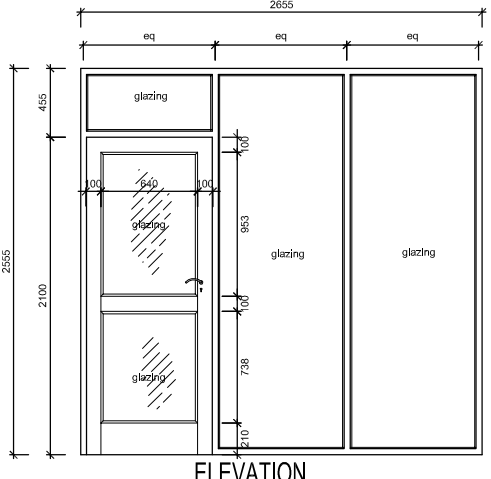
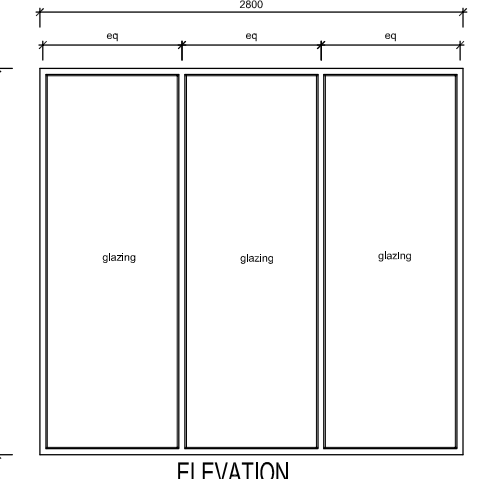


WC BUILD DETAIL AT EX. COLUMN
SCALE 1:10



SECURITY OFFICE
ROOF PLAN
SCALE 1:100

NOTE: DRAWING TO BE READ IN
CONJUNCTION WITH DWGS:
3062-Arc-SEC1 & 3062-Arc-SEC3

DOOR TYPE		DOOR TYPE	
SF1	 <p>ironmongery to door</p> <p>Fabricator to ensure upright sections used are of sufficient width to accept lock specified. 50mm R4 Type Styles are recommended.</p> <p>1.5 pair - HMP H090 100x44 sinkless centre leaf hinges 1.0 pair - DORMA SH810 solid SS lever handles with Euro cylinder escutcheon to match, 1.0 each - DORMA D036S euro-profile cylinder sash lock SS 1.0 each - Dorma DDC106501 nickel plated 65mm ten pin euro-profile grand masterkeyed double cylinder 1.0 each - DORMA TS73V EN Z-4 variable spring strength regular arm door closer</p>	SF2	
frame size	1455 x 1150mm	frame size	1455 x 1150mm
glazing quantity	6,5mm Laminated Safety Clear glazing to fixed and opening sections as required. 01	glazing quantity	6,5mm Laminated Safety Clear glazing to fixed and opening sections as required. 01
finish	Natural Anodized	finish	Natural Anodized

Purpose made aluminium window frames, with pane sizes as shown with opening sections, complying with AAAMSA performance criteria A0, glazed in accordance with SANS 10160, SANS 10137, SANS 10400 (Part N of Section 3), fitted with clip-on glazing beads with gasket seals with lugs plugged and screwed to brickwork, all in accordance with AAAMSA Selection Guide for Glazed Aluminium Architectural Aluminium Products - June 2004.

FINISHES SCHEDULE

NOTE: DRAWING TO BE READ IN
CONJUNCTION WITH DWGS:
3062-Arc-SEC1 & 3062-Arc-SEC2

BNM
ARCHITECTS
PROJECT MANAGERS

114 park drive, central, pe, 6001
box 12576, centrahill, port elizabeth, 6006

ck 2001/043172/72
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 82 891 5163
email bnmpe@bnm.co.za
web www.bnm.co.za

GREEN BUILDING COUNCIL
OF SOUTH AFRICA

structural engineer
mechanical engineer
electrical engineer

<div>project details</div> <div>SARS WAREHOUSE CAPE TOWN</div>	building	
	WAREHOUSE SECURITY / OFFICES / PUMP ROOM	
	client	project number
	SARS	3062

revisions		
date	rev	description
-	-	-

The contractor is to verify all dimensions on site before commencing any part of the work. Errors, discrepancies or omissions are to be reported for clarification.

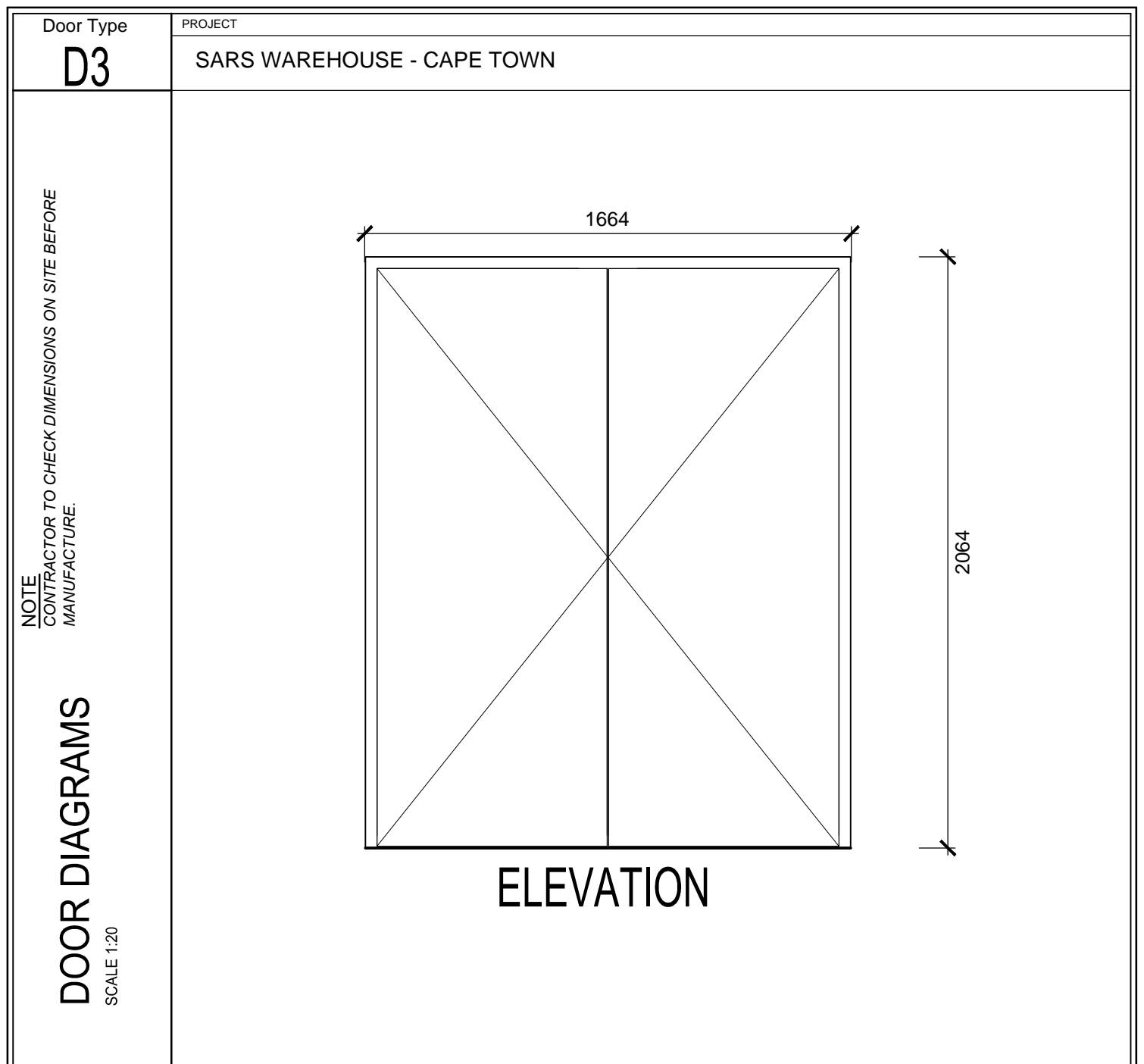
registered owner signature
architects signature

drawing name			
DOOR / WINDOW / SANITARY / FINISH			
drawn	checked	scale	date
WC	JOHANN CRONJE SACAP 4515 PROF. ARCH.	AS SHOWN	14/07/2015


drawing number	rev
3062-Arc-SEC3	3

Door Type D1	PROJECT SARS WAREHOUSE - CAPE TOWN
<div>NOTE CONTRACTOR TO CHECK DIMENSIONS ON SITE BEFORE MANUFACTURE.</div> <div>DOOR DIAGRAMS SCALE 1:20</div>	
frame	BITCON INDUSTRIES Class B single rebated grade 316 stainless steel (painted finish) frame supplied and installed by manufacturer as per manufacturer's specifications and details
door	Class D rebated single door (850 x 2032mm) to be supplied and installed by manufacturer as per manufacturer's specifications and details.
quantity	3
door no	03, 05, 14
glazing	no glazing
finish	As per manufacturer specification
ironmongery	4.5 pair – DORMA DBB-SS-009 102x75x3mm stainless steel two ball bearing butt hinge- 4.0 pair – DORMA SH840 solid SS lever handle with Euro cylinder escutcheon to match- 1.0 each – DORMA D036S euro profile cylinder sash lock SS 1.0 each – Dorma DDC106501 nickel plated 65mm ten pin euro profile grand master keyed double cylinder 1.0 each – DORMA TS73V EN 2-4 variable spring strength regular arm door closer

Door Type D2	PROJECT SARS WAREHOUSE - CAPE TOWN	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">NOTE CONTRACTOR TO CHECK DIMENSIONS ON SITE BEFORE MANUFACTURE.</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">DOOR DIAGRAMS</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">SCALE 1:20</p>	<p style="text-align: center;">ELEVATION</p> <p style="text-align: center;">PLAN</p>	
	<p>900</p> <p>2064</p> <p>19mm timber quadrant each side</p> <p>brick wall</p> <p>900</p> <p>Door grille as per mechanical engineers detail.</p>	
	<p>frame</p> <p>70x104mm Rebated wrot meranti hardwood door frame, no cill</p>	
	<p>door</p> <p>Hardboard horizontal grooved Heavy Duty 813 x 2032 Solid Core.</p>	
	<p>quantity</p> <p>1</p>	
<p>door no</p> <p>07</p>		
<p>glazing</p> <p>no glazing</p>		
<p>finish</p> <p>Apply one (1) coat Plascon Pink Wood Primer (ALL ROUND). Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.</p>		
<p>ironmongery</p> <p>1.0 pair - DORMA DBB-SS-009 102x75x3mm stainless steel two ball bearing butt hinge 1.0 pair - DORMA SH810 solid SS lever handle with Euro cylinder escutcheon to match. 1.0 each - DORMA D036S euro-profile cylinder sash lock SS 1.0 each - Dorma DDC106501 nickel plated 65mm ten pin euro-profile grand master-keyed double cylinder 1.0 only - DJW Concealed Fixing Rubber Doorstop fitted to Floor. Colour White</p>		



frame	<i>BITCON INDUSTRIES</i> Class B single-rebated grade 316 stainless steel (painted finish) frame supplied and installed by manufacturer as per manufacturer's specifications and details
door	Class D rebated meeting styles double doors (1612 x 2032mm) to be supplied and installed by manufacturer as per manufacturer's specifications and details.
quantity	5
door no	01, 15, 16, 19, 20
finish	As per manufacturer specification
ironmongery	3.0 pair - DORMA DBB-SS-009 102x75x3mm stainless steel two ball bearing butt hinge 2.0 sets - DORMA PHA 2000 series 2 point (top and bottom) locking panic bolt with cross bar for door leaf up to 1000mm wide, maximum door height 2270mm. 1.0 each - DORMA PHT 3901 external fire escape access with lever handle 1.0 each - Dorma DSC104201 nickel plated 65mm ten pin euro-profile grand master-keyed single cylinder 1.0 each - DORMA DPH301C 150x19mm stainless steel "D" shaped straight bolt through pullhandle. Pull Handle Fitted to Inside as per Architects Instruction 2.0 each - DORMA TS73V EN 2-4 variable spring strength regular arm door closer



BNM

ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

CLIENT


SARS

DRAWING NAME


DOOR
DIAGRAMS

SCALE	DATE	REVISIONS			DRAWING NO	REV
1:20	21 JULY 2015	Date	Rev	Description	403	1
DRAWN	CHECK				BNM REF	
WC	JC				3062	

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po box 12576, centrahil, port elizabeth, 6006

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Door Type D4	PROJECT SARS WAREHOUSE - CAPE TOWN
DOOR DIAGRAMS <small>SCALE 1:20</small>	<div><div>header space</div><div>3400</div><div>5400</div><div>ELEVATION</div></div>
	doorFireproof steel roller shutter door 5400x3400mm high, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
	quantity2
	door no04, 06
	finishNatural anodized finish as per manufacturer



ck2001/043172/23


tel+27 41 585 2125

fax+27 41 582 2127

cell+27 81 271 2606

emailbnmpe@bnm.co.za

webwww.bnm.co.za

GREEN BUILDING COUNCIL

OF SOUTH AFRICA

suite 1 lyndon, 114 park drive, central, pe, 6001

po box 12576, centrahil, port elizabeth, 6006

CLIENT

SARS

DRAWING NAME

DOOR DIAGRAMS

notes

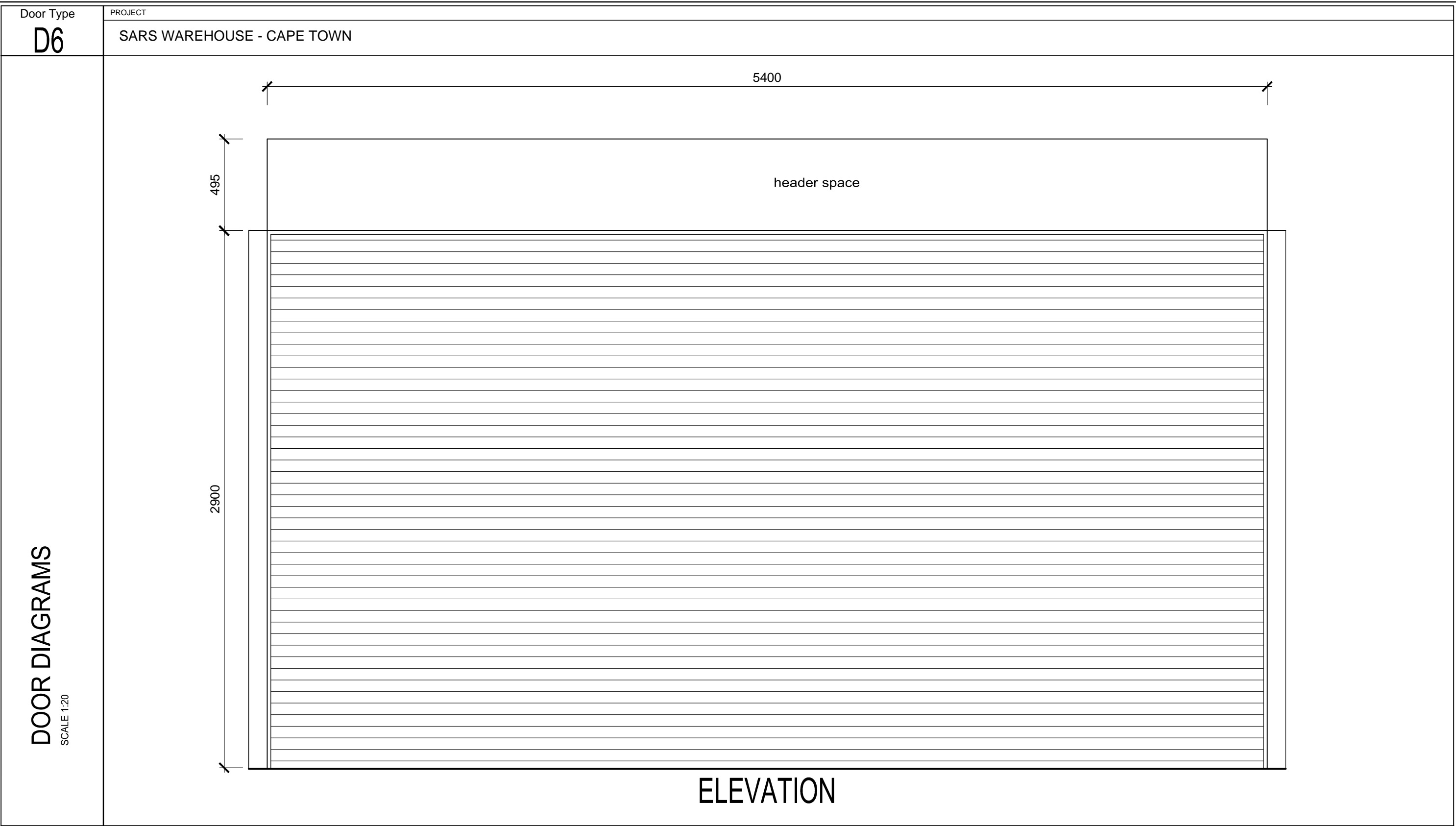
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revisions


date	rev	description
-	-	-

drawing number			revision
No. 404			1
drawn	checked	scale	date
WC	JC	1:20	21-07-2015

Door Type D5	PROJECT SARS WAREHOUSE - CAPE TOWN	
DOOR DIAGRAMS <small>SCALE 1:20</small>	<div><div><div>5400</div><div>header space</div></div><div><div>495</div><div>2490</div></div></div>	
	ELEVATION	
	door	Fireproof steel roller shutter door 5400x2490mm high, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
	quantity	2
	door no	17, 18
finish	Natural anodized finish as per manufacturer	



door	Fireproof steel roller shutter door 5400x2900mm high, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
quantity	1
door no	02
finish	Natural anodized finish as per manufacturer



ck2001/043172/23

tel+27 41 585 2125

fax+27 41 582 2127


cell+27 81 271 2606

emailbnmpe@bnm.co.za

webwww.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001

po box 12576, centrakil, port elizabeth, 6006



CLIENT
SARS

DRAWING NAME
DOOR DIAGRAMS

notes


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revisions

date	rev	description
-	-	-

drawing number			revision
No. 406			1
drawn	checked	scale	date
WC	JC	1:20	21-07-2015

Door Type D7	PROJECT SARS WAREHOUSE - CAPE TOWN	
<div>DOOR DIAGRAMS</div> <div>SCALE 1:20</div>	<div><div>495</div><div>header space</div><div>6670</div><div>3400</div><div>ELEVATION</div></div>	
	door	Fireproof steel roller shutter door 6670x3400mm high, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
	quantity	2
	door no	12, 13
	finish	Natural anodized finish as per manufacturer



ck2001/043172/23


tel+27 41 585 2125

fax+27 41 582 2127

cell+27 81 271 2606

emailbnmpe@bnm.co.za

webwww.bnm.co.za



suite 1 lyndon, 114 park drive, central, pe, 6001

po box 12576, centrahil, port elizabeth, 6006

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DRAWING NAME

DOOR DIAGRAMS

notes


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revisions

date	rev	description
-	-	-

drawing number			revision
No. 407			1
drawn	checked	scale	date
WC	JC	1:20	21-07-2015

Door Type D8	PROJECT SARS WAREHOUSE - CAPE TOWN
DOOR DIAGRAMS SCALE 1:20	<div><div>495</div><div>header space</div><div>6670</div><div>900</div><div>3400</div><div>door</div><div>2100</div></div>
	ELEVATION
	door Fireproof steel roller shutter door 6670x3400mm high with hinged door to RH side of exterior view, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
	quantity 1
	door no 11
finish Natural anodized finish as per manufacturer	



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tel+27 41 585 2125

fax+27 41 582 2127

cell+27 81 271 2606

emailbnmpe@bnm.co.za

webwww.bnm.co.za



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

suite 1 lyndon, 114 park drive, central, pe, 6001

po box 12576, centrakil, port elizabeth, 6006

CLIENT
SARS

DRAWING NAME
DOOR DIAGRAMS

notes

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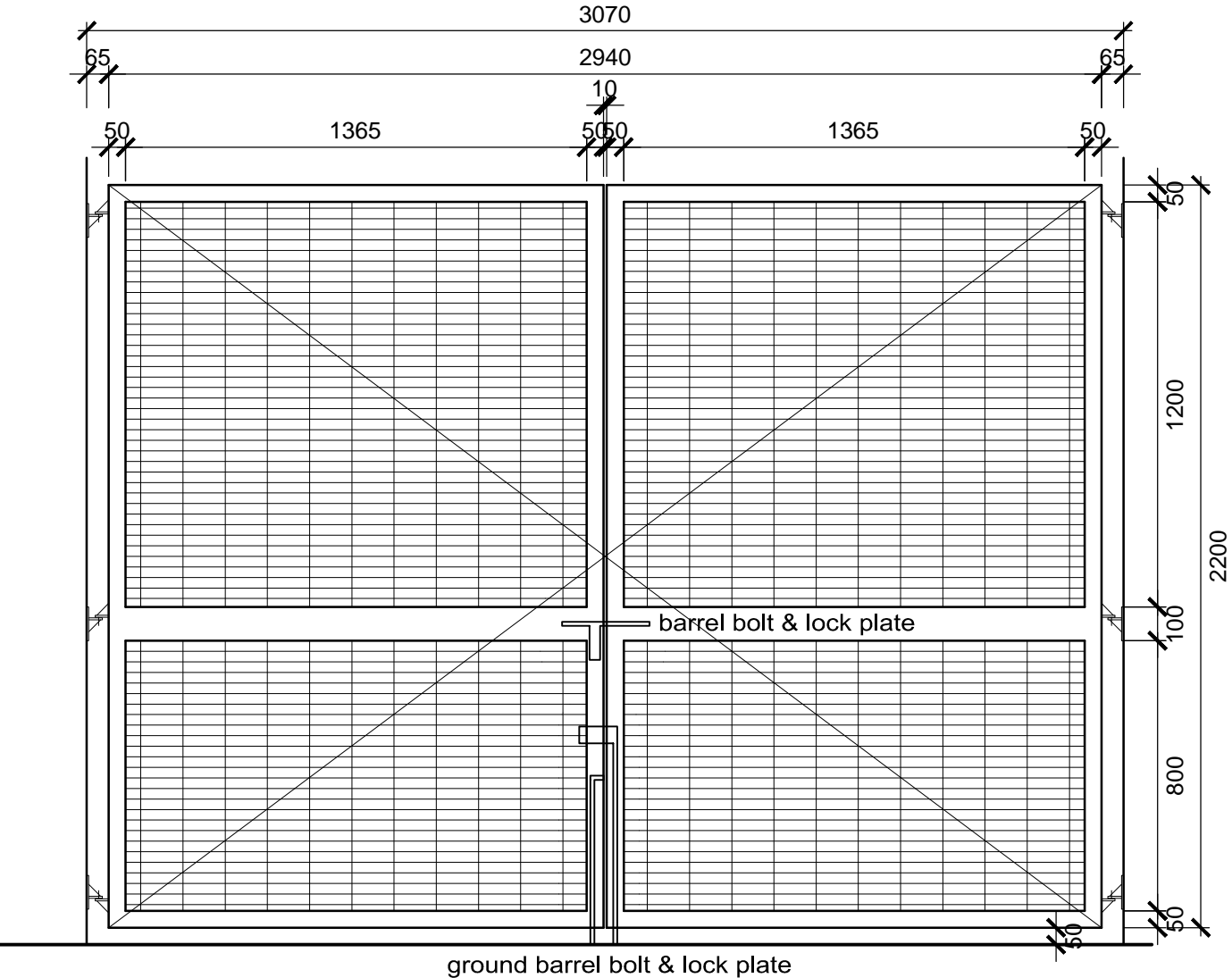
revisions


date	rev	description
-	-	-

drawing number			revision
No. 408			1
drawn	checked	scale	date
WC	JC	1:20	21-07-2015

Door Type D9	PROJECT SARS WAREHOUSE - CAPE TOWN	
DOOR DIAGRAMS <small>SCALE 1:20</small>	<div><div><div>3000</div><div>495</div><div>2490</div><div>header space</div></div><div><div><div>ELEVATION</div></div></div></div>	
	door	Fireproof steel roller shutter door 3000x2490mm high, with hinge-like interconnected galvanized steel profiles, double-skinned 1 mm galvanized steel filled with mineral wool, with header seal as standard with winding shafts welded onto each side for drive, anti-drop device or bearing support
	quantity	1
	door no	21
	finish	Natural anodized finish as per manufacturer

Window Type W1	PROJECT SARS WAREHOUSE - CAPE TOWN
<div>NOTE</div> <div>CONTRACTOR TO CHECK DIMENSIONS ON SITE BEFORE MANUFACTURE.</div> <div>WINDOW DIAGRAMS</div> <div>SCALE 1:20</div>	<p style="text-align: center;">ELEVATION</p>
	<div>frame</div> <div>Purpose made aluminium window frame, size 785 x 1000mm with pay gap at bottom with pane sizes as shown, complying with AAAMSA performance criteria A0, glazed in accordance with SANS 10160, SANS 10137, SANS 10400 (Part N of Section 3), fitted with clip-on glazing beads with gasket seals with lugs plugged and screwed to drywall frame, all in accordance with AAAMSA Selection Guide for Glazed Aluminium Architectural Aluminium Products - June 2004.</div>
	<div>quantity</div> <div>1</div>
	<div>window no</div> <div>01</div>
	<div>glazing</div> <div>8.6mm Laminated Safety Clear glazing to fixed sections as required.</div>
<div>finish</div> <div>Natural anodized</div>	

Gate Type G1	PROJECT SARS WAREHOUSE - CAPE TOWN
GATE DIAGRAMS SCALE 1:20	<div></div> <p>ELEVATION</p>
frame	50x50x3mm galvanized steel frame with100x50x3mm galvanized steel intermediate rail, double leaf gate, overall size 3000 x 2200mm
infill	Betafence security mesh zinc-alu fence panel 3mm diameter horizontal and vertical wire, with 72,2 x 12,7 inner apertures, all PVC coated as per spec manufacturer specification
quantity	11
gate no	02, 03, 04, 05, 10, 12, 13, 14, 15, 16, 19
finish	Galvanized steel finish as per manufacturer



ck2001/043172/23

tel+27 41 585 2125

fax+27 41 582 2127


cell+27 81 271 2606

emailbnmpe@bnm.co.za

webwww.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001

po box 12576, centrail, port elizabeth, 6006



CLIENT
SARS

DRAWING NAME
GATE DIAGRAMS

notes

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revisions

date	rev	description
-	-	-

drawing number			revision
No. 601			3
drawn	checked	scale	date
WC	JC	1:20	24-08-2015

Gate Type

G2

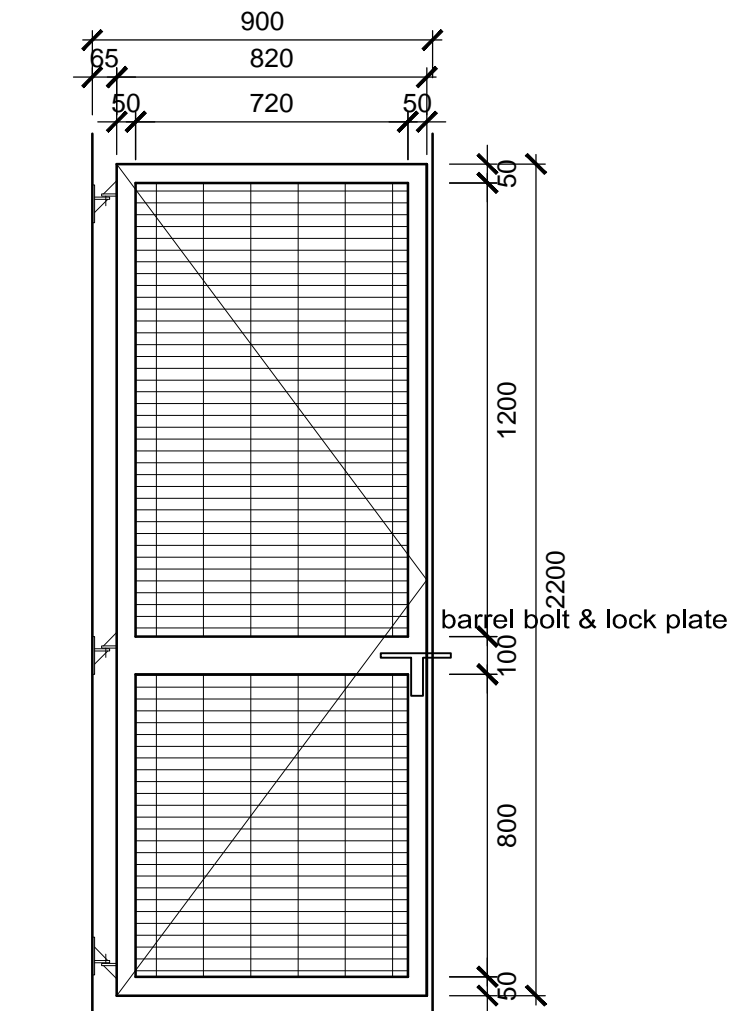
PROJECT

SARS WAREHOUSE - CAPE TOWN

NOTE
CONTRACTOR TO CHECK DIMENSIONS ON SITE BEFORE
MANUFACTURE.

GATE DIAGRAMS

SCALE 1:20



ELEVATION

frame

50x50x3mm galvanized steel frame with 100x50x3mm galvanized steel intermediate rail, overall size 820 x 2200mm

infill

Betafence security mesh zinc-alu fence panel 3mm diameter horizontal and vertical wire, with 72,2 x 12,7 inner apertures, all PVC coated as per spec manufacturer specification

quantity

3

gate no

08, 17, 18

finish

Galvanized steel finish as per manufacturer



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
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CLIENT

SARS

DRAWING NAME

**GATE
DIAGRAMS**

SCALE

1:20

DATE

24 Aug
2015

REVISIONS

Date

Rev

Description

DRAWING NO

602

REV

3

DRAWN

WC

CHECK

JC

BNM REF

3062

Gate Type

G5

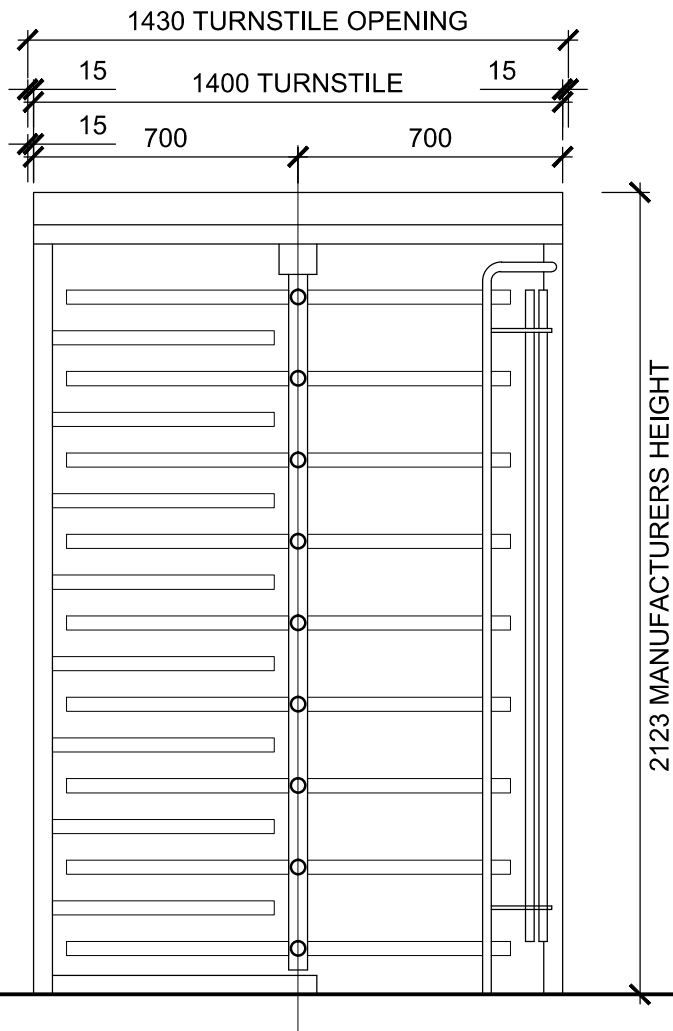
PROJECT

SARS WAREHOUSE - CAPE TOWN

NOTE
CONTRACTOR TO CHECK DIMENSIONS ON SITE BEFORE
MANUFACTURE.

GATE DIAGRAMS

SCALE 1:20



ELEVATION

gate

Stainless steel 'Turnstar Titan' turnstile with gate - TO BE FITTED WITH ELECTRONIC GATE RELEASE WITH ACCESS CONTROL TAGS AS PER ELECTRICAL ENGINEER

quantity

1

gate no

11

finish

Galvanized steel finish as per manufacturer



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

**GATE
DIAGRAMS**

SCALE

1:20

DATE

21 JULY
2015

REVISIONS

Date	Rev	Description
-	-	-

DRAWING NO

605

REV

2

DRAWN

WC

CHECK

JC

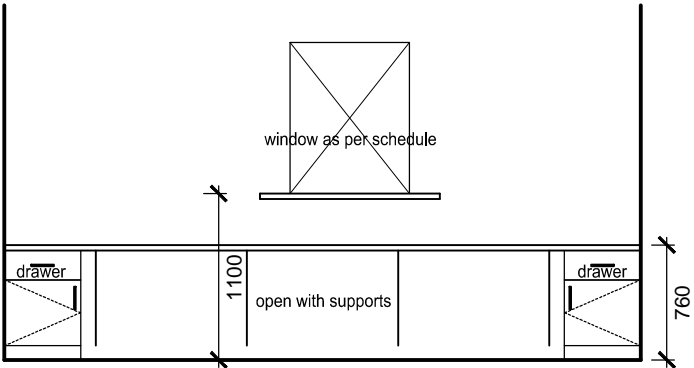
BNM REF

3062

CASH OFFICE

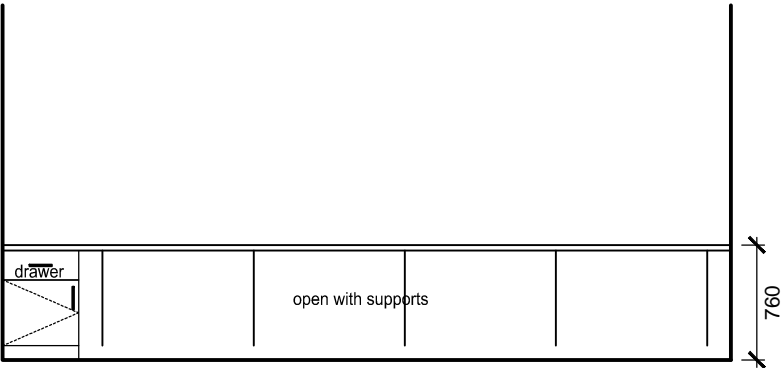
note (where applicable)

- All drawers, cupboard doors & fixed panels to be PG Bison 16mm thick Melawood MFB - Finish as per architect spec. compromising single layer of melamine-impregnated decorative paper, fused under heat and pressure to both sides of a smooth surface Bisonbord particleboard substrate, manufactured in accordance with SANS ISO 1763:1998 and constructed in accordance with the drawings, all with 2mm high impact edging to match colour.
- Countertops: 32mm / 40mm Formica Lifeseal Worktops, width as per detail
- all internal (non exposed) shelves to be of white MELAMINE with 2mm high impact edging, colour to match board. Exposed shelving / cupboard faces to match cupboard doors
- All shelving to be adjustable. Cupboards to be lockable with Union 452-22NP (Nickel Plated) cylinder cupboard dead locks or other approved. All locks to have master key to each one
- All doors to be fixed with Blum Clip top 107° hinges and accessories - 3 hinges per door.
- All drawers to be fitted with MEPLA or other approved easyglide slides.
- 16mm BISONLAM SUPER WHITE board backing to fitting.
- All handles to be Stainless steel T-handles, size 22 x 125 x 200mm with bolt through fixing
- Skirting: refer to detail section.
- All bases to be of solid SA Pine, treated for moisture resistance.
- Hardwood timber to be solid Meranti, plugged and countersunk screwed as needed, painted One Coat Plascon Woodcare Ultra Varnish thinned 3:1 with min turps (X44). Two Coats Plascon Woodcare Ultra Varnish(X44) and constructed in accordance with the drawings
- White silicone to be applied between worktops / sinks and walls / tiles.
- All internal cutouts to accommodate pipes to be cut neat & square / rectangular / circular and to be closed up with 4mm white faced MASONITE board cut to shape around pipe.



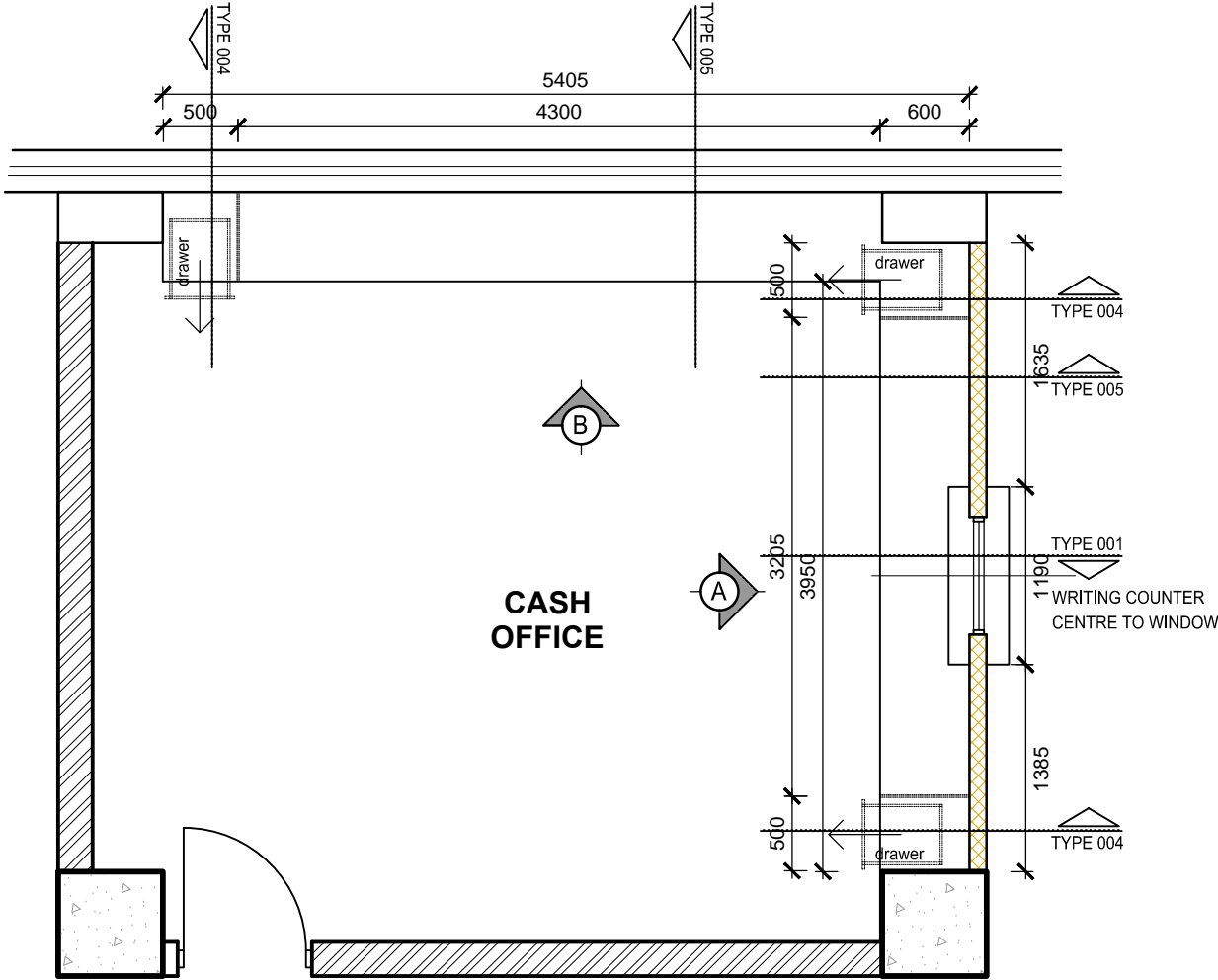
ELEVATION A

SCALE 1:50



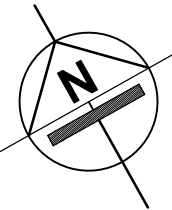
ELEVATION B

SCALE 1:50



PLAN

SCALE 1:50



suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 82 940 0286
email bnmpe@bnm.co.za
web www.bnm.co.za



project details

SARS WAREHOUSE
CAPE TOWN

client

SARS

drawing name

JOINERY SCHEDULE

drawing number

3062/801

revision

1

drawn

WC

checked

JC

scale

1:50

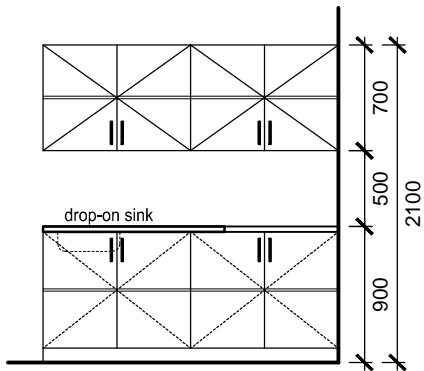
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21-07-2015

LOWER OFFICE TEA AREA

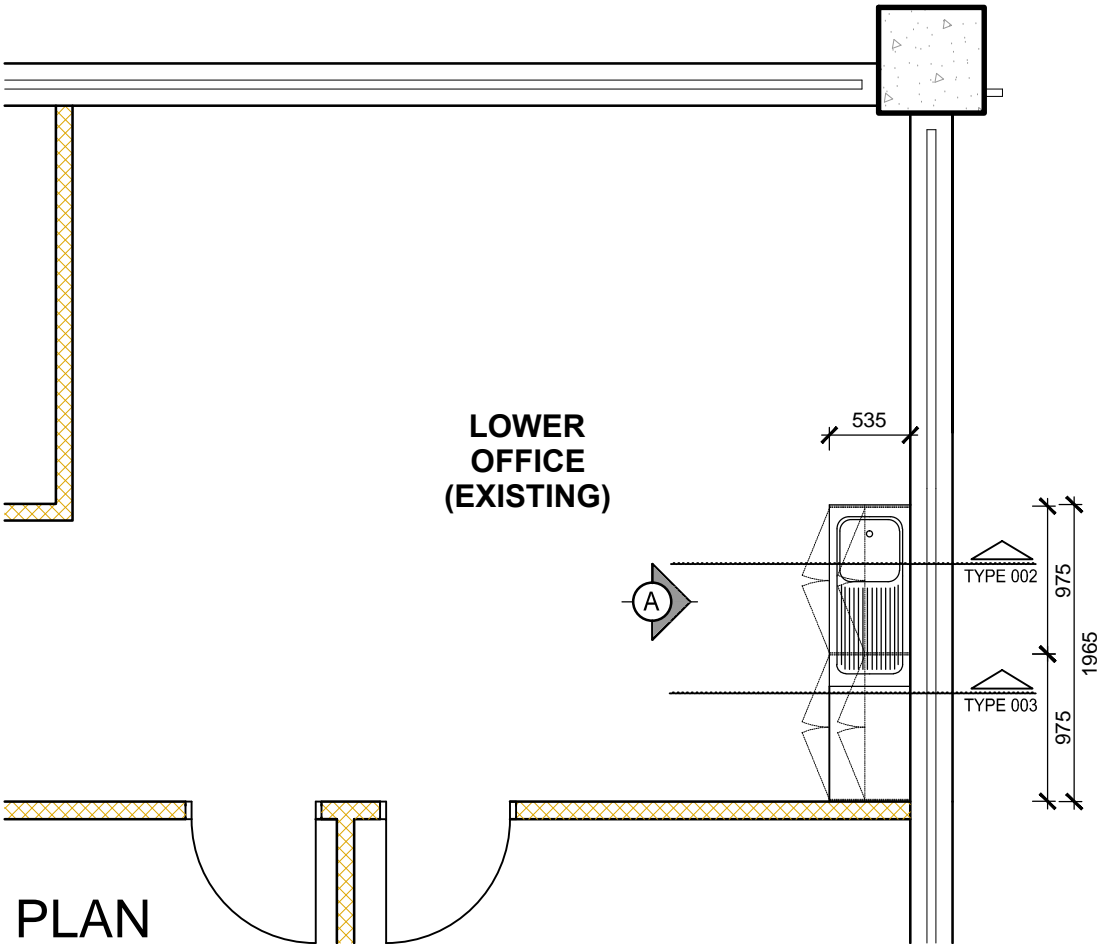
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- All handles to be Stainless steel T-handles, size 22 x 125 x 200mm with bolt through fixing
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- Hardwood timber to be solid Meranti, plugged and countersunk screwed as needed, painted One Coat Plascon Woodcare Ultra Varnish thinned 3:1 with min turps (X44). Two Coats Plascon Woodcare Ultra Varnish(X44) and constructed in accordance with the drawings
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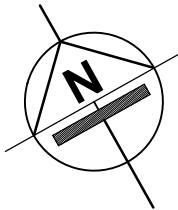
ELEVATION A

SCALE 1:50



PLAN

SCALE 1:50



suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 82 940 0286
email bnmpe@bnm.co.za
web www.bnm.co.za



project details

SARS WAREHOUSE
CAPE TOWN

client

SARS

drawing name

JOINERY SCHEDULE

drawing number

3062/802

revision

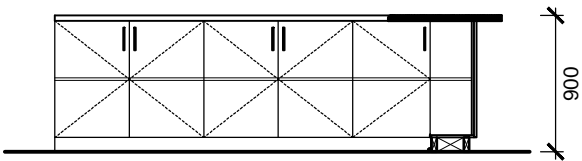
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WC	JC	1:50	21-07-2015

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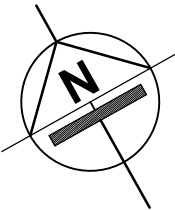
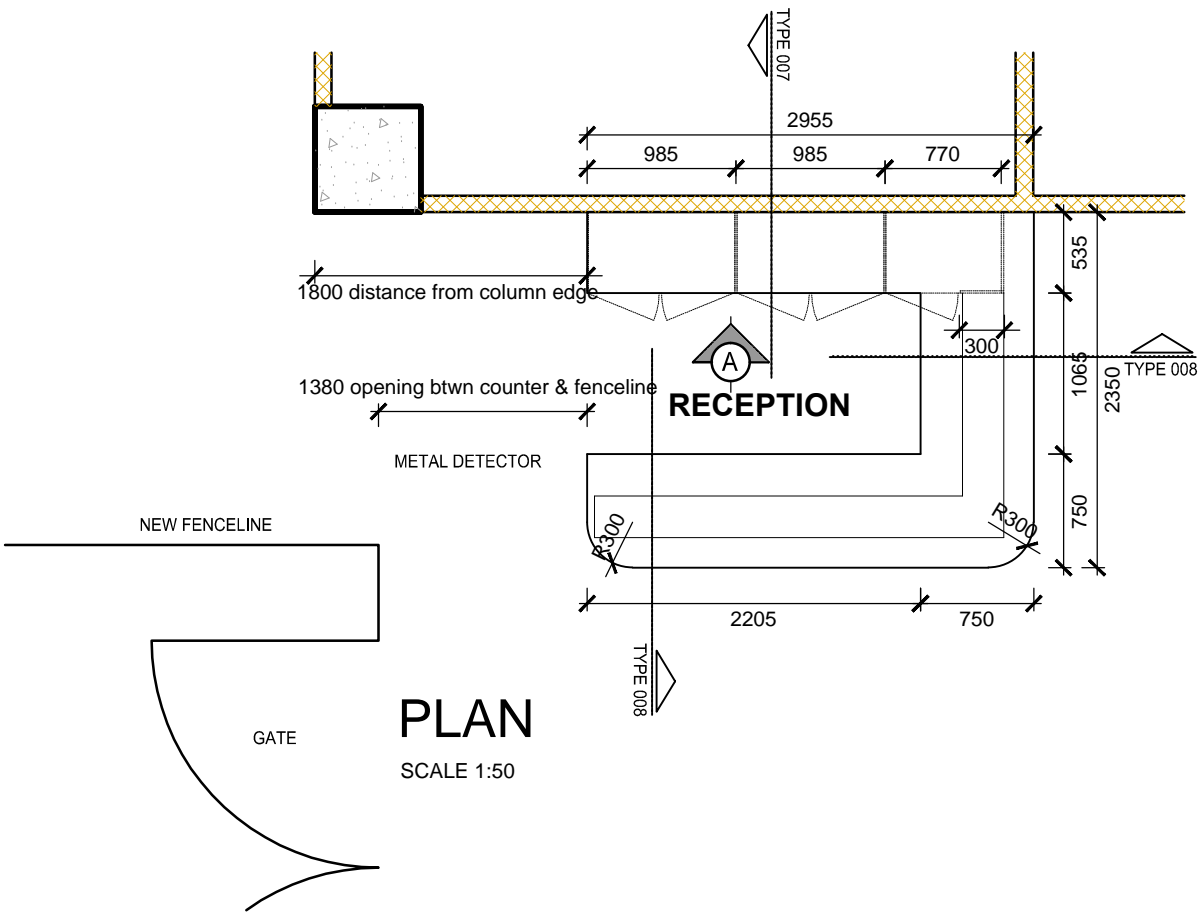
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- All bases to be of solid SA Pine, treated for moisture resistance.
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- All internal cutouts to accommodate pipes to be cut neat & square / rectangular / circular and to be closed up with 4mm white faced MASONITE board cut to shape around pipe.



ELEVATION A

SCALE 1:50



suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 82 940 0286
email bnmpe@bnm.co.za
web www.bnm.co.za



project details

SARS WAREHOUSE
CAPE TOWN

client

SARS

drawing name

JOINERY SCHEDULE

drawing number

3062/803

revision

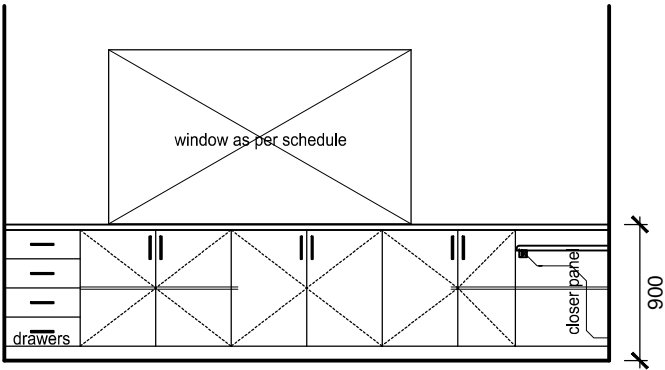
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SECURITY OFFICE

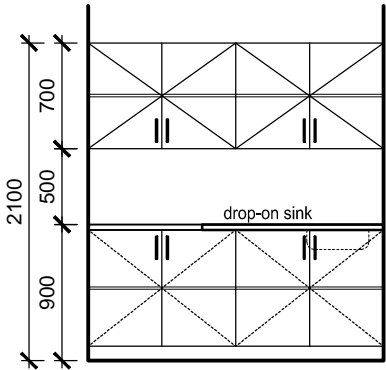
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- All bases to be of solid SA Pine, treated for moisture resistance.
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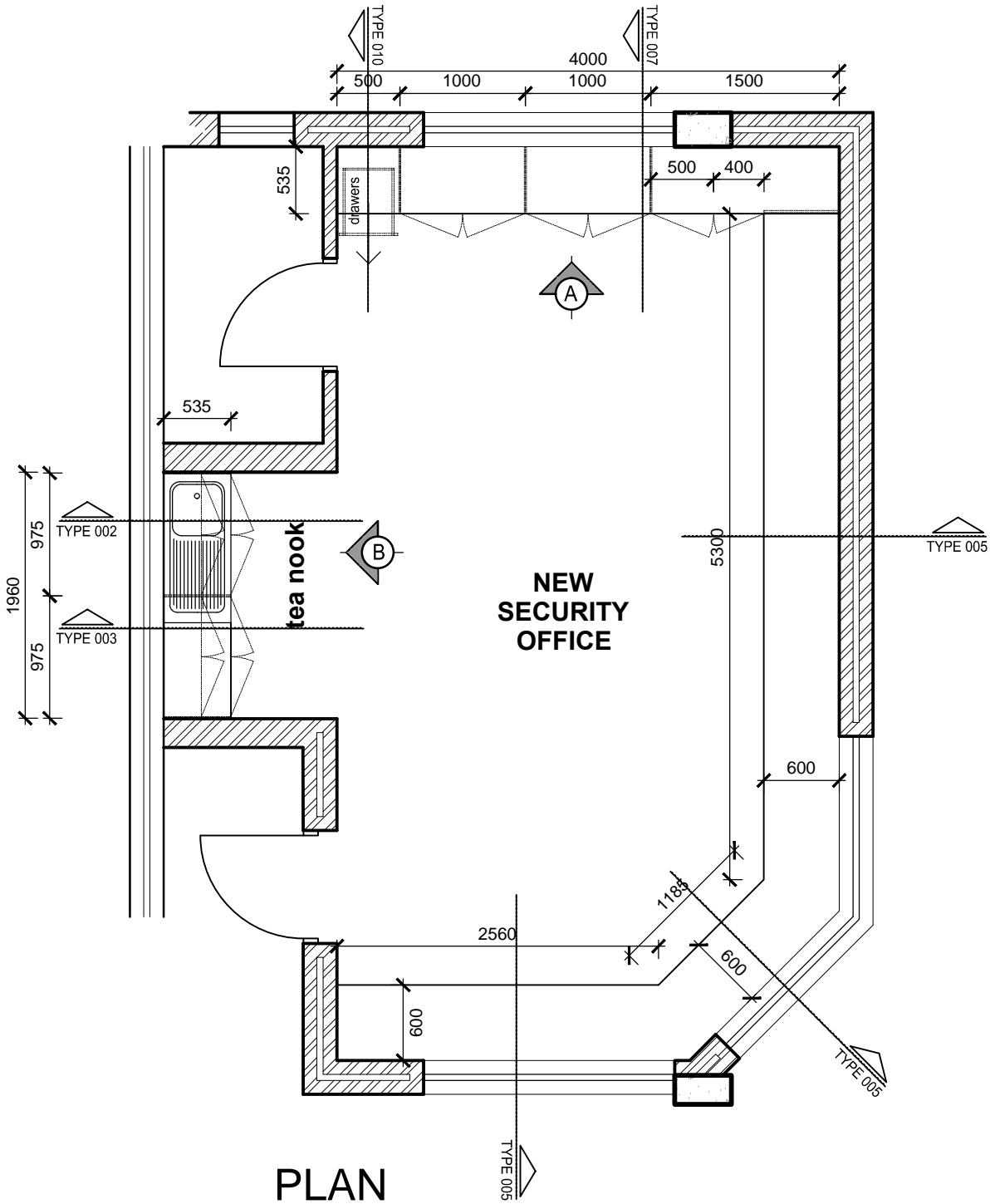
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SCALE 1:50



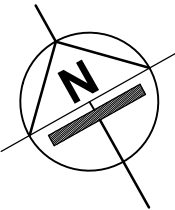
ELEVATION B

SCALE 1:50



PLAN

SCALE 1:50



suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 82 940 0286
email bnmpe@bnm.co.za
web www.bnm.co.za



project details

SARS WAREHOUSE
CAPE TOWN

client

SARS

drawing name

JOINERY SCHEDULE

drawing number

3062/804

revision

1

drawn

WC

checked

JC

scale

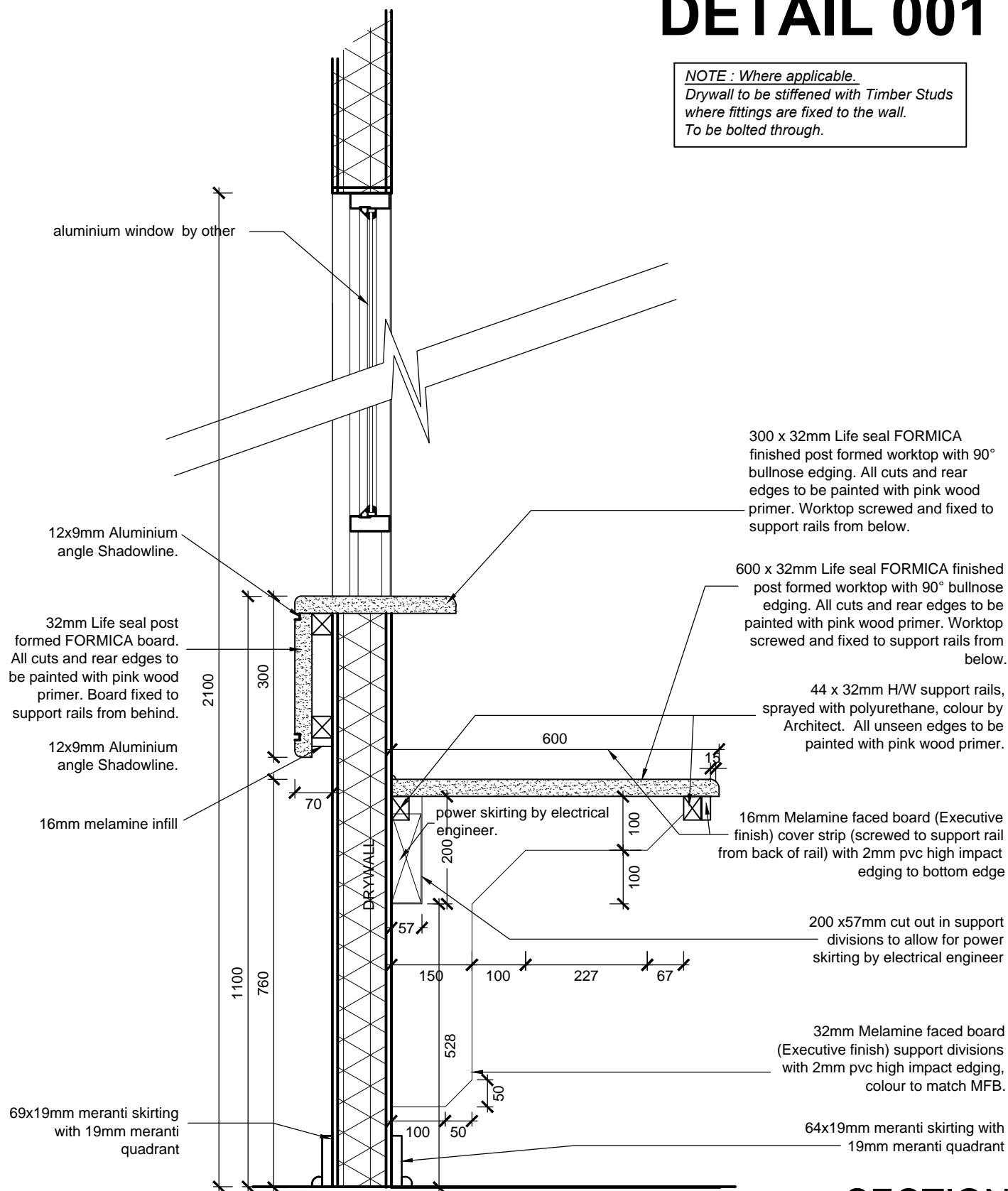
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date

21-07-2015

DETAIL 001

NOTE : Where applicable.
Drywall to be stiffened with Timber Studs
where fittings are fixed to the wall.
To be bolted through.



SECTION



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
mail bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

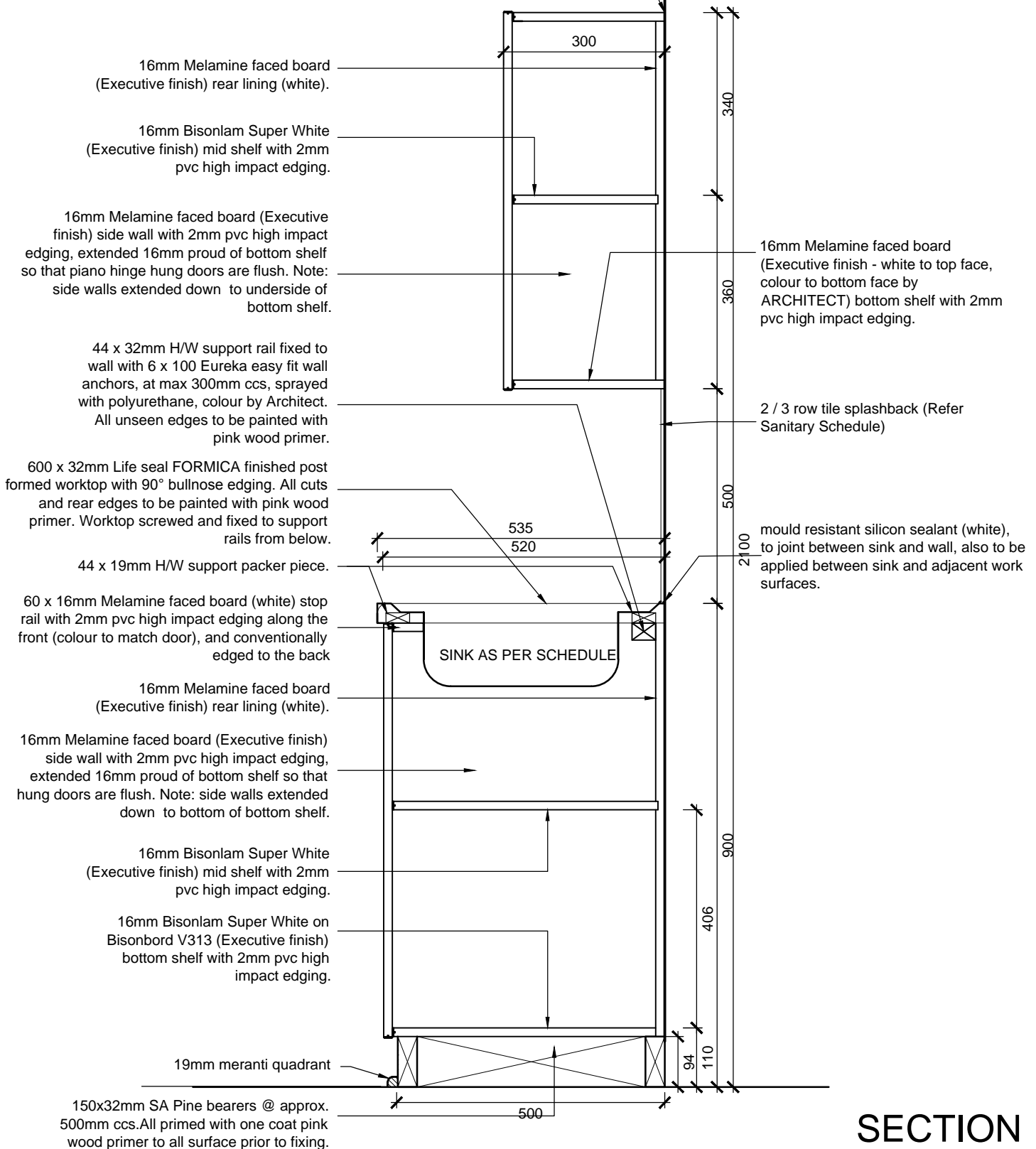
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1:10	21 JULY 2015	Date	Rev	Description	JD/801	1
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DRAWN	CHECK				BNM REF	
WC	JC				3062	

SARS WAREHOUSE - CAPE TOWN

silicon sealant in colour to match Melamine faced board, applied all round to joint between locker and wall

DETAIL 002



SECTION

SCALE	DATE	REVISIONS			DRAWING NO	REV
1:10	21 JULY 2015	Date	Rev	Description	JD/802	1
DRAWN	CHECK					
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					3062	

SARS WAREHOUSE - CAPE TOWN

silicon sealant in colour to match Melamine faced board, applied all round to joint between locker and wall

DETAIL 003

16mm Melamine faced board (Executive finish) rear lining (white).

16mm Bisonlam Super White (Executive finish) mid shelf with 2mm pvc high impact edging.

16mm Melamine faced board (Executive finish) side wall with 2mm pvc high impact edging. Note: side walls extended down to underside of bottom shelf.

16mm Melamine faced board (Executive finish - white to top face, colour to bottom face by ARCHITECT) bottom shelf with 2mm pvc high impact edging.

600 x 32mm Life seal FORMICA finished post formed worktop with 90° bullnose edging. All cuts and rear edges to be painted with pink wood primer. Worktop screwed and fixed to support rails from below.

100 x 16mm Melamine faced board (white) stop rail with 2mm pvc high impact edging along the front (colour to match door), and conventionally edged to the back, screw fixed to underside of Formica worktop

16mm Melamine faced board (Executive finish) rear lining (white).

16mm Melamine faced board (Executive finish) side wall with 2mm pvc high impact edging, extended 16mm proud of bottom shelf so that hung doors are flush. Note: side walls extended down to bottom of bottom shelf.

16mm Bisonlam Super White (Executive finish) mid shelf with 2mm pvc high impact edging.

16mm Bisonlam Super White on Bisonbord V313 (Executive finish) bottom shelf with 2mm pvc high impact edging.

19mm meranti quadrant

150x32mm SA Pine bearers @ approx. 500mm ccs. All primed with one coat pink wood primer to all surface prior to fixing.

2 / 3 row tile splashback (Refer Sanitary Schedule)

silicon sealant in colour to match worktop, applied all round to joint between worktop and wall, also to be applied between sidewalls and wall.

SECTION



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

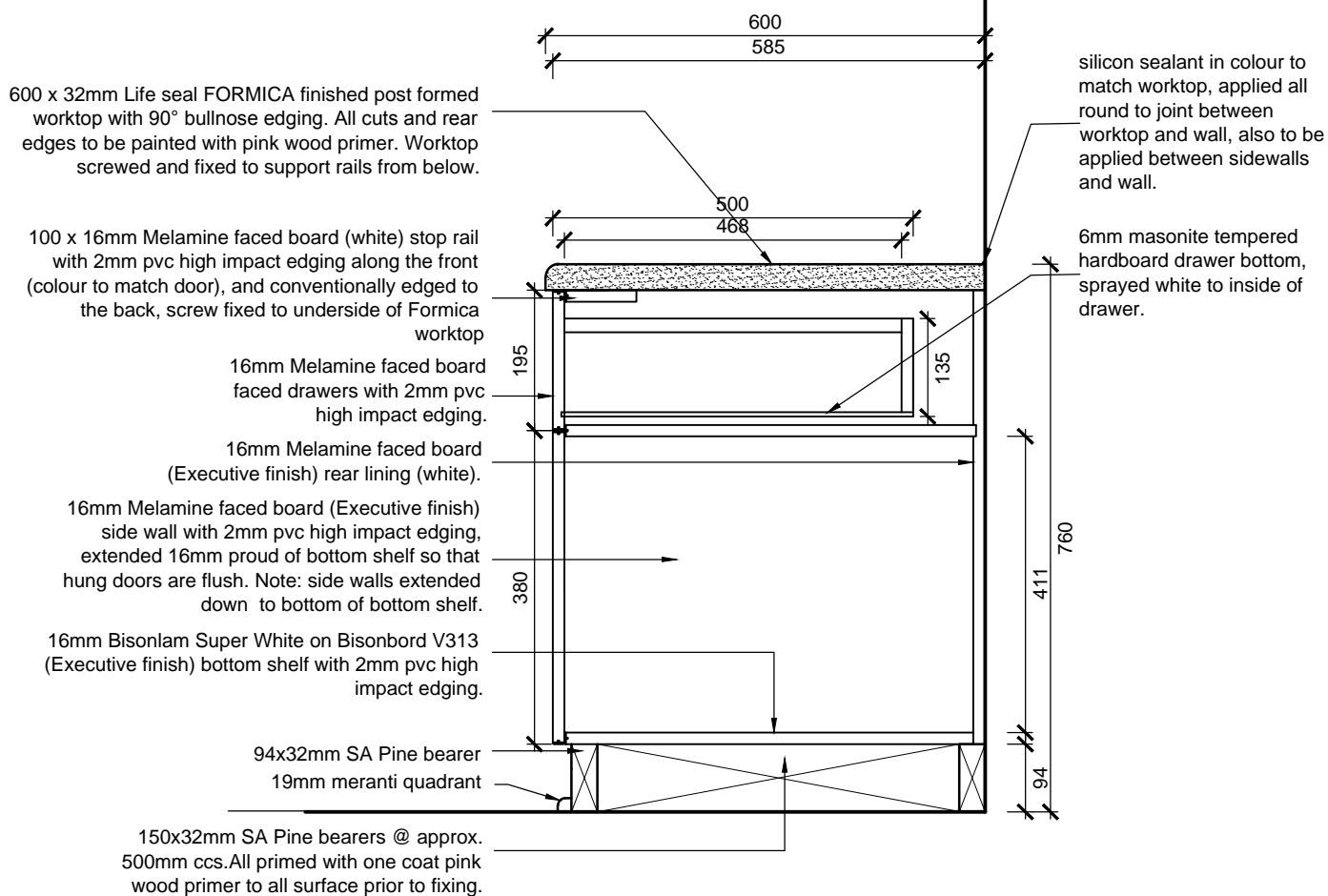
**JOINERY
DETAILS**

SCALE	DATE	REVISIONS			DRAWING NO	REV	
1:10	21 JULY 2015	Date	Rev	Description	JD/803	1	
DRAWN	CHECK						
WC	JC				BNM REF		
					3062		

DETAIL 004

NOTE : Where applicable.

Drywall to be stiffened with Timber Studs where fittings are fixed to the wall.
To be bolted through.



SECTION



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
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suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

**JOINERY
DETAILS**

SCALE

1:10

DATE

21 JULY
2015

REVISIONS

Date	Rev	Description
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DRAWING NO

JD/804

REV

1

DRAWN

WC

CHECK

JC

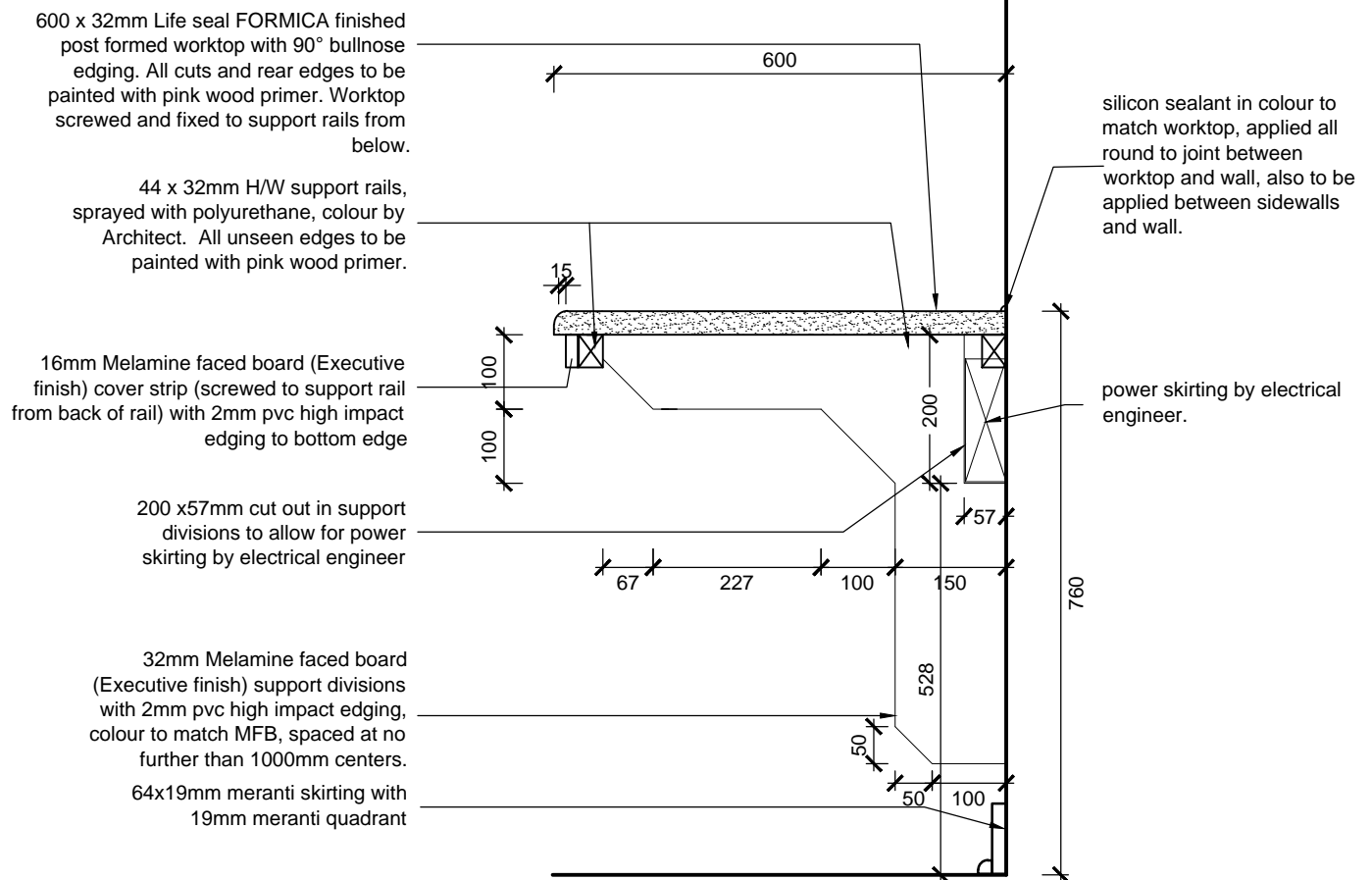
BNM REF

3062

DETAIL 005

NOTE : Where applicable.

*Drywall to be stiffened with Timber Studs where fittings are fixed to the wall.
To be bolted through.*



SECTION



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
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suite 1 lyndon, 114 park drive, central, pe, 6001
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GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

**JOINERY
DETAILS**

SCALE	DATE	REVISIONS			DRAWING NO	REV
1:10	21 JULY 2015	Date	Rev	Description	JD/805	1
DRAWN	CHECK				BNM REF	
WC	JC				3062	

DETAIL 006

44 x 32mm H/W support rail fixed to wall with 6 x 100 Eureka easy fit wall anchors, at max 300mm ccs, sprayed with polyurethane, colour by Architect.
All unseen edges to be painted with pink wood primer.

600 x 32mm Life seal FORMICA finished post formed worktop with 90° bullnose edging. All cuts and rear edges to be painted with pink wood primer. Worktop screwed and fixed to support rails from below.

44 x 19mm H/W support packer piece.

60 x 16mm Melamine faced board (white) stop rail with 2mm pvc high impact edging along the front (colour to match door), and conventionally edged to the back

16mm Melamine faced board (Executive finish) rear lining (white).

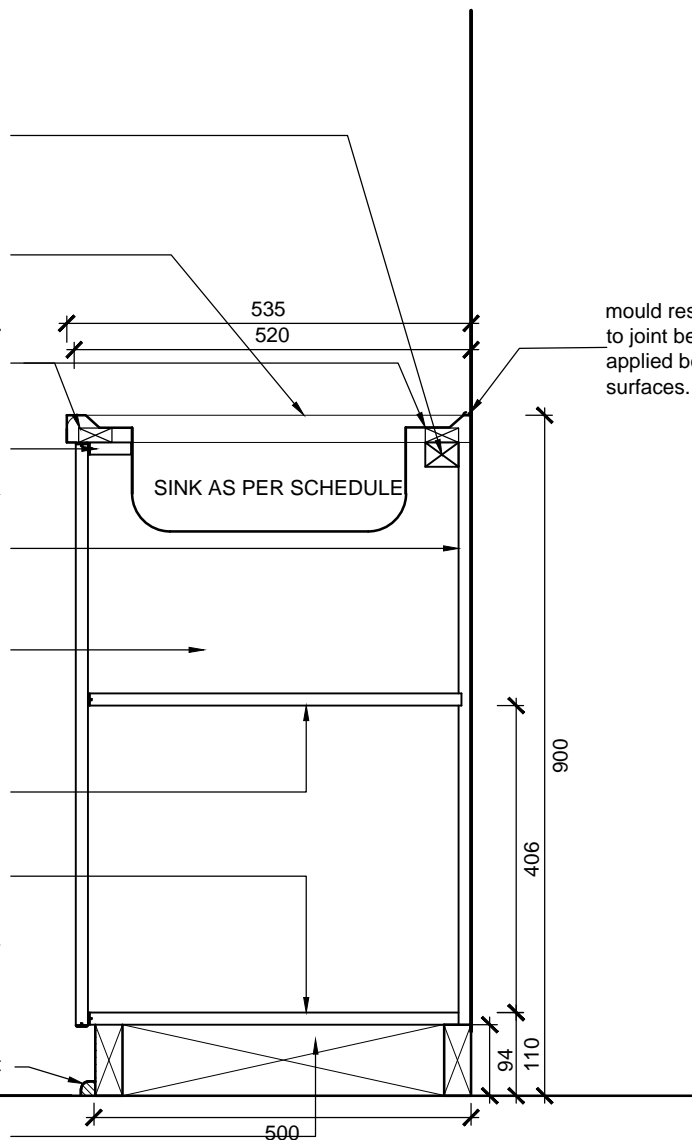
16mm Melamine faced board (Executive finish) side wall with 2mm pvc high impact edging, extended 16mm proud of bottom shelf so that hung doors are flush. Note: side walls extended down to bottom of bottom shelf.

16mm Bisonlam Super White (Executive finish) mid shelf with 2mm pvc high impact edging.

16mm Bisonlam Super White on Bisonbord V313 (Executive finish) bottom shelf with 2mm pvc high impact edging.

19mm meranti quadrant

150x32mm SA Pine bearers @ approx. 500mm ccs. All primed with one coat pink wood primer to all surface prior to fixing.



mould resistant silicon sealant (white), to joint between sink and wall, also to be applied between sink and adjacent work surfaces.

SECTION



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ARCHITECTS
PROJECT MANAGERS

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



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OF SOUTH AFRICA

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
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CLIENT

SARS

DRAWING NAME

JOINERY
DETAILS

SCALE

1:10

DATE

21 JULY
2015

REVISIONS

Date

Rev

Description

DRAWING NO

JD/806

REV

1

DRAWN

CHECK

WC

JC

BNM REF

3062

DETAIL 007

NOTE : Where applicable.

Drywall to be stiffened with Timber Studs where fittings are fixed to the wall.
To be bolted through.

600 x 32mm Life seal FORMICA finished post formed worktop with 90° bullnose edging. All cuts and rear edges to be painted with pink wood primer. Worktop screwed and fixed to support rails from below.

100 x 16mm Melamine faced board (white) stop rail with 2mm pvc high impact edging along the front (colour to match door), and conventionally edged to the back, screw fixed to underside of Formica worktop

16mm Melamine faced board (Executive finish) rear lining (white).

16mm Melamine faced board (Executive finish) side wall with 2mm pvc high impact edging, extended 16mm proud of bottom shelf so that hung doors are flush. Note: side walls extended down to bottom of bottom shelf.

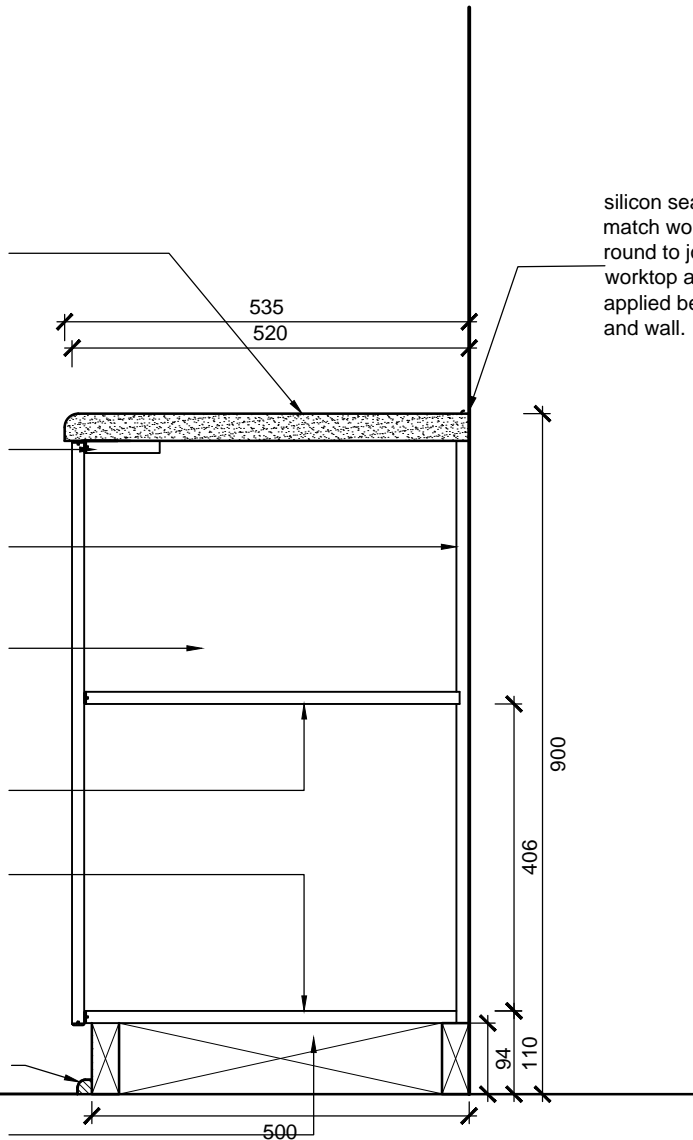
16mm Bisonlam Super White (Executive finish) mid shelf with 2mm pvc high impact edging.

16mm Bisonlam Super White on Bisonbord V313 (Executive finish) bottom shelf with 2mm pvc high impact edging.

19mm meranti quadrant

150x32mm SA Pine bearers @ approx. 500mm ccs. All primed with one coat pink wood primer to all surface prior to fixing.

silicon sealant in colour to match worktop, applied all round to joint between worktop and wall, also to be applied between sidewalls and wall.



SECTION



BNM
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ck 2001/043172/23
tel +27 41 585 2125
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cell +27 81 271 2606
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GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

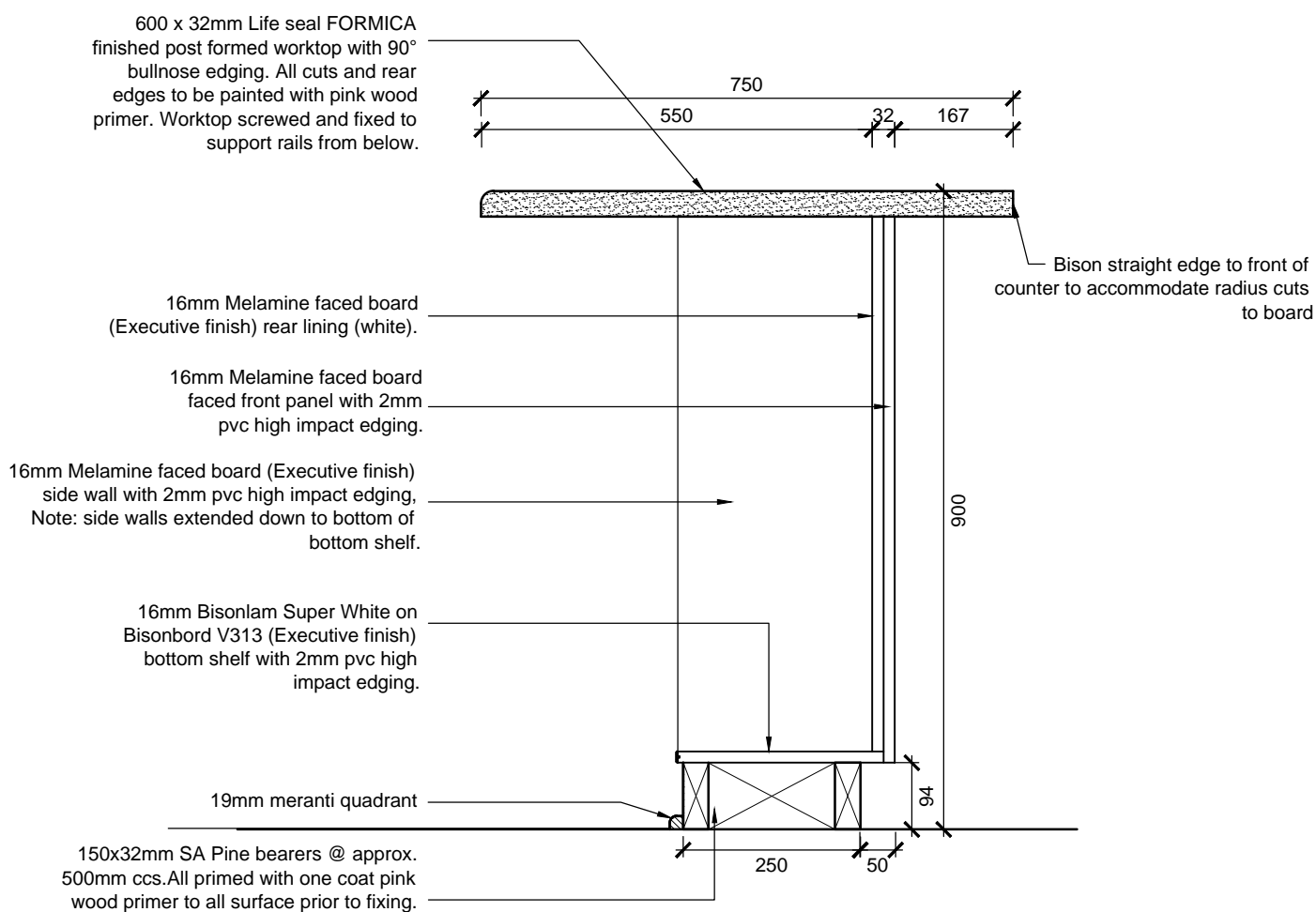
SARS

DRAWING NAME

**JOINERY
DETAILS**

SCALE	DATE	REVISIONS			DRAWING NO	REV	
1:10	21 JULY 2015	Date	Rev	Description	JD/807	1	
		-	-	-			
DRAWN	CHECK				BNM REF		
WC	JC				3062		

DETAIL 008



SECTION



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ARCHITECTS
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ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
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GREEN BUILDING COUNCIL
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SARS

DRAWING NAME

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SCALE	DATE	REVISIONS			DRAWING NO	REV
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DRAWN	CHECK				BNM REF	
WC	JC				3062	

SARS WAREHOUSE - CAPE TOWN

silicon sealant in colour to match Melamine faced board, applied all round to joint between locker and wall

DETAIL 009

16mm Melamine faced board (Executive finish) rear lining (white).

16mm Bisonlam Super White (Executive finish) mid shelf with 2mm pvc high impact edging.

16mm Melamine faced board (Executive finish) side wall with 2mm pvc high impact edging. Note: side walls extended down to underside of bottom shelf.

16mm Melamine faced board (Executive finish) white to top face, colour to bottom face by AP (BCT) bottom shelf with 2mm pvc high impact edging.

3 row tile on back (Refer Tiling Layout)

Sealant in colour to match worktop, applied all round to joint between worktop and wall, also to be applied between sidewalls and wall.

100 x 16mm Melamine faced board (white) stop rail with 2mm pvc high impact edging along the front (colour to match worktop and conventionally edged to be screw fixed to underside of melamine worktop).

16mm Melamine faced board as per spec drawers with 2mm pvc high impact edging.

16mm Melamine faced board (Executive finish) drawer side wall with 2mm pvc high impact edging, extended 16mm proud of bottom shelf so that piano hinge hung doors are flush. Note: side walls extended down to bottom of bottom shelf.

16mm Melamine faced board (Executive finish) rear lining (white).

16mm Bisonlam Super White on Bisonbord V313 (Executive finish) bottom shelf with 2mm pvc high impact edging.

94x32mm SA Pine bearers @ approx. 500mm ccs. All primed with one coat pink wood primer to all surface prior to fixing.

SECTION



BNM
ARCHITECTS
PROJECT MANAGERS

ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

SARS

DRAWING NAME

**JOINERY
DETAILS**

SCALE	DATE	REVISIONS			DRAWING NO	REV
1:10	21 JULY 2015	Date	Rev	Description	JD/809	1
		-	-			
DRAWN	CHECK				BNM REF	
WC	JC				3062	

DETAIL 010

600 x 32mm Life seal FORMICA finished post formed worktop with 90° bullnose edging. All cuts and rear edges to be painted with pink wood primer. Worktop screwed and fixed to support rails from below.

100 x 16mm Melamine faced board (white) stop rail with 2mm pvc high impact edging along the front (colour to match door), and conventionally edged to the back, screw fixed to underside of Formica worktop

16mm Melamine faced board as per spec. drawers with 2mm pvc high impact edging.

16mm Melamine faced board (Executive finish) drawer side wall with 2mm pvc high impact edging, extended 16mm proud of bottom shelf so that piano hinge hung doors are flush. Note: side walls extended down to bottom of bottom shelf.

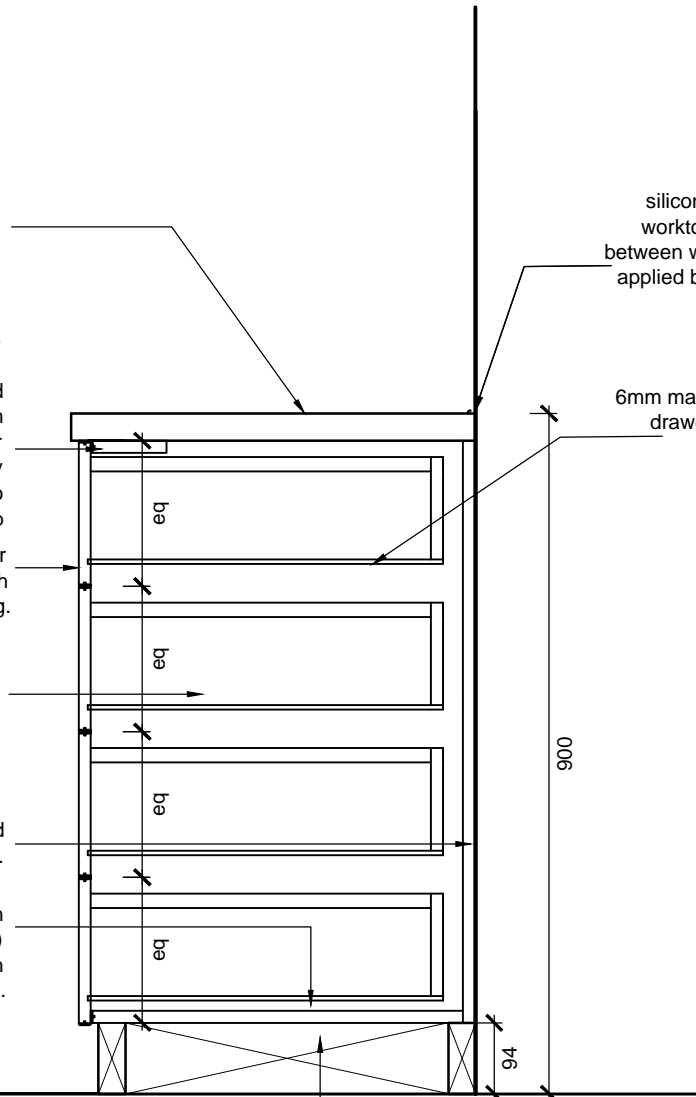
16mm Melamine faced board (Executive finish) rear lining (white).

16mm Bisonlam Super White on Bisonbord V313 (Executive finish) bottom shelf with 2mm pvc high impact edging.

94x32mm SA Pine bearers @ approx. 500mm ccs. All primed with one coat pink wood primer to all surface prior to fixing.

silicon sealant in colour to match worktop, applied all round to joint between worktop and wall, also to be applied between sidewalls and wall.

6mm masonite tempered hardboard drawer bottom, sprayed white to inside of drawer.



SECTION



BNM
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ck 2001/043172/23
tel +27 41 585 2125
fax +27 41 582 2127
cell +27 81 271 2606
email bnmpe@bnm.co.za
web www.bnm.co.za

suite 1 lyndon, 114 park drive, central, pe, 6001
po box 12576, centrahil, port elizabeth, 6006



GREEN BUILDING COUNCIL
OF SOUTH AFRICA

CLIENT

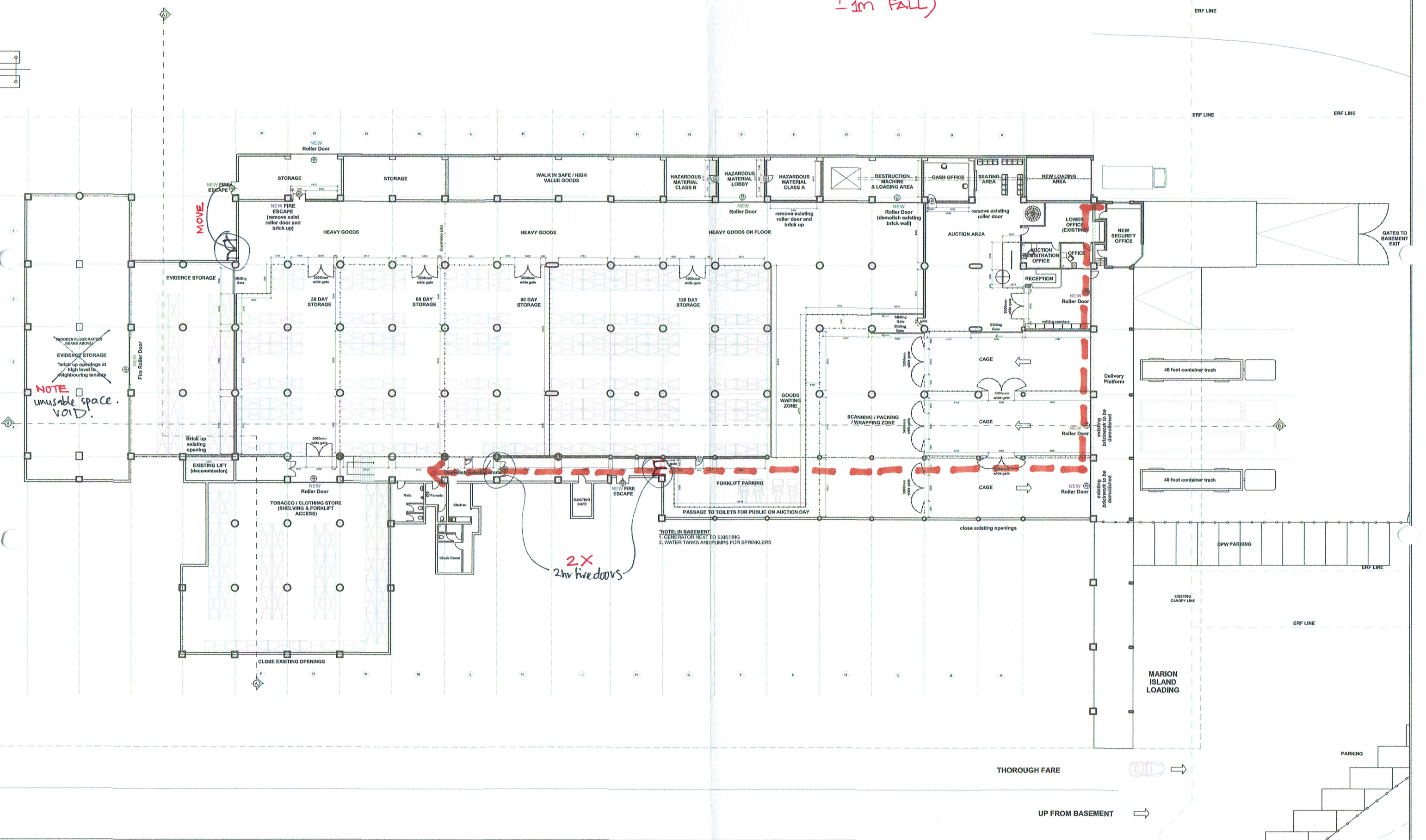
SARS

DRAWING NAME

**JOINERY
DETAILS**

SCALE	DATE	REVISIONS			DRAWING NO	REV	
1:10	21 JULY 2015	Date	Rev	Description	JD/810	1	
DRAWN	CHECK						
WC	JC				BNM REF		
					3062		

PROPOSE SEWER LINE
(HUNG FROM BASEMENT SOFFIT
± 1m FALL)

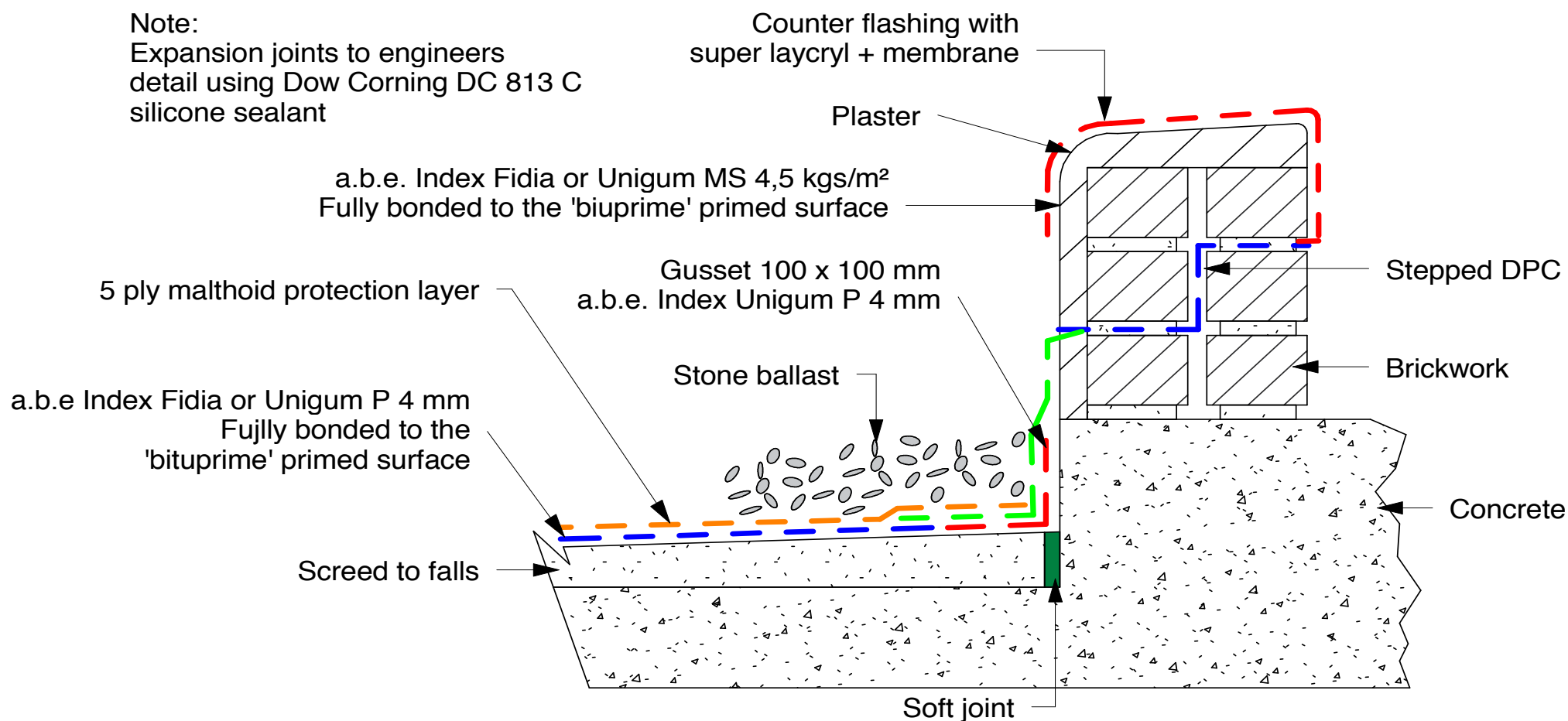




tradition • innovation • quality

Typical System Including Stone Ballast

Note:
Expansion joints to engineers
detail using Dow Corning DC 813 C
silicone sealant



C3.3

Architect's Schedules

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

NEW SECURITY OFFICE / LOWER OFFICE		QTY
WHB	Vaal Sanitaryware vitrous china 455X290 "BANTAM" basin with one taphole and integrated overflow with chainstay & pvc plug as required with Hansgrohe Code: HG31730000 - Decor E2 - Tap - Chrome - Single Lever Basin Mixer including 3/8" connections	X1
WC	Vaal Sanitaryware vitreous china "CHARISMA" (Product code: 431900) 09° outlet closed rim washdown pan complete with lid, fitments, quality thermoset soft-close seat and floor brackets, with Geberit Concealed cistern Code: 110.772.00.1 & Bolero Matt Chrome actuator plate	X1
SINK	Franke - Trendline 711 1200x535 SEB single end bowl drop-on sink Code: 311850 with Cobra 316-40mm CP sink waste with anti-theft plug and spindle – PVC traps specified elsewhere, with Hansgrohe - Code: HG31780000 Focus E - Tap - Chrome - Single Lever Sink Mixer including 3/8" connections with swivel spout	X2
HAND TOWEL DISPENSER	Kimberley Clarke: Stainless Steel hand towel dispenser Reflex MK2 Code: SA426125	X1
TOILET ROLL HOLDER	Kimberley Clarke: Toilet roll holder bath tissue Dispenser MR2 S/s T/T Code SA426130	X1
WALL MOUNTED BIN	Kimberly Clarke: Stainless steel wall bin Disposer Plus Code: SA426135	X1
SOAP DISPENSER	Kimberly Clarke: Stainless steel Serra NOX 3 soap dispenser Code: SD1226 Satin	X1
UNDERCOUNTER MOUNTED GEYSER	10 litre undercounter 'Kwikot'Prisma electric water heaters (Product Code: FPRX-10-UB). Size 340mm X 291mm X 347mm	X1 SECURITY
HYDROBOIL	2.5 Litre capacity Zip Hydroboil by Franke (380001). Size: 250mm wide X 150mm deep X 431mm high. Finish: White powder coated	X1 OFFICE

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM : NEW SECURITY OFFICE		
FLOORS	600x600mm, ceramic tile, colour as per architects specification with grey tile grout. Sweep clean and remove all loose material. Tiles to be set out from centre marks, and placed square to the wall. Tiles to be set out with joints no more than 3mm in width..Tiles to be fixed using TAL, or other approved tiling adhesives. Adhesive to be spread no more than one square meter at a time. Complete tiling. Clean off surplus glue after 24 hours and commence grouting. All grouting to be finished smoothly with all joints evenly raked out to approval. Wipe with a damp sponge on completion.	A12
SKIRTINGS	600x100mm high, ceramic cut tile as per floor tile specification, with grey tile grout	A12
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D2
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbasheen Matt varnish. Timber finish to be absolutely smooth.Lightly sand and wipe down between coats.	E6
CILLS	150x15mm Fibre Cement cill. Prepare and apply one (1) coat Plascon Plaster Primer followed by two (2) coats Plascon Velvagio Satin Enamel paint.	F1
WINDOWS	New Natural Anodized Aluminium window finish as per schedule. Clean down thoroughly with Sugar Soap solution.	G4
PELMETS	Nil	
CORNICE	Shadowline cornice as per drop-in ceiling grid	J1
CEILINGS	1200mm x 600mm EXPOSED ACOUSTIC GRID CEILING Lay 25mm thick Soundlite tile 1200mm x 600mm ceiling tile into the Donn ceiling grid. Ceiling grid consisting of Donn Wall Angle (SM26/M6) fixed to the perimeter wall using fixings at 300mm centres. Space Donn Main Tees (T38V/T37V) at 1200mm centres. Suspend main tees using Donn Pre-Stretched Galvanised Hanger wire 2.5mm thick or Donn Hanger strap 19mm wide at 1200mm centres. The hanger wire shall be put through the main tees hole and wound 3 times around itself. 2 steel pop-rivets or one Gyproc Wafer Head Tek screw 13mm shall be used to fix the hanger strap to the main tees web. Install Donn Cross Tees T38V/T32V (1200 long) at 600mm centres to create a 1200mm x 600mm ceiling grid. Main tee should be fixed to the wall using angle cleats.The tiles are to be thoroughly cleaned down to remove all hand marks etc.	K1
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	See Joinery Schedule	
SANITARY	See Sanitary Schedule	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	600x600mm mirror above WHB in WC	

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM :	LOWER OFFICE
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FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish.Lightly sand between all coats.	B1
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D2 & D13
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbesheen Matt varnish. Timber finish to be absolutely smooth.Lightly sand and wipe down between coats.	E6
CILLS	N/A	
WINDOWS	N/A	
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90.Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	See Joinery Schedule	
SANITARY	See Sanitary Schedule	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM :	AUCTION REGISTRATION OFFICE
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FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish.Lightly sand between all coats.	B1
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D13
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbesheen Matt varnish. Timber finish to be absolutely smooth.Lightly sand and wipe down between coats.	E6
CILLS	N/A	
WINDOWS	New Natural Anodized Aluminium window finish as per schedule. Clean down thoroughly with Sugar Soap solution.	G4
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90.Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvaglo Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	Nil	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM :	OFFICE 1
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FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish.Lightly sand between all coats.	B1
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D13
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbesheen Matt varnish. Timber finish to be absolutely smooth.Lightly sand and wipe down between coats.	E6
CILLS	N/A	
WINDOWS	New Natural Anodized Aluminium window finish as per schedule. Clean down thoroughly with Sugar Soap solution.	G4
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90.Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvaglo Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	Nil	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM :	UPPER OFFICE
---------------	---------------------

FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish. Lightly sand between all coats.	B1
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D2 & D13
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbesheen Matt varnish. Timber finish to be absolutely smooth. Lightly sand and wipe down between coats.	E6
CILLS	N/A	
ALUMINIUM WIN	New Natural Anodized Aluminium window finish as per schedule. Clean down thoroughly with Sugar Soap solution.	G4
EX. STEEL WIN	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvaglo Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	Nil	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**NEW SECURITY OFFICE / OFFICES RENOVATION**

ROOM :	NEW PUMP ROOM
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nil	
DADO	Nil	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	N/A	
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	Nil	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	120 DAY STORAGE
---------------	------------------------

FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	90 DAY STORAGE
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	60 DAY STORAGE
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	30 DAY STORAGE
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	GENERAL WAREHOUSE AREA
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	EVIDENCE STORAGE
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	STORAGE 1
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nil	
DADO	Nil	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nil	
FITTINGS	See specialist shelving layout	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	FORKLIFT PARKING
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FLOORS	Power Floated Screeded floor (mesh reinforced as per eng.), as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	WALK IN SAFE / HIGH VALUE GOODS
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	HAZARDOUS MATERIAL CLASS B
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FLOORS	Power Floated Screeded floor with Hengro (or similar approved) High performance epoxy floor paint coating, colour Grey, applied as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Screeded coved cornice as per detail	A3
DADO	Nil	
WALLS	Existing & New facebrick walls (New wall spec to match existing) to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Clean down with Plascon Galvanised Iron Cleaner, wash thoroughly and allow to dry. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel.	L4
FRAMES	Nil	
FITTINGS	See specialist shelving layout	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	HAZARDOUS MATERIAL LOBBY
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FLOORS	Power Floated Screeded floor with Hengro (or similar approved) High performance epoxy floor paint coating, colour Grey, applied as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nil	
DADO	Nil	
WALLS	Existing & New facebrick walls (New wall spec to match existing) to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nil	
FITTINGS	See specialist shelving layout	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	HAZARDOUS MATERIAL CLASS A
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FLOORS	Power Floated Screeded floor with Hengro (or similar approved) High performance epoxy floor paint coating, colour Grey, applied as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Screeded coved cornice as per detail	A3
DADO	Nil	
WALLS	Existing & New facebrick walls (New wall spec to match existing) to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Clean down with Plascon Galvanised Iron Cleaner, wash thoroughly and allow to dry. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel.	L4
FRAMES	Nil	
FITTINGS	See specialist shelving layout	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	DESTRUCTION MACHINE ROOM
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nil	
DADO	Nil	
WALLS	Existing & New facebrick walls (New wall spec to match existing) to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Nil	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nil	
FITTINGS	See specialist shelving layout	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	CASH OFFICE
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FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish.Lightly sand between all coats.	B1
DADO	Nil	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D2
PROTECTION	Nil	
CILLS	N/A	
WINDOWS	Existing steel windows only: Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nil	
CORNICE	Shadowline cornice as per drop-in ceiling grid	J1
CEILINGS	1200x600 Drop-in T grid ceiling tiles. The tiles are to be thoroughly cleaned down to remove all hand marks etc.	K1
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nil	
FITTINGS	See Joinery Schedule	
SANITARY	Nil	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nil	
OTHER	Nil	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	SEATING AREA
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FLOORS	Belgotex/Nexus – Style: Basket Weave – Colour: Rope, 500x500x6 carpet tiles, in tessellated laid pattern installation, fitted in accordance to manufacturer specification	A4
SKIRTINGS	69x19mm Hardwood timber skirtings, Prepare, stop, and apply one(1) coat Woodcoat Suede Matt varnish followed by two (2) coats Woodcoat Suede Matt varnish.Lightly sand between all coats.	B1
DADO	Nill	
WALLS	Clean down, prepare and apply one (1) coat Plascon Acrylic Filler. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler as required. Apply two (2) coats Plascon Double Velvet colour to Architects specification	D2
PROTECTION	108x22mm Hardwood timber chair rail, 750mm above FFL. Prepare, stop and apply one (1) coat Dulux Woodgard Timbasheen eggshell varnish, first coat diluted 10-15% with mineral Turpentine, followed by two (2) full coats Dulux Woodgard Timbesheen Matt varnish. Timber finish to be absolutely smooth.Lightly sand and wipe down between coats.	E6
CILLS	N/A	
WINDOWS	N/A	
PELMETS	Nill	
CORNICE	Shadowline cornice as per drop-in ceiling grid	J1
CEILINGS	1200x600 Drop-in T grid ceiling tiles. The tiles are to be thoroughly cleaned down to remove all hand marks etc.	K1
DOORS	Apply one (1) coat Plascon Pink Wood Primer. Stop, touch up where necessary and apply one (1) coat Universal Undercoat. Apply two (2) coats Plascon Velvagio Satin Enamel. All tops and bottoms of doors to be painted.	L1
FRAMES	Nill	
FITTINGS	See Joinery Schedule	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Chairs to area to be approved & specified	

SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	RECEPTION AREA
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See Joinery Schedule	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

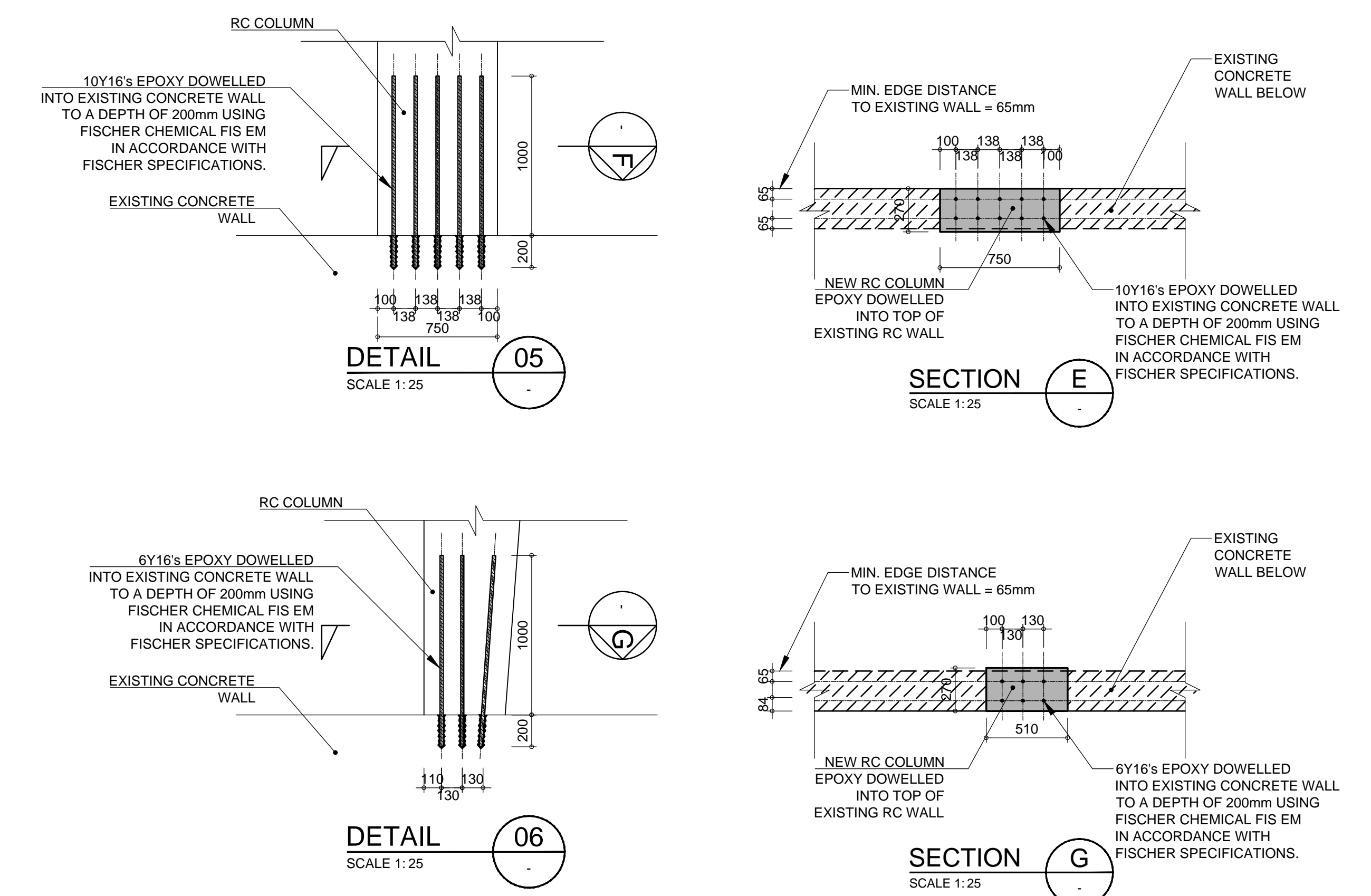
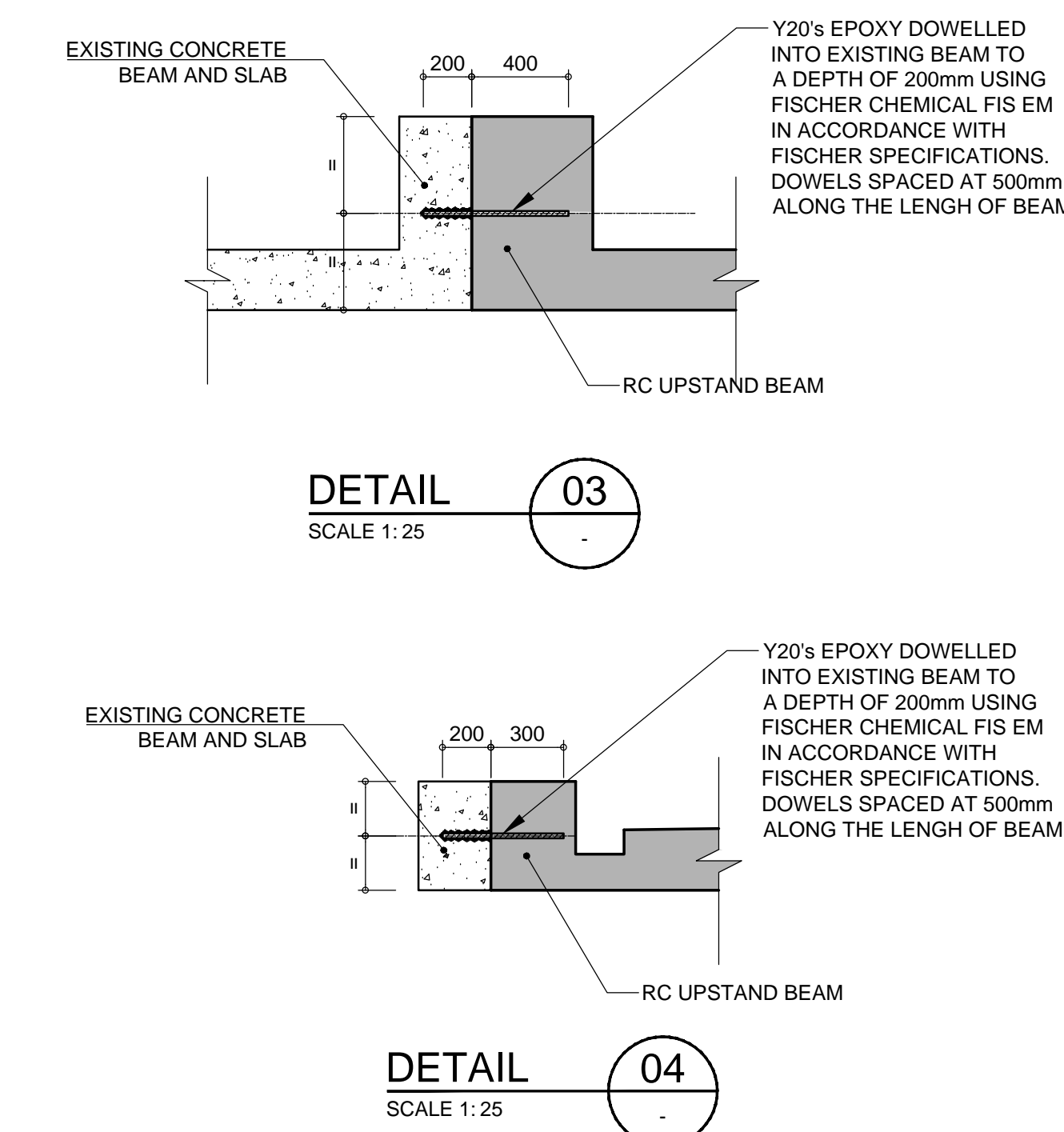
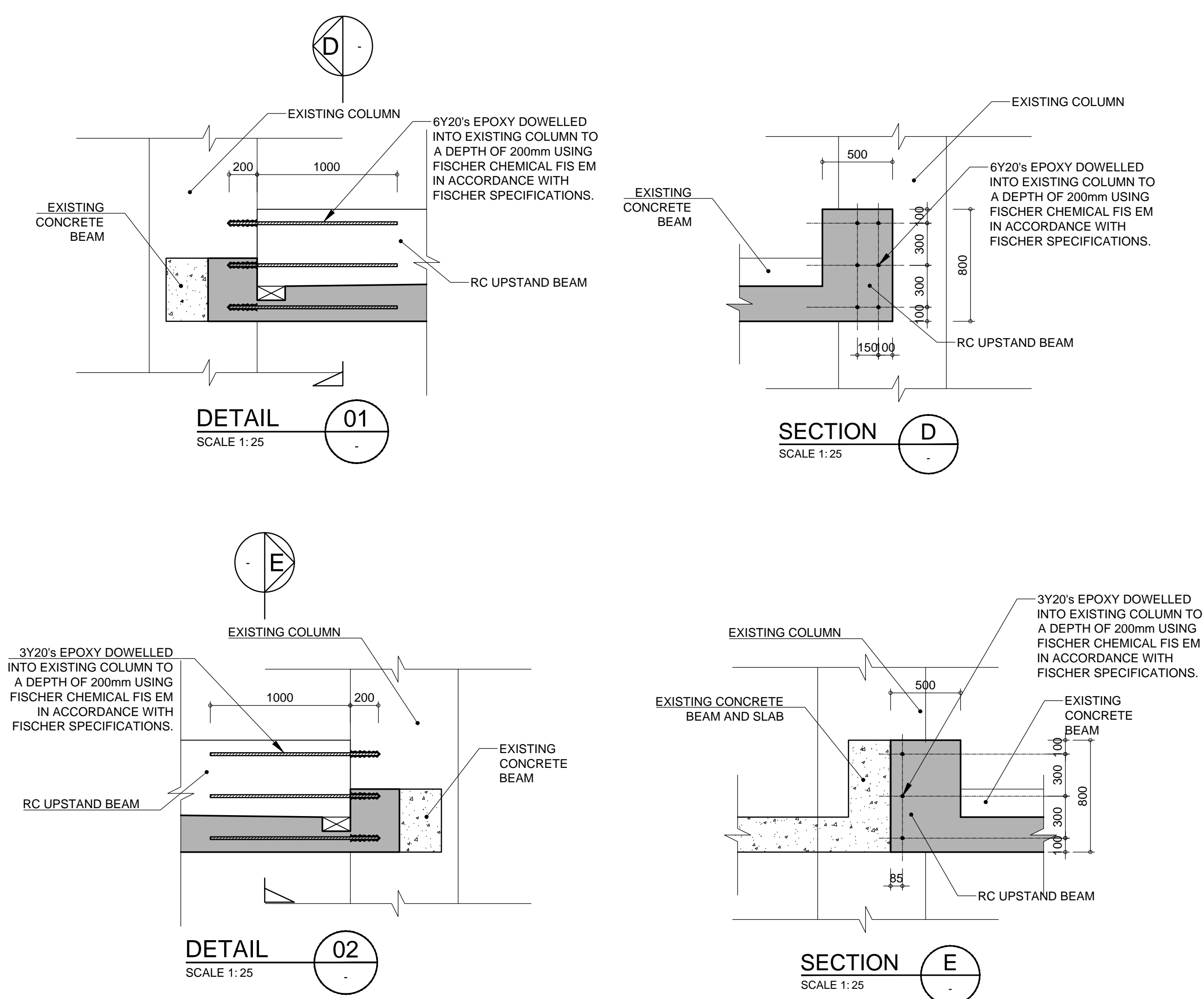
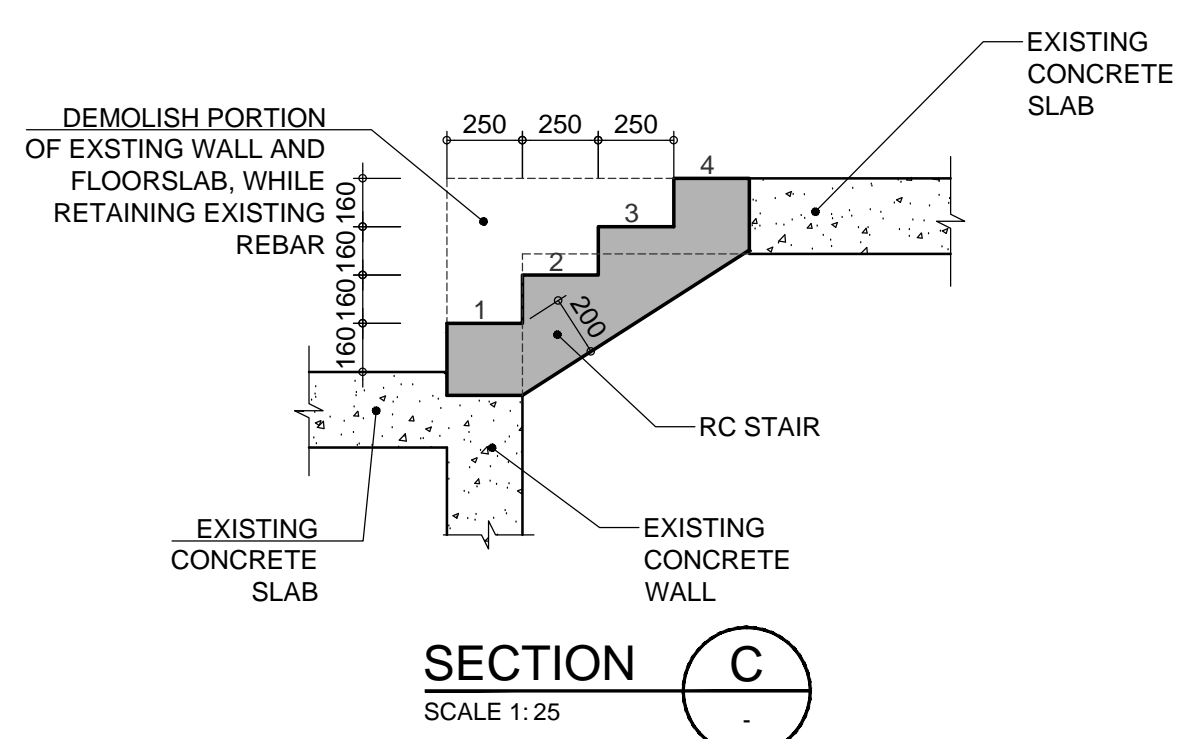
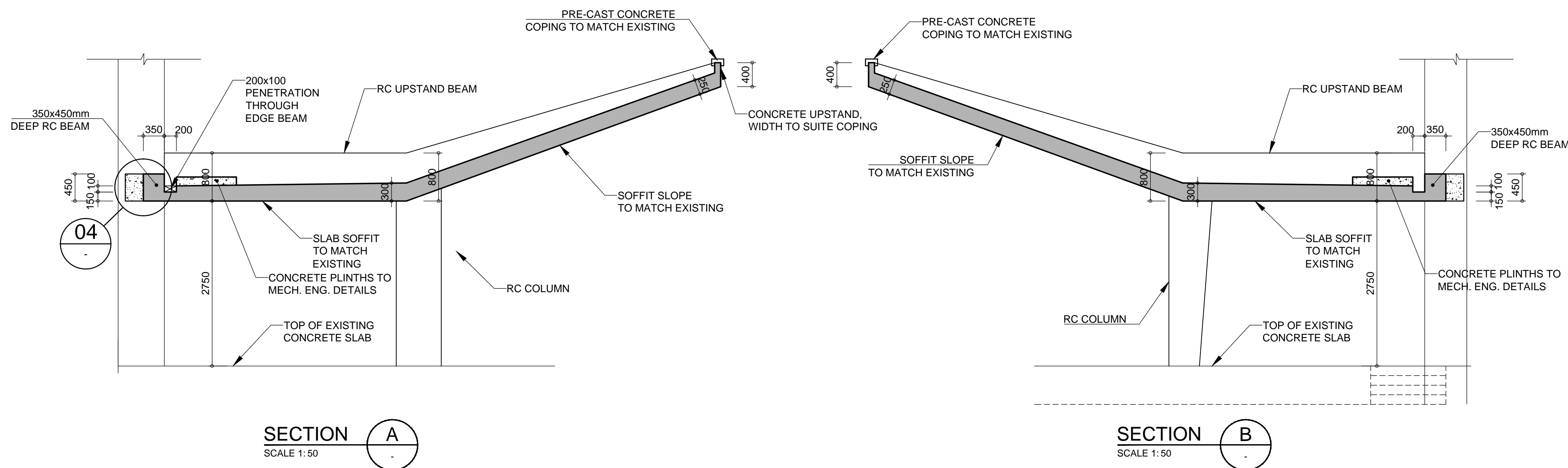
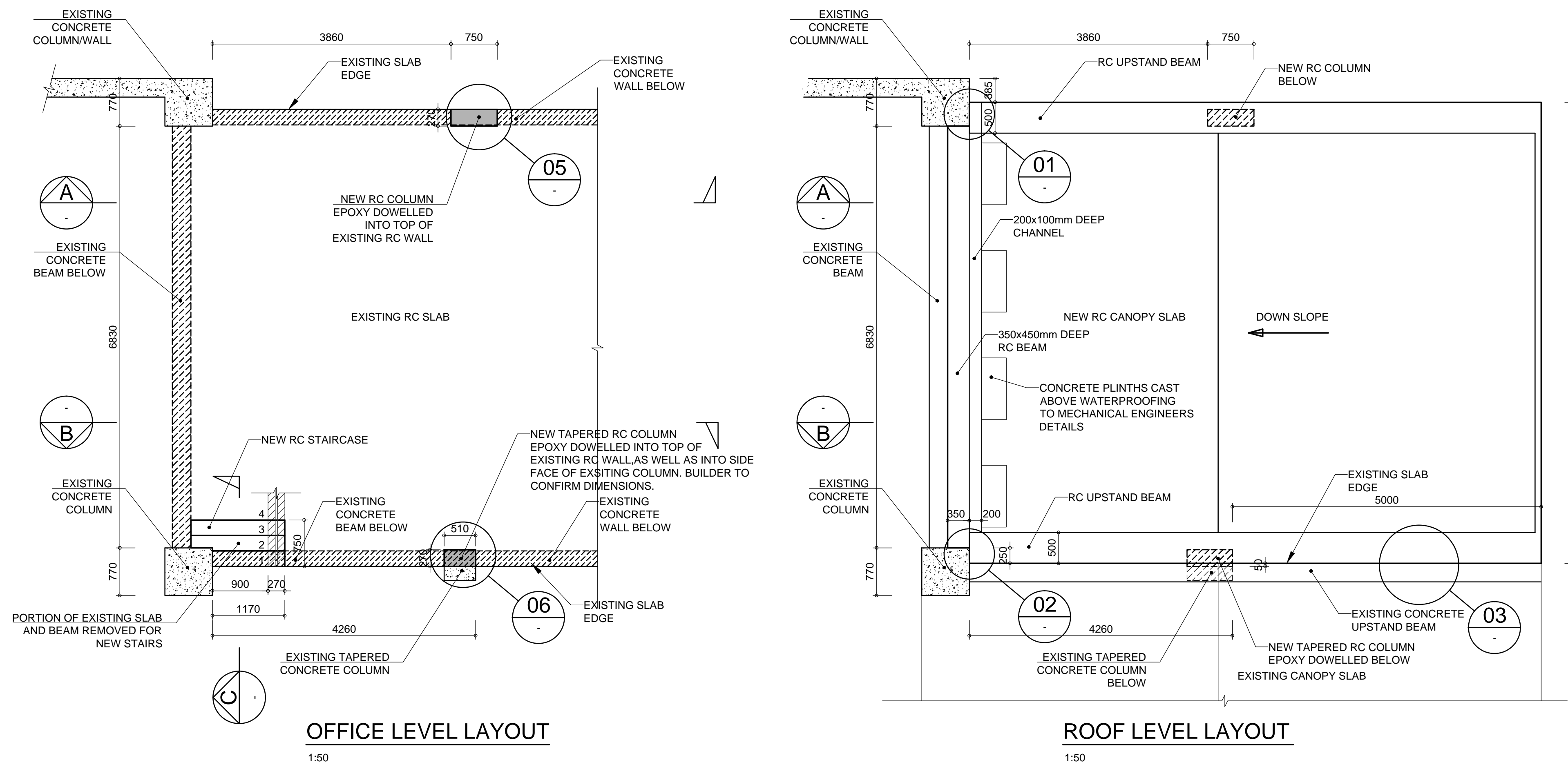
SARS CUSTOMS WAREHOUSE**EXISTING WAREHOUSE BUILDING**

ROOM :	TOBACCO & CLOTHING STORAGE
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FLOORS	Power Floated Screeded floor, as per specialist, sealed as per specialist approved specification	A3
SKIRTINGS	Nill	
DADO	Nill	
WALLS	Existing facebrick walls to be cleaned of any mortar stains occurring from repair / additional work. Existing plastered surfaces to be thoroughly cleaned down with sugar soap to remove all dust, soot etc. and prepared as specified. Stop with Mendall 90, sand and touch up with Plascon Acrylic Filler coat and Double Velvet as required. Apply two (2) coats Plascon Double Velvet, colour to Architects specification	D7 & D16
PROTECTION	Nill	
CILLS	N/A	
WINDOWS	Thoroughly clean down and remove all loose old paint. Wash with sugar soap and rinse. All surfaces to be sanded smooth and existing paint edges to be sanded smooth to approval. If flaking or loose paint is more than 20% of the surface area then all old paint is to be removed and stripped to bare. Apply one (1) coat Galvogrip Calcium Plumbate Primer followed by one (1) coat Universal Undercoat and two (2) coats Plascon Super Gloss Enamel paint, Colour White as per existing	G2
PELMETS	Nill	
CORNICE	Nill	
CEILINGS	Clean down to remove all loose particles and wash with sugar soap. Make good where necessary and fill cracks with Mendall 90. Apply one (1) coat Bonding Liquid. Apply two (2) coats of Plascon VIP Plastic PVA. If two (2) coats do not cover an additional coat to be applied. colour to Architects specification	K7
DOORS	Aluminium roller doors to be protected at all times Clean down thoroughly with Sugar Soap solution.	L10
FRAMES	Nill	
FITTINGS	See specialist shelving layout	
SANITARY	Nill	
ELECTRICAL	Refer Electrical Engineers Details	
MECHANICAL	Refer Mechanical Engineers Details	
FIRE DETECTION	Refer Mechanical Engineers Details	
REMARKS	Nill	
OTHER	Nill	

C3.4

Structural Engineer's Drawings



SCALE FOR REDUCED PLAN
100mm ON ORIGINAL PLAN

NOTES

1) REFER TO DWG. S-00 FOR CONSTRUCTION NOTES
2 ALL SETTING OUT & LVLS TO ARCHITECTS DETAILS

FOR INFORMATION

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.
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AMENDMENT

NO.	DATE	CHECKED	DONE BY	DESCRIPTION
A	13-08-15	PN	PN	FOR INFORMATION

CONSULTING ENGINEERS
The Vineyard Office Park
Wageningen, 7530
Tel: +27 (21) 913 9616
Fax: +27 (21) 913 0619
email: phadoo@stac.co.za
www.stac.co.za

DESIGNED **DRAWN** **CHECKED**
P.N. P.N. P.N.

PR. ENG. 20090361 **13-08-2015**
CONSULTING ENGINEER **DATE**

CLIENT

SARS

PROJECT

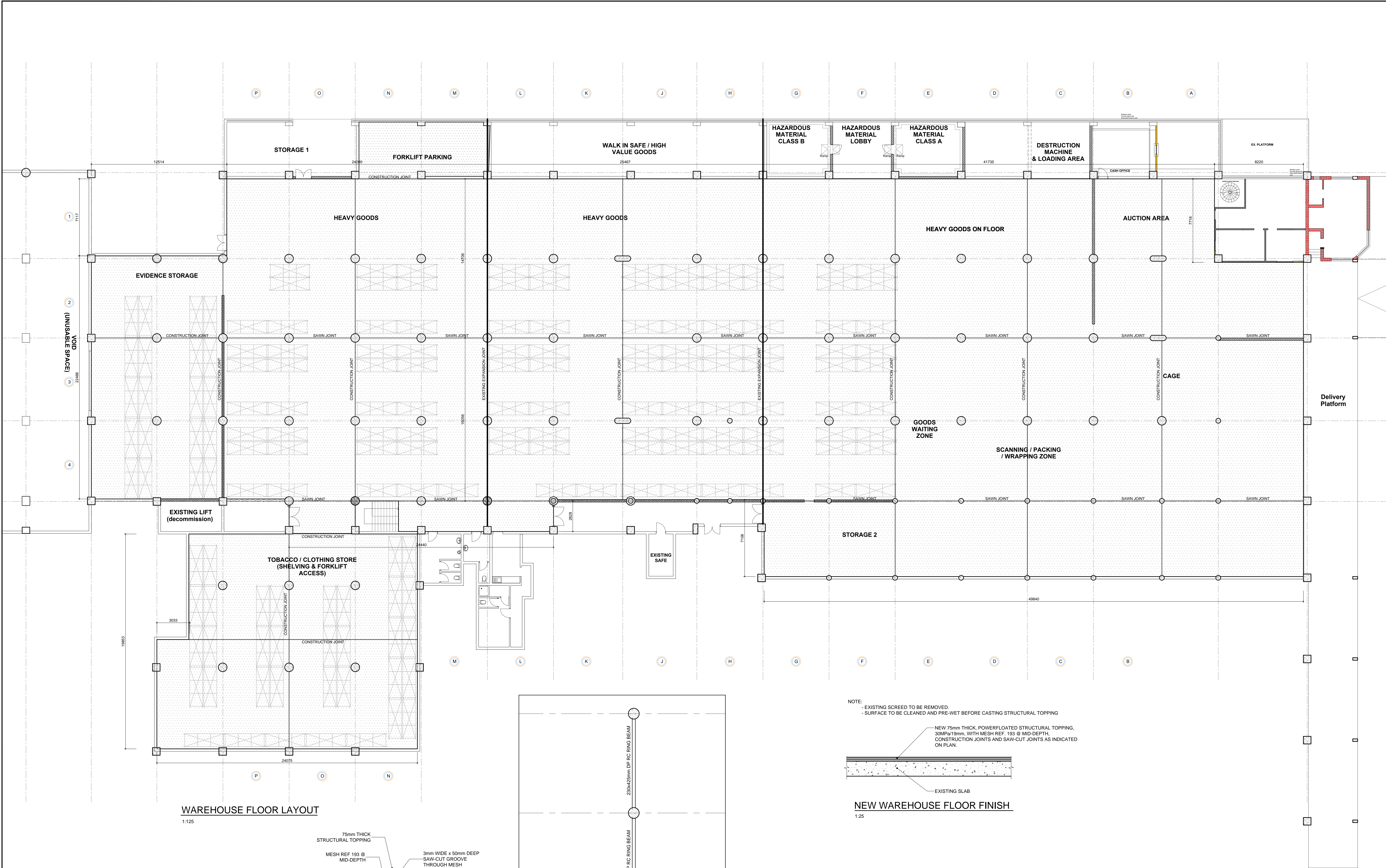
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CAPETOWN**

DRAWING DESCRIPTION

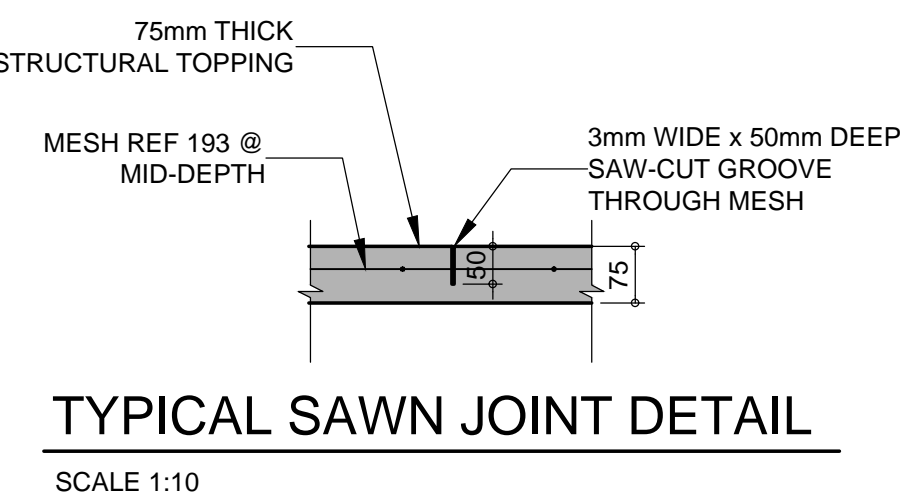
**SECURITY OFFICE
STRUCTURAL
DETAILS**
(PROJECT NO: 2190315)

SCALE **DATE OF FIRST ISSUE**
AS INDICATED **AUGUST 2015**

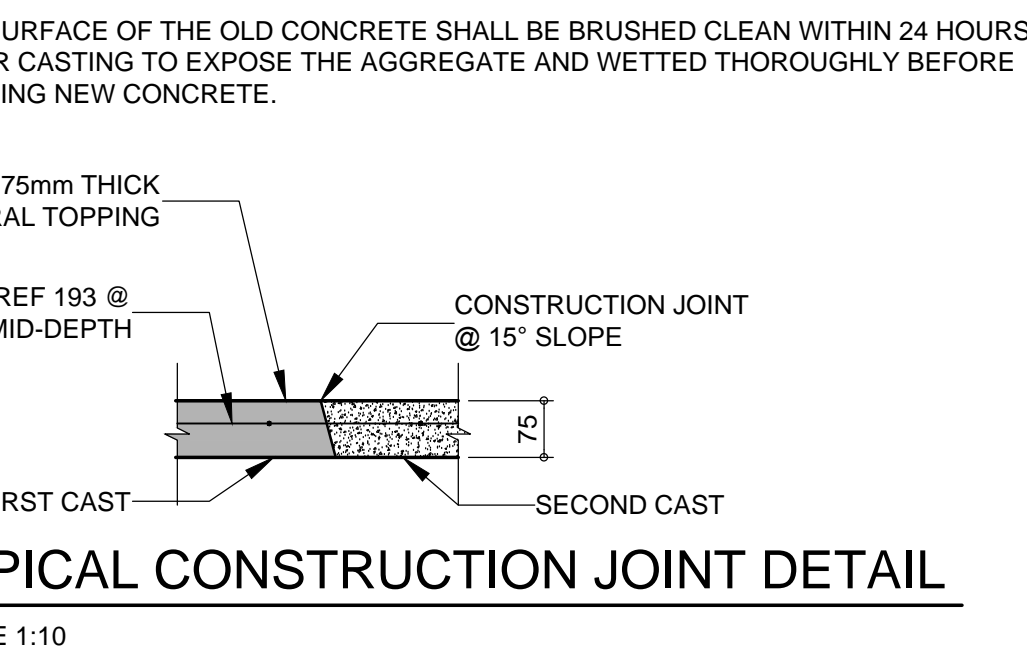
DRAWING NUMBER **REV NO**
S-01 **A**



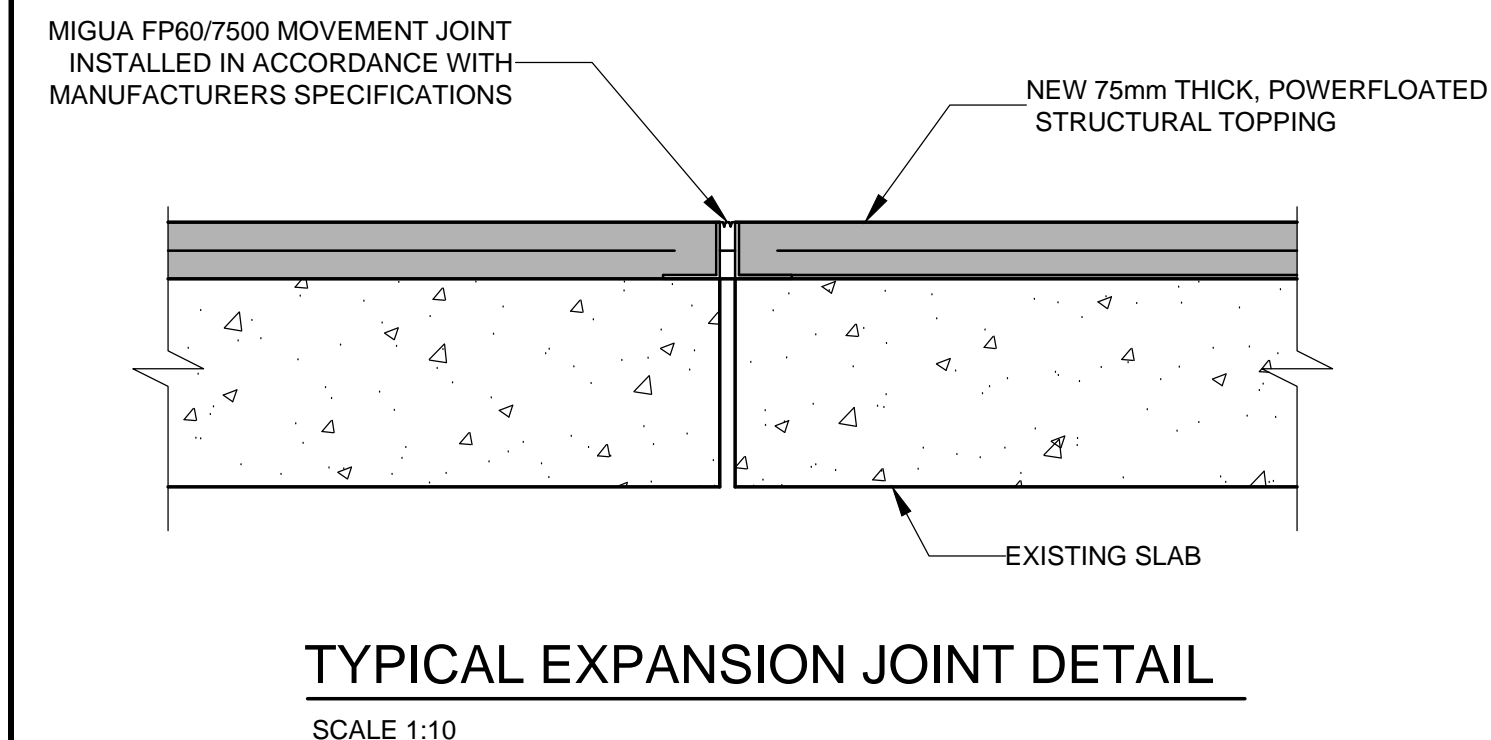
WAREHOUSE FLOOR LAYOUT
1:125



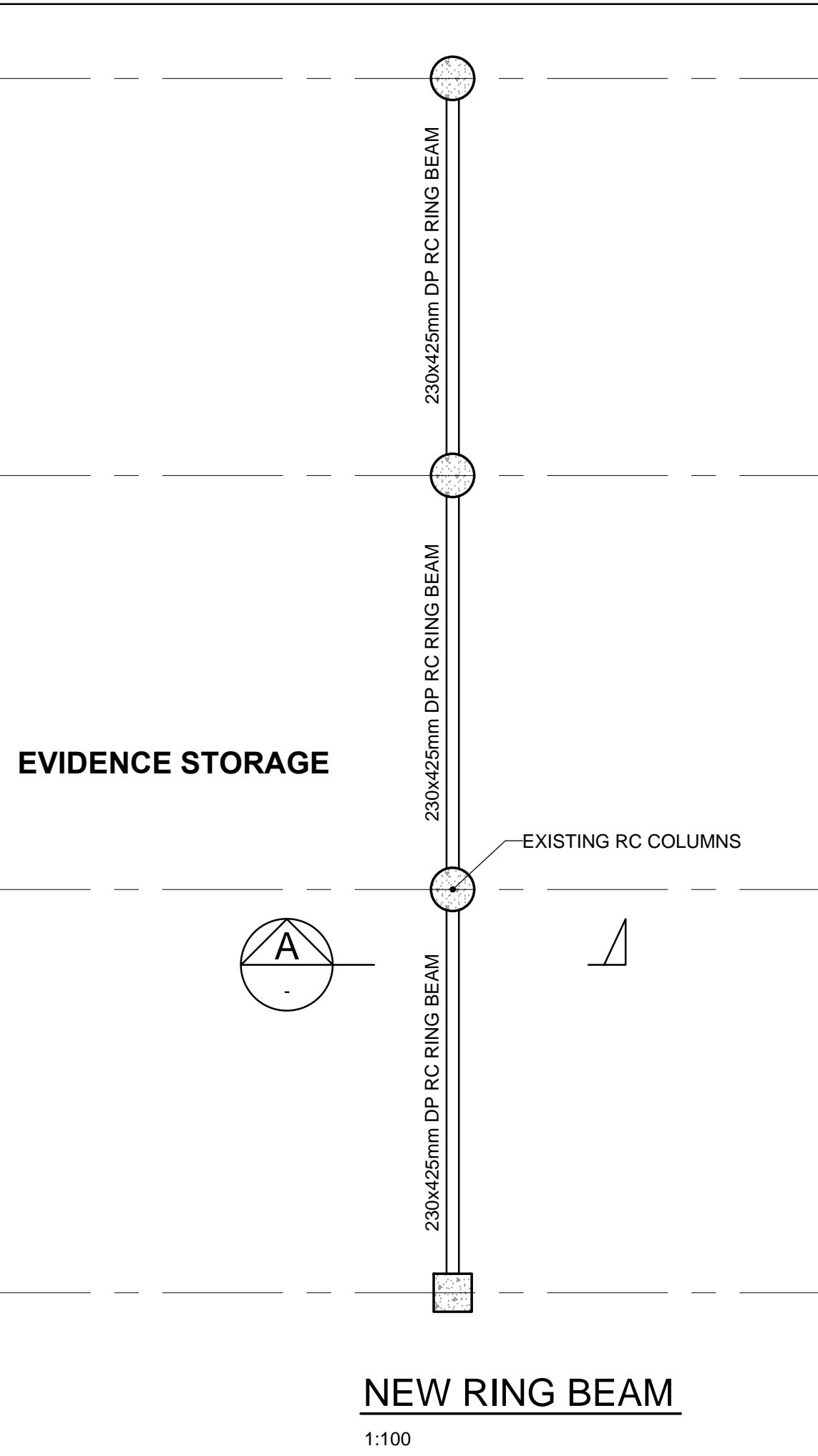
TYPICAL SAWN JOINT DETAIL
SCALE 1:10



TYPICAL CONSTRUCTION JOINT DETAIL
SCALE 1:10



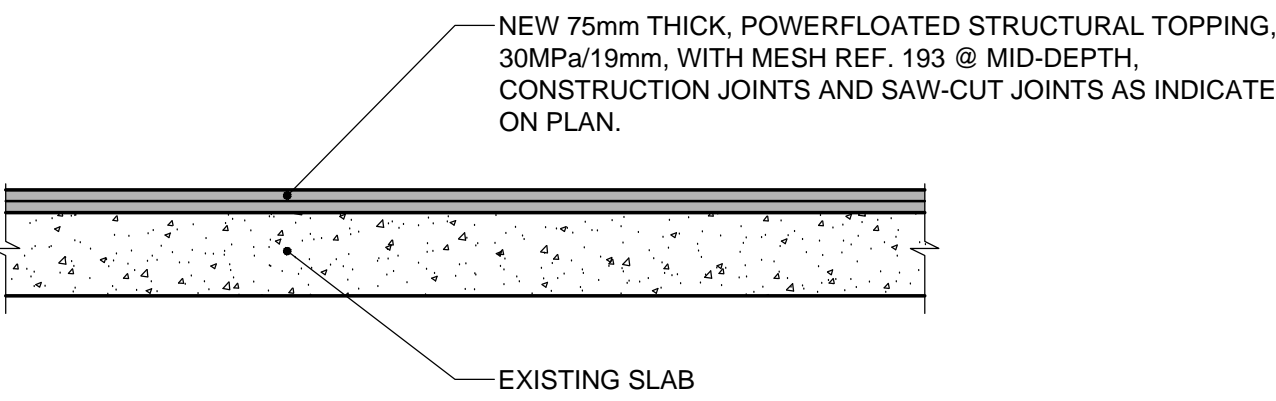
TYPICAL EXPANSION JOINT DETAIL
SCALE 1:10



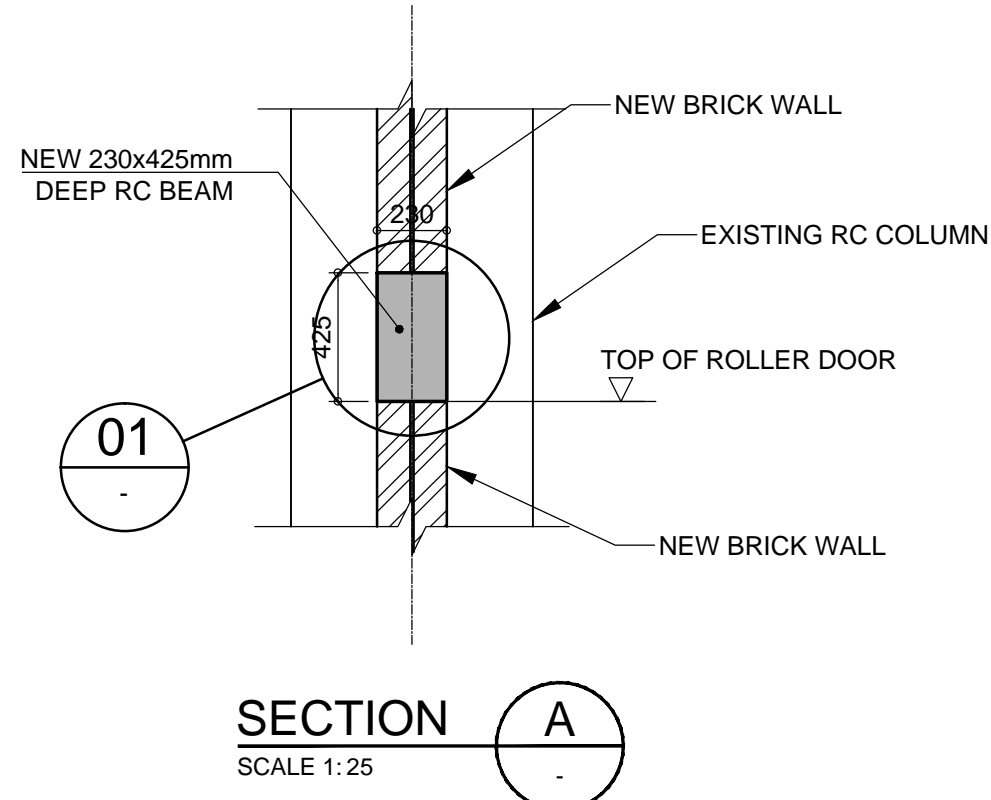
EVIDENCE STORAGE

NEW RING BEAM
1:100

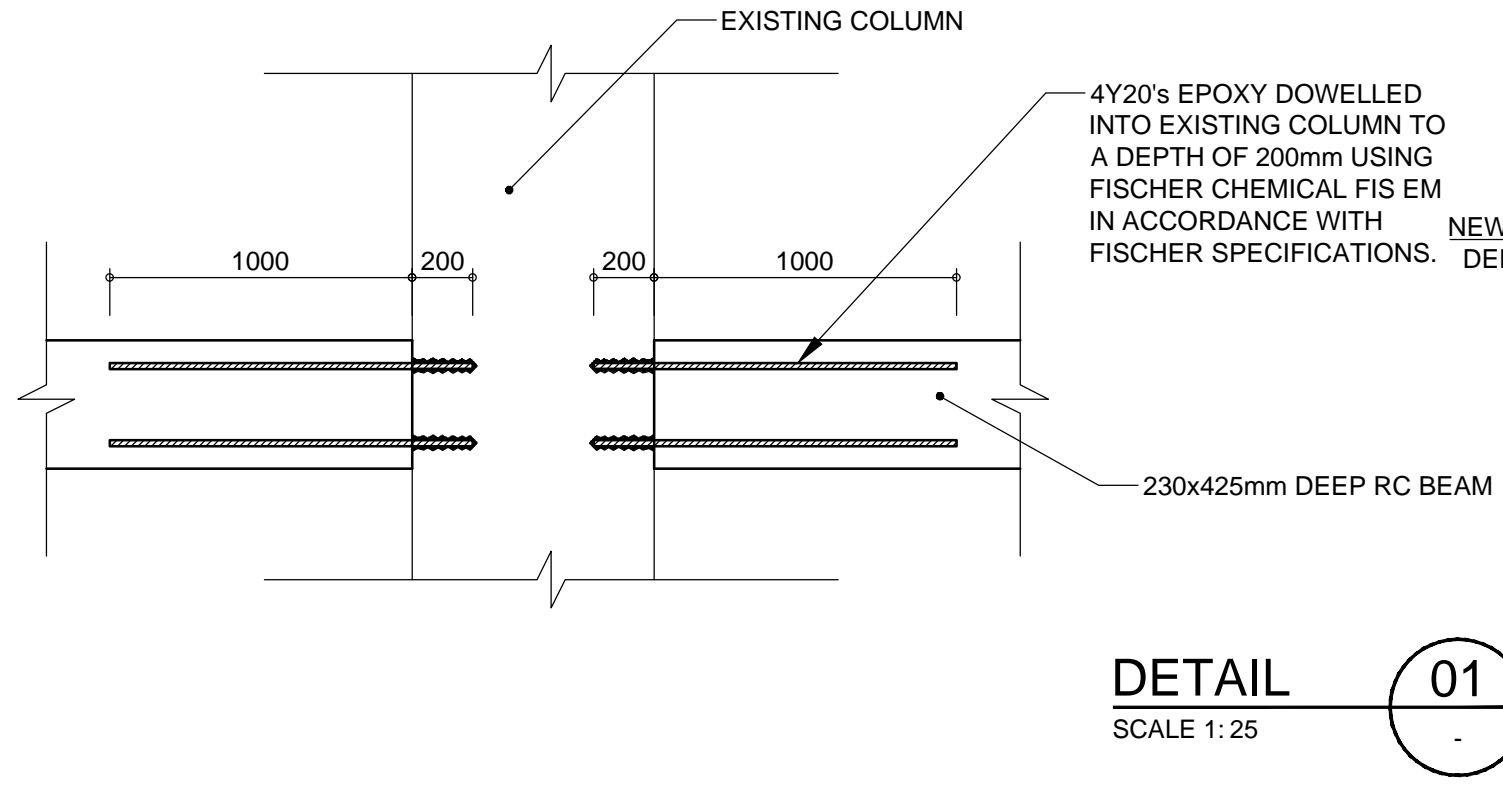
NOTE: EXISTING SCREED TO BE REMOVED.
- SURFACE TO BE CLEANED AND PRE-WET BEFORE CASTING STRUCTURAL TOPPING



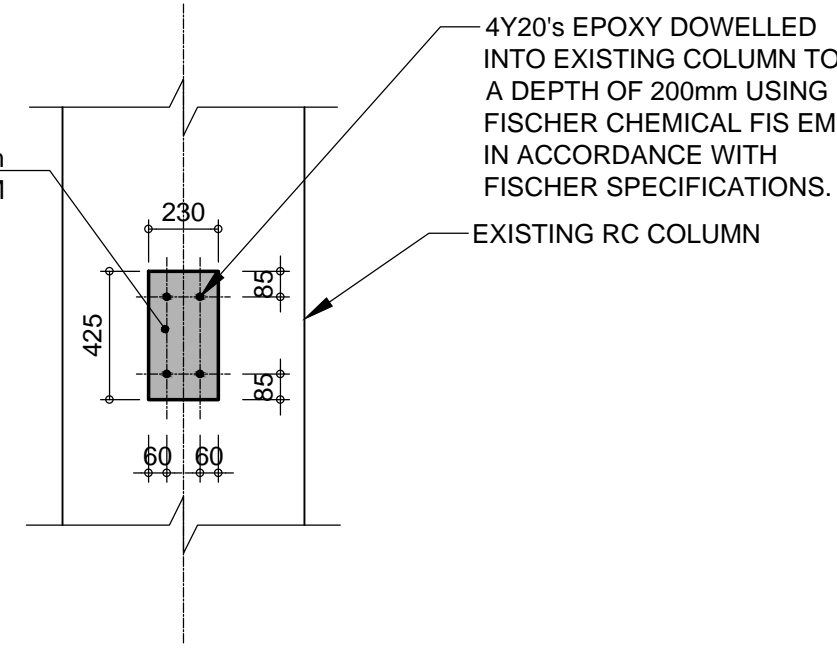
NEW WAREHOUSE FLOOR FINISH
1:25



SECTION A
SCALE 1:25



DETAIL 01
SCALE 1:25



SCALE FOR REDUCED PLAN
100mm ON ORIGINAL PLAN

NOTES
1) REFER TO DWG. S-00 FOR CONSTRUCTION NOTES
2 ALL SETTING OUT & LVLS TO ARCHITECTS DETAILS

FOR INFORMATION

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.
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AMENDMENT
NO. DATE CHECKED DONE BY DESCRIPTION
A 18-08-15 PN PN FOR INFORMATION
B 19-08-15 PN PN FOR INFORMATION
C 20-08-15 PN PN FOR INFORMATION

S
I
B
C

CONSULTING ENGINEERS
The Vineyard Office Park
Wegmoed, 7530
Tel: +27 (21) 913 9616
Fax: +27 (21) 913 0619
email: pradoo@stac.co.za
www.stac.co.za

DESIGNED	DRAWN	CHECKED
P.N.	P.N.	P.N.

PR. ENG. 20090361
CONSULTING ENGINEER

20-08-2015
DATE

CLIENT
SARS

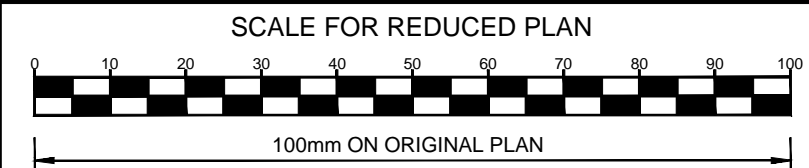
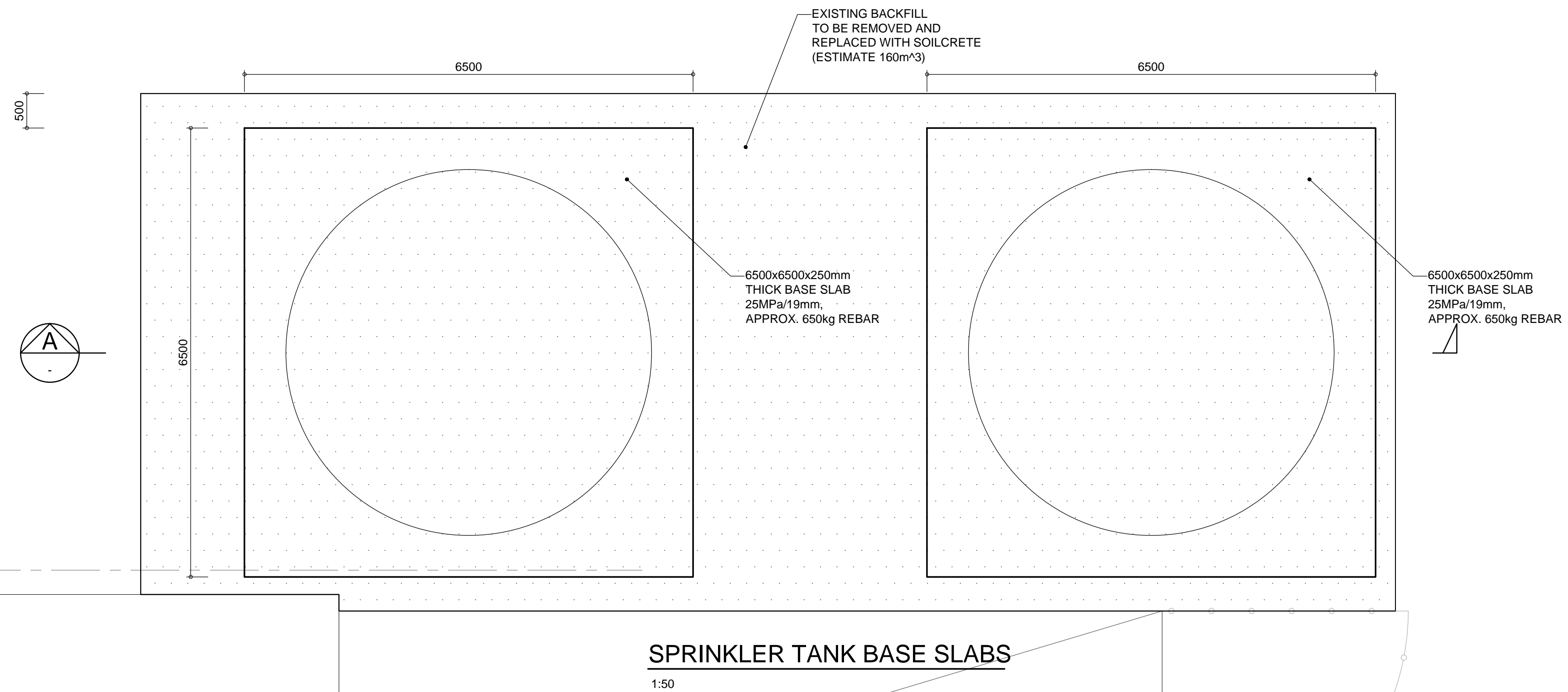
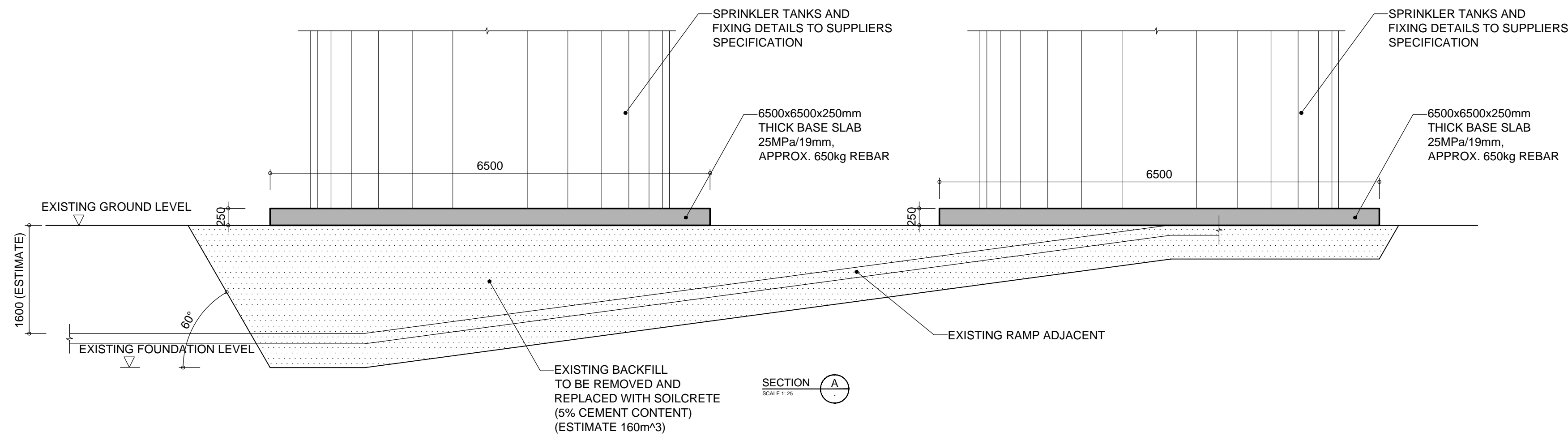
PROJECT
SARS WAREHOUSE
CAPETOWN

DRAWING DESCRIPTION
WAREHOUSE FLOOR
& RING BEAMS
(PROJECT NO: 2190315)

SCALE ORIGINAL DWG. AS DRAWING NUMBER	DATE OF FIRST ISSUE AUGUST 2015
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S-02

C



NOTES

- 1) REFER TO DWG. S-00 FOR CONSTRUCTION NOTES
- 2) ALL SETTING OUT & LVLS TO ARCHITECTS DETAILS

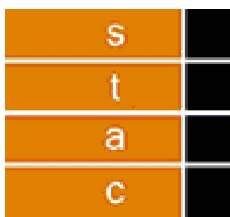
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AMENDMENT

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A	18-08-'15	PN	PN	FOR INFORMATION
B	24-08-'15	PN	PN	FOR INFORMATION



CONSULTING ENGINEERS
The Vineyard Office Park
Welgemoed, 7530
Tel: +27 (21) 913 0616
Fax: +27 (21) 913 0619
email: pnaidoo@stac.co.za
www.stac.co.za

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P.N.	P.N.	P.N.

	PR. ENG. 20090361	24-08-2015
CONSULTING ENGINEER	CLIENT	DATE

CLIENT

SARS

PROJECT

SARS WAREHOUSE
CAPETOWN

DRAWING DESCRIPTION

SPRINKLER TANK
BASE SLABS

(PROJECT NO: 2190315)

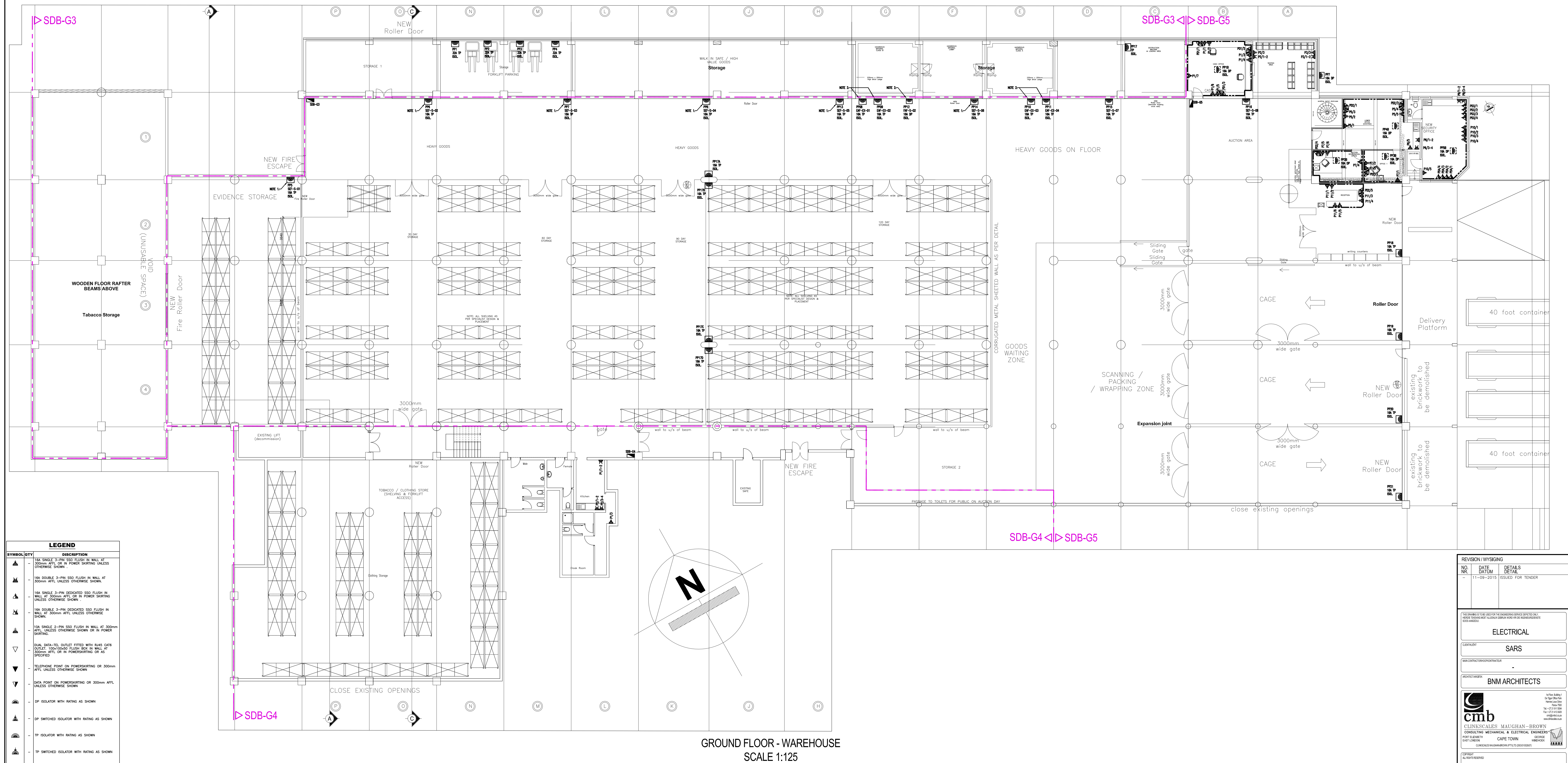
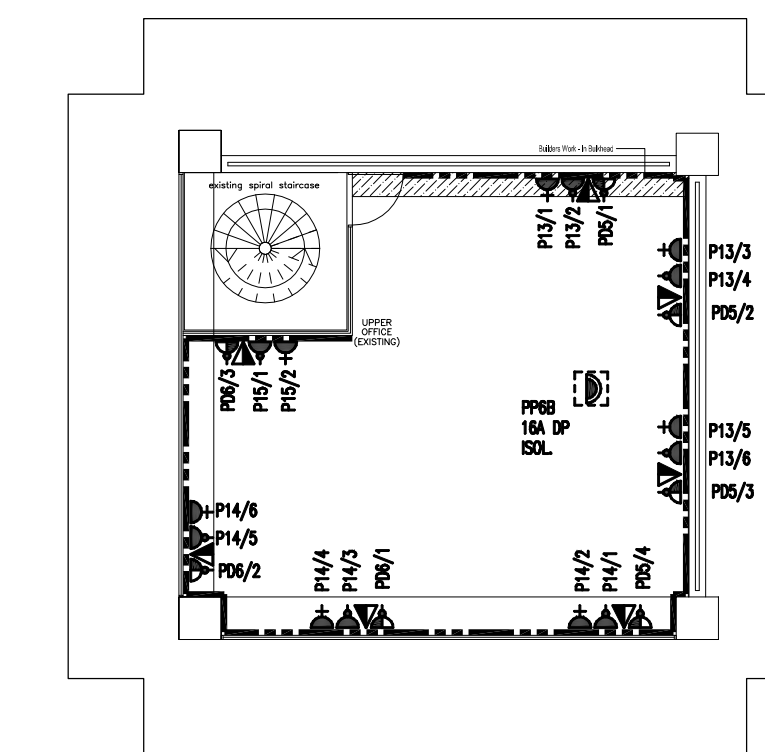
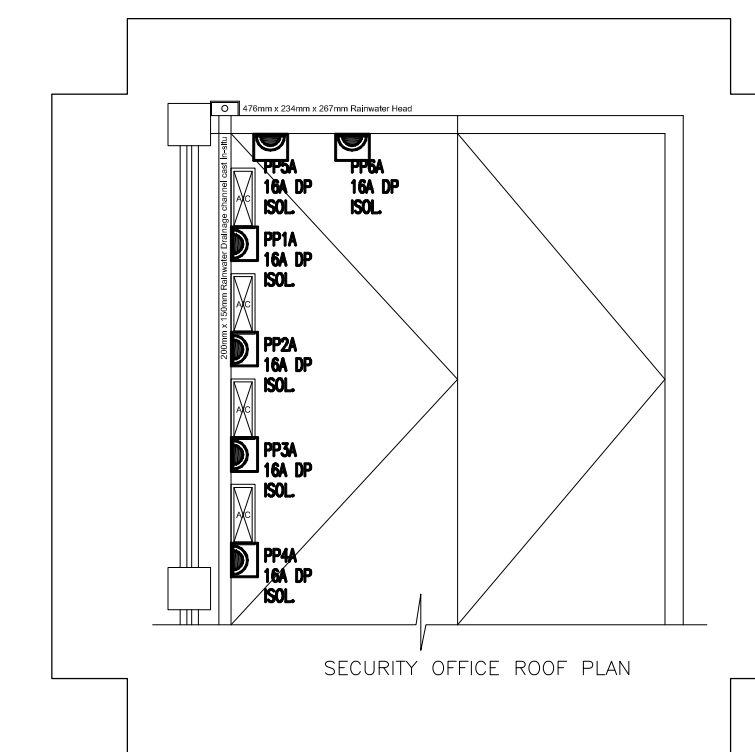
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AS INDICATED	AUG 2015

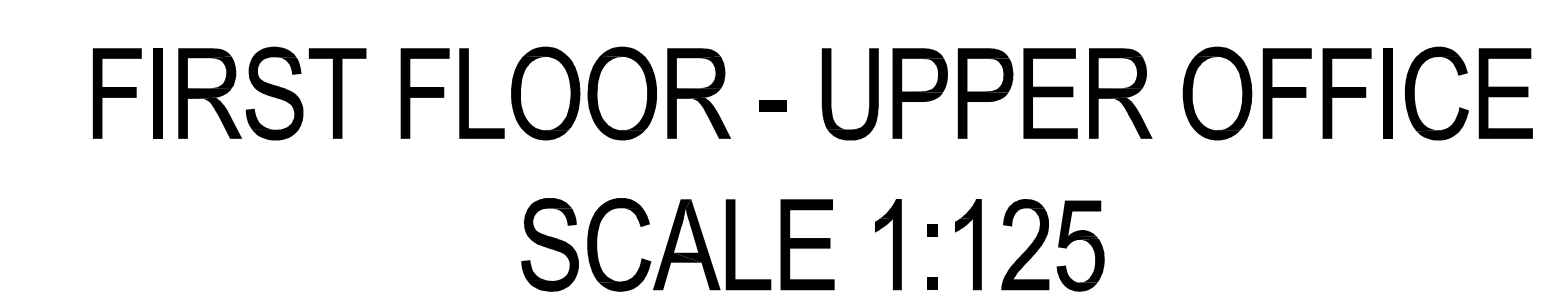
DRAWING NUMBER	REV NO
S-03	B

C3.5

Electrical Engineer's Drawings

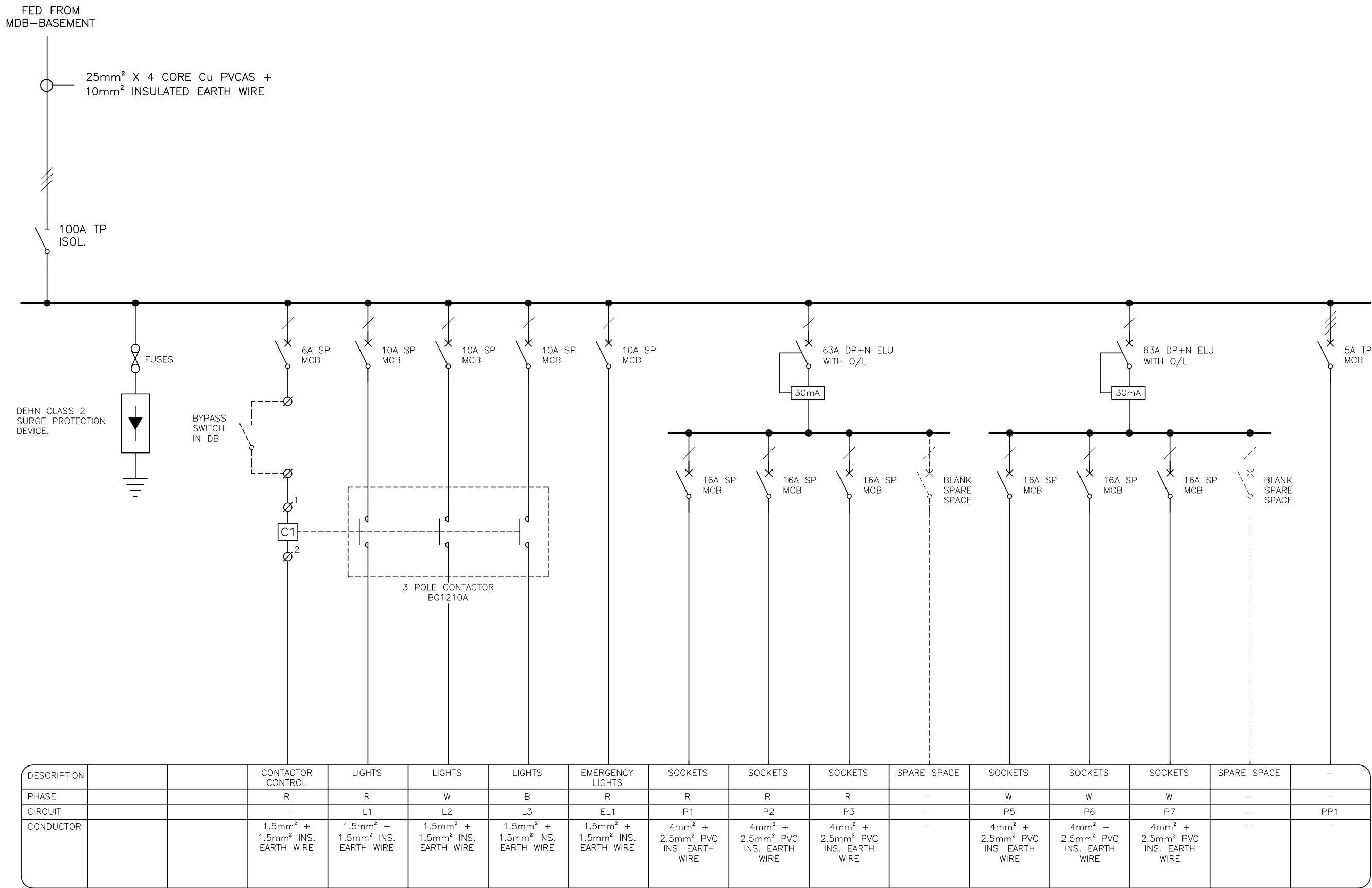
[illegible]

[illegible][illegible]

[illegible]

SDB - G4

SDB-G4	
NAME	SDB-G4
FAULT LEVEL	6kA (PROSPECTIVE)
PHASE	3
VOLTS	400V / 230V
MATERIAL	POWDER COATED MILD STEEL 1.6mm
AREA	INDOORS
DOORS	YES
LOCKABLE	YES
INSTALLATION	SURFACE MOUNTED
COLOUR	ORANGE / NORMAL SECTION-WHITE, DEDICATED SECTION-RED
EQUIPMENT	CBI / SCHNEIDER / ABB
STATUS	-
SPARE SPACE	40%



REVISION / WYSIGING

NO. NR.	DATE DATUM	DETAILS DETAIL
-	11-09-2015	ISSUED FOR TENDER

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ELECTRICAL

CLIENT/KLIËNTSARS

MAIN CONTRACTOR/HOOFKONTRAKTEUR-

ARCHITECT/ARGITEKBNM ARCHITECTS



1st Floor Building 1
De Tiger Office Park
Hannes Louw Drive
Parow 7500
Tel: +27 21 911 5094
Fax: +27 21 453 0428
cmb@cmbt.co.za
www.clinksc.com

CLINKSCALES MAUGHAN-BROWN
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS
PORT ELIZABETH CAPE TOWN GEORGE WINDHOEK
CLINKSCALES MAUGHAN-BROWN PTY LTD (2003/010026/07)



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PROJECT/PROJEKTSARS CUSTOMS WAREHOUSE

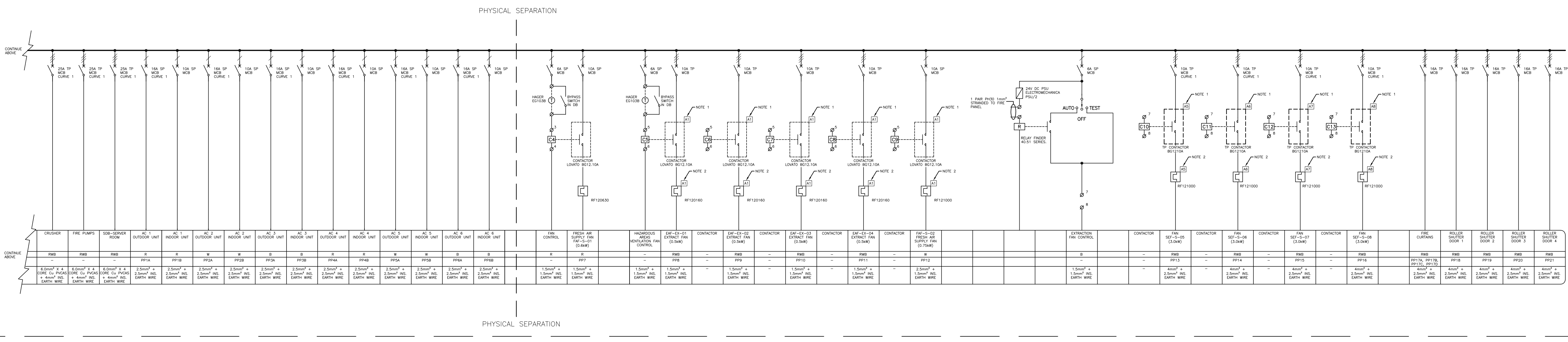
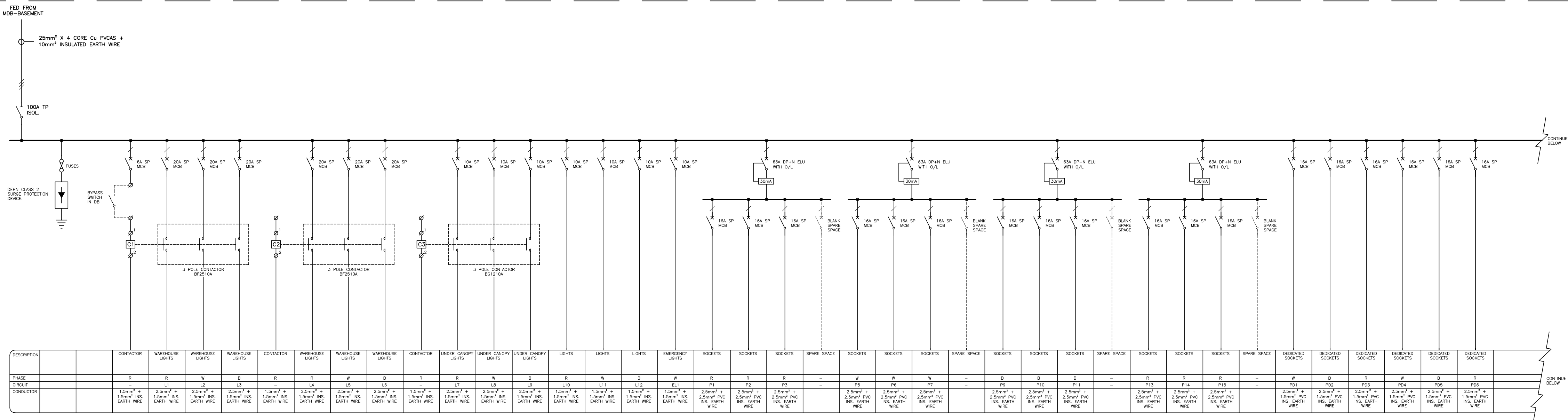
DRAWING TITLE/TEKENING TITELSCHEMATIC DIAGRAM
SDB-G4

DRAWN GETEKEN NCM	DESIGNED ONTWERP RvdM	CHECKED NAGESIEN -	APPROVED GOEDGEKEUR -
SCALE SKAAL NTS	DATE DATUM 11-09-2015	CAD REF. NO. CAD VERW. NR. -	DWG. SIZE TEKEN-GROOTTE A2
DRAWING NO./TEKENING NR. 6352/E/SCH/02			REVISION HERSENSING -

1. RUN AUXILIARY INDICATOR LIGHT (GREEN)
2. TRIP AUXILIARY INDICATOR LIGHT (RED)

SOB-G5	
NAME	SOB-G5
FAULT LEVEL	6AA (PROSPECTIVE)
PHASE	3
VOLTS	400V / 230V
MATERIAL	POWDER COATED MILD STEEL 1.6mm
AREA	1600cms
DOORS	YES
LOCKABLE	YES
INSTALLATION	SURFACE MOUNTED
COLOR	ORANGE / NORMAL SECTION-WHITE, DEDICATED SECTION-RED
EXEQUENT	MR. T. SCHNIDER / ABB
STATUS	-
SQUARE SPACE	40X

SDB - G5

REVISION / WYSIGING

NO. NR.	DATE DATUM	DETAILS DETAIL
—	11-09-2015	ISSUED FOR TENDER

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 soos aangedui.

ELECTRICAL

CLIENT/QUẢN

SARS

MAIN CONTRACTOR/HOOFKONTRAKTEUR

BNM ARCHITECTS



CLINKSCALES MAUGHAN-BROWN
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS
PORT ELIZABETH CAPE TOWN GEORGE
EAST LONDON WINDHOEK
CLINKSCALES MAUGHAN-BROWN (PTY) LTD (2003/01008/07)

1st Floor, Building 1
De Tijger Office Park
Hannes Louw Drive
Parijs 7500
Tel: +27 21 911 5094
Fax: +27 21 413 0428
cmb@cmbco.co.za
www.dinkscales.co.za

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PROJECT/PROJEX

DRAWING TITLE/TEKENING TITEL
SCHEMATIC DIAGRAM
SDB-G5

DRAWN GETEKEN	DESIGNED ONTWERP	CHECKED NAGESIEN
NCM	RvdM	-

SCALE SKAAL NTS	DATE DATUM 11-09-2015	CAD REF. NO. CAD VERW. NR. -
---------------------------	---------------------------------	--

DRAWING NO./TEKENING N

6352/E/SCH/03

1. RUN AUXILIARY INDICATOR LIGHT (GREEN)
2. TRIP AUXILIARY INDICATOR LIGHT (RED)

SDB-G3	
NAME	SDB-G3
TAULT LEVEL	RRA (PROSPECTIVE)
PHASE	3
VDLTS	400V / 230V
MATERIAL	POWDER COATED MILD STEEL 1.6mm
AREA	INDOORS
DOORS	YES
LOCKABLE	YES
INSTALLATION	SURFACE MOUNTED
CLOUR	ORANGE / NORMAL SECTION-WHITE, DEDICATED SECTION-RED
COUPLER	CBI / SCHNEIDER / ABB
STATUS	-
LOUVER	40%
SPARE SPACE	

ELECTRICAL

SARS

ARCHITECTS



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SARS CUSTOMS WAREHOUSE

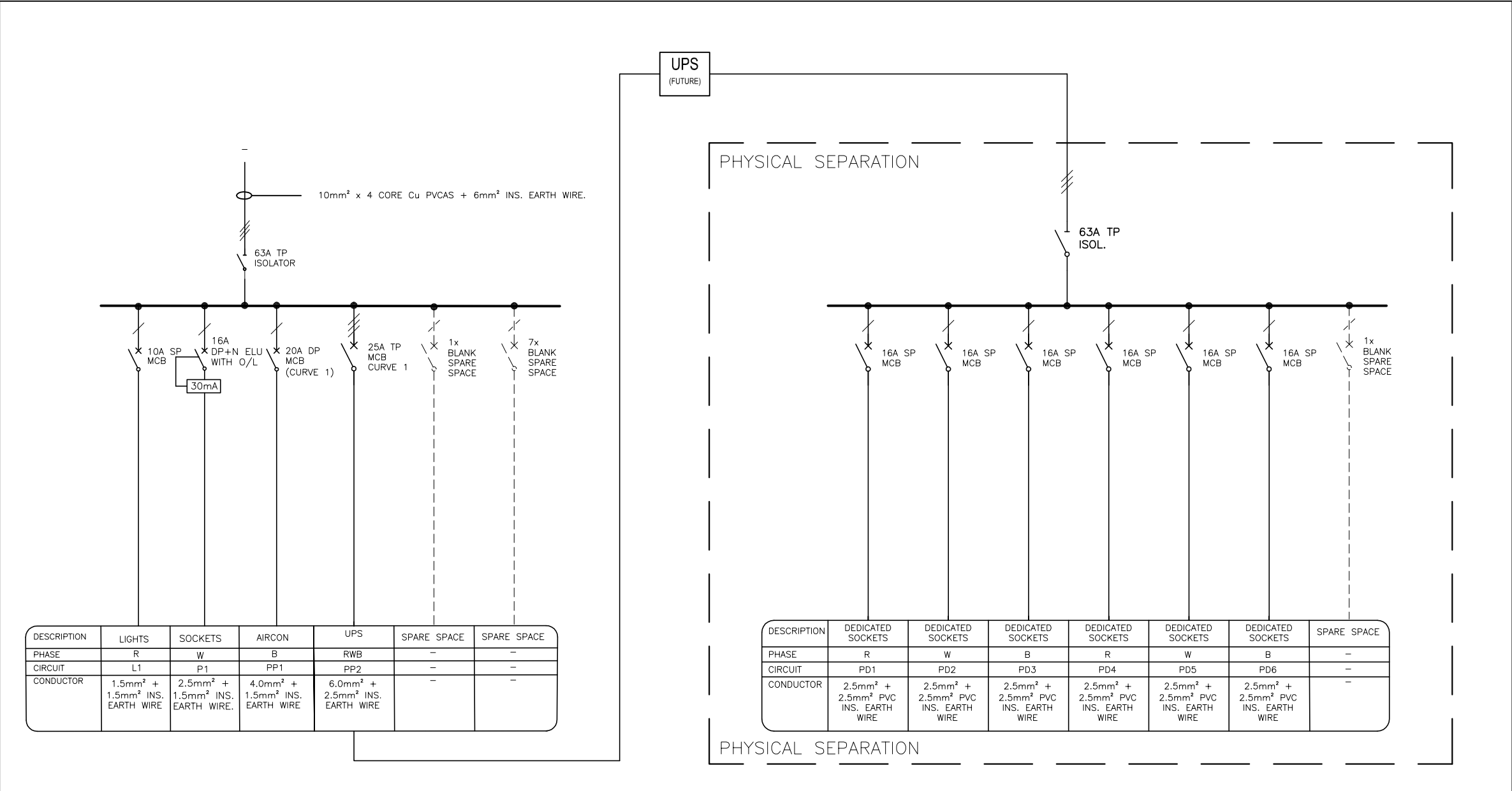
SARS CUSTOMS WAREHOUSE

SCHEMATIC DIAGRAM
SDB-G3

DRAWING GETEKEN NCM	DESIGNED ONTWERP RvdM	CHECKED NAGESIEN -	APPROVED GOEDGEKEURD -
SCALE SCHAAL NTS	DATE DATUM 11-09-2015	CAD REF. NO. CAD VERM. NR. -	DWG-SIZE TEKEN-GROOTTE A1
DRAWING NO./TEKENING NR. 6352/E/SCH/01			REVISION HERSIJENING -

SDB-NETWORK ROOM

SDB-NETWORK ROOM	
NAME	SDB-NETWORK ROOM
FAULT LEVEL	6kA
PHASE	3
VOLTS	400
MATERIAL	1.6mm 3CR12
AREA	INDOORS
DOORS	YES
LOCKABLE	YES
INSTALLATION	FLUSH
COLOUR	NORMAL - ORANGE / EMERGENCY - RED
EQUIPMENT	CBI
STATUS	NEW
SPARE SPACE	25%



REVISION / WYSIGING

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-	28-09-2015	ISSUED FOR TENDER

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ELECTRICAL

CLIENT/KLIËNT	SARS
---------------	------

MAIN CONTRACTOR/HOOFKONTRAKTEUR	-
---------------------------------	---

ARCHITECT/ARGITEK	BNM ARCHITECTS
-------------------	----------------



CLINKSCALES MAUGHAN-BROWN
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS
PORT ELIZABETH EAST LONDON CAPE TOWN GEORGE WINDHOEK

1st Floor, Building 1
De Tiger Office Park
Hannes Louw Drive
Parow 7500
Tel: + 27 21 911 5094
Fax: + 27 21 413 0428
cmb@cmbtd.co.za
www.clinkscases.co.za



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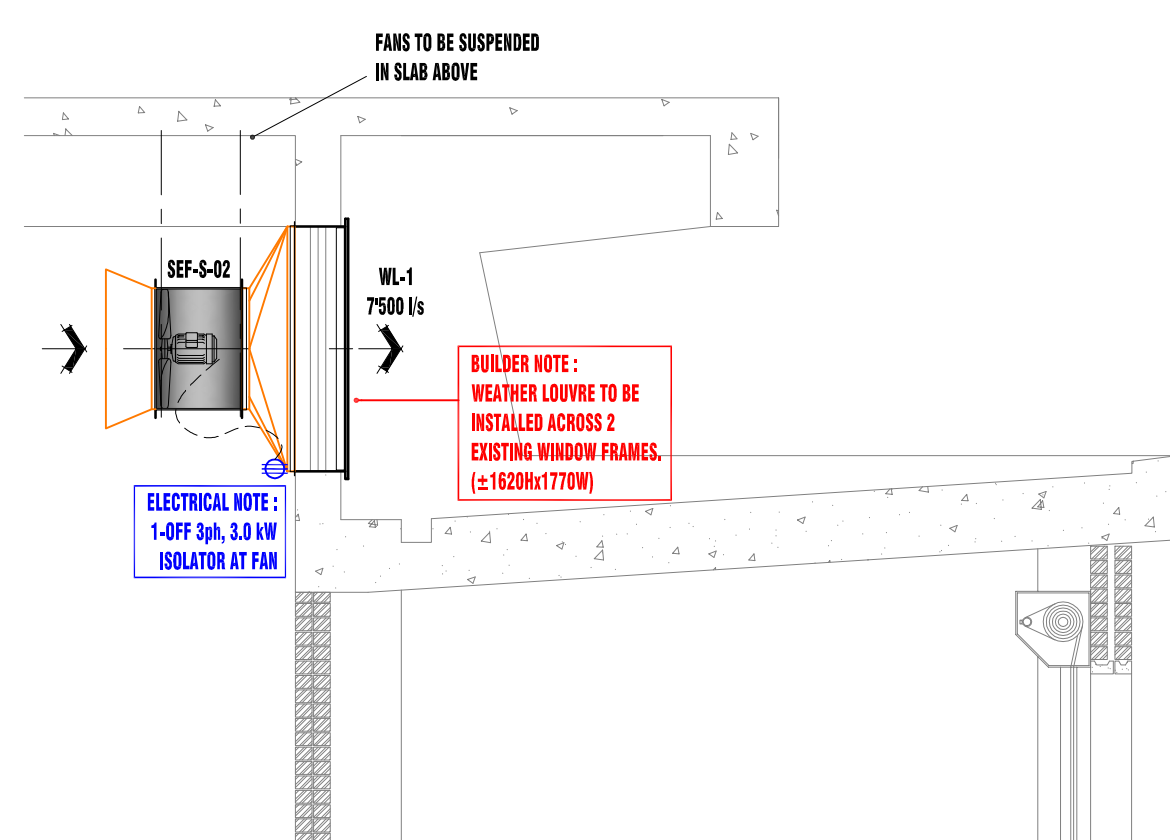
PROJECT/PROJEK	SARS CUSTOMS WAREHOUSE
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DRAWING TITLE/TEKENING TITEL	SDB-NETWORK ROOM SCHEMATIC DIAGRAM
------------------------------	---------------------------------------

DRAWN GETEKEN NCM	DESIGNED ONTWERP RM	CHECKED NAGESIEN -	APPROVED GOEDGEKEUR -
SCALE SKAAL NTS	DATE DATUM 28-09-2015	CAD REF. NO. CAD VERW. NR. 6352E	DWG-SIZE TEKEN-GRROOTTE A3
DRAWING NO./TEKENING NR. 6352/E/SCH/04			REVISION HERSIENING -

C3.6

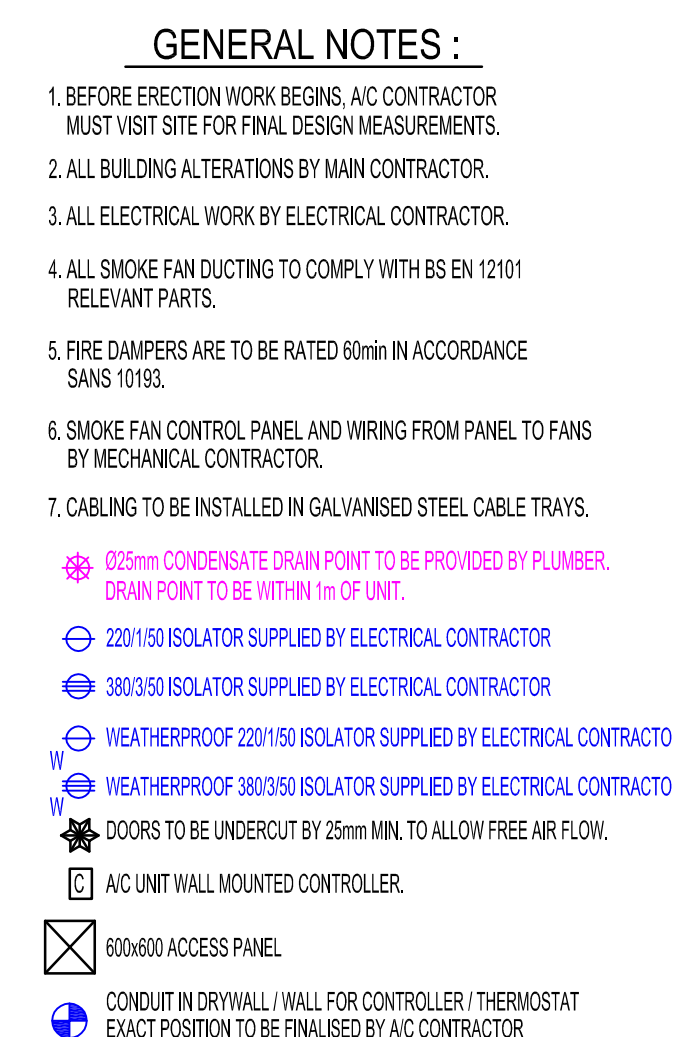
Mechanical Engineer's Drawings

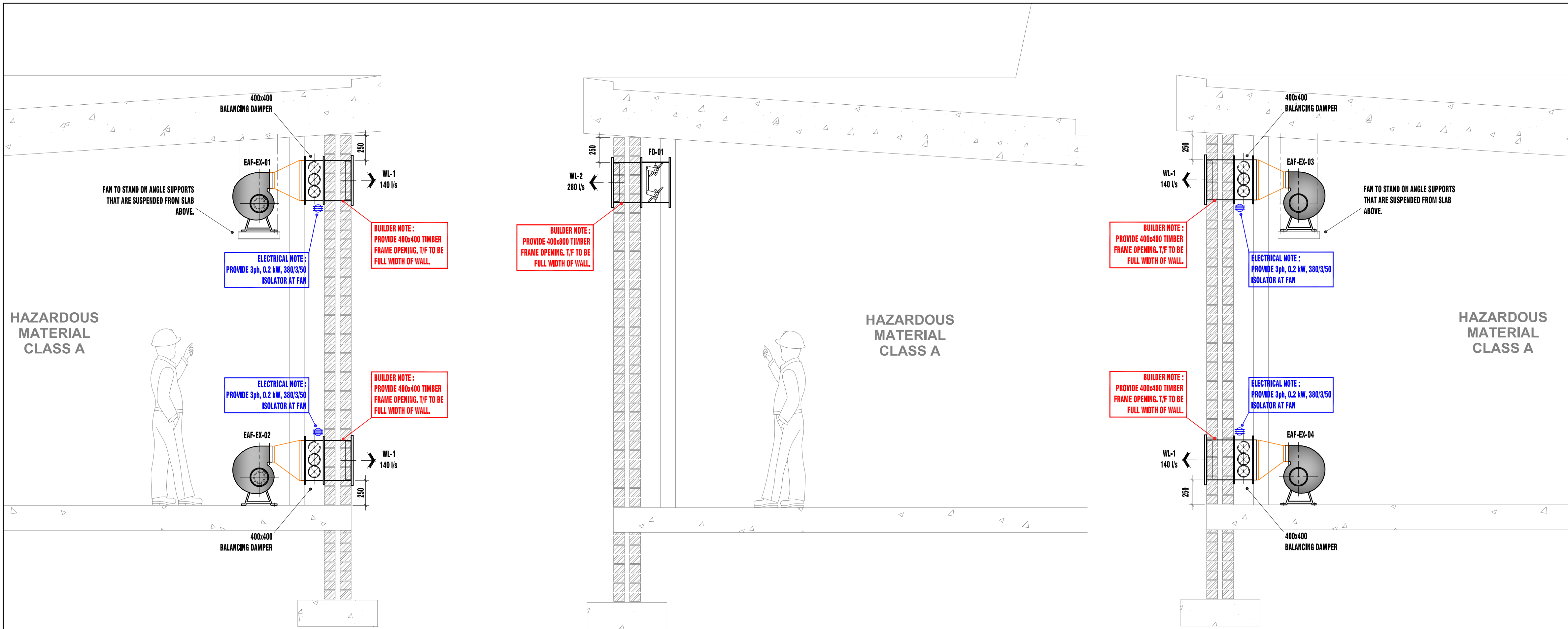


SECTION B - B | 1:50

EQUIPMENT No.	WL-1	
MAKE	AME	
TYPE/SIZE	WLOUVRÉ 1770x1620	
RE-HEATER (KW)	-	
FINISH	GALV. STEEL	
O.B.D.	-	
QUANTITY	8	
AIR QUANTITY (l/s)	AS SHOWN	

SMOKE EXTRACT AIR MECHANICAL VENTILATION FANS:			
FAN No.	SEI-S01	SEI-S02 to 98	
FAN TYPE (DOKN)	FUMAX 70.20.0.4	FUMAX 80.20.2.4	
AREA-SERVICED	WAREHOUSE	WAREHOUSE	
QUANTITY	1	1	0715
EXHAUSTION SIZE (mm)	676	676	
AIR CAPACITY EACH (l/s)	3000	7500	
STATIC PRESSURE (Pa)	120	120	
MAXIMUM ROTATIONAL SPEED (rpm)	1440	1440	
MOTOR SIZE (kW)	2.2 / 4 hp	3.0 / 4 hp	
SOUND ATTENUATORS:	DISCHARGE	-	
	SUCTION	-	
ISOLATOR	20 amp	20 amp	
POWER SUPPLY (PHASE/Hz)	380/50	380/50	
CONTROL	SMOKE SIGNAL FROM FIRE DETECTION TO SMOKE CAP	SMOKE SIGNAL FROM FIRE DETECTION TO SMOKE CAP	

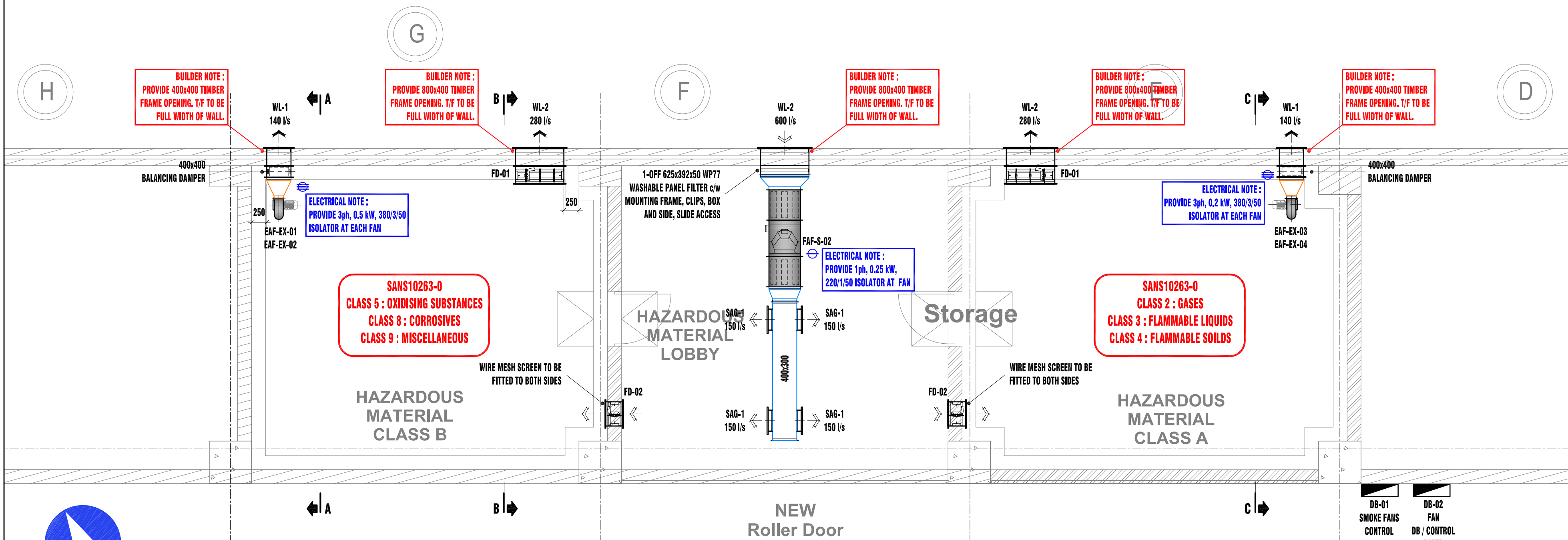
[illegible]



SECTION A - A | 1:25

SECTION B - B | 1:25

SECTION C - C | 1:25



PART GROUND FLOOR PLAN | 1:50

GRILLES / DIFFUSERS / FIRE DAMPERS :

EQUIPMENT No.	SAG-1	WL-1	WL-2	FD-01	FD-02
MAKE	AME	AME	AME	TROX	TROX
TYPE/SIZE	D/D SAG 350x250	WL0UVRE 400x400	WL0UVRE 800x400	MOTORISED F/D 800x400	MOTORISED F/D 400x400
RE-HEATER (kW)	-	-	-	-	-
FINISH	-	GALV. STEEL	GALV. STEEL	-	-
O.B.D.	Y	-	-	-	-
QUANTITY	4	4	3	2	2
AIR QUANTITY (l/s)	AS SHOWN	AS SHOWN	AS SHOWN	AS SHOWN	AS SHOWN

FRESH AIR MECHANICAL VENTILATION FANS:

FAN No.	FAF-S-02
FAN TYPE (DONKIN)	VFC 355/550
QUANTITY	1
AREA SERVED	HAZARDOUS
DIAMETER / SIZE	(mm) 520x450x450
AIR QUANTITY EACH	(l/s) 600
STATIC PRESSURE	(Pa) 200
MAXIMUM ROTATIONAL SPEED	(rpm) 1350
MOTOR SIZE	(kW) 0.75
SOUND ATTENUATORS:	DISCHARGE -
	SUCTION -
ISOLATOR	20 amp
POWER SUPPLY	(PHASE/HZ) 220/1/50
CONTROL	SEE NOTE 1

NOTE 1:
FANS TO RUN CONTINUOUSLY. FANS STOPPED BY FIRE SIGNAL.
FD-01 OPENS IN CASE OF FIRE. FD-02 CLOSSES IN CASE OF FIRE.
EXTRACT AIR MECHANICAL VENTILATION FANS:

FAN No.	EAF-EX-01	EAF-EX-02	EAF-EX-03	EAF-EX-03
FAN TYPE (SOCECA)	CPV-1020-4T ATEX PLASTIC ANTI-CORROSIVE	CPV-1020-4T ATEX PLASTIC ANTI-CORROSIVE	C304T ATEX C-SERIES	C304T ATEX C-SERIES
QUANTITY	1	1	1	1
AREA SERVED	HAZARDOUS d B	HAZARDOUS d B	HAZARDOUS d A	HAZARDOUS d A
DIAMETER / SIZE	(mm) Ø160	Ø160	Ø160	Ø160
AIR QUANTITY EACH	(l/s) 140	140	140	140
STATIC PRESSURE	(Pa) 220	220	125	125
MAXIMUM ROTATIONAL SPEED	(rpm) 1350	1350	1350	1350
MOTOR SIZE	(kW) 0.5	0.5	0.5	0.5
SOUND ATTENUATORS:	DISCHARGE -	-	-	-
	SUCTION -	-	-	-
ISOLATOR	20 amp	20 amp	20 amp	20 amp
POWER SUPPLY	(PHASE/HZ) 380/3/50	380/3/50	380/3/50	380/3/50
CONTROL	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1	SEE NOTE 1

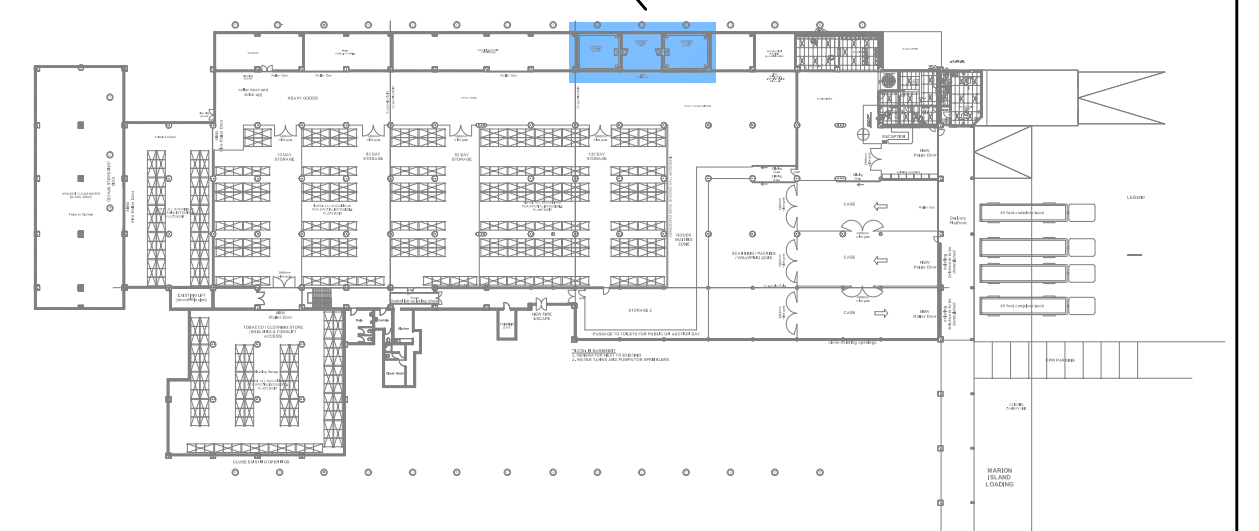
NOTE 1:
FANS TO RUN CONTINUOUSLY. FANS STOPPED BY FIRE SIGNAL.
FD-01 OPENS IN CASE OF FIRE. FD-02 CLOSSES IN CASE OF FIRE.

GENERAL NOTES :

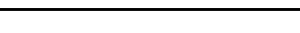

- BEFORE ERECTION WORK BEGINS, A/C CONTRACTOR MUST VISIT SITE FOR FINAL DESIGN MEASUREMENTS.
- ALL BUILDING ALTERATIONS BY MAIN CONTRACTOR.
- ALL ELECTRICAL WORK BY ELECTRICAL CONTRACTOR.
- ALL SMOKE FAN DUCTING TO COMPLY WITH BS EN 12101 RELEVANT PARTS.
- FIRE DAMPERS ARE TO BE RATED 60min IN ACCORDANCE SANS 10193.
- SMOKE FAN CONTROL PANEL AND WIRING FROM PANEL TO FANS BY MECHANICAL CONTRACTOR.
- CABLEING TO BE INSTALLED IN GALVANISED STEEL CABLE TRAYS.

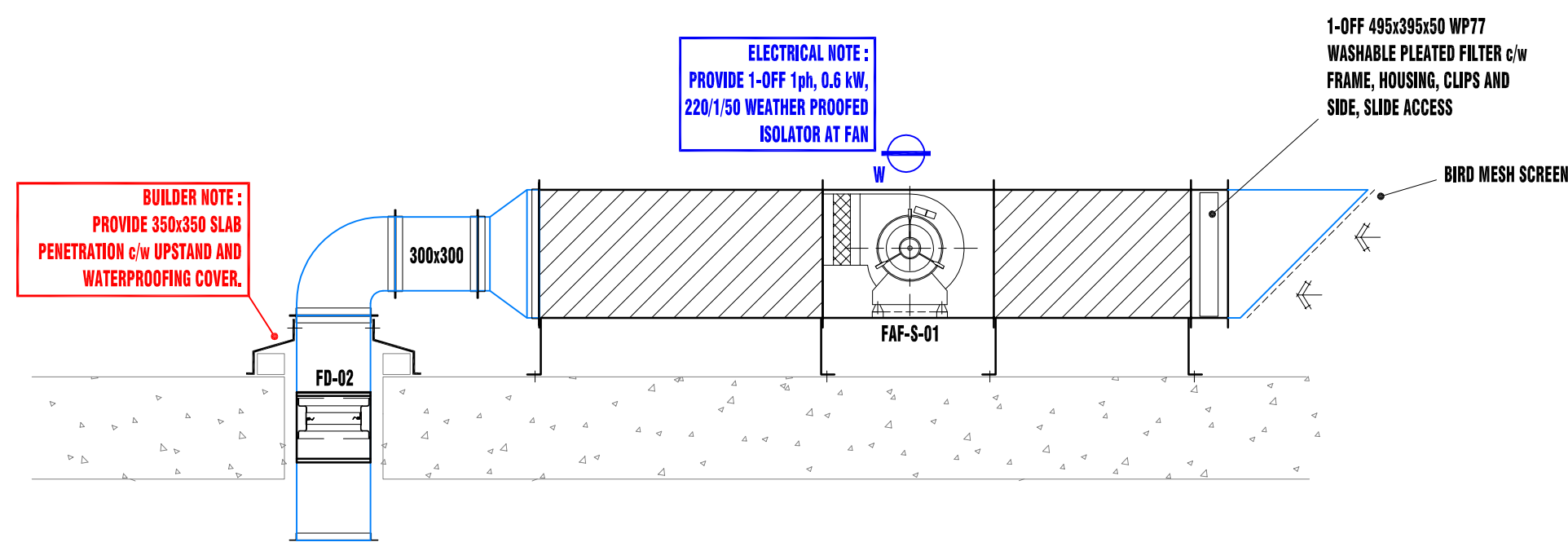
- Ø25mm CONDENSATE DRAIN POINT TO BE PROVIDED BY PLUMBER. DRAIN POINT TO BE WITHIN 1m OF UNIT.
- 220/150 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- 380/350 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- WEATHERPROOF 220/150 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- WEATHERPROOF 380/350 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- DOORS TO BE UNDERCUT BY 25mm MIN. TO ALLOW FREE AIR FLOW.
- A/C UNIT WALL MOUNTED CONTROLLER.
- 600x600 ACCESS PANEL.
- CONDUIT IN DRYWALL / WALL FOR CONTROLLER / THERMOSTAT EXACT POSITION TO BE FINALISED BY A/C CONTRACTOR

AREA IN DETAIL

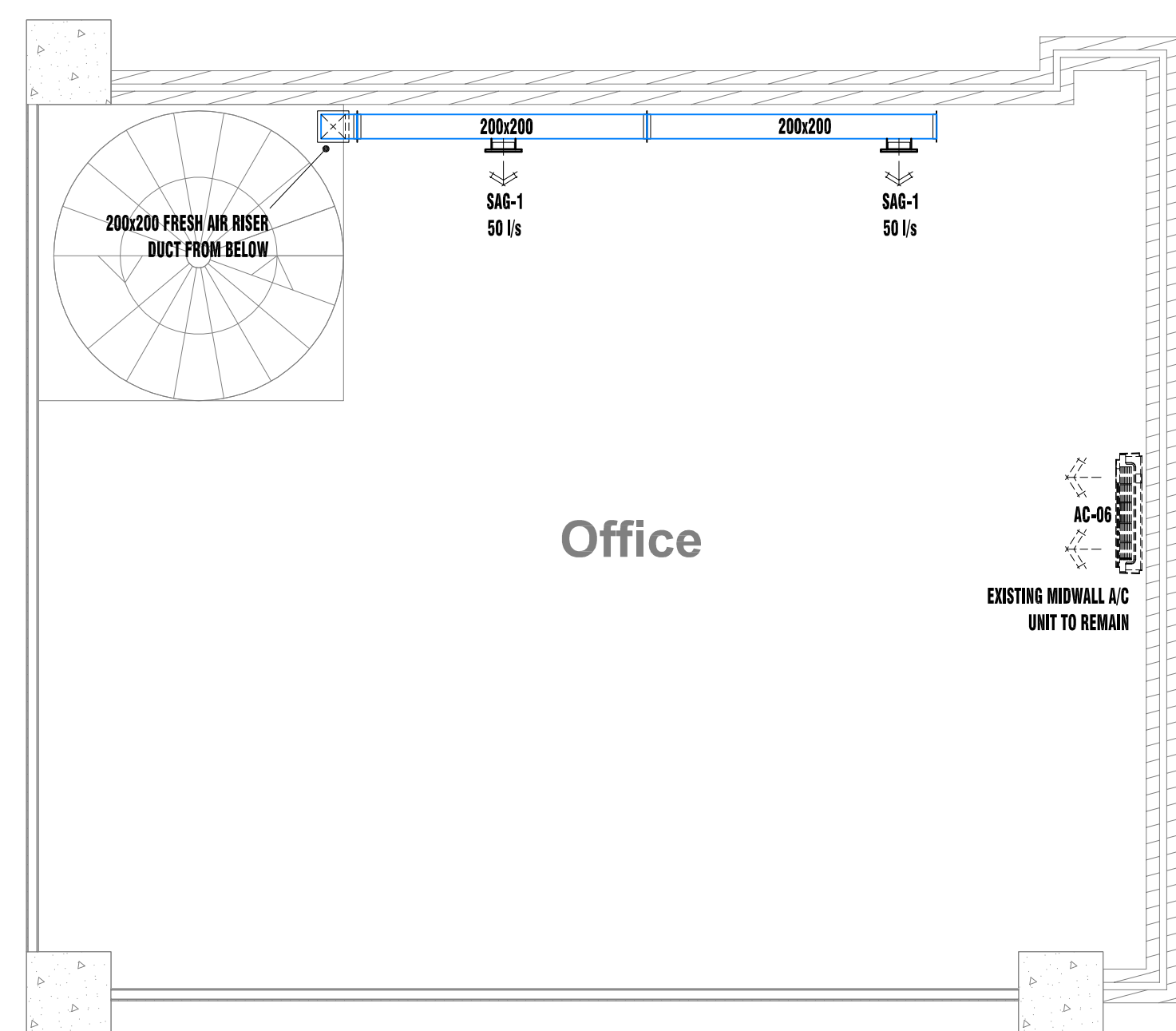


SITE PLAN

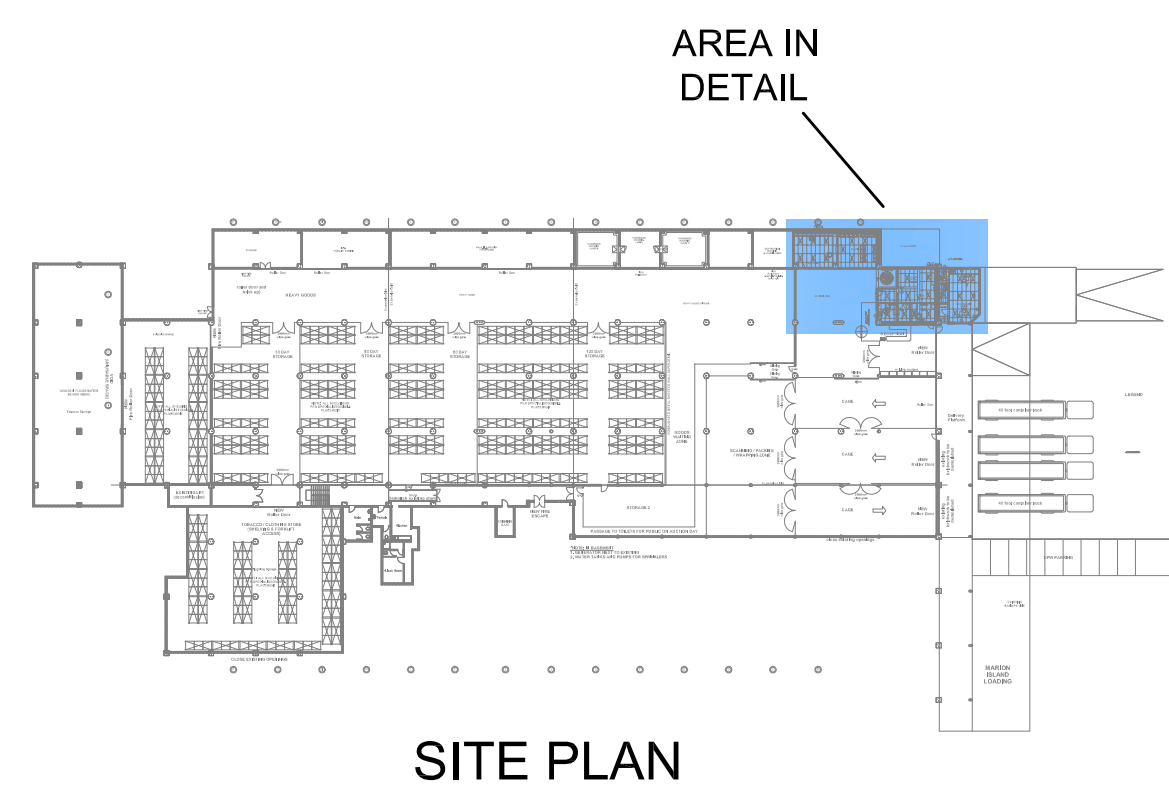
Amendment					Notes				Client		Project		Drawing description		Scale	
No.	Date	Checked	Done by	Description	C				Designed		E.S.				1 : 50 (A1)	
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									Checked				CONSULTING ENGINEER		REV.	
													SARS WAREHOUSE CAPE TOWN		0	
													GROUND FLOOR HAZARDOUS MATERIAL STORAGE VENTILATION			



SECTION C - C | 1:25



FIRST FLOOR PLAN | 1:50



SITE PLAN

[illegible]

FRESH AIR MECHANICAL VENTILATION FANS	
FAN NO.	FAN-S-01
FAN TYPE (DOWN)	VFC 355/550
QUANTITY	1
AREA SERVED	OFFICES
DIAMETER / SIZE	500x450x450
AIR QUANTITY EACH	455
STATIC PRESSURE	330
MAXIMUM ROTATIONAL SPEED	1350
MOTOR SIZE	0.6
SOUND ATTENUATORS:	DISCHARGE - SUCTION -
ISOLATOR	20 amp
POWER SUPPLY	(PHASE)Hz 220/150
CONTROL	TIMER IN DIE

NOTES:
1. FANS SHALL BE CONTROLLED BY AN ADJUSTABLE ELECTRONIC
TIMER MOUNTED IN THE RM.

UNIT No.	AC-01	AC-02	AC-03	AC-04	AC-05	AC-06
NAME						
UNIT TYPE	CASSETTE	MIDWALL	MIDWALL	MIDWALL	CASSETTE	MIDWALL
QUANTITY	1	1	1	1	1	1
TOTAL COOLING CAPACITY (kW)						
TOTAL HEATING CAPACITY (kW)						
REFRIGERANT						
ISOLATOR						
INDOOR OUTDOOR						
POWER SUPPLY (PHASE/Hz)	220/150	220/150	220/150	220/150	220/150	220/150

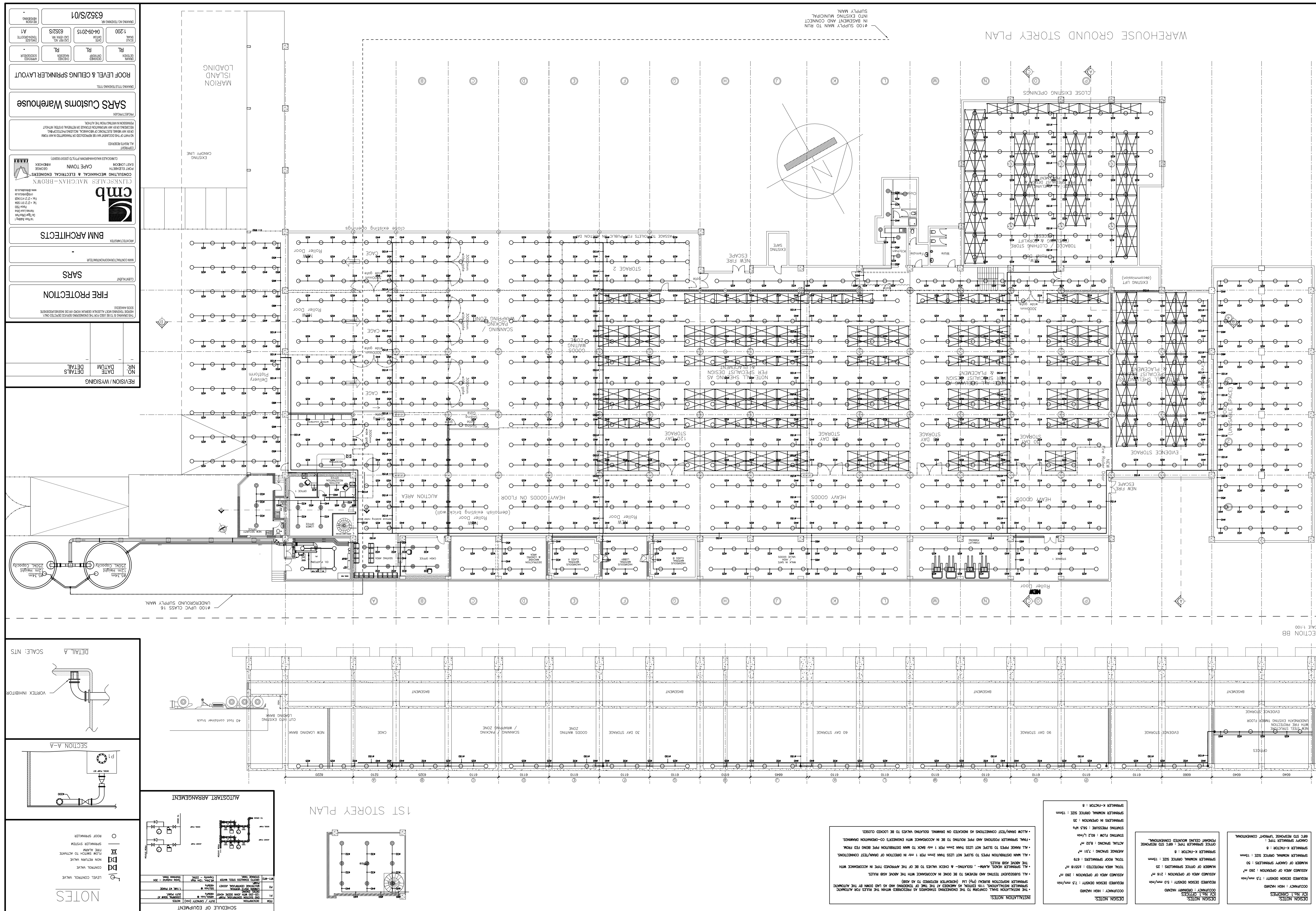
GENERAL NOTES :

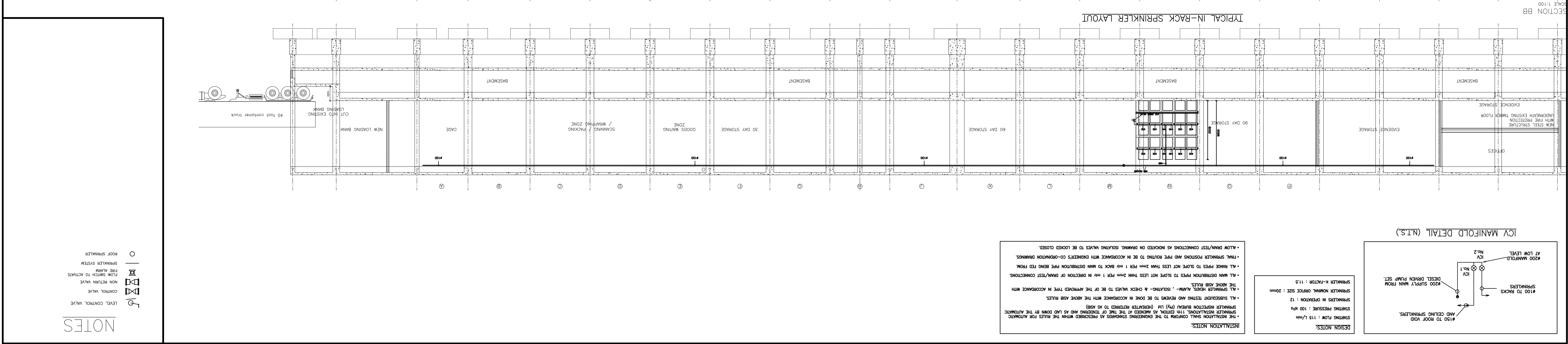
1. BEFORE ELECTRICAL WORK BEGINS, AS CONTRACTOR MUST VISIT SITE FOR FINAL DESIGN MEASUREMENTS
2. ALL BUILDING & ALTERATIONS BY MAIN CONTRACTOR.
3. ALL ELECTRICAL WORK BY ELECTRICAL CONTRACTOR.
4. ALL DUCTWORK TO BE MANUFACTURED TO S.A.B.S. 1208/2006 AS LOW PRESSURE DUCTWORK IN GALVANISED SHEETMETAL.
5. ALL DUCTS SHOULD BE RIGIDLY SUPPORTED.
6. ALL DUCTS TO BE CLAMPED TOGETHER.
7. ALL RETURN AIR DUCTS TO BE INTERNALLY LINED.
8. REFER TO ARCHITECT'S CEILING LAYOUT CO-ORDINATION DRAWING FOR POSITION FOR AIR REGISTERS.
9. FINAL POSITION OF OUTDOOR AC UNITS TO ARCHITECT'S APPROVAL.
10. FINAL POSITION OF INDOOR AC UNITS TO ARCHITECTS APPROVAL.
11. FINAL REPRESENTATION PIPING ROUTE TO BE DETERMINED UNQUOTE TO ARCHITECT'S APPROVAL.
12. GOOD DRAIN PIPES TO SERVICE EACH ROOM UNIT TO BE INSTALLED PRIOR TO THE WORK BEING COMMENCED. HOWEVER, COSE DRAINING BY OTHERS, AS SUB-CONTRACTOR TO MARK OUT POSITIONS ETC.
13. ALL PANS IN CEILING DUCTS TO BE INSULATED WITH 100mm THICK PIR-FIBREGLASS AND CAPPED WITH 10mm THICK M.S. CAP.
14. PIR INSULATION TO BE RATED WITHIN IN ACCORDANCE SANS 10113.

- ⚙️ 802mm CONDENSATE DRAIN POINT TO BE PROVIDED BY PLUMBER. DRAIN POINT TO BE WITHIN 1m OF UNIT.
- ⚙️ 220/150 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- ⚙️ 380/3 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- W ⚙️ WEATHERPROOF 220/150 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- W ⚙️ WEATHERPROOF 380/300 ISOLATOR SUPPLIED BY ELECTRICAL CONTRACTOR
- ★ DOORS TO BE UNDERCUT BY 25mm MIN. TO ALLOW FREE AIR FLOW.
- 📺 A/C UNIT WALL MOUNTED CONTROLLER.
- 📺 800x600 ACCESS PANEL.
- 🌀 CONDUIT IN DRYWALL (WALL FOR CONTROLLER) THERMOSTAT EXACT POSITION TO BE FINISHED BY A/C CONTRACTOR.

C3.7

Fire Engineer's Drawings





PART C4:

ANNEXURES

C4.1

Electrical Installation Bills of Quantities and Specifications

**TENDER DOCUMENT
FOR
SOUTH AFRICAN REVENUE
SERVICES
WAREHOUSE UPGRADE
FORESHORE, CAPE TOWN**

***PART C4.1
ELECTRICAL
INSTALLATION***

September 2015

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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 luminaires, 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 luminaires 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 2,5mm² 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 by 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 The use of power driven mechanical excavators shall be subject to the approval of the Department. Should the excavator produce trenches that exceed the required dimensions, payment based on volumetric excavation rates will be calculated on the required dimensions only.

3.3 BLASTING

- 3.3.1 No guarantee is given or implied that blasting will not be required.
- 3.3.2 Should blasting be necessary and approved by the Department, the Contractor shall obtain the necessary authority from the relevant Government Departments and Local Authorities. The Contractor shall take full responsibility and observe all conditions and regulations set forth by the above authorities.

3.4 ROUTES

- 3.4.1 Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Department beforehand. Refer also to par. 10.4.
- 3.4.2 The Department reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.
- 3.4.3 The removal of obstructions along the cable routes shall be subject to the approval of the Department.

3.5 SHORING AND WATERLOGGING

- 3.5.1 The Contractor shall provide shoring for use in locations where there is a danger of the sides of the trench collapsing due to waterlogging or other ground conditions. Refer to the The Occupational Health and Safety Act.
- 3.5.2 The strength of shoring must be adequate for site conditions prevailing and the shoring must be braced across the trench.
- 3.5.3 The Contractor shall provide all pumps and equipment required to remove accumulated water from trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

3.6 TRENCHING

- 3.6.1 Trenching shall be programmed in advance and the approved programme shall not be departed from except with the consent of the Department.
- 3.6.2 Trenches shall be as straight as possible and shall be excavated to the dimensions indicated in this specification.
- 3.6.3 The bottom of the trench shall be of smooth contour, and shall have no sharp dips or rises which may cause tensile forces in the cable during backfilling.
- 3.6.4 The excavated material shall be placed adjacent to each trench in such a manner as to prevent nuisance, interference or damage to adjacent drains, gateways, trenches, water furrows, other works, properties or traffic. Where this is not possible the excavated materials shall be removed from site and returned for backfilling on completion of cable laying.
- 3.6.5 Surplus material shall be removed from site and disposed of at the cost of the Contractor.
- 3.6.6 Trenches across roads, access ways or footpaths shall not be left open. If cables cannot be laid immediately the Contractor shall install temporary "bridges" or cover plates of sufficient strength to accommodate the traffic concerned.
- 3.6.7 In the event of damage to other services or structures during trenching operations the Contractor shall immediately notify the Department and institute repairs. (Refer to par. 3.1.3 and 3.1.4)
- 3.6.8 Prior to cable laying the trench shall be inspected thoroughly and all objects likely to cause damage to the cables either during or after laying shall be removed.
- 3.6.9 Where ground conditions are likely to reduce maximum current carrying capacities of cables or where the cables are likely to be subjected to chemical or other damage or electrolytic action, the Department shall be notified before installing the cables. The Department will advise on the course of action to be taken.
- 3.6.10 Extreme care shall be taken not to disturb surveyor's pegs. These pegs shall not be covered with excavated material. If the surveyor's pegs are disturbed, they shall be replaced by a person qualified to do so.

3.7 DIMENSIONS OF TRENCHES

- 3.7.1 Cable trenches for one or two cables shall not be less than 300 mm wide and need not be more than 450 mm wide. This dimension shall be valid for the total trench depth.
- 3.7.2 The width shall be increased where more cables are installed to allow for the spacings stipulated in par. 4.2.
- 3.7.3 Where trenches change direction or where cable slack is to be accommodated, the Contractor shall ensure that the requirements of the relevant SANS Specification regarding the bending radii of cables are met when determining trench widths.
- 3.7.4 Trench depths shall be determined in accordance with cable laying depths and bedding thickness.
- 3.7.5 Payment will be made on a volumetric excavation rate calculated on the basis of the given maximum dimensions or the actual dimensions, whichever is the lesser. Refer also to par. 3.2.2 and 3.7.1 above.

3.8 JOINT HOLES

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

3.9 BEDDING

- 3.9.1 The bottom of the trench shall be filled across the full width with a 75mm layer of suitable soil sifted through a 6mm mesh and levelled off.
- 3.9.2 Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,5°C m/W) may be used for this purpose. Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used. The use of crusher sand is acceptable.
- 3.9.3 Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for excavations.
- 3.9.4 After cable laying a further layer of bedding shall be provided to extend to 75 mm above the cables.
- 3.9.5 The bedding under joints shall be fully consolidated to prevent subsequent settling.

3.10 CABLE SLEEVES

- 3.10.1 Where cables cross under roads, railway tracks, other service areas, etc. and where cables enter buildings, the cables shall be installed in Polyethylene (6mm thickness), asbestos cement pipes or earthenware pipes. Pitch fibre and PVC pipes are not acceptable because of the adhesion that occurs after a period of time between the pipe and the sheathing or outer serving of the cables.
 - 3.10.2 Pipes shall be joined in accordance with the manufacturer's instructions.
 - 3.10.3 Sleeves shall cross roads and railway tracks at right angles.
 - 3.10.4 Sleeves shall have a minimum diameter of 100mm. They shall extend at least 2m beyond the tracks of a railway line or of the outermost tracks where there is more than one line. In the case of roads, the sleeves shall extend at least 1m beyond the road edge or kerb on both sides of the road.
 - 3.10.5 All sleeves shall be graded 1:400 for water drainage.
 - 3.10.6 Cable sleeves shall be installed to the spacings and depths stated in paragraph 4 below.
 - 3.10.7 Galvanised metallic sleeves up to and including 76mm dia. shall be supplied and installed by the contractor.
 - 3.10.8 The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.
- ### 3.11 BACKFILLING
- 3.11.1 The Contractor shall not commence with the backfilling of trenches without prior notification to the Department so that the cable installation may be inspected. Should the Contractor fail

to give a timeous notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection will not be unreasonably delayed.

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

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

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

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

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

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

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

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

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

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

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

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

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

3.13 TRANSNET, PROVINCIAL ADMINISTRATION OR NATIONAL ROAD CROSSINGS

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

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

- 3.13.3 The Contractor shall carry out the crossing installation in strict accordance with the TRANSNET and Provincial Administration's requirements and stipulations. Where these requirements are in contradiction with this specification, the Department's ruling shall be sought.
- 3.13.4 The Contractor shall ensure that he will comply with the various Administration's requirements regarding crossing of Provincial and National roads, especially with regard to the safeguarding of the public. The Contractor shall also provide proof of adequate insurance cover against any claim from any accident as a result of work done by the Contractor during the crossing operation. The Department shall also be indemnified from all liability in this regard.
- 3.13.5 The Contractor shall liaise with the various Administrations well in advance regarding the intended dates, times and expected duration of the crossing operations and obtain their approval of the programme and method of operation before commencing with the work.

4. INSTALLATION OF UNDERGROUND CABLES

4.1 INSTALLATION DEPTHS

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

Up to 11kV : 800mm

- 4.1.2 All cable depth measurements shall be made to the top of the cable when laid directly in ground or to the top of the duct or sleeve where these are provided.
- 4.1.3 The above depths shall apply to the top layer where cables are installed in layers.
- 4.1.4 The Contractor may only deviate from the above depths provided prior authority in writing has been obtained from the Department. In this event the cables shall be protected with a suitable concrete covering.
- 4.1.5 The depth of cable pipes or ducts beneath railway lines or roads shall be not less than 1,1 m below the formation level.

4.2 CABLE SPACINGS

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

LV/LV	:	2 cable diameters
LV/HV	:	150mm minimum
HV/HV	:	150mm minimum
LV/HV/PILOT	:	1 cable diameter

- 4.2.2 Where HV and LV cables have to be installed in the same trench, both shall be laid at a depth of 800 mm and then covered with 200mm of soil. The soil shall then be compacted, and then backfilled layer by layer and compacted until the trench is completely backfilled.
- 4.2.3 Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables by at least 1m. All control or pilot cables without a lead sheath and steel armouring shall be laid at least 300mm from power cables.
- 4.2.4 Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200mm.

4.3 CABLE LAYING

- 4.3.1 Except where ducts, tunnels or pipes are provided, cables shall be laid directly in the ground.
- 4.3.2 The cable shall be removed from the drum in such a manner that the cable is not subjected to twisting or tension exceeding that stipulated by the cable manufacturer.
- 4.3.3 Cable rollers shall be used as far as possible to run out cables. Rollers shall be spaced so that the length of cable in the trench will be totally suspended during the laying operation and sufficiently close to prevent undue sagging and the cable from touching the ground. Rollers shall also be placed in the trench in such a manner that they will not readily capsize.
- 4.3.4 Cable rollers shall have no sharp projecting parts liable to damage the cables.
- 4.3.5 Where cables have to be drawn around corners, well-lubricated skid plates shall be used. The skid plates shall be securely fixed between rollers and shall constantly be examined during cable laying operations.
- 4.3.6 Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used and particular care shall be exercised to avoid abrasion, elongation or distortion of any kind. In the case of oil filled cables, a cable sock may never be used. Special eyes giving access to the interior of the cable, must be utilised.
- 4.3.7 The maximum allowable tension when pulling a cable, is 70 N/mm² of conductor area.
- 4.3.8 It will be assumed that the price or rates contained in the tender includes for the installation of cables in pipes and ducts or below existing or newly installed services.
- 4.3.9 The Department shall be informed timeously of the intention to carry out all cable laying operations to allow an inspection of the works by the Department if so required.

5. INSTALLATION OF CABLES IN CONCRETE TRENCHES

5.1 GENERAL

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

5.2 INSTALLATION

Cables shall be installed in one of the following ways:

- (a) On horizontal cable trays.
- (b) On horizontal metal supports with suitable clamps.
- (c) On vertical cable trays or metal. supports fixed to the side of the trench. The cables shall be clamped in position.

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

5.3 COVERS

- 5.3.1 The covering of concrete trenches shall as a rule fall outside the scope of the electrical installation. The Contractor shall however be responsible for the cutting or drilling and

smoothing of holes for cables through chequer plates, concrete or other coverings as required.

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

5.4 FILLED TRENCHES

- 5.4.1 Where specified, floor trenches shall be filled with fine crusher sand (no river or sea 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 may 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 $130\text{ C} \pm 5\text{ C}$.
- (b) Cut a small length ($\pm 300\text{mm}$) 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 that 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	18	12	18	11
	20	30	20	30	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 C10.

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 luminaires shall be verified on site. All luminaires 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 luminaires that are not covered by the luminaires 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 luminaires, all luminaires with the exception of fluorescent luminaires mounted against ceilings, shall be fixed directly to the box. Fluorescent luminaires and luminaires 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 luminaires, 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 luminaires 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 luminaires. 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

Luminaires (especially fluorescent luminaires) 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 luminaires to the cable channel.

7. CEILING BATTENS

Where wooden blocks are used to suspend luminaires, 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 luminaires with metal canopies have to be installed against a false ceiling.

8. GLASS-BOWL LUMINAIRES

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

9. FLUORESCENT LUMINAIRES FIXED TO CONCRETE SLABS

Fluorescent luminaires 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 luminaires 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 luminaires to cable channels.

10. FLUORESCENT LUMINAIRES FIXED TO CEILINGS

- 10.1 In all cases where luminaires are fixed to false ceilings, the Contractor shall ensure that the ceiling is capable of carrying the weight of the luminaires 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 luminaires shall fit firmly against the ceiling branderling 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 luminaires 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 Luminaires may alternatively be fixed to metal cross-pieces resting in the ceiling tees.
- 10.6 Drilling of holes in ceiling tees to support luminaires will not be allowed.
- 10.7 Luminaires shall be fixed in neat relation to the ceiling lay-out.

11. CONTINUOUS ROWS OF LUMINAIRES

In cases where fluorescent luminaires are installed in tandem, only one connection outlet need be supplied per circuit. All luminaires 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. Luminaires 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 luminaires are specified, the Contractor shall maintain close liaison with the ceiling Contractor. In the case of tiled ceilings, the luminaires 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 luminaires 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 luminaires in the ceiling.

14. BULKHEAD LUMINAIRES

Surface mounted bulkhead luminaires 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 luminaires or luminaires 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 luminaires shall be securely suspended from the roof structure.
- 17.2 The luminaires may 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 unswitched 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 be 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 mm². 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 be 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 be 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, an 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 by 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 be 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 grommited. 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 grommited. 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 lines" 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.

**STANDARD
ELECTRICAL SPECIFICATION**

**SECTION C: QUALITY SPECIFICATIONS
FOR MATERIALS AND EQUIPMENT OF ELECTRICAL
INSTALLATIONS**

SEPTEMBER 2005

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SECTION C1**C.1 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 SANS Specifications as set out below and the conduit shall bear the mark of approval of the South African National Standards.

- (a) Screwed metallic conduit and accessories: SANS 1065 parts 1 and 2.
- (b) Plain-end metallic conduit and accessories: SANS 1065 Parts 1 and 2.
- (c) Non-metallic conduit and accessories: SANS 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 SANS 1065 and shall bear the SANS mark.
- 2.2 All conduit 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 SANS 32 & 121.
- 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 pressed steel with brass bushes in accordance with SANS 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

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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 SANS 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 SANS 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 SANS 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 SANS 10142.

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 SANS 1065.
- 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 SANS 32 & 121. In inland areas electro-galvanised or cadmium-plated accessories will be accepted.

8. NON-METALLIC CONDUIT

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 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

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secured with a brass bolt, nut and washer and shall be so constructed that the clamp fit firmly to the conduit without any additional packing.

SECTION C.2**C.2 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 SANS 32 & 121 or epoxy powder coated |
| (b) Cast in concrete | Pre-galvanised |
| (c) False ceiling voids | Pre-galvanised |
| (d) Vertical building ducts coated | Hot-dip galvanised to SANS 32 & 121 or epoxy powder |
| (e) Surface mounted in plant rooms, substations, service tunnels, basements | Epoxy powder coated or electro galvanized |
| (f) Damp areas, exposed to weather underground runs in contact with earth | Hot-dip galvanised to SANS 32 & 121 or epoxy powder coated |
| (g) Undercover industrial applications | Hot-dip galvanised to SANS 32 & 121 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 dueling 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 dueling to accommodate pedestal or recessed socket units. Tapped holes shall be provided to fix the pedestal units to the dueling.

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 C3**C.3 CABLE TRAYS AND LADDERS****1. METAL CABLE TRAYS**

Metal cable trays shall be manufactured from perforated rolled steel. Metal trays manufactured to the following standards shall be used:

- | | | |
|-----|-----------------------------|--|
| (a) | Less than 150mm wide | 1,2mm minimum thickness with 12mm minimum return |
| (b) | 150mm to 457mm | 1,2mm minimum thickness with 19mm minimum return |
| (c) | 460mm to 610mm (Heavy duty) | 2,5mm minimum thickness with 76mm return |

2. CABLE LADDERS

- 2.1 Metal cable ladders shall consist of a 76mm high side rail of 2mm minimum thickness. Cross pieces shall be spaced at maximum intervals of 250mm. Where cables of 10mm² or smaller are installed on cable ladders, the spacing of the cross pieces shall be 125mm. Cables shall be clamped in position by means of purpose-made cable clamps that fit into the cross pieces.
- 2.2 Cable ladders consisting of slotted metal rails which accommodate plastic or metal cable binding bands may be used in vertical cable runs against walls, etc. These cable ladders will be considered in horizontal cable runs for small cables for communication and control wiring upon the prior approval of the Department.
- 2.3 Purpose made cable trays consisting of 6mm angle iron and 6 x 40mm minimum cross pieces are acceptable in industrial applications. Cross pieces shall be welded in pairs at 250mm maximum centre-to-centre intervals. The pairs shall be spaced approx. 10mm apart to allow cable clamps or metallic binding bands to affix the cables to the tray.

3. PLASTIC CABLE TRAYS

Rigid un-plasticine PVC cable trays complying with the following standards may be used if specified in the Detail Technical Specification:

The up stands of trays listed in (a) and (b) shall not be perforated and the top of the up stand shall be smooth. The same cable tray type shall be used in long parallel tray runs.

4. FINISHES

Metal cable trays and ladders shall be finished as follows:

(a) In coastal areas	Hot-dip galvanised to SANS 32 & 121 or epoxy powder coated
(b) False ceiling voids	Electro-galvanised baked enamel power coated
(c) Vertical building ducts	Hot-dip galvanised to SANS 32 & 121 or baked enamel epoxy powder coated

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(d) Plant rooms, substations, service tunnels	Electro-galvanised baked enamel or basements epoxy powder coated
(e) Damp areas, exposed to weather	Hot-dip galvanised to SANS 32 & 121 baked enamel or epoxy powder coated
(f) Undercover industrial application	Hot-dip galvanised to SANS 32 & 121 or baked enamel epoxy powder coated

The above-mentioned finishes shall apply unless specified to the contrary in the Detail Technical Specification. Hot-dip galvanised trays and ladders shall be cold galvanised at all joints, sections that have been cut and at places where the galvanising has been damaged. Powder coated or enamel painted trays and ladders shall likewise be touched up at joints, cuts and damaged portions using spray canisters recommended by the manufacturer of the trays and ladders.

5. ACCESSORIES

Horizontal and vertical bends, T-junctions and cross connections shall be supplied by the Contractor. The dimensions of these connections shall correspond to the dimensions of the linear sections to which they are connected. The radius of all bends shall be 1m minimum. The inside dimensions of horizontal angles or connections shall be large enough to ensure that the allowable bending radius of the cables is not exceeded. Sharp angles shall be 45° mitred.

SECTION C4**C.4 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 SANS 1507, 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/black 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 SANS 1507.

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.

3.3 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

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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 SANS 1507.

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C.5 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 SANS 32 & 121.
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 SANS 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**C.6 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.

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- 2.4 The mould and resin shall be completely waterproof and non-hygrosopic 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 C7**C.7 PAPER-INSULATED CABLES****1. GENERAL**

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

2. CONSTRUCTION

- 2.1 Cables shall be manufactured in accordance with SANS 97 and shall come only from fresh stocks.
- 2.2 The cable construction shall be impregnated paper-insulated/lead or lead alloy E sheathed/PVC bedding/galvanised steel wire armoured/outer PVC sheath.
- 2.3 The conductors shall be of high conductivity, annealed, stranded copper that may be shaped or circular.
- 2.4 The conductor insulation shall consist of impregnated paper tapes, either pre-impregnated or mass-impregnated with a non-draining compound.
- 2.5 The sheath shall be lead or lead alloy E. The cable shall be sheathed with watertight extruded black PVC to eliminate electrolytic corrosion of the cable. Abbreviation for this type is PLSTC or PESTC.
- 2.6 Armouring shall consist of galvanised steel wire. It should be noted that a cable with wire armour has a much higher fault rating than a cable with tape armour and that in vertical installations only wire armour shall be used.
- 2.7 The cable insulation shall be suitable for the supply voltage specified and the cable must be suitable for a system with an unearthed neutral.

3. LENGTHS

Cable shall be manufactured and supplied in one length to the lengths specified unless these lengths exceed the standard drum length.

4. TESTS

Tests shall be carried out on production runs of the cable in accordance with SANS 97.

SECTION C8**C.8 CABLE END BOXES AND COMPOUND****1. CABLE END BOXES**

- 1.1 Cable end boxes shall be suitable to accept PLSTS, PLSTC, PESTS and PESTC cables.
- 1.2 The cable end boxes shall be of the metal clad type suitable for indoor or outdoor use as required for the specific application.

Only inverted type boxes shall be supplied for outdoor use. The insulators of the inverted type boxes are angled downwards.
- 1.3 The boxes shall be equipped with armour clamps and brass or gunmetal conical wiping glands.
- 1.4 All cable end boxes shall comply with BS 542.
- 1.5 The cable boxes shall be suitable for filling with bituminous, cold filling compound or resin oil semi-fluid compound.
- 1.6 The cable boxes for resin oil semi-fluid compound shall be equipped with a sight glass for compound level indication.

2. CABLE END BOX FILLING COMPOUND

- 2.1 Bituminous Compound
 - 2.1.1 The compound shall be suitable for filling metal clad cable end boxes.
 - 2.1.2 The compound shall comply with BS 1858, shall be non-hygroscopic and shall have a high dielectric strength and insulation resistance.
 - 2.1.3 The compound shall have good adhesive properties & shall not be susceptible to cracking.
 - 2.1.4 The compound shall be suitable for use in high ambient temperatures and system voltages of up to 22kV nominal.
- 2.2 Resin Oil Semi-fluid Compound
 - 2.2.1 The compound shall be suitable for filling metal clad cable end boxes with level indicators.
 - 2.2.2 The compound shall have a pouring temperature above 100°C,
 - 2.2.3 The compound shall be non-hygroscopic and shall have a high dielectric strength and insulation resistance.
 - 2.2.4 The compound shall have minimal contraction when cooling.
 - 2.2.5 Specification "HENLEY COMPOUND NO. 57018. INSULOL DG" conforms to this specification.

3. QUANTITY

An adequate quantity of compound shall be supplied to fill each cable end box. The supply of the compound is included in the contract. The compound level shall be checked after approximately 6 months and topped up.

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C.9 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**C.10 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 SANS 1663 and shall bear the SANS 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 SANS 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 SANS 1084.

SECTION C11**C.11 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 SANS 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.
- 1.3 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.

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- 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**C.12 LUMINAIRES FOR INTERIOR AND EXTERIOR APPLICATIONS****C.12.1 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 National Standards shall apply to this luminaire specification:

- | | | |
|------|---------------|--|
| 3.1 | SANS 1119: | Interior luminaires for fluorescent lamps. |
| 3.2 | SANS 1250: | Capacitors for use with fluorescent and other discharge lamp ballasts. |
| 3.3 | SANS 890: | Ballasts for fluorescent lamps. |
| 3.4 | SANS 1464: | Safety of luminaires. |
| 3.5 | SANS 1479: | Glow starters for fluorescent lamps. |
| 3.6 | IEC 400: | Lamp holders for tubular fluorescent lamps. |
| 3.7 | SANS 1041: | Tubular fluorescent lamps for general service. |
| 3.8 | SANS VC 8031: | Coatings applied by the powder-coating process. |
| 3.9 | SANS 783: | Baked enamels. |
| 3.10 | SANS 10142: | The wiring of Premises |

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 SANS 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 SANS 890. Part 1.

5. GENERAL TECHNICAL REQUIREMENTS**5.1 GENERAL**

- 5.1.1 Tubular fluorescent lamp luminaires shall comply fully with SANS 1119 and all amendments as well as the additional requirements of this specification. Luminaires shall bear the SANS mark, or at least have a SANS Certificate of Compliance.
- 5.1.2 The Department reserves the right to have samples of luminaires offered tested by the SANS for compliance with SANS 1119. If a sample luminaire is found not to comply with SANS 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

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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 SANS 890 and SANS 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 SANS 1119 are not exceeded.
- 5.5.4 Starters shall comply with SANS 1479 or with BS 3772 if it is not covered by SANS 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 SANS 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 SANS 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 SANS 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 SANS 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.

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- 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**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 National Standards shall apply to this luminaire specification:

- 3.1 SANS 1119: Interior luminaires for fluorescent lamps.
- 3.2 SANS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.3 SANS 890: Ballasts for fluorescent lamps.
- 3.4 SANS 1464: Safety of luminaires.
- 3.5 SANS 1479: Glow starters for fluorescent lamps
- 3.6 IEC 400: Lamp holders for tubular fluorescent lamps.
- 3.7 SANS 1041: Tubular fluorescent lamps for general service.
- 3.8 SANS VC8031: 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 IP66 and this shall be substantiated by a certificate of the South African National Standards.
 - 4.4.2 The luminaire shall have no dust-collecting or sharp edges and comers 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 SANS 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 SANS 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 six 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

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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 SANS VC8031.

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 SANS 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 SANS mark or shall at least have an SANS 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 twistlock 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 SANS 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**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 National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- | | | |
|-----|------------------------------|---|
| 3.1 | SANS1119:
latest | Interior luminaires for fluorescent lamps. Note: The amendments whereby luminaires with compact fluorescent lamps are covered, shall apply. |
| 3.2 | SANS 1250:
discharge | Capacitors for use with fluorescent and other lamp ballasts. |
| 3.3 | SANS 890, IEC 920 & IEC 921: | Ballasts for fluorescent lamps. |
| 3.4 | SANS 1464: | Safety of luminaires. |
| 3.5 | SANS 1479: | Glow starters for fluorescent lamps. |
| 3.6 | IEC 400: | Lamp holders for tubular fluorescent lamps. |

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- 3.7 SANS 1041, IEC 81 & IEC 901: Tubular fluorescent lamps for general service.
- 3.8 SANS 1247: Coatings applied by the powder-coating process.
- 3.9 SANS 783: Baked enamels.
- 3.10 SANS 10142: The wiring of Premises
- 3.11 SANS 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 SANS 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 SANS 890, Part 1 or IEC 920 and IEC 921.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 GENERAL

- 5.1.1 Compact fluorescent lamp luminaires shall comply fully with SANS 1119 and all amendments as well as the additional requirements of this specification. Luminaires which bear the SANS mark, are preferred. Luminaires shall at least have an SANS Certificate of Compliance.
- 5.1.2 The Department reserves the right to have samples of luminaires offered tested by the SANS for compliance with SANS 1119. If a sample luminaire is found not to comply with SANS 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.

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- 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	<u>LAMP</u>	<u>HOLDER</u>	<u>LAMP</u>	<u>HOLDER</u>
	7W PL	2G11	13W PLC	G24d-1
	9W PL	2G11	16W 2D	GR10q
	11W PL	2G11	18W PLC	G24d-2
	60/100E 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 SANS 890 & SANS 891, or IEC 920 & 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 SANS 1119 are not exceeded.
- 5.5.4 Starters shall comply with SANS 1479 or with BS 3772 if it is not covered by SANS 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

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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 SANS 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 SANS 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 SANS 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 SANS 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**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.
- 2.3 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.
- 2.4 Lamps shall be delivered separately.

3. STANDARDS

The following standard specifications of the South-African National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- | | | |
|------|------------------------------|---|
| 3.1 | SANS 60188: | High-pressure mercury vapour lamps. |
| 3.2 | IEC 662: | High-pressure sodium vapour lamps |
| 3.3 | IEC 61167: | Metal Halide lamps |
| 3.4 | SANS 56: | Incandescent lamps |
| 3.5 | SANS 1250: | Capacitors for use with fluorescent and other discharge lamp |
| | Ballasts. | |
| 3.6 | SANS 1464: | Safety of luminaires. |
| 3.7 | IEC 922 & IEC 923: | Ballasts for discharge lamps. |
| 3.8 | IEC 926 & IEC 927: | Starting devices (other than glow starters). |
| 3.9 | SANS 890. IEC 920 & IEC 921: | Ballasts for fluorescent lamps |
| 3.10 | IEC 400: | Lamp holders for fluorescent lamps |
| 3.11 | SANS 1247: | Coatings applied by the powder-coating process. |
| 3.12 | SANS 783: | Baked enamels. |
| 3.13 | SANS 10142: | The wiring of Premises |
| 3.14 | SANS 1507: | Electric cables with extruded solid dielectric insulation for |
| | fixed | installations. |
| 3.15 | SANS 60238 and VC8011: | Lamp holders |
| 3.16 | SANS 1277: | Street lighting luminaires. |

- 3.17 SANS 1088: Luminaire entries and spigots
- 3.18 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 SANS 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 SANS report.
- 4.4 SAFETY: The luminaire shall bear the SANS 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 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.
- 5.1.3.1 The luminaire shall bear the SANS 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 Alien 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.

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- 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 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 igniters 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 SANS 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:

<u>Lamp</u>	<u>Lamp holder</u>
Mercury Vapour 50W, 80W and 125W	E27

<u>Lamp</u>	<u>Lamp holder</u>
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

PLC 18W G24d-2

PLC 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 SANS 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**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.

3. STANDARDS

The following standard specifications of the South-African National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 3.1 SANS 10098: Code of practice for public lighting.
- 3.2 SANS 10142: The wiring of Premises
- 3.3 SANS 60238 & VC8011 Lamp holders
- 3.4 ~~SANS 783~~ Baked enamels
- 3.5 SANS 1119 Interior luminaries for fluorescent lamps (clauses applicable to compact fluorescent lamps)
- 3.6 SANS 1222: Enclosures for electrical equipment
- 3.7 SANS 1247 Coatings applied by the powder -coating process
- 3.8 SANS 1250 Capacitors for use with fluorescent and other discharge lamp ballasts
- 3.9 SANS 1277 Street lighting luminaires
- 3.10 SANS 1279 Floodlighting luminaires
- 3.11 SANS 1464 Safety of luminaires
- 3.12 SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations
- 3.13 IEC 662: High-pressure sodium vapour lamps
- 3.14 IEC 922 & IEC 923: Ballasts for discharge lamps.
- 3.15 IEC 926 & 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 SANS report.
- 4.4 SAFETY: The luminaire shall bear the SANS 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 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.

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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 SANS 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 luminaire's diffuser shall be suitable for Class B roads in terms of SANS 10098. 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 ignitor, 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 SANS 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.

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- 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 SANS 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 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 SANS 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:

<u>LAMP</u>	<u>LAMP HOLDER</u>
Sodium Vapour	E40 (All lamps shall be of the tubular clear type.)
150W or 250W	
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 SANS 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**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 National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- | | | |
|------|---------------------|---|
| 3.1 | SANS 10098: | Code of practice for public lighting. |
| 3.2 | SANS 10142: | The wiring of Premises |
| 3.3 | SANS 60238 & VC8011 | Lamp holders |
| 3.4 | SANS 783 | Baked enamels |
| 3.5 | SANS 1119 | Interior luminaires for fluorescent lamps (clauses applicable to compact fluorescent lamps) |
| 3.6 | SANS 1222: | Enclosures for electrical equipment |
| 3.7 | SANS 1247 | Coatings applied by the powder-coating process |
| 3.8 | SANS 1250 | Capacitors for use with fluorescent and other discharge lamp ballasts |
| 3.9 | SANS 1277 | Street lighting luminaires |
| 3.10 | SANS 60188 | Mercury vapour lamps |
| 3.11 | SANS 1464 | Safety of luminaires |
| 3.12 | SANS 1507: | Electric cables with extruded solid dielectric insulation for fixed installations |
| 3.13 | IEC 662: | High-pressure sodium vapour lamps |

- 3.14 IEC 922 & IEC 923: Ballasts for discharge lamps.
- 3.15 IEC 926 & 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 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 SANS report.
- 4.4 SAFETY: The luminaire shall bear the SANS 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 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 SANS 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 SANS 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 an 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 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 SANS 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 SANS 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:

<u>LAMP</u>	<u>LAMP HOLDER</u>
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 SANS 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**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.

3. STANDARDS

The following standard specifications of the South-African National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 3.1 SANS 10142: The wiring of Premises.
- 3.2 SANS 60238: Lamp holders and VCSOU
- 3.3 ~~SANS 783:~~ Baking enamels.
- 3.4 SANS 1222: Enclosures for electrical equipment.
- 3.5 SANS 1247: Coatings applied by the powder-coating process.
- 3.6 SANS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.7 SANS 1464: Safety of luminaires.
- 3.8 SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations.
- 3.9 IEC 662: High-pressure sodium vapour lamps.
- 3.10 SANS 60188 Mercury vapour lamps
- 3.11 IEC 61167 Metal halide lamps
- 3.12 IEC 922 & IEC 923: Ballasts for discharge lamps.
- 3.13 IEC 926 & IEC 927: Starting devices (other than glow starters).
- 3.14 Any standard referred to in the above standards.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 AREAS OF APPLICATION: The luminaires are intended for interior use in establishments under the control of the Department of Public Works.
- 4.2 FIXING: The luminaires shall be suitable for mounting against horizontal surfaces or beams or as described in the project specification.
- 4.2 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires

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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 SANS report.

4.4 SAFETY: The luminaire shall bear the SANS 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 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 preferably bear the SANS mark.

6. CONSTRUCTION

6.1 BODY

6.1.1 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.

6.1.2 Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.

6.1.3 The overall height of the luminaire shall not exceed 550mm.

6.1.4 The mass of the complete luminaire shall not exceed 12kg.

6.2 REFLECTOR

6.2.1 The reflector shall be of a spun-aluminium construction. The aluminium shall be of high purity and shall be brightened and anodised.

6.2.2 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 preferably be adjustable to accommodate the particular type of lamp used.

6.2.3 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.

6.2.4 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.

6.2.5 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.

6.2.6 The reflectors shall be manufactured with such close tolerances that all luminaires of the

same type have the same light distribution characteristics.

6.3 CONTROL GEAR

- 6.3.1 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.
- 6.3.2 Ballasts shall comply with IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V. 50Hz supplies.
- 6.3.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1 above are not exceeded.
- 6.3.4 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.
- 6.3.5 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.
- 6.3.6 The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.
- 6.3.7 In those applications where igniters 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.
- 6.3.8 Capacitors shall comply with SANS 1250. The power factor of each complete luminaire shall be corrected to at least 0,85.

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. Silicon insulation shall be used throughout.
- 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. The terminal block shall be mounted in the control gear compartment.
- 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.
- 6.4.6 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.

6.5 LAMP HOLDERS

- 6.5.1 Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall

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not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SANS VC8011 and shall be able to withstand a temperature of 240°C.

- 6.5.2 Lamp holders shall not degenerate under normal working conditions and shall not work loose as a result of vibration.

6.6 LAMPS

- 6.6.1 The following standard lamps shall be used for the purposes of this specification:

<u>LAMP</u>	<u>LAMP HOLDER</u>
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

- 7.1 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 SANS 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**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.

3. STANDARDS

The following standard specifications of the South-African National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 3.1 SANS 10142: The wiring of Premises.
- 3.2 SANS 60238 & VC8011 Lamp holders
- 3.3 ~~SANS 783:~~ Baking enamels.
- 3.4 SANS 1222: Enclosures for electrical equipment.
- 3.5 SANS 1247: Coatings applied by the powder-coating process.
- 3.6 SANS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.7 SANS 1279: Floodlighting luminaires.
- 3.8 SANS 1464: Safety of luminaires.
- 3.9 SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations.
- 3.10 IEC 662: High-pressure sodium vapour lamps.
- 3.11 SANS 60188: Mercury vapour lamps
- 3.12 IEC 61167: Metal halide lamps
- 3.13 IEC 922 & IEC 923: Ballasts for discharge lamps.
- 3.14 IEC 926 & IEC 927: Starting devices (other than glow starters).
- 3.15 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 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 SANS report.
- 4.4 SAFETY: The luminaire shall bear the SANS 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 IEC 922 and IEC 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 bear the SANS 1279 and SANS 1464 marks.

5.2 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 SOW (both elliptical) mercury

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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.

B. Flood-lights for use with 400/250/1 SOW HPS or 400/250W MH or 400/250W MV lamps

1. The luminaire shall consist 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.

5.3 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 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.
- 5.3.6 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.

5.4 LAMP HOLDERS

5.4.1 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 SANS VC8011 and shall be able to withstand a temperature of 240°C.

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 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 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.

5.5.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

5.6 CAPACITORS

Capacitors shall comply with SANS 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:

<u>LAMP</u>	<u>LAMP HOLDER</u>	<u>LAMP TYPE</u>
HP Sodium Vapour 400W, 250W, 150W or 100W 70W	E40 E27	Tubular clear or coated elliptical Coated elliptical
Metal halide 400W or 250W	E40	Tubular clear or coated elliptical
Mercury vapour 400W and 250W 125W and 80W	E40 E27	Coated elliptical 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, Medium Beam and Narrow Beam

7. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SANS 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**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.

3. STANDARDS

The following standard specifications of the South-African National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 3.1 SANS 1119: Interior luminaires for fluorescent lamps. Note: The latest amendments whereby luminaires with compact fluorescent lamps are covered, shall apply.
- 3.2 SANS 1250 : Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.3 SANS 890,& IEC 920 & 921 : Ballasts for fluorescent lamps.
- 3.4 SANS 1464 : Safety of luminaires.
- 3.5 SANS 1479 : Glow starters for fluorescent lamps.
- 3.6 SANS VC8031 : Coatings applied by the powder-coating process.
- 3.7 ~~SANS 783~~ : Baking enamels.
- 3.8 SANS 10142 : The wiring of Premises
- 3.9 ~~SANS 56~~: Incandescent lamps
- 3.10 SANS 60238: Lamp holders and VC8011
- 3.11 Any standard referred to in the above standards.

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 against ceilings as described in the project specification.

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- 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 SANS 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 SANS 890 - Part 1 or IEC 920 and IEC 921.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 GENERAL

- 5.1.1 Compact fluorescent lamp luminaires shall comply fully with SANS 1119 and all amendments as well as the additional requirements of this specification. Luminaires which bear the SANS mark are preferred. Luminaires shall at least have an SANS Certificate of Compliance.
- 5.1.2 The Department reserves the right to have samples of luminaires offered tested by the SANS for compliance with SANS 1119. If a sample luminaire is found not to comply with SANS 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 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 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in metal parts.

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- 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:

<u>LAMP</u>	<u>HOLDER</u>
7WPL	2G11
9WPL	2G11
13W.PLC	G24d-1
60/1 OOW 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 SANS 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 SANS 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:

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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 SANS 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 C12.10**C12.10 INFRA-RED ENERGY SOURCES FOR USE IN POULTRY APPLICATIONS****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 National Standards and the International Electrotechnical Commission shall apply to this specification:

- 3.1 SANS 10142: The wiring of Premises.
- 3.2 SANS 60238: Lamp holders and VC8011
- 3.3 SANS 1222: Enclosures for electrical equipment.
- 3.4 SANS VC8031: Coatings applied by the powder-coating process.
- 3.5 SANS 1464: Safety of luminaires.
- 3.6 SANS 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 SANS 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 from 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 cabletyre 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.

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- 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 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

- 7.1 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. TECHNICAL INFORMATION

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

SECTION C12.11**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 National Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 3.1 SANS 60188: High-pressure mercury vapour lamps.
- 3.2 IEC 662: High-pressure sodium vapour lamps.
- 3.3 IEC 61167: Metal Halide lamps.
- 3.4 SANS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.5 SANS 1464: Safety of luminaires.
- 3.6 SANS 1278: Interior luminaires for low pressure sodium vapour and high intensity discharge lamps.
- 3.7 IEC 922 & IEC 923: Ballasts for discharge lamps.
- 3.8 IEC 926 & IEC 927: Starting devices (other than glow starters).
- 3.9 SANS VC8031: Coatings applied by the powder-coating process.
- 3.10 **SANS 783:** Baked enamels.
- 3.11 SANS 10142: The wiring of Premises
- 3.12 SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations.
- 3.13 SANS 60238 & 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 SANS 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 IEC 922 and IEC 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.

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- 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 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 igniters are used, these shall be of the superposed pulse type.
- 5.5.8 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 SANS 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:

<u>LAMP</u>	<u>LAMP HOLDER</u>
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

Metal halide lamps
 70W and 150W (tubular)
 100W (elliptical)

LAMP HOLDER

RX7s
 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 Alien 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 SANS 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 C13**C.13 FIXED WATER STORAGE HEATERS**

1. The water heaters shall comply with SANS 151 and shall bear the SANS mark.
2. This specification covers the following types of water heaters:
 - TYPE 1: (Free outlet type) - A water heater provided with an open outlet. The flow of water is controlled by means of a stopcock in the inlet pipe.
 - TYPE 2: (Combination type) - A water heater having an integral cold water cistern. The flow of water is controlled on the outlet side.
 - TYPE 3: (Low pressure type) - A water heater designed for a working pressure of 100kPa with or without an open expansion or vent pipe and intended to work from a supply derived from either a pressure control valve or a cold water cistern that does not form an integral part of the heater. The flow of water is controlled on the outlet side.
 - TYPE 4: (High pressure type) - A water heater designed for a working pressure of 400kPa derived from the mains via a combined pressure control/expansion valve. The flow of water is controlled on the outlet side.
3. The background colour of the nameplate indicating details of the cylinder shall be in accordance with the appropriate working pressure specified in SANS 151 namely:
 - 50kPa or less - Yellow
 - 100kPa - Blue
 - 200kPa - Black
 - 300kPa - Brown
 - 400kPa - Red
 - 500kPa - Grey
4. The working pressure of types 1 and 2 shall be 20kPa and the minimum working pressure of type 3 shall be 100kPa. Where a working pressure higher than 100kPa is required, type 4 shall be used.
5. The rating of the heating units shall be as follows:

TYPE	CAPACITY (LITRES)	220/250 V, 50 Hz (kW)
1	15	0.5
1 & 3	25	0.5
2 & 3	50	1.0
2,3 & 4	100	2.0
2,3 & 4	150	3.0
2,3 & 4	200	4.0
2,3 & 4	250	4.0

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3	350	Will be specified by the Department
3	450	
3	550	

6. The paint finish shall be at least equal to Class I baked enamel of SANS 757 with a dry film thickness of at least 0,03mm.
7. The insulation between the cylinder and the outer casing shall consist of a 50mm high density fibreglass blanket or granulated cork.
8. The heating element shall be of the immersion type.
9. The following safety accessories shall be supplied as standard :
 - On types 1, 2 & 3 (a) Fail-safe type thermostat graduated to operate at any temperature between 40°C and 75°C
 - On type 4 (b) Fail-safe type thermostat graduated to operate at any temperature between 40°C and 75°C
 - (c) Emergency over-pressure/temperature Relief valve relieving at 600/650 kPa or at 94-97°C
10. In areas with aggressive water, an incolloy heating element shall be provided.

SECTION C14**C.14 INCINERATORS****1. GENERAL**

This section covers sanitary incinerators for installation in single or multi-storey buildings.

2. CONSTRUCTION**2.1 BODY**

The incinerator shall be suitable for either surface or flush installation as specified in the Detail Technical Specification. The body shall be of substantial construction with white stove enamelled finish.

2.2 FAN

The fan shall be driven by a shaded pole motor and shall provide circulation of air between the combustion chamber and outer body to ensure a cool outer surface during and after operation.

2.3 HEATER

The heater shall comprise high temperature resistance wire wound on ceramic formers and shall be completely housed in a nickel alloy container. The electrical loading of the heater shall not be less than 1,5 kW.

2.4 TIMER

The timing period shall be for a minimum of 15 minutes and shall be initiated on opening of the door. If the machine is re-used whilst already in a burning cycle, the timer shall be reset to avoid partial incineration.

2.5 ASH DISPOSAL

An automatic ash shaker shall be provided to break up residual ash deposits and an ash drawer shall be provided to collect residual ash for disposal.

3. MAINTENANCE

No maintenance of working parts shall be necessary as all components shall be lubricated for life.

4. WIRING

All wiring shall be brought to a ceramic terminal block and the unit shall be provided with knockouts for 20mm conduit.

SECTION C15**C.15 BUSBARS (RISING AND OVERHEAD FOR VOLTAGES UP TO 1 KV)****1. GENERAL**

- 1.1 Busbars shall be designed and manufactured in compliance with SANS 1473 and SANS 1195.
- 1.2 Rising and overhead busbar trunking shall be fully enclosed in a sheet metal duct which shall form part of the busbar support.
- 1.3 The entire busbar system shall be manufactured in sections. It shall be possible to remove intermediate sections without having to dismantle or remove adjacent sections.

2. BUSBAR ENCLOSURE

- 2.1 The metal enclosure shall form an integral part of the bus section and shall be of the same length as the conducting sections of the busbar. Bus sections shall be securely fixed at each joint by means of bolted fishplates.
- 2.2 The busbar shall be splash proof and vermin proof and adequately ventilated.
- 2.3 Each bus section shall have at least four fixing points. These points shall be capable of accepting M10 bolts with hexagonal heads.
- 2.4 The covers of the busbar trunking shall be firmly secure to one chassis or framework by at least four points per section.
- 2.5 Self-tapping screws are not acceptable as a means of fixing or securing any part or component on busbar trunking.
- 2.6 Suitable locking devices, i.e. spring washers or locknuts, shall be incorporated with all threaded parts to withstand vibration and stresses caused under normal and fault conditions.'
- 2.7 Busbar covers shall be so designed to facilitate removal of the covers after installation. Sections of the busbars which pass through walls and floors shall have separate covers. This is necessary because the walls and floors will be built up to the busbar enclosure as a fire barrier.

3. PAINT FINISH

Metal components of the framework and panels of the busbar trunking shall be painted in accordance with the Department's "STANDARD PAINT SPECIFICATION", Section C39. The colour shall be "LIGHT ORANGE", colour B26 of SANS 1091.

4. BUSBARS**4.1 GENERAL**

Busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross section in accordance with SANS 1473 and SANS 1195 and BS 159 and BS 1433 where applicable.

- 4.1.2 The voltage and current rating of the busbar shall comply with the Detail Technical Specification.

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4.1.3 The current rating shall be indicated on a stamped metal label on each section of the busbar trunking as well as the name and address of the manufacturer.

4.2 VOLTAGE RATING

4.2.1 The busbar system shall be designed to withstand the service voltage and the corresponding test voltage specified in SANS 1473.

4.2.2 The minimum clearance between current carrying parts and other metal parts specified in SANS 1473 shall be maintained.

4.3 CURRENT RATING

4.3.1 The maximum allowable temperature of busbars (including joints) carrying full load current in an ambient temperature as specified shall not exceed 80°C, unless different ambient temperatures are specified, an ambient temperature of 35°C shall be assumed with a maximum temperature increase of 45°C.

4.3.2 Table C15.2 may be used as a guide in determining busbar ratings where the distance between the phase busbars is at least the distance of the longer side of the cross-section with a minimum spacing of 50mm and at least 150mm from the sheet metal enclosure. It is however essential that the busbar manufacturer shall make due allowance for the "proximity and skin" effects, the effect of ferrous enclosures, ventilation etc. and for the arrangement used in his busbar design. Manufacturers shall, where requested, prove that the busbar rating and enclosure design comply with the temperature rise specified above. The busbars can also be rated to DIN 43671 for unpainted busbars.

4.3.3 Neutral busbars in three-phase, four wire supplies shall have the same dimensions as the phase busbars.

4.3.4 Busbars may not be tapered. The rating of the bars shall be equal to the incoming current rating. In cases where the main switch is an isolator, the isolator rating may not be taken as the incoming current rating.

4.3.5 In addition to the current rating busbars shall comply with the following fault level rating:

$$A = 8,2 \times I \times (t)^{1/2}$$

where

A = minimum cross-section (mm²)

I = prospective fault current (kA)

t = maximum time in seconds required for protection equipment to clear the fault.

(Minimum allowable value for t = 0,2s).

4.3.6 Where a busbar consists of two or more busbars per phase (laminations), the laminations shall be separated by a minimum distance of the thickness of one lamination. The laminations shall be clamped together with copper spacers at intervals not exceeding 450mm in order to equalise the current distribution in the laminations. The busbar ratings in Table C15.2 shall be multiplied by the factors shown in Table C15.1 to determine the total current rating per phase.

4.4 MOUNTING

4.4.1 Busbar sections shall be supported at a minimum of two points in each section.

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Busbars shall be supported by resin bound synthetic wood panels or other suitable dielectric material. The surface of these supports shall be treated to prevent surface tracking. The supports shall be bolted securely to the framework and busbars shall fit tightly in the supports.

4.4.2 The rating and fixing of busbars shall be designed to withstand mechanical and temperature stresses during fault conditions. The busbar system shall withstand a fault current under test conditions of 20 times rated current for 1 second when applied :

- (a) between all three phases,
- (b) any two phases,
- (c) neutral and the adjacent phase, and
- (d) earth conductor and nearest phase conductor.

4.4.3 If no other methods are specified, the stresses under fault conditions shall be calculated as follows, taking into account correction factors for different configurations.

Mechanical stresses

$$F = \frac{16 \times I^2 \times k}{D \times 10\,000} \text{ N/m}$$

where F = force (N/m)

I = maximum fault current (A RMS symm.)

d = spacing between bars (m)

k = space factor for rectangular bars (Fig. C15.1)

4.4.4 The maximum allowable spacing of busbar supports for fault levels of 15 kA and more is 600mm.

4.5 BENDS

Busbars shall be radius edged where they change direction.

4.6 BUSBAR SECTIONS

Busbars shall be divided into sections (par. 1.3) and jointed to overlap for a distance equal to twice the width of the bar to prevent localised heating. Contact surfaces shall be tinned (acid-base flux may not be used) or silver-plated and bolted down with cadmium-plated bolts and nuts and spring washers with an applied torque in accordance with SANS 1473. Busbars shall be prepared for extension where they terminate at the ends of the trunking.

4.7 EARTH BUSBAR

4.7.1 An earth busbar shall be installed in a convenient position along the entire length of the busbar.

4.7.2 The cross-sectional area of earth busbars shall be calculated in accordance with the following formula in IEC 439 with a minimum cross-section of 6,3 x 20mm:

$$S = \frac{I \times (t)^{1/2}}{X (d)^{1/2}}$$

where S = cross-section (mm²)

I = the r.m.s. value of the current (A)

X = 13 for Copper

t = operating time of protection equipment (s) (Minimum value = 0,2s)

dT = temperature rise ($^{\circ}\text{C}$) = 120°C for insulated conductors = 180°C for
uninsulated
conductors

If t is between 2s and 5s, then dT may be increased in the same formula to:

dT = 145°C for insulated conductors
= 215°C for uninsulated conductors.

4.7.3 In addition to the above considerations, the longer side of the earth busbar shall be at least twice the diameter of the largest bolt that will be fitted to the busbar.

4.7.4 The method of installation of the earth bar shall permit the connection of earth conductors at any point.

4.8 EXPANSION JOINTS

4.8.1 Expansion joints to allow for thermal expansion and contraction shall be provided at intervals not exceeding 10m to allow for a temperature variation from 0°C to 90°C .

4.8.2 These expansion joints shall be made with flexible braided copper strap or laminated copper foil with the same current carrying capacity as the rest of the busbar trunking.

4.8.3 Connections to transformers and switchboards shall consist of similar flexible connections.

5. EARTHING OF METAL PARTS

5.1 All non-current carrying metal parts of the busbar system, e.g. framework, panels, transformer cores, metal covers, etc. shall be bonded to the earth busbar.

5.2 Provision shall be made at each fused take-off for a connection to the earth bar. This connection shall consist of a hole to accommodate one or more M10 bolts with nuts and washers and be prepared as described in par. 4.6.

6. BOLTS AND NUTS

Only cadmium-plated high tensile steel bolts and hexagonal nuts may be employed at busbar joints and connection points. All nuts shall be provided with spring washers or be of the "NYLOCK" type with washers. The largest possible size bolt that will fit into holes in lugs and fixing holes of equipment shall be used in every instance. Bolts shall be of sufficient length so that at least two but not more than five threads protrude beyond the nut.

7. ACCESSORIES AND CONNECTIONS

7.1 All the accessories such as bends, cable connection boxes and fused take-offs shall be purpose-made and comply with the same specification as the busbars.

7.2 The temperature rise of terminals or connections at incoming or outgoing cables may not exceed the temperature rating of the cable insulation. This final temperature shall not

exceed 70°C for PVC insulated cables.

- 7.3 Where busbars terminating at the ends of switchboards are intended for future extension, these busbars shall be pre-drilled to accommodate the extension. Where pre-fitted space is specified for future equipment, the busbars in the proposed position shall be pre-drilled and nuts and bolts shall be provided to accommodate the future busbars or cables feeding the equipment.

8. FUSED TAKE-OFFS

- 8.1 Fused take-offs for secondary supplies and equipment shall be supplied and installed in accordance with the Detail Technical Specification.
- 8.2 No connections shall be made to the main busbar without fuses. Take-offs shall comply with SANS 1473.
- 8.3 The fuses of these take-offs shall comply with the Department's standard specification for "CARTRIDGE FUSES AND FUSE HOLDERS", Section C22.

9. FIRE BARRIERS

- 9.1 Two fire barriers in the busbar trunking shall form an integral part of each section of rising busbars.

Non-flammable, non-conducting material such as asbestos-cement shall be used for this purpose.

- 9.3 The fire barriers shall be placed to prevent the spreading of fire from one floor of a building to the next but not restrict the ventilation of the busbars.
- 9.4 Overhead busbars shall be equipped with fire barriers where the busbars pass through walls or partitions from one room to another, in accordance with par. 3.5 of SANS 1473.

10. TESTING

- 10.1 Completed busbars shall be subjected to a test voltage of 2,5 kV r.m.s. for 1 min. in accordance with SANS 1473.
- 10.2 Where required, fault current tests in accordance with par. 4.4.2 above shall be conducted.

TABLE C15.1

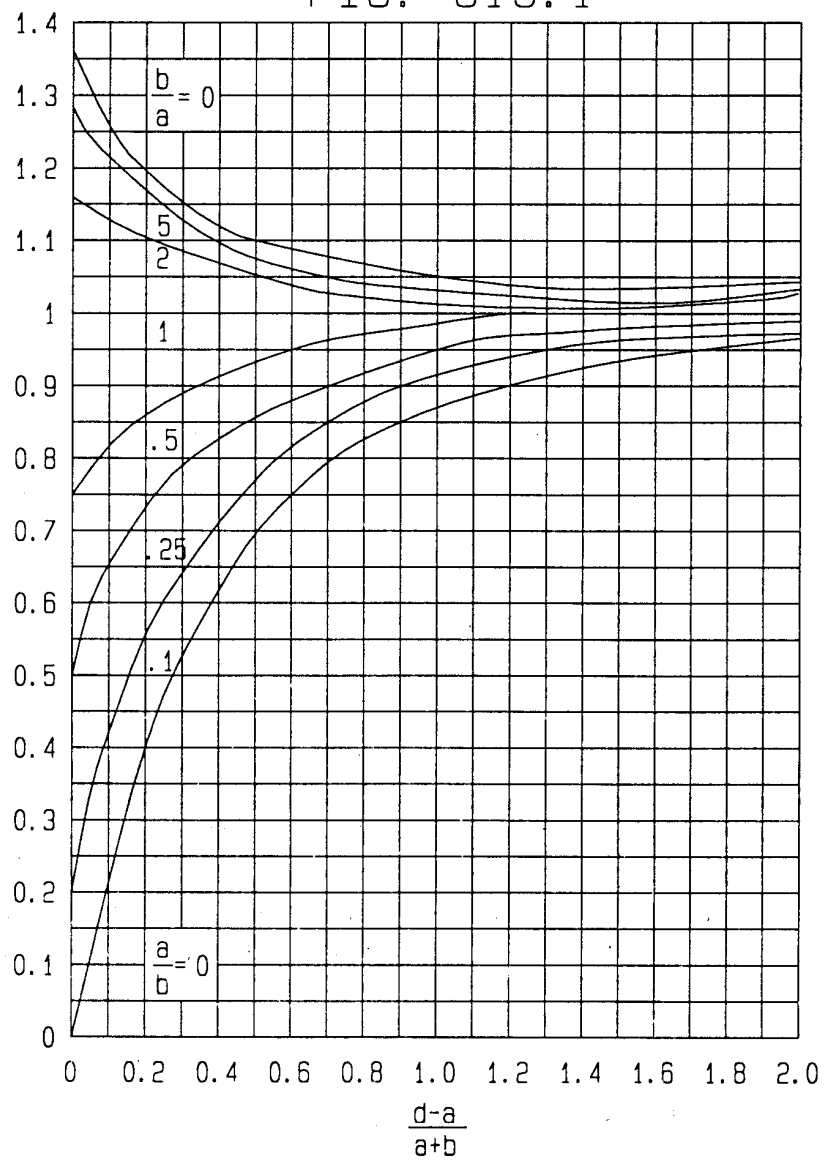
DERATING FACTORS FOR LAMINATED BUSBARS

Area of Cross Section (mm ²)	No of parallel busbars per phase		
	2	3	4
500	1,78	2,45	3,13
1 000	1,72	2,36	3,00
1 500	1,65	2,24	2,84
2000	1,60	2,16	2,70
2500	1,55	2,10	2,60
3000	1,52	2,02	2,52
3500	1,48	1,98	2,48
4000	1,44	1,96	2,45

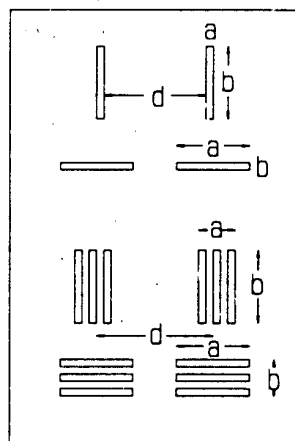
TABLE C15.2**CURRENT RATING OF SINGLE COPPER BUSBARS (A)**

Width (mm)	Thickness (mm)						
	2,5	3.15	4,0	6,3	10	12,5	16
12,5	155	180					
16	190	220	250				
20	230	265	300				
25	280	320	365	470			
31,5	340	385	440	560			
40	420	475	540	680	870		
50	510	575	650	820	1030	1160	
63			790	990	1240	1370	
80			970	1200	1480	1640	
100			1160	1430	1760	2180	
125				1710	2100	2310	2570
160				2070	2530	2780	3090
200						3290	3660
250						3900	4300
315						4630	5120
400							6230

FIG. C15.1



k =space factor for rectangular bars



SECTION C16**C.16 EARTHING ELECTRODES****1. GENERAL**

This section covers uncoated, coated and metal clad circular rod electrodes intended to provide an earth in soil for electrical and lightning arrestor systems.

2. CATEGORY AND TYPE

2.1 Only the following type of earth rods shall be used:

- 1(a) - Solid copper.
- 1(b) - Solid stainless steel.
- 2 (a) - Solid steel with bonded copper protection.
- 2 (b) - Solid steel with plated copper protection.
- 2 (c) - Solid steel with a shrunk-on copper jacket.
- 3 - Solid steel with a shrunk-on stainless steel jacket.
- 4 - Galvanised steel.

2.2 Bare aluminium is not acceptable as an electrode material.

2.3 All rods shall be solid and of circular cross section with length as specified in the Detail Technical Specification.

2.4 The nominal diameter of the earthing rods shall not be less than 16mm unless the rods are specified for placing in pre-drilled holes in which event the minimum nominal diameter shall not be less than 12mm.

3. COUPLINGS AND CONDUCTOR CLAMPS

3.1 Earthing electrodes shall be provided with (n-1) couplings where n = number of rods supplied.

3.2 Rods designed for coupling by means of external sleeves shall be provided with an adequate quantity of hydrocarbon or silicon grease to be applied to the coupling before the joint is made.

3.3 Rods designed for coupling by means of internal pins or splines shall be provided with thin-walled tubes and hydrocarbon or silicon grease to seal the joint.

3.4 Conductor clamps shall be provided to suit the type and size of rods provided and the type and size of conductor specified in the Detail Technical Specification.

3.5 The material of the clamps shall be electrolytically compatible with the rod and conductor materials.

3.6 Where brazed or welded connections are specified, the supplier of the rods shall stipulate at least two types of metals which are compatible with the rod and conductor materials.

3.7 An adequate number of driving caps or bolts shall be supplied with the rods to protect the

ends of the earthing rods whilst being driven into hard soil.

SECTION C17

C.17 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 2,2m. Cubicle type boards may be up to 2,4m 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 SANS 1765. 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 115mm thick walls, expanded metal shall be spot-welded to the rear of the bonding trays. The expanded metal shall protrude at least 75mm 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 20mm and 25mm 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 20mm. No equipment may 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 450mm, 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 450mm 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 SANS 1765.

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 4mm².

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 20mm 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 wire 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 300mm 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 compound 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 SANS 1765 where applicable. Equipment to

SECTION C.41

be mounted on the chassis shall be mounted by bolts, washers and nuts or by bolts screwed into tapped holes in the chassis plate. In the latter case the minimum thickness of the chassis plate shall be 2,5mm. The latter method shall not be used where boards will be subject to vibration or mechanical shocks. Self-tapping screws will not be accepted.

6.2 SPACE REQUIREMENTS

In designing the switchboards the following requirements shall be strictly adhered to:-

- (a) A minimum of 50mm 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 row may be reduced to 25mm if the incoming side of the circuit-breakers is busbar connected.
- (a) A minimum of 75mm 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 40mm 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 SANS 1765. 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-

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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 effuse-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.

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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 SANS 1091 |
| (b) | Standby power | "SIGNAL RED", | colour A11 of SANS 1091 |
| (c) | No-break supply | "DARK VIOLET", | colour F06 or |
| | | "OLIVE GREEN". | colour H05 of SANS 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 SANS 1473, SANS 1195 and BS 159 and BS 1433, where applicable.

7.1.2 Although SANS 1473 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 70mm² 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

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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 INTERN

Nominal cross- Section mm ²	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 SANS 10142. Table 10.

8.4 INTERNAL WIRING

- Standard 600/1 000 V grade PVC-insulated stranded annealed copper conductors to SANS 1507 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.
- Where heat generating equipment is present and the internal temperature of the board is

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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 protected where they cross metal edges.
- (k) Conductors may be jointed at equipment terminals or numbered terminal strips only. No other connections are allowed.
- (l) 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.
- (m) 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.
- (n) 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.
- (o) 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.
- (p) 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 70mm² 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

BEHEERBORDA4

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

GELEISTAMSEKSIE2

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

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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.

12. 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:

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- (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**C.18 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 be installed within 50km 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 SANS 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 1,2kg/m². The strength shall be increased to 1,3 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.

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- 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 300mm, 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 have 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 SANS 1091 "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 2mm minimum sheet steel. The panels shall have upturned edges which are recessed in the frame or which fit over lips on the frame. The side panels may be either bolted or welded 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 SANS 1091. A tin of matching touch-up paint (not smaller than 500ml) 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 6mm
 - 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 SANS 1091. A tin of matching touch-up paint (not smaller than 500ml) 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 12mm.
- 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 SANS 32&121.
- 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 4mm 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 900mm 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 SANS 32&121.
- 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 SANS 1765 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
HUIS473
- PUMP SUPPLY
POMPTOEVOER

(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, 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 C19**C.19 METAL CLAD AIR CIRCUIT BREAKERS, WITHDRAWABLE TYPE**

1. This section covers with drawable air circuit breakers for use in power distribution systems up to 1kV, 50 Hz.
2. The circuit breakers shall be metal clad and shall comply with BS 4752 and IEC 157.
3. The circuit breaker shall be horizontally withdrawable and shall be a self-contained unit of the dead front type, allowing maintenance and tests to be carried out without having to remove the circuit breakers from the withdrawal mechanism.
4. The unit shall contain the necessary mechanical interlocks to prevent:
 - (a) Access to "LIVE" terminals when the circuit breaker is withdrawn.
 - (b) The withdrawal or insertion of the unit, when the circuit breaker is in the closed position.
 - (c) Closing of the circuit breaker following an automatic trip condition without resetting the mechanism.
5. Adjustable thermal overload releases shall be provided to suit the required current range. In addition instantaneous magnetic short circuit trips which are adjustable shall be fitted. The tripping devices shall be direct acting. The delay adjustment shall be bypassed with an instantaneous making current release when the circuit breaker is closed to prevent the delay timer from operating when the circuit breaker is closed on a fault.
6. The air circuit breakers shall be of the quick make and quick break type with a stored energy spring assisted operating mechanism provided with:
 - (a) A trip free mechanical hand operated closing mechanism.
 - (b) A manually operated mechanical trip mechanism suitably protected to prevent inadvertent tripping.
 - (c) A positively driven mechanical device to provide ON/OFF/ TRIP indication. This indication shall be clearly visible with the circuit breaker in position.
7. Provision shall exist for the addition, if required, of a supply side under voltage release.
8. Air circuit breakers shall have electrically separate auxiliary contacts as specified. Where none are specified two N/O and two N/C auxiliary contacts shall be provided.
9. Shunt trips and electrical stored energy circuit breakers shall be interlocked to prevent repeated operation of the trips or winding mechanisms when the circuit breaker is in the tripped or closed position.
10. All non current carrying metal parts of air circuit breakers shall be solidly interconnected and connected to an earth contact on the truck which shall engage with a mating contact or copper plate on the cradle which is connected to the earth busbar of the switchboard. The arrangement shall be such that the air circuit breaker frame is earthed in the test position and before the circuit breaker contacts engage the live fixed contacts.

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11. The fixed cradle shall be of high mechanical strength.
12. The circuit breaker shall have "RACKED OUT", "TEST" and "ENGAGED" positions that are clearly marked.
13. The air circuit breaker shall bear a clearly legible rating plate indicating the current rating, breaking capacity and voltage rating.
14. The complete circuit breaker and its electrical and mechanical constituents and accessories shall be from a standard product range of a single original supplier.
15. Extension type operating handles shall be fixed to the air circuit breaker on completion of the installation.
16. A description and illustration of the circuit breaker as well as trip curves, operating manuals and rupturing test certificates shall be provided.
17. The circuit breakers shall be designed to allow the incoming terminals to be at the top or bottom without affecting the operation of the unit.
18. Circuit breakers shall be derated if necessary to compensate for the following environmental factors:
 - (a) Maximum ambient air temperature in excess of 40°C or the daily average ambient air temperature in excess of 30°C. This is especially important with regard to the type of enclosure in which the circuit breaker is to be installed.
 - (b) Height above sea level.
 - (c) Operational duty cycle and estimated loading.

SECTION C20**C.20 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 SANS 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.

SECTION C21**C.21 COMBINATION FUSE-SWITCH UNITS**

1. Combination fuse-switch units shall be triple pole devices fitted with neutral links and shall comply fully with SANS 60947 or BS 5419.
2. The fuse-switches shall be of the on load type capable of carrying the rated current continuously, making and breaking rated current and tested to IEC 408 for making and breaking capacity.
3. The units shall be of the double air-break, quick-make, quick-break type with an arc chamber. The mechanism shall be driven by springs on both sides.
4. The unit shall consist of a fixed contact assembly, heavy duty mechanism, moving contact carriage and a retractable operating handle mounted on a rigid frame. The contacts shall be of high quality material, e.g. silver plated.
5. The fixed contacts shall be shrouded.
6. When the fuse-switch is in the open position, the double air-break shall isolate the HRC fuse links, permitting fuse replacement in safety.
7. Interlocks shall be provided to prevent the cover from being opened when the switch is "ON" and to prevent the switch from being operated when the cover is open unless purposely defeated.
8. The cartridge fuses used in the units shall comply with SANS 172 or BS 88 or the equivalent DIN and VDE standards. The category of duty shall be suitable for the voltage level and the fault level at the point where the fuses are installed. Time/current characteristics shall be matched to the equipment supplied and protected by the switch.
9. Fuse-gear carrying the HRC fuses on the cover, the cover also forming the operating lever, is regarded as a fuse isolator and is not acceptable.

SECTION C22**C.22 CARTRIDGE FUSES AND FUSE HOLDERS**

This section covers cartridge fuses and holders used for the protection of distribution and power system equipment up to 600 V.

1. TYPES

- 1.1 The following fuse and fuse holder types are acceptable for use in distribution and power systems:
 - (a) A cartridge type fuse link which fits into a fuse carrier together with a fuse base with fixed terminals. The fuse can be removed by taking out the fuse carrier and then removing the fuse from the carrier.
 - (b) A cartridge type fuse link which fits into a fuse base with fixed terminals. In this case a fuse puller is required to disengage the fuse from the base. These fuses are only acceptable on equipment imported with these fuses as a standard item. One puller shall be supplied for each board or box in which these fuses are used.
- 1.2 Rewirable fuses are not acceptable and shall not be used.
- 1.3 Fuses shall normally be installed in moulded plastic fuse holders or rigid isolating barriers shall be installed between the fuses. Sufficient spacing to prevent accidental contact when inserting or withdrawing fuses shall be maintained. The covers or barriers shall be manufactured for the specific fuses to be used.
- 1.4 Striker pin fuses shall be equipped with an alarm contact so that the contact closes and remains closed when the striker pin operates.

2. STANDARDS

All fuses used for distribution systems shall comply with the following standards :

- 2.1 Fuses : SANS 172 or BS 88. Parts 1 and 2
- 2.2 Holders : SANS 172.
- 2.3 Fuses of the types described in par. 1 above and complying with the relevant DIN (49510, 49511, 49515, 49522, 49360, 49367) and VDE (0635.0660) standards are also acceptable.

3. RATINGS

- 3.1 Fuse ratings shall be accurate to within $\pm 5\%$ of the published value for unused fuses and shall not vary significantly after long periods of service.
- 3.2 Fuses shall be derated for ambient temperatures above 25°C in accordance with the manufacturer's recommendation. If no such recommendation exists, a derating factor of 1% per °C above 25°C shall be applied.
- 3.3 Fuses shall be derated for elevations of more than 1 000m above sea level in accordance with the manufacturer's recommendation. If no such recommendation exists, a derating factor of 1% per 300m above 1 000m above sea level shall be applied.
- 3.4 Time/current characteristics shall be chosen to suit the application.

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- 3.4.1 Cable protection: The fusing factor shall not exceed 1,5.
- 3.4.2 Motor circuits: Time lag characteristic so that the starting currents will not cause deterioration of the fuse.
- 3.4.3 Capacitor circuits: Fuses shall be chosen to withstand a higher than normal full load current (1,5 times rated capacitor current) to allow for harmonics and shall not deteriorate due to the high transients at switch on.
- 3.4.4 Distribution systems: The total operating Ft let through by secondary (minor) fuses shall be less than that of primary (major) fuses in any specific branch.
- 3.5 It shall be ensured that the rupturing capacity of a fuse chosen for a specific application shall be adequate, both as far as short circuit current and applied voltage are concerned.

SECTION C23**C.23 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 96mm.
- 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.

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- 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**C.24 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 SANS 767 as amended, and shall bear the SANS 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 SANS 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 SANS 60497.
6. The fault current rating of the unit shall be 2,5kA or 5kA as required, when tested in accordance with SANS 156.

SECTION C25**C.25 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 \pm 10%.
3. The switches shall comply with SANS 60947.
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**C.26 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

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, 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-tum 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 C27**C.27 INDICATOR LIGHTS**

1. Indicator lights shall be of neon, incandescent (filament) or LED types. Lamp voltages shall suit the supply or control voltage. Lamps shall be derated for continuous duty by using economy resistors or using input voltages at least 20% lower than the rated lamp voltages.
2. Where LED's are used as indicators on main supply voltages a suitable current limiting capacitor and reverse voltage protection diode shall be used. For low AC or DC voltages (+ 24 V) a current limiting resistor will suffice.
3. Indicator lights shall comply with BS 1050 where applicable.
4. Indicator lights shall be suitable for installation in switchboard panels and doors and shall consist of interchangeable lenses, lamp base, suitably rated and accessible terminals and a chromed screw-on retaining ring or other suitable means to secure the units.
5. It shall be possible to replace lamps from the front of the panel without the use of tools.
6. Surface mounted indicator lights shall be housed in purpose-made boxes with suitable cover plates.
7. Indicator lights shall be equipped with standard removable legend plates. Alternatively, the function shall be clearly indicated by means of labels or by engraving on the lenses.
8. All indicator lights for a specific application or switchboard shall be from the range of one manufacturer and shall preferably be of the same size and shall use the same lamp types.
9. The following are the preferred colours for indicator lights:
 - (a) RED : Abnormal state.
 - (b) YELLOW : Attention or caution, (or amber)
 - (c) GREEN : Ready for operation.
 - (d) WHITE : Circuit live or circuit operating (or clear) normally
 - (e) BLUE : Any function not covered by the above colours.

SECTION C28**C.28 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 SANS 60947.
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 C29**C.29 ROTARY CAM SWITCHES**

1. This section covers rotary cam switches used for control functions in switchboards, motor control centres, etc., up to 600 V.
2. The switches shall be rotary cam switches and shall comply with BS 4794, IEC 337 and VOE 0113. where applicable.
3. The switches shall be of the cam actuated type with two breaks per pole. The required number of poles and number of control functions shall be provided by the assembly of switching units on a common spindle.
4. The spindle shall be operated by a control handle suitable for the method of installation of the switch. The control handle shall be located by a key way on the spindle.
5. The switches shall be provided with a suitable face plate of non-conductive material, indicating the angle of throw and the switch positions. The latching mechanism shall ensure positive positioning in accurate relation to the positions indicated on the face plate.
6. The switches shall be suitable for use with the supply voltage level. The contacts shall be silver plated or gold laminated and shall be suitably rated for the switching functions intended.
7. For normal applications the making capacity of the switch shall be at least three times the normal current rating. For AC4 duties (inching, reversing, plugging) the rated current of the switch shall be at least equal to the stalled rotor current of the motor.
8. Special contacts, e.g. late-making, early-breaking, etc. shall be inherent in the design and shall not be improvised by loading or bending contacts, etc.
9. Time-delay units (if required) shall be of the electronic type with an adjustable time delay on energisation from 50 to 600 s. The units shall be suitable for clip-on rail mounting and supply voltage as specified.

SECTION C30**C.30 TIME SWITCHES AND PHOTOCELLS**

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.

PHOTOCELLS**1. GENERAL**

- 1.1 The switches shall be used for the control of street lights and shall be provided with switch contacts able to carry at least 5 A. The current during no-load conditions may not exceed 50 mA.
- 1.2 The units shall be suitable for 240 V + 6%. 50Hz. single-phase alternating current.

2. CONSTRUCTION

- 2.1 The units shall be weather and vibration resistant as they are to be mounted on top of streetlight luminaires. The design shall be of such a nature that the units will be able to withstand both hail damage and damage by stone-throwers. If the units do not meet with these requirements, separate wire screens shall be provided for this purpose.
- 2.2 The units shall be provided with a standard NEMA plug and socket. The socket shall have a bracket for mounting on a pole.
- 2.3 All components shall be treated to be corrosion resistant.

3. OPERATING CONDITIONS

- 3.1 The units shall be suitable for operating under dusty conditions between temperatures of -5 EC and 55 EC.

4. TECHNICAL REQUIREMENTS

- 4.1 units shall switch on when the light intensity drops to 15 lux + 20% and shall switch off when the light intensity again reaches 40 lux + 20%.
- 4.2 When the unit is in the "on" position there must be a delay of one minute if it were to switch off in the case of a sudden increase in the light intensity.

SECTION C31**C.31 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 ~~SANS 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 ~~SANS 1092~~ or IEC 158-1, utilisation category ACI 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/O and 1 x N/C spare auxiliary contacts in addition to the contacts specified or 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.

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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 C32**C.32 PUSH-BUTTONS AND PUSH-BUTTON ASSEMBLIES**

1. Push-buttons and push-button arrangements may be used in switchboards and control boards or in self-contained units for control functions.
2. Push-buttons and push-button assemblies for one specific project shall be supplied from a single reputable supplier's product range.
3. The various types of push-buttons employed shall be specifically selected for the required duty and mounting characteristics, e.g. flush mounted, enclosed, self-contained, illuminated, etc.
4. All push-buttons on a specific switchboard shall be of the same physical dimension (round or square) and shall be fully interchangeable as far as possible. Push-buttons must preferably be interchangeable with indicator lamps, key switches, etc.
5. Push-buttons shall be designed for long life, low contact bounce and constant contact resistance. Mechanisms may be of the mechanical type with spring control and a clutch or catch frame or of the solid state type operating on the principle of a non contacting, inductive proximity switch.
6. All push-buttons shall be provided with replaceable lenses with a variety of symbols. Legend plates shall be interchangeable.
7. Push-button terminals shall be suitable for the application with regard to spacing, conductor capacity, etc. Terminals shall be suitable for conductor sizes to be used. Push-button assemblies mounted on doors of control boards shall be enclosed to prevent inadvertent contact with the terminals and when the doors are open.
8. Push-buttons shall be suitable for the environmental conditions to be encountered. e.g. moisture, excessive temperatures, mechanical shock, vibration, etc.
9. Contact duty shall be chosen to suit the application. Wiping contacts shall be used for low voltages and currents and snap action contacts for high voltages and currents. Contacts shall be constructed of high quality material such as silver-tipped or gold laminated contacts.
10. Illuminated push-buttons may employ neon, incandescent or LED lamps. Lamp voltages shall suit system control voltages. Lamps shall be derated when used for continuous duty. e.g., using 20 V supply on 28 V rated lamps. External resistors shall be used with LED lamps to avoid excessive current.
11. Push-buttons may be grouped together in purpose-made stations, suitable for the environment in which they are to be installed.
12. Keylock push-buttons shall be supplied with duplicate keys. The removal action of the key shall suit the application.
13. Push-buttons shall comply with the applicable requirements of BS 4794.
14. The following are the preferred colours for push-buttons:

(a)	RED	:	Stop or emergency stop.
(b)	GREEN	:	Start (preparation)
(c)	GREEN	:	Start (implementation) (or black)
(d)	YELLOW	:	Interrupt a function (action)

- (e) WHITE : Any function not covered by the (or pale blue) above colours

SECTION C33**C.33 INDOOR SURGE ARRESTORS**

1. Surge arrestors shall comply with the requirements of SANS 61643 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 C34**C.34 INDOOR METAL CLAD SWITCHGEAR AND ASSOCIATED EQUIPMENT****1. GENERAL**

- 1.1 This section covers the manufacturing and testing of indoor metal-clad switchgear and associated equipment for general installations in normal environmental conditions and for system voltages of 3,3 kV to 11 kV.
- 1.2.1 A switchboard shall comprise metal-clad, pedestal type three-phase single or duplicate busbar extensible switch panels, each panel containing a circuit breaker or switch and the associated auxiliary equipment.

2. STANDARDS

All materials and apparatus shall be new and of the best quality and shall comply with the relevant current specifications of the SANS, BSI or IEC and as stated in this document.

The following standards may be used as a guide but must not be regarded as a complete list.

<u>DESCRIPTION</u>	<u>SANS</u>	<u>BSI</u>	<u>IEC</u>
Air & Oil Switches	1195	5463	265-A-C
Busbar & Busbar Connections		159	
Bushings		223	
Cable Glands & Sealing Boxes		542, 2562	
Circuit Breakers		5311	56
Current Transformers		3938	185
Voltage Transformers		3941	186
HV Fuses		2692	282-1
LV Fuses	172	88	269-1
Electrical Power Switchgear		5227	298
Galvanising	32&121	729	51
Indicating Instruments		89	296
Insulating Oil	555	148	129
Isolators and Earthing Switches		52, 53	43
Meters		37	255
Protective Relays		142	
Colours for Specific Purposes	1091		

4. SERVICE CONDITIONS

Nominal Voltage	3.3 kV	6.6 kV	11 kV
Rupturing Capacity	25 kA	20 kA	20 kA
Impulse Level	45 kV	75 kV	95 kV
Highest System Voltage	3,6 kV	7.2 kV	12 kV
Rated Short Time Current (3 s)	26.3 kA	21.9 kA	18.3 kA
Frequency	50 Hz		
Phases	3		
Atmospheric Temperature	-5°C minimum +40°C maximum		

Altitude	0 m minimum 1850 maximum
Lightning & Dust	severe
Average Power Factor	0,8
Maximum Humidity	95%

The system neutrals will be solidly earthed. However, all switchgear and auxiliary equipment shall be designed to withstand the stresses of an unearthed system.

4. SWITCHGEAR LAYOUT

- 4.1 The switchboard shall be designed as a continuous assembly in a straight line, capable of being extended at either end.
- 4.2 The switchboard will be located in a totally enclosed, naturally ventilated chamber and shall be suitable for installation directly on a finished floor.

5. CIRCUIT BREAKERS

5.1 GENERAL CONSTRUCTION

- 5.1.1 Circuit breakers may be of the low oil content, inert gas (gis) or vacuum type.
- 5.1.2 Circuit breakers shall be of the horizontal draw-out truck mounted type with either vertical or horizontal isolation action.
- 5.1.3 Each circuit breaker shall be installed in a free standing metal clad cubicle and the front of each panel shall be totally enclosed.
- 5.1.4 It shall be possible to remove the circuit breakers from the cubicles without moving the cubicle, without removing parts thereof or without disconnecting any wiring thereto. Secondary wiring may be unplugged.
- 5.1.5 Any circuit breaker shall be interchangeable with any other panel of the board of the same rating. It shall not be possible to insert a circuit breaker into a higher rated circuit.
- 5.1.6 Contact spouts, bushings, covers, busbar insulators, etc. shall be designed to minimise dust collection.
- 5.1.7 Mechanical stops shall be provided to ensure accurate location of the circuit breaker truck prior to racking into the service position. The breaker carriage shall be locked in position on both sides of the cubicle with a robust mechanical lock that will not distort or jam under fault conditions.
- 5.1.8 All openings, joints, etc. in the entire switchboard shall be adequately vermin proofed.
- 5.1.9 All components including screws, nuts, bolts, washers, etc. used in the construction of or fixing of components shall be rendered corrosion proof.

5.2 CIRCUIT BREAKING FEATURES

- 5.2.1 The contacts shall ensure rapid and consistent extinction of the arc with a minimum release of arc energy under all loading and fault conditions and a low power factor.
- 5.2.2 The arcing contacts shall be tipped or coated with an erosion resistant material. preferably a tungsten alloy.
- 5.2.3 The main contacts shall be self-aligning with a high contact pressure and a self-cleaning action.

5.3 BUSBAR AND CIRCUIT SHUTTERS

- 5.3.1 Protective shutters, which automatically cover the contacts of the fixed portion of the switchgear when the circuit breaker or voltage transformer is withdrawn to the isolation position, shall be provided.
- 5.3.2 The busbar and voltage transformer orifices shall be provided with automatic separate shutters.
- 5.3.3 Facilities shall be provided for padlocking the shutters in the closed position.
- 5.3.5 All shutters shall close automatically after being opened by hand and it shall not be possible for the shutters or shutter operating links to be jammed by the circuit breaker.
- 5.3.5 Shutters shall be painted and designated as follows:
 - (a) Busbar shutters: The word "BUSBAR" in black lettering on a red background.
 - (b) Circuit shutters: The word "CABLE" in black lettering on a yellow background.
 - (c) Earthing shutters: The word "EARTH" in black lettering on a green background.

Lettering shall be a minimum of 40 mm high.

5.4 INTERLOCKS

The switchgear shall be mechanically interlocked in accordance with BS 5227 and all interlocks shall be robust and shall not distort or jam in the event of a maloperation. The minimum safety features provided shall prevent the following actions:

- (a) A closed circuit breaker from being withdrawn from or inserted into the isolating contacts. The circuit breaker shall not trip if an attempt is made to do so.
- (b) The closing of the circuit breaker except when it is correctly located and fully racked in the "service" or "earthing" positions or in the fully lowered position. It must, however, be possible to close the circuit breaker when it is fully withdrawn from the cubicle.
- (c) The lowering of the tank of bulk oil circuit breakers unless the circuit breaker is fully withdrawn and the racking-in of the circuit breaker unless the tank is securely bolted in position.
- (d) The circuit breaker from being closed when the secondary circuits are not fully engaged. It shall also not be possible to remove the secondary circuit plugs unless the circuit-breaker contacts are fully open.
- (e) Electrical tripping of the circuit breaker when the circuit breaker is in the earthed position. Padlocking facilities shall also be provided to lock off the mechanical trip lever on the breaker mechanism.
- (f) The integral earthing switch (where applicable) from closing unless the circuit breaker is in the correct earth position. It must not be possible to close the earth switch onto live busbars.

5.5 EARTHING

- 5.5.1 An earth busbar in accordance with the requirements of par. 7.3 shall be provided.
- 5.5.2 All joints shall be tinned or silver-plated and clamping bolts, nuts, washers and lockwashers of cadmium-plated high tensile steel shall be fitted.
- 5.5.3 Integral earthing facilities through the circuit breaker are preferred, but separate earthing

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devices or earthing switches mounted on separate trucks are acceptable.

5.5.4 Where separate earthing devices or earthing trucks are supplied, the gear shall be suitable for use on all the circuit breakers in a switchboard and shall also be suitable for earthing either the busbar or the cables. A full set of earthing devices or earthing trucks shall be supplied for each switchboard.

5.5.5 Earthing equipment shall have a making capacity and a 3s short time current rating equal to the rest of the switchboard.

5.6 CAPACITIES AND FAULT LEVELS

5.6.1 The complete primary circuit (OCB's, busbars, etc.) shall be capable of withstanding the rated short time current specified in par. 3 above.

5.6.2 The circuit breakers shall have continuous current ratings as specified in the Detail Technical Specification.

5.6.3 Circuit breaker tanks and top plates shall be capable of withstanding, without permanent distortion, a hydraulic pressure of 700kPa for 1 minute, unless a lower pressure is approved after reference to actual pressures measured during short circuit tests.

5.6.4 Each circuit breaker shall be clearly and indelibly marked to show the current and voltage ratings and breaking capacities.

5.7 CLOSING MECHANISMS

5.7.1 The closing mechanism shall be either of the hand charged, spring or hand operated, spring assisted or motor wound spring charging or solenoid operated types as specified in the Detail Technical Specification.

5.7.2 The closing action of the hand operated, spring assisted mechanisms shall ensure that once closing is initiated the action becomes independent of the operator.

5.7.3 Motor wound spring charging mechanisms shall be provided with hand cranks for emergency use should the electrical closing circuitry become inoperative.

5.7.4 Slow closing facilities shall be provided on all mechanism types for maintenance purposes and these facilities shall only be accessible with the circuit breaker in the "withdrawn" position.

5.7.5 All mechanisms shall be of the trip-free type and it shall not be possible for the mechanism to maintain the circuit breaker in a "closed" position during fault conditions or when the "open" signal has been initiated.

5.7.6 The electrical closing circuitry shall be open circuited as soon as the closing sequence has been completed to prevent continued electrical loading of the closing circuitry and to deactivate the closing signal until a new sequence is initiated.

5.7.7 Where auto-reclosing duties are specified, the mechanisms shall be capable of performing a "BREAK-MAKE-BREAK" operation.

5.7.8 All electrically operated closing devices shall be at least suitable for operation at any voltage between 80% - 120% of the nominal control voltage at the device terminal. The nominal control voltages are specified in the Detail Technical Specification.

5.7.9 Anti-pumping devices shall be provided on all mechanisms to prevent pumping while the closing circuit remains energised and the circuit breaker either fails to latch or trip during closing due to the operation of the protection system. The arrangement shall be to the

approval of the Department.

5.8 TRIPPING MECHANISMS:

- 5.8.1 A manual tripping mechanism shall be provided on each circuit breaker. It shall be clearly marked "MANUAL/HANDBEDIEN".
- 5.8.2 Two 2,5 A trip coils (for overload and short circuit protection) and one 1,0 A trip coil (for earth fault protection) shall be provided where current transformer operated direct acting series tripping is specified. The trip coils shall be suitably rated to withstand the secondary saturation current of the current transformers specified.
- 5.8.3 Where shunt tripping is specified DC shunt trip coils shall be provided. The rated control voltage shall be 32 V DC unless specified to the contrary in the Detail Technical Specification.
- 5.8.4 Shunt trip coils shall be suitable for operation at any voltage between 80% -120% of the nominal voltage at the device terminals.
- 5.8.5 Secondary contacts operated by the circuit breaker mechanism shall be provided and rated to interrupt the maximum trip coil current after the circuit breaker has opened. These contacts shall close the tripping circuitry before the circuit breaker closes.

5.9 RACKING MECHANISMS

The racking mechanisms for inserting or withdrawing the circuit breaker shall be designed and constructed to provide a positive action throughout the operations.

5.10 INDICATING DEVICES

- 5.10.1 Each circuit breaker shall be equipped with mechanical indicators to indicate the switching positions and the state of the spring mechanisms (if applicable).
- 5.10.2 A mechanical indicator shall also be provided to indicate whether the circuit breaker is racked in or out.
- 5.10.3 All mechanical indicators shall be clearly visible from the front of the panel.
- 5.10.4 In all cases positive indication must be provided.

5.11 AUXILIARY CONTACTS

- 5.11.1 Circuit breakers shall be provided with sufficient auxiliary contacts to suit the circuits served.
- 5.11.2 Auxiliary contacts shall be coupled in such a manner as to follow positively the operation of the switching device concerned.
- 5.11.3 At least two spare normally open and two spare normally closed contacts shall be provided and shall be completely wired to an accessible terminal block.

6. NON-AUTOMATIC OIL SWITCHES AND FUSED OIL SWITCHES

6.1 GENERAL

- 6.1.1 Oil switches shall be of the fault-making, load-breaking type with earthing and testing facilities.
- 6.1.2 Oil switches shall be manufactured and tested in accordance with BS 5463.

6.2 CONSTRUCTION

- 6.2.1 The switches shall be totally enclosed, metal-clad, of the bulk or low oil content type.
- 6.2.2 The switch units shall be designed for extension with circuit breaker panels described in this specification and/or similar switch units.
- 6.2.3 Each unit shall be installed in a free stand-ing metal dad cubicle and the front of the cubicle shall be totally enclosed.
- 6.2.4 The switch may be either of the horizontal draw-out with vertical or horizontal isolation, or non-withdrawable fixed tank types.

6.3 BUSBAR AND CIRCUIT SHUTTERS

Busbar and circuit shutters shall be provided on all withdrawable type switches as specified for circuit breakers.

6.4 INTERLOCKS

- 6.4.1 The mechanism shall be incapable of moving directly to the "EARTH" position from the "ON" position.
- 6.4.2 A time delay shall be built into the mechanism to prevent immediate opening of the switch after closure. This shall be achieved by means of non-reversible operating handles, mechanical sliding interlocking gates or a non-reversible movement.
- 6.4.3 Padlocking facilities shall be provided.
- 6.4.4 Access to the testing facilities shall only be possible with the switch in the "EARTH" position. With the testing devices fitted operation to either the "ON" or "OFF" positions shall be prevented.
- 6.4.5 Interlocks shall be provided on withdrawable type switches to prevent:
 - (a) The switch from being withdrawn from or inserted into the isolating contacts.
 - (b) The closing of the switch except when it is correctly located or fully withdrawn.
 - (c) The opening of the tank unless the switch is fully withdrawn and the racking-in of the switch unless the tank is securely fitted.

6.5 OPERATING MECHANISM

- 6.5.1 The switch shall have three positions, namely "ON", "OFF" and "EARTH".
- 6.5.2 Except for removing the earth, the switch actuating mechanism shall have a positive action and shall be spring assisted to ensure that once the operation is initiated it becomes completely independent of the operator.
- 6.5.3 The fused oil switch shall close fully when making onto a fault to ensure full clearance of the fault by the fuses before tripping and opening the switches.
- 6.5.4 A blown fuse on any of the three phases shall open all three phases of the switch and shall inhibit the closure of the switch pending fuse replacement,

6.6 EARTHING

- 6.6.1 Refer to par. 5.5.1.

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6.6.2 Integral cable earthing facilities shall be provided for non-withdrawable switch units. For withdrawable switches earthing facilities similar to that of circuit breakers shall be provided. Refer to par. 5.5.2, 5.5.3 and 5.5.4.

6.7 CABLE TEST FACILITIES

6.7.1 Cable test facilities are required and must be easily accessible.

6.7.2 Refer to par. 6.4.4 regarding interlocking of test facilities.

6.7.3 In the event of a separate test unit being provided, it shall be easily fitted.

6.8 RATINGS

6.8.1 The fault making capacities, impulse levels and busbar ratings shall be identical to the ratings of the circuit breakers installed in the same switchboards.

6.8.2 The continuous current rating shall not be less than 400A.

6.8.3 Each unit shall be clearly marked to show the current and voltage ratings and fault making capacity.

6.9 INDICATING DEVICES

6.9.1 Each switch shall be equipped with positive mechanical indicators to indicate the switching position and the racked mode (where applicable).

6.9.2 All indicators shall be visible from the front of the panel.

6.9.3 Neon indicator lights shall be provided on the incoming panel of a switchboard to indicate the status of all three phases of the incoming cable.

6.10 FUSES

6.10.1 Fuses shall comply with BS 2692.

6.10.2 Fuse links shall be of the striker pin type, hermetically sealed and shall be suitable for use under oil.

6.10.3 The fuse link carriage shall be suitable to accept either 254mm or 359mm long fuses both with a diameter of 63,5mm. The carriage shall be adjustable for this purpose and shall not necessitate additional parts.

6.10.4 Automatic shutters shall be provided to safeguard against inadvertent contact with live parts when the fuse carriage is removed.

6.10.5 The ratings of the fuses shall be as specified.

7. BUSBARS

See Section C15 for details

8. CABLE END BOXES

8.1 Cable end boxes to accept the cables specified for each panel shall be provided.

8.2 The boxes shall be of the metal clad type suitable for indoor use. They shall be equipped with armour clamps and brass or gunmetal conical wiping glands for lead covered steel tape or galvanised steel wire armoured, paper-insulated cables.

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- 8.3 The cable end boxes shall comply with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8.
- 8.3 The cable boxes shall be fitted with insulating pieces to allow for the possible future installation of frame leakage busbar zone protection when specified in the Detail Technical Specification.
- 8.5 The lowest point of any cable gland position shall be at least 300mm above finished floor level.
- 8.6 Cable boxes shall be so designed that cable terminal connections can be made below compound level.

9. SECONDARY CIRCUITRY

9.1 CABLING

- 9.1.1 Gland plates, suitably drilled to accept the glands for all the external power, control, protection and DC supply cables, shall be provided.
- 9.1.2 The internal wiring to be connected to the cabling mentioned in par.
- 9.1.3 Where external DC supplies are connected to the switchboard, semiconductor diodes of a suitable power and voltage rating shall be installed in all DC circuits, in both the positive and negative conductors, to prevent reverse polarity connections.

9.2 WIRING

- 9.2.1 All wiring shall present a neat appearance and shall be suitably braced, placed in wiring channels or clipped and/or laced.
- 9.2.2 Connections to equipment mounted on doors shall be arranged to give a twisting motion and not a bending motion to the conductors.
- 9.2.3 All panel and equipment terminals, labels, etc. shall be completely accessible after the wiring and cabling has been completed.
- 9.2.4 Conductors shall be identified at both ends by means of durable closed ring interlocking cable marking ferrules. PVC or other tape is not acceptable. The numbers on the markers shall also be shown on the wiring diagrams.
- 9.2.5 Where conductors are terminated on equipment terminals that do not require the use of lugs, the identification ferrules shall be fixed so that they do not fall off when disconnecting a conductor.
- 9.2.6 Identification ferrules shall read from the terminal along the wire.
- 9.2.7 All wiring 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. Conductors connected to terminals complying with the Departments standard specification for "WIRING TERMINALS", Section C9 need not be soldered or ferruled.
- 9.2.8 Secondary wiring shall generally consist of insulated stranded copper conductors with a minimum cross-sectional area of 2,5mm². Solid core conductors are not acceptable. Flexible cords not smaller than 1,0mm² shall be installed between equipment mounted on doors and the rest switchboard. For voltage ratings in excess of 50 V the wiring insulation shall withstand a test voltage of 2 kV to earth for one minute. For voltages of 50 V or less the insulation shall withstand 500 V to earth for one minute.

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9.2.9 All wiring between different panels within the same switchboard shall be installed in wiring channels. Grommets shall be installed in each hole in the metalwork through which conductors pass. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges. All wiring shall be installed away from terminals, clamps or other current carrying parts.

9.2.10 Conductors may be jointed at equipment terminals or numbered terminal strips only.

9.2.11 To minimise the effect of electrolysis, DC circuits shall be so arranged that the isolator or N/O operation contacts are connected to the positive pole of the battery.

9.3 SECONDARY TERMINALS

9.3.1 All external wiring and connections to auxiliary contacts, all alarm, protection, intertripping. DC supply circuits, etc. shall terminate on numbered terminal strips. All numbers shall appear on the switchboard drawings.

9.3.2 Terminals of the type where clamping screws are in direct contact with the conductor are not acceptable.

9.3.3 Where stud type terminals are provided they shall have a minimum size of 0 B.A.

9.3.4 Approximately 10% with a minimum of 2 spare terminals shall be provided on each terminal strip.

9.3.5 Terminal and test blocks shall be provided in each panel for the secondary wiring of the current transformers.

10. CUBICLE CONSTRUCTION

10.1 GENERAL

10.1.1 All cubicles shall be of the totally enclosed, floor mounted type and shall be vermin proof and where possible dust proof.

10.1.2 Cubicles shall be designed so that it is possible to add additional panels to existing switchboards without undue difficulty.

10.2 SEGREGATION OF CIRCUITS

10.2.1 Each circuit in a switchboard shall be provided with an individual cubicle so arranged that accidental contact with live metal in adjacent circuit cubicles is impossible.

10.2.2 It shall be possible to terminate the cables of any circuit without exposure to any live conductors of the same circuit while the busbars are energised.

10.3 DOORS

10.3.1 Where doors are provided on circuit breaker or switch cubicles, the doors shall be fitted with handles consisting of a push-button and handle combination with spring loaded latch or a rotary handle-and-catch combination. The closing mechanism shall be designed to draw the door closed. Flush mounted ring type handles or square key operated latches are not acceptable. Locking latches shall be padlock able.

10.3.2 Doors shall be suitably braced and stiffened to carry the weight of equipment installed in doors and to prevent warping.

10.3.3 Control panel doors shall be fitted with handle closing mechanisms as described in par. 10.3.1 above. Alternatively, captive knurled bolts designed to be screwed in by hand may

be used.

10.3.4 Doors shall have stops to prevent overswing of the door when opening and to prevent interference with adjacent panels.

10.3.5 Doors shall be fitted with suitable rubber or synthetic rubber seals.

10.3.6 All doors shall be bonded to the framework by a braided copper earth strap.

10.4 EARTHING

10.4.1 All metal parts other than those forming part of electrical circuits shall be connected to the cubicle earth bar.

10.4.2 All non-current carrying conductive parts, including relays, instruments, transformer and contactor cores, etc. shall be effectively connected to the earth bar either by means of their mounting arrangements on the panel or by means of a special earthing conductor fitted with lugs for attaching to the earth bar.

11. CURRENT TRANSFORMERS

11.1 GENERAL

11.1.1 Current transformers shall comply with the Department's standard specification for "CURRENT TRANSFORMERS", Section C26.

11.1.2 The short time current rating of current transformers shall not be less than that of the associated circuit breaker.

11.1.3 Current transformers shall be easily replaceable.

11.1.4 The secondary windings of the current transformers shall be brought out to terminal and test blocks. Windings shall be earthed at one point only. (Refer also to par. 9.3.5).

11.1.5 Current transformers shall be installed and labelled so that the ratio is clearly visible.

12. VOLTAGE TRANSFORMERS

12.1 GENERAL

12.1.1 Voltage transformers shall comply with BS 3941 and IEC 186A and IEC 358 where applicable.

12.1.2 The transformers shall be double wound. The neutral (star point) connection shall be brought out via a neutral link. The secondary voltage shall be 110V unless specified to the contrary.

12.1.3 Voltage transformers shall be metal-clad, of the oil-immersed or epoxy resin encapsulated type. Oil filled types may not be used with air or vacuum circuit-breakers.

12.1.4 The transformer shall be withdrawable and shall be so arranged that the primary fuses are not accessible unless the transformer is in the fully isolated or withdrawn position. The voltage transformer shall be padlock able in both the withdrawn and inserted positions.

12.1.5 Automatic shutters shall be provided to cover the isolating contact when the transformer is withdrawn. Refer also to par. 5.3. The shutters shall be padlock able.

12.2 VOLTAGE TRANSFORMER PROTECTION

12.2.1 The primary side of all voltage transformers shall be connected to the circuit through high voltage HRC fuses.

12.2.2 Secondary HRC fuses shall be provided on the voltage transformer, preferably under a removable cover secured by captive knurled nuts. The fuses shall be located as close as possible to the transformer output terminals.

12.3 VOLTAGE TRANSFORMER RATINGS AND TESTS

12.3.1 The voltage transformers shall have an output suitable for the connected load but at least 200VA per phase at class B accuracy.

12.3.2 The voltage ratios shall be suitable for the primary busbar and the required output voltages.

12.3.3 Voltage transformers shall be tested in accordance with BS 3941 and shall withstand an impulse level of 95 kV.

13. PROTECTION RELAYS

13.1 Protection relays shall be contained in dustproof cases which shall not allow accumulated dust to fall into the relay when opened.

13.2 All cases shall be of the flush mounting withdrawable type.

13.3 Relay contacts shall be capable of repeatedly making and, where the circuit renders it necessary, repeatedly breaking the maximum current possible in the circuits they control.

13.4 Where more than one set of contacts are provided, all contacts shall operate simultaneously.

13.5 Tripping contacts shall not dose due to vibration engendered by the normal or the fault condition operation of the associated or adjacent circuit breakers.

13.6 Hand resetting shall be accomplished without opening the case and these relays shall be accessible to a person standing on the floor.

13.7 All relays shall be provided with test blocks to permit tests to be carried out without disconnecting any wiring. These test blocks may be either included in the relay cases or separately mounted.

13.8 The ratio of the associated current transformer shall be clearly marked on the relay face plate.

13.9 All relays shall be adjusted during manufacture to conform to the limits stipulated in BS 142.

14. INSTRUMENTS

14.1 Instruments, i.e. ammeters, voltmeters, combined maximum demand and indicating ammeters, kilowatt-hour meters, frequency meters and running-hour meters shall generally comply with the Department's standard specification for "DIRECT ACTING INDICATING INSTRUMENTS", Section C23.

14.2 Voltmeter and ammeter scales shall have a full scale reading at least 5% higher - than the system voltage or associated current transformer rating with the latter values clearly marked.

14.3 The instruments shall be suitably rated for the supply voltage, current and frequency.

14.4 Each voltmeter shall be protected with easily accessible HRC fuses.

14.5 Each circuit breaker shall be equipped with a trip counter with cyclometer dial.

15. AUXILIARY EQUIPMENT

15.1 CONTROL SWITCHES

15.1.1 Circuit breaker closing and tripping control switches shall close the associated circuit breaker when rotated clockwise.

15.1.2 Control switches may be fitted with one pair of lazy contacts, i.e. contacts which make when the control switch is turned to the closed position, remain closed when the handle returns to the neutral position and only open when the control switch is moved to the trip position.

15.1.3 The switches shall be provided with a suitable face plate indicating the angle of throw and the switching positions.

15.1.4 The switches shall be suitable for the supply voltage and the contacts shall be silver-plated or gold laminated and shall be suitably rated for the switching functions intended.

15.1.4 Control switches shall be lockable in the "NEUTRAL" or "OFF" position.

15.2 FUSES

15.2.1 All fuses for the protection of auxiliary circuits shall be of the high rupturing capacity cartridge type and shall be mounted on insulated draw-out carriers which shall hold the fuses positively after withdrawal.

15.2.2 The top terminal shall be the live terminal in all cases.

15.2.3 HRC fuses shall be provided in the positive leads of all DC circuits.

15.2.4 Fuses shall be so positioned that they are readily accessible to a person standing on the floor in front of the panel.

15.2.5 Labels shall be fitted adjacent to fuses stating their use, rating and duty.

15.3 INDICATOR LAMPS

15.3.1 Indicator lamps shall comply with the Department's standard specification for "INDICATOR LIGHTS". Section C27

15.3.2 The following indications shall be provided:

<u>FUNCTION</u>	<u>COLOUR</u>
Circuit breaker closed	Red
Circuit breaker open	Green
Incoming supply available (on incoming panel only)	White
Auto-trip	Amber
Trip circuit healthy	White

15.3.3 A lamp test push-button for all the indicating lights shall be provided on each switchboard.

15.3.4 The "trip circuit healthy" indication shall normally be off and a push-button shall be provided to indicate the status. The purpose of the indication is to ensure that the tripping voltage supply is available on the panel before the circuit breaker is closed. An indicator light with

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push-button is required on each panel and one indication per switchboard is not sufficient. The circuitry shall be arranged to provide an indication with the circuit breaker in both the "OPEN" and "CLOSED" positions.

15.3.5 The condition indicated shall be designated below each light.

15.4 Push-buttons and Push-button Assemblies Push-buttons and push-button assemblies shall comply with the Department's standard specification for these items, Section C32.

16. DC AUXILIARY SUPPLIES

If specified, a battery derived DC supply shall be provided with the switchboard. The nominal voltage shall be 32 V DC unless specified to the contrary.

16.1 BATTERIES

16.1.1 The batteries shall be of the nickel-cadmium type and the cells shall be in high impact polystyrene containers with a large reserve of electrolyte.

16.1.2 The number of cells and capacity shall be determined from the voltage requirements of the circuit breaker closing and tripping circuitry and the discharge duties required by the switchboard.

16.1.3 The battery capacity shall be sufficient to perform either of the following functions:.

(a) Five successive tripping and reclosing operations of all the circuit breakers on the switchboard.

or

(b) A single tripping and reclosing operation of all the circuit breakers on the switchboard plus supplying all the standing loads on the battery for at least 10 hours.

Note: The alternative requiring the larger battery shall be used.

16.2 BATTERY CHARGING UNIT

16.2.1 A constant voltage type charger with current limiting facilities shall be provided. The output voltage shall be kept within 1% of the float charge voltage designed for maximum charge conservation and a maximum battery life for variations of + 10% of the input voltage.

16.2.2 The ripple content in the output of the charger shall be less than 2%.

16.2.3 The charger capacity shall be adequate to supply any standing load on the battery plus a charging current which will recharge a fully discharged battery within 8 hours.

16.2.4 A switch operated boost charge control shall be provided.

16.2.5 An auxiliary winding shall be added to the charger transformer providing a secondary

16.2.6 AC output suitable for all the indicating lights on the switchboard. The lights shall be supplied from this winding and not from the batteries.

16.2.7 The charger shall be suitable for operation on a nominal 230 V, 50 Hz mains supply or from a supply obtained from a voltage transformer.

16.2.8 The charger shall be complete with all the required controls including the following standard equipment:

(a) Power supply isolator.

- (b) Ammeter indicating rectifier output.
- (c) Battery voltmeter.

16.2.9 The following HRC fuses shall be provided:

- (a) Input fuses.
- (b) Rectifier output fuses.
- (c) Voltmeter fuses.
- (d) Fuses in charger transformer auxiliary output.
- (e) A pair of fuses for each DC circuit plus fuses for 3 spare circuits.

If more than one battery output circuit is specified, each circuit shall be fitted with a pair of fuses.

16.3 CUBICLE

16.3.1 The batteries and charger shall be housed separately from the switchboard in a self-contained cubicle with the same finish and colour as the switchboard.

16.3.2 The cubicle shall be dust proof and vermin proof.

16.3.3 An undrilled removable cable gland plate shall be provided for bottom cable entry.

17. FINISH

17.1 All welds shall be ground smooth and joints wiped with plumber's metal in order to provide a smooth finish.

17.2 All the metalwork shall be painted in accordance with the Department's "STANDARD PAINTING SPECIFICATION", Section C39.

17.3 The final colour shall be "ADMIRALTY GREY", colour G12 to SANS 1091.

18. LABELS

18.1 Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions appear in both official languages.

18.2 Panel designation labels shall appear on the front and back of each panel and on the circuit breaker truck.

18.3 Engraved sandwiched interchangeable plastic or ivory strips shall be used throughout. The strips shall bear white lettering on a black background.

18.4 Labels shall be secured by means of brass bolts, nuts and washers. Where this is not practicable cadmium-plated self-tapping screws may be used. The glueing of labels will not be acceptable. Sufficient fixing screws shall be provided to prevent labels from warping.

19. TESTS

19.1 MANUFACTURER'S TESTS

19.1.1 All component parts of the equipment shall be subject to type tests and routine tests in accordance with the relevant SANS, BSI or IEC standard specifications.

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19.1.2 Oil circuit-breakers shall be subjected to the following tests in accordance with BS5311-Part 4, adjusted for atmospheric correction:

Type Tests: (a) Mechanical Endurance.
 (b) Temperature Rise.
 (c) Dielectric Strength and
 (d) Impulse Voltage.
 (e) Making and Breaking Capacity
 (f) and Short Time Current.

Routine Tests: (a) Power Frequency Voltage.
 (b) Resistance of the MainCircuit.
 (c) Mechanical Operation.

19.2 ON SITE TESTS

19.2.1 The equipment shall be tested on site after erection and prior to commissioning.

19.2.2 The following minimum tests shall be performed:

- (a) Pressure tests on the primary and secondary circuits in accordance with BS 5227 or IEC 298.
- (b) Insulating oil tests in accordance with SANS 555.
- (c) Insulation resistance tests.'
- (d) Primary injection tests.
- (e) Earth continuity and earth resistance tests.
- (f) Operating tests.
- (g) Any other tests which may be required to ascertain the correct functioning of the equipment.

19.3 TEST CERTIFICATES

19.3.1 Copies of type test certificates shall be submitted together with the tender.

19.3.2 Copies of test certificates of all other tests i.e. routine tests and on site tests shall be forwarded to the Department on completion of the tests.

19.4 TEST PERFORMANCE AND INSPECTION

19.4.1 The Department shall be notified in writing at least two weeks in advance of any tests to be conducted to allow its representative to be present at such tests.

19.4.2 The Department shall also be notified timeously of the completion of the equipment in order that an inspection may be carried out prior to delivery.

20. OIL AND COMPOUND

20.1 The first filling of insulating oil for all the circuit breakers, oil switches, voltage transformers, etc. shall be provided by the switchgear supplier.

20.2 An adequate quantity of bituminous or cold filling compound shall be provided by the switchgear supplier for all the cable end boxes.

20.3 All other oils or compounds which may be required shall be provided by the switchgear

supplier.

21. TOOLS AND AUXILIARY EQUIPMENT

The following equipment shall be provided with each switchboard and the cost shall be included in the tender price:

- (a) One raising and lowering handle for every three circuit breakers.
- (b) One complete set of special maintenance tools for all sizes of circuit breakers.
- (c) A full set of earthing devices or earthing trucks.
- (d) One wall mounted steel box for the storage of the above loose equipment. The door shall be padlockable.
- (e) At least six spare HRC fuses of each rating for secondary circuits and three voltage transformer, high voltage HRC fuses.
- (f) At least three spare high voltage HRC fuses of each rating suitable for the fused oil switches.
- (g) One cable test unit for each size circuit breaker or oil switch housed in a wall mountable metal box.

22. TECHNICAL INFORMATION

- 22.1 Tenderers shall submit descriptive literature of the equipment with their tenders.
- 22.2 Two copies of erection, operating and maintenance instruction manuals covering each type of equipment shall be provided with each switchboard.

23. DRAWINGS AND DIAGRAMS

23.1 DRAWINGS FOR APPROVAL

- 23.1.1 A set of three prints of the following drawings shall be submitted to the Department for approval.
 - (a) General Arrangement Drawings.
 - (b) Detailed Dimensional Drawings.
 - (c) Schematic Diagrams.
 - (d) Wiring Diagrams.
 - (e) Foundation Drawings.

23.1.2 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.

23.2 FINAL DRAWINGS

23.2.1 On completion, a complete set of final transparent drawings shall be delivered to the Department. These drawings shall include the following:

- (a) An accurate "as built" wiring diagram of the complete installation showing circuit numbers, terminal strip numbers, conductor colours and numbers, etc.
- (b) A schematic diagram clearly showing the functions of all equipment.

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- (c) An equipment schedule showing the make, model and characteristics of all components used including a recommended spares list.
- (d) Fully dimensioned "as built" physical layout of the panel.

24. COMPLETION

The 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 C35**C.35 11 KV NON-AUTOMATIC OIL SWITCHES, FUSED OIL SWITCHES AND RING MAIN UNITS****1. GENERAL**

This section covers the manufacturing and testing of indoor and outdoor non-automatic oil switches, fused oil switches and ring main units.

1.1 STANDARDS

All materials and apparatus shall be new and of the best quality and shall comply with the relevant current specifications of the SANS, BSI or IEC and the Department's Quality and Installation Specifications.

The following standards may be used as a guide but must not be regarded as a complete list.

<u>DESCRIPTION</u>	<u>SANS</u>	<u>BSI</u>	<u>IEC</u>
Air & Oil Switches	-	5463	265-A-C
Busbar & Busbar Connections	-	1195	159
Bushings	-	223	137
Cable Glands & Sealing boxes	-	542, 2562	
HV Fuses	-	2692	282-1
LV Fuses	172	88	269-1
Electrical Power Switchgear	-	5227	-
Galvanising	32&121	729	-
Insulating Oil	555	148	296
Isolators and Earthing Switches	-	5253	129
Oil Switches	-	5463	-
Protective Relays	-	142	255
Colours for specific purposes	1091		

2.1 Service Conditions

Frequency	50 Hz	
Phases	3	
Nominal voltage	11 kV	
Rupturing Capacity	250 MVA	
Impulse Level	95 kV	
Highest System Voltage	12 kV	
Atmospheric Temperature	-5°C to 40°C	
Altitude	0mm minimum	1850m maximum
Lightning & Dust	severe	
Average Power Factor	0,8	
Maximum Humidity	95%	

The system neutrals will be solidly earthed. All switchgear and auxiliary equipment shall be designed to withstand the stresses of an unearthed system.

2. CONSTRUCTION AND FINISH

- 2.1 The switches shall be totally enclosed, metal clad and of the bulk oil content type. Air break switches will not be acceptable. Switches shall be suitable for both indoor or outdoor use as specified.
- 2.2 The switches shall be self-supporting and free standing. At least four M20 high tensile steel holding-down bolts shall be provided with each switch. The holding-down bolts shall be

suitable to be cast into the concrete base.

- 2.3 The switch shall be treated and painted in accordance with the requirements of clause 3.23 of SANS 780 as amended.
- 2.4 In the case of switches supplied for installation within 50km of the coast, in polluted industrial atmospheres or as specified, the total dry film thickness of the paint shall be increased to at least 0,125mm.
- 2.5 The colour shall be "DARK ADMIRALTY GREY" to BS 381 C (Shade 632) or colour G12 of SANS 1091. A tin of matching touch up paint (not smaller than 500ml) shall be provided with each consignment.

3. MECHANISM

- 3.1 The switch shall have three positions, namely "ON", "OFF" and EARTH".
- 3.2 Except for removing the earth, the switch actuating mechanism shall have a positive action and shall be spring assisted to ensure that once the operation is initiated it becomes completely independent of the operator.
- 3.3 The fused oil switch shall close fully when making onto a fault to ensure full clearance of the fault by the fuses before tripping and opening the switch.
- 3.4 A blown fuse on any one of the three phases shall open all three phases of the switch and shall inhibit the closure of the switch pending fuse replacement.

4. INTERLOCKS

- 4.1 The mechanism shall be incapable of moving directly to the "EARTH" position from the "ON" position.
- 4.2 A time delay shall be built into the mechanism to prevent immediate opening of the switch after closure. This shall be achieved by means of non-reversible operating handles, mechanical sliding interlocking gates or a non-reversible movement.
- 4.3 Padlocking facilities shall be provided to prevent either operation.
- 4.4 Access to the testing facilities shall only be possible after the switch is in the "EARTH" position. With the testing devices fitted, operation to either the "ON" or "OFF" positions must be prevented.
- 4.3 Access to the fuse carriage shall only be possible with the switch in the "OFF" position.

5. CABLE TEST FACILITIES

- 5.1 Cable test facilities are required and must be easily accessible.
- 5.2 All units required for installation in miniature substations must be equipped with integral testing facilities. Testing by means of a separate test harness is not acceptable.
- 5.3 Refer to par. 4.4 regarding interlocking of test facilities.
- 5.4 Where a separate test unit is supplied for use in a substation (not mini substation) it shall be easily fitted and shall be supplied and stored in a suitable padlockable receptacle mounted in a convenient position on the switch.

6. RATINGS

- 6.1 Continuous rated currents (minimum):

Busbars	400A
Oil switch contacts	400A
Fused oil switch contacts	90A

7. FUSES

- 7.1 Fuse-links shall be of the striker pin type, shall be hermetically sealed and shall be suitable for use under oil.
- 7.2 The fuse-link carriage shall be suitable to accept either 254mm or 359mm long fuses both with a diameter of 63,5mm. The carriage shall be adjustable for this purpose and shall not necessitate additional parts.
- 7.3 Automatic shutters shall be provided to safeguard against inadvertent contact with live parts when the fuse carriage is removed.
- 7.4 Three spare fuses in addition to the three fuses supplied with the fused oil switch shall be supplied with each unit. The rating of the fuses will be specified in the Detail Technical Specification.

8. CABLE END BOXES

- 8.1 The switches must be supplied with cable end boxes suitable to accept armoured, paper-insulated cables as specified.
- 8.2 The cable end boxes shall be of the metal clad type suitable for indoor or outdoor use.
- 8.3 The boxes shall be equipped with armour clamps and brass or gunmetal conical wiping glands for lead covered steel tape or galvanised steel wire armoured cables.
- 8.4 The cable boxes shall comply with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8.

9. OIL FOR SWITCHES

9.1 OIL FILLING

Sufficient oil shall be supplied with the switchgear to fill the fuse and switch chambers.

9.2 BUSBAR CHAMBER

If the busbar chamber is designed to be filled with compound, sufficient compound shall be supplied with the switchgear for this purpose if the chamber is not factory filled.

10. UNIT COMBINATIONS

10.1 A SINGLE OIL SWITCH OR FUSED OIL SWITCH

A single oil switch shall be supplied with a busbar end cap and insulating compound on one end. A cable end box shall be fitted to the opposite busbar end.

10.2 EXTENSIBLE OIL SWITCHES AND FUSED OIL SWITCHES

Extensible oil switches and fused oil switches shall be supplied complete with two busbar end caps, busbar coupling links, busbar band joints and filling compound for the end caps and joints.

10.3 EXTENSIBLE RING MAIN UNIT WITH FUSED OIL SWITCH TEE-OFF

An extensible ring main unit with a fused tee-off shall comprise two extensible oil switches and one extensible fused oil switch complete with equipment and material. (Refer to par. 10.2). The fused

oil switch tee-off shall be located between the two oil switches.

10.4 NON-EXTENSIBLE RING MAIN UNIT WITH FUSED TEE-OFF

A non-extensible ring main unit shall comprise two oil switches and one fused oil switch tee-off combined in a compact single unit with no external busbar access.

The three switches shall preferably be housed in a common oil tank. The fused oil switch tee-off shall be located between the two oil switches.

11. LABELS

11.1 Labels shall consist of engraved plastic or ivory sandwiched strips. The labels shall bear white lettering on black background. Painted or printed labels are not acceptable.

11.2 Each switch shall have a label designating the circuit. All label designations shall be obtained from the Department and shall be confirmed in writing with the Department before manufacture.

11.2 Labels shall be secured by means of brass bolts, nuts and washers. Where this is not practicable cadmium-plated self-tapping screws may be used. The gluing of labels is not acceptable. Sufficient fixing screws shall be provided to prevent labels from warping.

12. INSPECTION AND TESTS

The Department shall be notified at least two weeks in advance of the completion of the switches and of the date of testing in order that an inspection may be carried out before delivery and that tests may be witnessed.

13. TECHNICAL INFORMATION

13.1 One copy of each of the following information shall be submitted to the Department together with the tender:

- (a) Type test certificates.
- (b) Complete technical details and brochures.

13.2 Immediately after the award of the contract, a detail drawing of the concrete bases showing concrete mixes, dimensions, cable entry openings, steel reinforcing details and holding-down bolt fixing shall be submitted to the Department. Three prints of each of the different drawings shall be provided.

13.3 The following information shall be supplied together with the equipment:

- (a) One operating and maintenance manual.
- (b) Installation and commissioning instructions.
- (c) Two copies of the unit test certificates.
- (d) A test certificates stating the average breakdown voltage of the oil at the time of filling.

13.3 One operating handle of each type of switch shall be supplied.

14. COMPLETION

The supply contract shall be regarded as incomplete until the technical information, operating handles, filling compound, fuses, test units (if required) and all other items as specified have been supplied to the Department.

SECTION C36**C.36 DISTRIBUTION TRANSFORMERS****1. GENERAL**

- 1.1 This specification covers the manufacture of distribution transformers for general reticulation and distribution systems in normal environmental conditions for 50 Hz, three-phase, 11 kV (nominal) primary and three-phase four-wire 400 V (nominal) secondary systems.
- 1.2 The transformers shall be of the low loss type and shall comply with SANS 780.
- 1.3 The number of transformers required shall be as specified.

2. POWER RATINGS

The rated power of the transformer shall be as specified and shall be one of the standard values given below in accordance with SANS 780:

- 2.1 Single-phase Transformers (kVA): 16, 25.
- 2.2 Three-phase Transformers (kVA): 16, 25, 50, 100, 200, 315, 500, 800, 1250, 2000.

3. BREATHING

- 3.1 Single-phase transformers shall be of the sealed type, with the tank covers welded to the tank.
- 3.2 Three-phase transformers shall be of the sealed type up to power ratings of 500kVA. Transformers rated at 800kVA and above may be of the free-breathing or sealed type. Sealed transformers shall have welded tank covers. Bolted tank covers will not be accepted on sealed transformers.
- 3.3 Sealed transformers above 500kVA rating shall be fitted with a pressure relief device, secured to the welded tank cover.

4. CONSTRUCTIONAL DETAILS AND FITTINGS

The transformer shall be fitted with the recommended standard fittings for transformers as specified in Table 1 of SANS 780 and as specified below:

- 4.1 An off-load tapping switch shall be provided on all transformers including miniature substation transformers.
- 4.2 A maximum indicating thermometer shall be provided on all transformers with a power rating of 1 000kVA and above to sense the oil temperature directly above a winding. One pair of alarm contacts shall be calibrated to close at 85°C one pair of trip contacts shall be calibrated to close at 95°C. These contacts shall not be easily adjustable without removal of, a cover.
- 4.3 Gas-and-oil actuated relays shall be provided on all transformers of power ratings of 1000kVA and above. One pair of alarm and one pair of tripping contacts shall be provided.
- 4.4 Single-phase transformers shall be fitted with pole clamps.
- 4.5 Longitudinal skid under bases shall be provided on all transformers of power ratings of 800KVA and above. Axles and wheels are not required.

5. BUSHINGS AND CABLE BOXES

- 5.1 Open bushings and outdoor terminals shall be provided on both the primary and secondary sides of the transformers unless specified to the contrary. The bushings on the low voltage side shall all be of the same size.
- 5.2 If specified, cable boxes shall be provided. Cable boxes on the primary side of the transformer shall comply with the following requirements:
 - 5.2.1 Cable boxes shall be of the metal-clad type suitable for indoor and outdoor use and suitable to accept armoured, paper-insulated cables as specified.
 - 5.2.2 The boxes shall be equipped with armour clamps and brass or gunmetal conical wiping glands for lead covered, tape or wire armoured cables.
 - 5.2.3 The boxes shall comply with BS 2562.
 - 5.2.4 The boxes shall be suitable for filling with bituminous or cold filling compound.
 - 5.2.5 The boxes shall comply with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8.
- 5.3 Cable boxes on the secondary side shall comply with the following requirements:
 - 5.3.1 The cable boxes shall be of the metal-clad type suitable for indoor and outdoor use and suitable to accept PVC-insulated and armoured cables as specified.
 - 5.3.2 The boxes shall be air insulated and shall be equipped with the required number, sizes and types of glands and waterproofing shrouds. Glands shall be equal or similar to "PRATLEY" adjustable glands.
 - 5.3.3 Where single core cables are used the base plate of the cable box shall be manufactured of non-ferrous material.

6. CABLE BOX FILLING COMPOUND

Where cable boxes are specified an adequate quantity of filling compound shall be provided. The filling compound shall comply with the Department's standard specification for "CABLE END BOXES AND COMPOUND", Section C8.

7. TERMINALS FOR THREE-PHASE TRANSFORMERS

- 7.1 Three terminals shall be provided on the primary side. Each terminal shall be fitted with the correct size and number of lugs, bolts, nuts, washers, etc. to accept the cables as specified. Bolted connections only are acceptable.
- 7.2 Four terminals shall be provided on the secondary side i.e. three phases and an insulated neutral. Each terminal shall be fitted with the correct size and number of lugs, bolts, nuts, washers, etc. to accept the cables as specified. Where parallel cables are specified bushing stud clamps or similar connectors of adequate size to accommodate the bolted cable lugs without overlapping of the lugs shall be provided.
- 7.3 Where busbars are specified on the secondary side, provision shall be made for the busbar enclosure to be made off on the transformer. Busbars rated at the transformer's full load current shall be accommodated. Adequate space shall also be allowed for busbar protection current transformers and allowance shall be made for the neutral to be brought out of the enclosure for external earthing.

8. CURRENT TRANSFORMERS

Current transformers are not required.

9. CORROSION PROTECTION

Corrosion protection shall comply strictly with SANS 780, clause 3.2.3. Where the transformers are required for installation within 50km of the coast the total dry film thickness of the paint shall be increased to at least 0,125mm.

10. METHOD OF COOLING

The transformers shall be of the ONAN type

11. OIL

The transformers shall be supplied completely filled with oil. The oil shall comply with SANS 555. Sealed transformers shall be filled with passivated transformer oil.

12. TECHNICAL INFORMATION

All the relevant technical information i.e. outline drawings, test cards, drawings of rating plate, etc. as specified in SANS 780 shall be submitted to the Department.

In addition a test certificate stating the average breakdown voltage of the oil at time of filling shall be submitted to the Department.

SECTION C37**C.37 MINIATURE SUBSTATIONS****1. GENERAL**

- 1.1 This specification covers the manufacture and supply of miniature substations suitable for use on 11 kV (three-phase) and 400 V (three-phase and neutral), 50 Hz systems.
- 1.2 The substation shall comply with the requirements of SANS 1029 and SANS 1030 unless otherwise specified.

2. CONSTRUCTIONAL REQUIREMENTS**2.1 FIBREGLASS HOUSINGS**

Where specified and for all substations to be installed within 50km of the coast and in all corrosive industrial atmospheres, the roof, walls, and doors shall be manufactured of fibreglass in accordance with the following minimum requirements:

- 2.1.1 The laminate shall be constructed to SANS 141.
- 2.1.2 The fibreglass shall comply with the minimum strength requirements of clause 3.4 of SANS 1029.
- 2.1.3 An outer isophthalic 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.
- 2.1.4 The gelcoat shall be backed by multiple layers of chopped strand mat glass rendering not less than 1,2kg/m². The strength shall be increased to 1,35kg/m² on all panels larger than 500 x 500mm.
- 2.1.5 The fibreglass shall be thoroughly impregnated with polyester resin. The resin should preferably be clear.
- 2.1.6 The resin to fibreglass ratio shall not be less than 2,5:1 and not more than 3,0:1.
- 2.1.7 Air entrapped between the glass mat layers shall be thoroughly worked out. The laminate must be free of air bubbles and voids.
- 2.1.8 All edges shall be reinforced with an additional 700g/m² of fibreglass.
- 2.1.9 All large surfaces, wider than 300mm. shall be reinforced or panelled to improve stiffness and rigidity.
- 2.1.10 A resin coat shall be applied to the inside of the panels to cover the fibre pattern.
- 2.1.11 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 stress.
- 2.1.12 Doors shall be adequately, reinforced, ribbed or double laminated with an air gap between the two layers of laminate to ensure rigidity.

2.2 FINISH AND COLOUR OF FIBREGLASS MINIATURE SUBSTATIONS

- 2.2.1 The outside surface of the fibreglass shall have a glossy, smooth finish to ensure good weathering. To obtain this the manufacturer shall ensure that the moulds are smooth, free of voids, hairline cracks, pores or other defects.
- 2.2.2 Compound rubbing or sanding of the outside surface will not be permitted.
- 2.2.3 Pigments shall be added to the outer gelcoat to obtain a matching colour to "AVOCADO GREEN", colour C12 or "LIGHT STONE", colour C37 of SANS 1091.
- 2.2.4 Fibreglass panels shall not be painted.

2.3 SHEET STEEL HOUSINGS

- 2.3.1 Where specified, the roof, walls and doors shall be manufactured of steel.
- 2.3.2 The sheet steel construction shall comply with the minimum strength requirements of clause 3.4 of SANS 1029.
- 2.3.3 All welds shall be ground smooth and the joints wiped with plumber's metal in order to provide a smooth finish.
- 2.3.4 All panels, the roof and doors shall be suitably braced and stiffened to ensure rigidity and to prevent warping.
- 2.3.5 The colour of the outer coat of paint on the outer surfaces of the substation shall be an acceptable match to "AVOCADO GREEN" colour C12 or "LIGHT STONE", colour C37 of SANS 1091. A tin of matching touch-up paint (not smaller than 500ml) shall be provided with each mini-substation:

3. CONCRETE PLINTH

- 3.1 The mini-substation shall be mounted on a concrete plinth. Plinth shall be cast on site.
- 3.2 The Contractor shall issue to the Department a detailed plinth drawing suitable for each type of mini-substation supplied. Refer to par. 11.1.1 (e).
- 3.3 The top of the plinth shall protrude at least 200mm above the final surrounding, ground level. The concrete plinth shall protrude approximately 100mm beyond the edges of the mini-substation to form an apron.
- 3.4 The concrete apron and plinth shall be wood float finished and shall slope from the base to permit rain water run off. A 3mm thick gasket of approved malthoid shall be inserted between the mini-substation and the concrete surface. The gasket shall be as wide as the base.
- 3.5 Cable ducts shall be provided in the plinth to accommodate all the incoming and outgoing cables. The cable ducts shall be sealed to prevent entry of rodents. The sealing shall be easily removable in the event of future cable work and may consist of a layer of 10:1 sand and cement mix, approximately 10mm thick, and finished flush with the top of the concrete plinth.

4. BASE

Steel bases shall be supplied for the mini-substations. Bases shall be hot-dip galvanised and then epoxy tar coated before being painted.

5. DOORS

- 5.1 Long pedestal type hinges with at least two fixing bolts per hinge or similar hinges shall be used to hang the doors. The pedestal hinges shall be arranged in opposed fashion so that doors cannot be lifted off. Piano hinges are not acceptable. The hinges shall be of brass or other corrosion resistant materials. Nylon or aluminium hinges are not acceptable.
- 5.2 At least three hinges shall be provided on doors higher than 1,2m.
- 5.3 Door restraints shall be provided. Cloth or canvas straps are not acceptable. The fixing points of the restraints at both the door and the door frame shall be reinforced.
- 5.4 Doors shall be fitted with brass or stainless steel lever locks equal or similar to the "BARKER & NELSON" type with a 180° 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 by brass or galvanised steel plates. The locking mechanism shall be padlockable. Padlocks will be provided by the Department.
- 5.4 Bypass bolts and nuts shall be used to fix the hinges.

6. HIGH VOLTAGE COMPARTMENT

- 6.1 The high voltage compartment shall be equipped with a non-extensible bulk oil filled ring main unit with a fused tee-off unless otherwise specified. This unit shall be manufactured and supplied in accordance with the Department's standard specification for "11kV NON-AUTOMATIC OIL SWITCHES. FUSED OIL SWITCHES AND RING MAIN UNITS", Section C35.
- 6.2 All ring main units or other HV switchgear installed in miniature substations must be fitted with integral testing facilities. Testing by means of a separate test harness is not acceptable.
- 6.3 The minimum clearances between connecting cables and jumpers and any sharp metal edges or protrusions shall be at least 75mm.
- 6.4 "DELARON" or "THIOLITE" resin bound synthetic wood or other suitable dielectric material shall be used to maintain the phase-to-phase and phase-to-earth spacing of the cables and jumpers. The surfaces of these spacers shall be treated to prevent surface tracking.
- 6.5 Stranded annealed copper conductors only shall be used for jumper cables.
- 6.6 All terminals shall be shrouded with "RAYCHEM", or similar heat-shrinkable shrouds. Taping is not acceptable.
- 6.7 The high tension connections between the fused switch unit and the transformer shall be suitably blanked off so that they cannot be touched.

7. TRANSFORMER COMPARTMENT

- 7.1 The transformer compartment shall be equipped with a transformer as specified and in accordance with the Department's standard specification for "DISTRIBUTION TRANSFORMERS". Section C36 and the requirements of SANS 1029.
- 7.2 An off-circuit tap switch shall be provided.
- 7.3 The transformer shall be sealed and shall not contain a silica-gel breather.

8. LOW VOLTAGE COMPARTMENT**8.1 EQUIPMENT**

- 8.1.1 The specified equipment shall be installed in the low voltage compartment.
- 8.1.2 The equipment shall comply with the Department's standard quality specifications.
- 8.1.3 The low voltage compartment shall be of ample size to accommodate the specified equipment and provide space for future requirements as specified.

8.2 EQUIPMENT SUPPORT FRAME

- 8.2.1 A rigid angle iron or folded metal support framework shall be provided.
- 8.2.2 The frame shall be bolted down on the base by at least four M16 high tensile steel bolts.
- 8.2.3 A cable gland plate shall be provided at the bottom of the frame across the full width of the compartment. The gland plate shall be at least 100mm above the plinth height. A minimum distance as required by the bending radius of the cores of the outgoing cables shall be provided between the lowest terminals of major equipment and the gland plate.
- 8.2.4. The gland plate shall be suitably punched to accept the number and size of cables specified.
- 8.2.5 All steelwork shall be hot-dip galvanised in accordance with SANS 32&121.
- 8.2.6 A resin bound synthetic wood or other suitable dielectric material panel shall be provided for the mounting of all equipment and busbars. Impregnated hardboard or other treated or untreated wood products are not acceptable.
- 8.2.7 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.

8.3 BUSBARS**8.3.1 Application**

- (a) Busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross section in accordance with SANS 1195 and BS 159 and BS 1433, where applicable.
- (b) Although SANS 1473 refers to overhead and rising busbars, busbars in miniature substations 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.
- (c) Busbars shall be supplied for the following applications:
 - (i) Distribution of supply voltage.
 - (ii) Connecting of equipment with ratings exceeding the current rating of 70mm² conductors.
 - (iii) Connection of outgoing circuits with current ratings in excess of that allowed for 70mm² conductors (par. 8.4.1).
 - (iv) Collector bars for parallel cables.
 - (v) Connection bars for neutral conductors (par. 8.3.8).
 - (vi) Earth busbars (par. 8.3.9).

(vii) Connections to miniature circuit breakers.

8.3.2 See Section C15 for details.

8.4 WIRING

See Section C17 for details 8.4.1

8.5 MOUNTING OF EQUIPMENT

8.5.1 The mounting of equipment shall comply with SANS 1765 where applicable. Equipment shall be fixed to the support panel with bolts, nuts, washers and spring washers. Self-tapping screws will not be accepted.

8.5.2 Equipment shall be arranged and grouped in a logical fashion.

8.5.3 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.

8.5.4 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.

8.6 ACCESS

All equipment, busbars and wiring shall be completely accessible with the front cover panel removed.

8.7 LABELLING

8.7.1 All equipment shall be fully labelled and accurate descriptions and safety warning notices shall be given in both official languages.

8.7.2 Engraved plastic or ivory sandwiched strips shall be used for labels. The labels shall bear white lettering on a black background, painted or printed labels are not acceptable.

8.7.3 The following labels shall be supplied as a minimum requirement:

8.7.3.1 Designation of mini-substation

CHURCH ST.	MINI-SUB
E.g. KERKSTR.	MINI-SUB

(Lettering: At least 40mm high. Label on the outside in a prominent position on both the front and back of the substation).

8.7.3.2 Designation of circuit i.e. circuit breaker, isolator, meter, etc.

e.g. HOUSE 473
HUIS 473

PUMP SUPPLY
POMPTOEVOER

(Lettering: At least 5mm high. One label installed directly below each item of equipment pertaining to the particular circuit shall be provided).

8.7.3.3 The main switch shall be labelled in accordance with the regulations.

8.7.3.4 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

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panel. The labels for all equipment installed behind panels shall be fixed to the support panel close to the equipment.

8.7.3.5 The labels shall be secured by means of brass nuts and bolts, self-tapping screws, pop-rivets or slotted label holders. Engraved labels shall be secured to facilitate a neat alteration of the designation of the labels. Labels shall not be glued to their mounting positions. Sufficient fixing points shall be provided to prevent labels from warping.

8.7.3.6 All label designations shall be confirmed with the Department before manufacture.

9. NOTICES

The notices in terms of clause C52 of the Occupational Health and Safety Act 1941 and labels as required on the outside of the mini-substation, shall be rivetted to the steel door or panelling so that they cannot easily be removed. Brass rivets shall be used. In the case of fibreglass housings, the notices shall be laminated into the fibreglass except for the designation label.

10. INSPECTION

The Department shall be notified at least two weeks in advance of the completion of the mini-substation in order that an inspection may be carried out before delivery.

11. DRAWINGS

11.1 DRAWINGS FOR APPROVAL

11.1.1 A set of three prints of the shop drawings of the mini-substations shall be submitted to the Department for approval before manufacture commences. The following information shall be presented:

- (a) Schematic and wiring diagrams.
- (b) A complete layout of the internal arrangement of the mini substations 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 scheduled on a separate sheet.
- (e) A detail drawing of the concrete plinth showing concrete mixes, dimensions, opening sizes, steel reinforcing details and holding down bolts fixing details.

11.1.2 The approval of drawings shall not relieve the Contractor of his responsibility to the Department to supply the mini-substations according to the requirements of this Specification.

11.2 FINAL DRAWINGS

A complete set of "as built" transparent drawings of the mini substations shall be submitted to the Department within two weeks after delivery. The information called for in par. 11.11 (a) to (e) above shall be provided.

11.3 COMPLETION

The supply contract shall be regarded as incomplete until all drawings have been handed to the Department.

SECTION C38**C.38 INSULATORS AND FITTINGS FOR OVERHEAD LINES****1. GENERAL**

- 1.1 This section covers the manufacture, supply and delivery of insulators and associated fittings for use on overhead lines with system voltages up to 22 kV and with a frequency of 50 Hz.
- 1.2 Insulators together with their metal fittings shall comply with the following standards:
 - (a) For system voltage up to 1 kV (Low Voltage): SANS 461
 - (b) For system voltages from 1 kV to 22 kV (High Voltage): SANS 60383.
- 1.3 All other non-current carrying accessories shall comply with SANS 61284.
- 1.4 Insulators shall be suitable for use with the size and type of conductor specified.
- 1.5 All low voltage and high voltage pin insulators shall be of glazed ceramic manufacture. Glass string insulators shall only be used in areas with abnormal air pollution and where specified. In all other cases glazed ceramic string insulators shall be used.
- 1.6 Insulators, complete with all fittings, shall not exhibit excessive or localised corona formation at voltages less than 1,3 times nominal phase-to-neutral voltage.

2. HV INSULATORS

- 2.1.1 Pin insulators shall comprise a ceramic insulator mounted on a steel pin.
- 2.1.2 Pin insulator shall be of Class B to SANS 60383.
- 2.1.3 The insulators for nominal system voltages of 11 kV and 22 kV shall be designed to limit radio interference and the marking "RIF" shall appear on the insulator. A semi-conductive glaze coating applied to the tie-top portion of the insulator and cemented-in metal thimbles in the pin hole may be employed for this purpose.
- 2.1.4 The pins of pin insulators shall be straight and shall be complete with washers and nuts. The shank and threaded lengths shall be as specified on the drawings or as required for the mounting application. Pins, nuts and washers shall be hot-dip galvanised in accordance with SANS 32&121.

2.2 STRING INSULATORS

- 2.2.1 String insulators shall comprise a single string insulator unit together with its metal fittings or multiple-string insulator units arranged in a single string together with their metal fittings.
- 2.2.2 String insulators shall normally be applied in tension positions. However they may be specified for suspension positions.
- 2.2.3 String insulator units shall be in accordance with SANS 60383 and shall be complete with gudgeon pins, washers and split pins.
- 2.2.4 Wherever string insulators are required, a single insulator shall be used on 11 kV systems

and two insulators on 22 kV systems.

2.2.5 All metal parts shall be hot-dip galvanised in accordance with SANS 32&121 excluding the split pins for the securing of the gudgeon pin which shall be of phosphor bronze or stainless steel.

2.2.6 The insulators for nominal system voltages of 11kV and 22kV shall be designed to limit radio interference and the marking "RIF" shall appear on the insulator.

2.3 VOLTAGE RATINGS

2.3.1 The voltage ratings of pin insulators shall be as follows:

		SYSTEM VOLTAGE	
		11kV	22kV
(a)	Flashover voltage		
	dry	95kV	110kV
	wet	53kV	80kV
(b)	Puncture withstand voltage	95kV	130kV
(c)	50% lightning impulse voltage		
	positive	140kV	170kV
	negative	165kV	215kV

2.3.2 The voltage ratings of string insulators shall be as follows:

(a)	Flashover voltage	
	dry	84kV
	wet	53kV
(b)	Puncture withstand voltage	115kV
(c)	50% lightning impulse withstand voltage	
	positive	152kV
	negative	148kV

3. LV INSULATORS

3.1 LV PIN INSULATORS

3.1.1 Low voltage insulators shall be of white glazed porcelain with top and side grooves. The groove sizes shall be suitable for the size of conductor used.

3.1.2 The insulators shall be internally threaded to accept "CORDEAUX" threaded spindles.

3.1.3 Insulators shall be supplied complete with mild steel straight spindles, fibrous or neoprene washers, washers and nuts. All steel parts shall be hot-dip galvanised in accordance with SANS 32&121.

3.2 LV SHACKLE AND REEL INSULATORS

3.2.1 All low voltage shackle and reel insulators shall be of white glazed porcelain with a side groove. The groove size shall be adequate to accept the conductor size used.

3.2.2. Where these insulators are specified for tension or angle points, hot-dip galvanised mild steel straps or "D" brackets and bolts, nuts and washers shall be provided. Two fibrous or

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neoprene washers shall also be provided for each insulator. Galvanising shall be in accordance with SANS 32&121.

4. STAY INSULATORS

- 4.1 Stay insulators shall be of brown glazed porcelain.
- 4.2 The minimum dry and wet flashover voltages shall be 35 kV and 30 kV respectively.
- 4.3 The ultimate breaking strength of the insulators shall be at least 110kN.

5. FITTINGS

5.1 GENERAL

- 5.1.1 All fittings made of steel or malleable iron, including the threaded portions of bolts, shall be hot-dip galvanised in accordance with SANS 32&121 to prevent corrosion.
- 5.1.2 Bolts and nuts shall be of steel with hexagonal heads. Where metal parts are secured by bolts and nuts, single flat mild steel washers shall be used at both the bolt head and nut sides.
- 5.1.3 Bolts shall be locked by means of locknuts or other approved methods.
- 5.1.4 All line, earth conductor and staywire fittings shall not employ screw threads loaded in tension with the exception of cross-arm eye bolts and tumbuckle type stay rods.
- 5.1.5 Adequate bearing areas between fittings shall be provided. Point or line contacts shall be avoided where possible without adversely affecting the flexibility of the fittings.
- 5.1.6 All split pins shall be of phosphor bronze or stainless steel and shall be backed by flat steel washers.
- 5.1.7 The mechanical strength of insulators and fittings shall provide a factor of safety of at least 2.5 based on the guaranteed minimum failing load when they are subjected to the maximum design tension in the conductor or earth wire to which they are attached. The ultimate breaking strength of insulators and fittings specified for tension applications shall in any event not be less than 70kN.

5.2 TENSION CLAMPS

- 5.2.1 Tension clamps shall be of the bolted type "snail" clamps.
- 5.2.2 The clamps shall be made of malleable cast iron to BS 310 and manufactured in compliance with SANS 61284.
- 5.2.3 Tension clamps shall not permit slipping of or cause damage to or failure of the complete line conductor or any part thereof at a load less than 95% of the ultimate strength of the line conductor for which it is intended.
- 5.2.4 The tension clamps shall be designed so that relative movement between individual conductor layers shall not occur during assembly.
- 5.2.5 All bolts or U-bolts shall be provided with locknuts or an alternative locking manner approved by the Department. All nuts shall be backed with flat steel washers.
- 5.2.6 The clamps shall match the clevis and tongue string insulator units without additional adaptors and shall also be suitable for the specified conductor type and size.

5.3 THIMBLE CLEVISES

- 5.3.1 Thimble clevises shall be used with preformed dead-ends.
- 5.3.2 Thimble clevises shall be made of malleable cast iron to BS 310.
- 5.3.3 The radii of the thimble clevis shall be suitably designed to accept the preformed dead-ends.
- 5.3.4 The thimble clevises shall match the clevis and tongue string isolating units without any additional fittings.

5.4 CROSS-ARM AND TOWER ATTACHMENTS, SHACKLES, LINKS, ADAPTORS AND YOKE-PLATES

- 5.4.1 These fittings shall be made of malleable cast iron to BS 310 and manufactured in compliance with SANS 61284.
- 5.4.2 The fittings shall match the specified immediate adjacent fitting or string insulator unit without the use of additional adaptors.

6. SURGE DIVERTERS

Surge diverters are surge protective devices for repeated operation to limit voltage surges on AC power circuits and to interrupt power follow current.

6.1 LOW VOLTAGE SURGE DIVERTERS

- 6.1.1 Surge diverters for installations with a rated voltage of up to 660V shall comply with SABC 171.
- 6.1.2 The voltage rating for these surge diverters shall be 250V, 500V or 660V with an insulation resistance of not less than 50 megohms.
- 6.1.3 Surge arresters for indoor use shall be clearly marked "INDOOR".

6.2 HIGH VOLTAGE SURGE DIVERTERS

- 6.2.1 Surge diverters for installations with a rated voltage above 660V shall conform to IEC 99-1 for "NON-LINEAR RESISTOR TYPE ARRESTERS FOR AC SYSTEMS" and shall be 10 kA Series A arresters of the heavy duty type.
- 6.2.2 The line and earth connections shall consist of terminal lugs, complete with bolts, nuts, stainless steel washers and cable washers.
- 6.2.3 The mounting bracket which will be supplied with the surge diverter shall be hot-dip galvanised steel brackets complete with damping band, bolts, nuts and washers. The mounting bracket shall have the dimensions of and comply with the NEMA bracket 1. All the bracket accessories shall be hot-dip galvanised.

SECTION C39**C.39 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 SANS 166.

3. EDGES

Care shall be taken to ensure that all edges and comers are properly covered.

4. SURFACE PREPARATION

Surface preparation shall comply with SANS 10064. 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 SANS 783, Type III.
- 5.4 Other metal parts e.g. switchboard panels, etc., shall comply with SANS 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 2kg

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 0,05mm. 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 SANS 1091.
- 8.2 The colour of LV switchboards and equipment enclosures in buildings shall be "LIGHT ORANGE", colour B26 of SANS 1091 as recommended in SANS 10140, 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 SANS 1091.
- 8.4 The standby power section of LV switchboards in buildings shall be coloured "SIGNAL RED", colour A11 of SANS 1091.
- 8.4 Switchboards for No-Break Power Supplies or sections of switchboards containing No-break power supplies, shall be coloured "DARK VIOLET", colour F06 or "OLIVE GREEN" colour H05 of SANS 1091.

SECTION C40**C.40 FIBREGLASS REINFORCED POLYESTER LIGHTING POLES**

The poles offered shall be of a filament fibreglass reinforced polyester type. The pole shall be cylindrical in shape and have a continuous taper of 18mm per metre. The poles shall be manufactured according to Quality System Assurance SANS 9000.

The material used must comply with the requirements of SANS 141.

The material shall be of glass filament wound manufacture, employing a filament winding process achieving optimum results for strength and rigidity. The surface shall be smooth tapered seamless.

The pole shall be coloured throughout in the standard colour grey.

The surface shall be of a special pure resin coat to achieve a weatherproof U.V. resistant fire retardant and impact resistant surface.

The mechanical strength of the pole shall be designed for a fluctuating wind load of 700 PA onto a surface area of 0,25m². Under these circumstances a maximum deflection of 5% of the mounting height (height above ground) shall be permissible. The pole shall be designed with a safety factor of 3.

A cable entry of 80mm diameter shall be provided \pm 600mm below ground level.

The pole shall have an access door of 250mm x 80mm. The door cover shall be an overlapping polycarbonate cover smaller in diameter than the pole to ensure a tight fit. The cover shall be secured to the pole by means of two captive stainless steel ALLEN cap screws that are completely tamper proof and only accessible with an ALLEN key. The door cover shall be completely replaceable and interchangeable.

The poles shall have a minimum filament wall thickness of 8mm \pm 20%.

The pole is to have a 300mm x 300mm hot dipped galvanised baseplate secured to the pole by means of 2 x M8 hook bolts.

The pole shall be supplied with a gland plate to accommodate 2 x 20mm glands. MCCB, 4x16 amp terminal block and earth stud. This gland plate shall be removable so that the work can be executed outside the pole.

A SANS certificate certifying the bending strength of the pole shall be enclosed.

Copy of Quality Assurance Certificate of SANS 9000 shall be enclosed.

A pamphlet furnishing full details of the pole offered, shall be submitted with the tender.

SECTION C41**C.41 GALVANISED STEEL LIGHTING POLES****1. GENERAL**

All poles supplied must be absolutely straight, have the same shape and shall be as described in this specification. The poles must have a well-finished appearance and must not be twisted in any way due to manufactured or as result of handling. The pole must be of sufficient strength that it will not undergo any permanent shape change as a result of normal of normal transportation, handling or erection.

The pole as a whole, including all fittings shall be galvanised on the inside as well as on the outside in accordance with SANS 32&121. The welding work on the pole shall be smooth and neat. No splatter, slag or air bubbles shall be visible. The galvanising process shall be done after all welding and machine work have been done.

The pole diameter shall decrease gradually or in steps from the pole's base to the pole top and the pole shall be as slender as possible with an outer diameter of $145 \pm 5\text{mm}$ at the bottom. The minimum material thickness of the pole shall be 4,5mm. The pole shall be absolutely round.

The manufactures shall provide acceptable ventilation holes in the pole to prevent condensation of moisture in the pole. The pole shall also be rain and bee-proof

A rectangular access hole shall be provided at the bottom end of the pole $\pm 0,9$ above finished ground level.

The opening shall be provided with a rain proof cover plate with the same profile as the pole. The cover plate may only be removed by using special tools. The cover plate shall undergo the same galvanising process after forming, cutting and drilling. The thickness of the cover plate shall not be less than 4mm.

A back plate suitable for the mounting of equipment shall be bolted in the pole. A clip-tray suitable for mounting two circuit breaker's shall be provided on the mounting plate as well as a Din track for terminal blocks of the clip on type and a 6mm earth stud with nut, washer and spring washer.

The poles shall be provided with foot plates of size of 350mm and thickness of 6mm attached to the pole with a least two hook bolts of sufficient strength.

The foot plate shall not be welded onto the pole and the same rust protection that is used on the pole shall be applicable on the foot plate and hook bolts. The thread of the hook bolts shall be cleaned after been galvanised.

Each pole shall be provided with a cable entry at the bottom end of the pole. When planted $\pm 600\text{m}$ below finished ground level.

The cable entry shall be manufactured in such a way the cables will not be damaged by the sides of the hole. The minimum dimensions of the hole are 100mm x 60mm. The cable entry shall be at the back of the pole.

Pole extension and pole stubs shall comply with this specification.

A pamphlet furnishing full details of the pole's extensions and stubs offered shall be submitted with the tender.

2. STANDARDS

- 2.1 The poles to be provided in accordance with this specification shall comply fully with all the requirements of this specification. Any deviations from this specification shall be clearly indicated.
- 2.2 The poles to be provided in accordance with this specification shall comply with the relevant subdivisions of the following standard specification:
- | | | |
|-------|---------------|--|
| 2.2.1 | SANS 62 | Steel pipes and pipefittings with a nominal bore of 150mm, suitable to be screwed to ISO R7 - pipe thread. |
| 2.2.2 | SANS 657 - | Steel tubes for general engineering purposes. |
| 2.2.3 | SANS 32&121 - | Hot-dip (galvanised) zinc coatings.
(Other than on continuously zinc-coated sheet and wire.) |
| 2.2.4 | SANS 10160 - | General procedures and loading to be adopted for the design of buildings. |
| 2.2.5 | BS 4360 - | Weldable structural steel. |

3. ENVIRONMENTAL CONDITIONS

- 3.1 The poles to be provided in accordance with this specification shall be suitable for outdoor use in the varied weather conditions prevailing in the Pretoria area during the various seasons. The following conditions are of special import:
- | | | |
|-------|-----------------------------------|--------|
| 3.1.1 | Attitude above sea-level | 1 530m |
| 3.1.2 | Maximum environmental temperature | 40 EC |
| 3.1.3 | Minimum environmental temperature | -5 EC |
| 3.1.4 | Wind velocity | 40m/s |

4. DESIGN REQUIREMENTS

4.1 GENERAL

- 4.1.1 The poles shall be manufactured in accordance with the attached drawing:
- SLP-1 Streetlight pole for Townships.
- SLP-2 Streetlight pole (Double bracket).
- SLP-3 Streetlight pole (Single bracket).
- 4.1.2 The poles can take on any of the following shapes:
- Round, tubular (pole diameter decreases step by step from pole base to pole end).
 - Round, tapered.
 - Octagonal, tapered.
- 4.1.3 The poles shall be property finished and shall not be skew in any respect because of the manufacturing process or the handling thereof.
- 4.1.4 The poles shall be strong enough in order that no permanent deformation shall take place as a result of normal transportation, handling or erection or after the luminaire has been mounted and during the life span of the pole.
- 4.1.5 The poles shall be provided complete with mounting plate for the terminal blocks, clip plate

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for a miniature circuit breaker, pole base plate, cable access hole, inspection hole and lantern-mounting piece.

- 4.1.6 The Tenderer shall provide a complete design, including all calculations and drawings. This design shall be approved and certified by a registered professional mechanical engineer as being suitable to the proposed operating conditions.

4.2 MEASUREMENTS

- 4.2.1 Every pole shall be manufactured in accordance with the measurements indicated on the applicable drawing.

- 4.2.2 The following measurements are of special import and may not be altered:

- a) Mounting height and overhang.
- b) Minimum inside diameter at access opening.
- c) Outside diameter at end of pole.
- d) Position and size of holes in flange.
- e) Mounting pieces (see paragraph 4.7.4).

4.3 CABLE INLET

- 4.3.1 Each pole shall be provided with a cable inlet of 100mm x 60mm at the bottom end of the pole, as indicated on the applicable drawing.

- 4.3.2 The cable inlet shall be manufactured in such a manner that the sides of the opening will not damage the cable.

4.4 POLE BASE PLATE

- 4.4.1 Each pole shall be provided with a square steel base plate with a diameter of 350mm and shall be at least 4mm thick.

- 4.4.2 The pole base plate shall be welded to the base of the pole.

4.5 PROVISION FOR CONTROL EQUIPMENT

- 4.5.1 A rectangular access opening shall be provided at the bottom end of the pole, as indicated on the drawing. The opening shall be covered by a rainproof cover plate with the same profile as the pole and shall be kept in position by means of one heptagonal 10mm brass nut. The cover plate shall be manufactured from the same material as the pole and shall endure the same galvanising process after it has been shaped, cut and drilled. The thickness of the cover plate shall be at least the thickness of the pole.

- 4.5.2 A mounting plate suitable for the mounting of equipment shall be welded into the pole. Two dip-on mounting rails for Heinemann circuit breakers, as well as a rail for a Klippon terminal block shall be provided on the mounting plate. The clip plate shall be mounted after the pole has been galvanised.

- 4.5.3 Two rectangular holes shall be made next to the opening and each one shall be provided with a galvanised or plated 8mm x 25mm coach bolt.

- 4.5.4 Full particulars shall be provided if the Tenderers should offer an alternative with regard to the access opening and the cover plate of the control equipment.

4.6 FLANGE

- 4.6.1 Poles with flanges shall be delivered complete with bolts and nuts as indicated on the drawings. The strength of the flanges and the quality of the welding shall be such that the pole will show no signs of deterioration in its structure.

4.7 STREET-LIGHT BRACKETS AND MOUNTING PIECES

- 4.7.1 The streetlight brackets shall be manufactured according to the attached drawings:
- 4.7.2 The streetlight bracket shall not be welded to the pole. Special care shall be taken to ensure that the bracket(s) will not rotate.
- 4.7.3 Provision shall be made at the end of the bracket(s) for the mounting of a streetlight luminaire.
- 4.7.4 The ends of the mounting pieces to which the luminaire will be secured shall be round, with a outside diameter of 42,5 (+0,-1mm) and a length of 125mm.

4.8 VENTILATION

- 4.8.1 The manufacturer shall provide ventilation holes in the pole in an acceptable manner so that no condensation of moisture will take place inside the pole. The pole shall also be rain- and insect-proof.

4.9 STREET-LIGHT LUMINAIRE

- 4.9.1 The following requirements are applicable to poles manufactured in accordance with drawings

4.9.1.1 Each pole shall be used to carry a street luminaire with a mass of 20kg.

4.9.1.2 The projected lateral area of the luminaire shall be 0,1m².

4.9.2 The following requirements are applicable to poles manufactured according to drawing

4.9.2.1 Each pole shall be used to carry a streetlight luminaire with a mass of 10kg.

4.9.2.2 The projected lateral area of the luminaire shall be 0,025m².

4.10 INTERCHANGEABILITY

Spares for poles manufactured according to the drawings shall be interchangeable, whether for a single- or a double-bracket pole.

5. FINISHING**5.1 WELDING**

- 5.1.1 Welding work on the poles shall be smooth and neat. There may be no spatters, slag or air bubbles.

5.2 GALVANISING

- 5.2.1 The galvanising process shall take place after all welding and machining have been completed.
- 5.2.2 The poles, including all fittings, but excluding the circuit-breaker dip-on rail, shall be hot-dip galvanised inside as well as outside, in accordance with the latest edition of SANS 32&121.

6. TESTS

6.1 The manufacturer shall personally and in the presence of a representative Engineer execute the following tests on five poles and shall make the results of such tests available for submission to the Engineer.

6.2 TESTING OF STREET-LAMP POLES

In order to ensure that the actual situation is simulated, the vertical gravitational forces and horizontal wind forces (simulated) shall simultaneously act upon the lamp pole. The following testing methods shall be followed in order to simulate the combined loads, viz.:

- (i) Place the lamp pole in the vertical position, as it would be mounted under normal circumstances.
- (ii) Determine the position of the end of the bracket (unloaded condition) to the nearest one millimetre from the pole base as reference A (see figure 1). This may be done by attaching a plumb to the end of the bracket. The method shall be sufficiently accurate for the purposes of the test provided that the tests take place in fine weather conditions.
- (iii) The resultant loading and angle of application obtained from the combined horizontal and vertical loading shall be applied by means of a nylon rope (minimum breaking force 500kg) put up from the top end of the lamp pole. The loading may be applied in various ways, for example by attaching weights to the rope, or by placing a turnbuckle or ratchet tensioner and spring scale in line with the rope.
- (iv) The loading shall be applied in increments of 4 kg. After each loading the momentary deformation of the lamp pole shall be measured ($x_1, x_2 \dots x_n$) and be plotted against the loading. A linear course of momentary deformation is considered to be normal, whilst a non-linear course will be an indication of a deterioration in the structure.
- (v) After the lamp pole has been loaded to the maximum, the loading shall be removed and the position of the plumb shall be measured (X_d) permanent deformation).
- (vi) Steps (iii), (iv) and (v) shall be repeated three (3) times in order to determine an average value for the permanent deformation (X_d).
- (vii) The following table indicates the loading and application angle to be applied for each individual lamp pole. Details of calculations appear in paragraph 6.4.

Note that amp-pole numbers refer to drawings in accordance with Council Specifications.

Lamp-pole number	Loading (N)	Equivalent load	Angle of application	Length of rope (m)
	224,7	24	40 E	10,9
	409,4	43	45 E	15,1
	383,3	40	49 E	12,2

- (viii) By comparing the unloaded condition (X_o) to the average of the conditions obtained after loading (X_d), the percentage permanent deformation can be determined by means of the following formula:

$$\text{Def \%} = (X_d - X_o)/X_d \times 100.$$

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If this permanent deformation exceeds the proposed 15%, the pole does not comply with the specification and does not pass the test.

The above mentioned test is based on the principles of SANS 10160 viz, the general procedures and loading to be adopted for the design of buildings.

6.4 DETAILED CALCULATIONS OF LOADING

All formulae refer to SANS 10160.

The wind pressure on the element. $F_n = C_f q_z A_e$ [refer SANS 10160 - p39 5 (c)]

C_f = pressure coefficient

= 1,1 [refer SANS 101601 - p68, Table 15]

q_z = free current wind pressure at height z (N/m²)

= $k_p V_z^5$ [refer SANS 10160 - p49, 5(d)]

k_p = constants with a view to allowance for altitude above sea-level

[refer SANS 10160-p49]

V_z = characteristic wind velocity at altitude Z

Take a site category 3 with a design wind velocity of 20m/s [refer SANS 10160 - p123. Table D-1].

$q_z = k_p V_z^5 = 0.5 (20)^5 = 200$ N/m²

$C_f q_z = 1.1 (200) = 220$

A_e = Total effective frontal area

Lamp pole number	Total frontal area A_e (m ²)
	$(0,14 \times 1,3) (0,09 \times 6,7) = 0,785$ $(0,1651 \times 2) (0,1143 \times 8,7) = 1,325$ $(0,1651 \times 2) (0,1143 \times 7,2) = 1,153$

The following represents the resultant force with the angle at which it shall be applied:

Lamp-pole number	Vertical loading (N) F_v	Horizontal loading (N) F_h	Resultant Loading (N) F_r	Application angle θ	Rope length (m)
	143,7	172,7	224,7	40 E	10,9
	287,4	291,5	409,4	45 E	15,1
	287,4	253,7	383,3	49 E	12,2

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(Gravitational force = 9,58 for the PWV.)

NB: The vertical loading provides for the mass of the light luminaire with a safety factor of 1,5.

- 6.5 The Tenderer shall include in his tender all measurements and results of tests in the form of a table for submission to the Department of Public Works.

7. DELIVERY

- 7.1 The successful Tenderer shall timeously notify the Engineer in writing before the delivery of the poles in order that they may be inspected upon receipt. No payment shall be made for poles, which have not been inspected or certified by the Engineer as being in order.

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PART D

GENERAL SPECIFICATION

SECTION 1

PRELIMINARY AND GENERAL INFORMATION

1. **PREAMBLE**

This Part of the Specification deals with general requirements to be met and standards for plant and workmanship which shall be observed in the execution of the Contract covered by this Specification. "Plant" is defined as machinery, apparatus, materials, equipment and parts of all kinds to be provided under the Contract other than Constructional Plant.

This Specification is indexed at the beginning hereof. Pages are numbered and Tenderers must check that all pages are included. In the event of any material omission, discrepancy, or otherwise occurring, the attention of the Engineer must be directed thereto at the time of tendering. If this is not done, it will be taken that the Tenderer is in possession of a complete copy and is aware of the contents thereof.

When the requirements of this Part are at variance with any detailed requirement of any other Part hereof or the Drawings, such detailed requirements shall take precedence. All items of plant which are specified in this Specification or by nature of the installation are required, shall comply with this Part, unless stated otherwise elsewhere in this Specification. In the event of ambiguity the Engineer shall be asked for his clarification prior to submission of the Tender.

Any reference herein to "elsewhere in this Specification" shall be deemed to mean in any of the other Parts of this Specification or on the Drawings.

This Specification covers major items required for this installation but shall not limit the Contractor's responsibility to provide everything necessary to complete the Contract. The works shall be carried out with the best quality items of plant and equipment to a high class of workmanship. All items of plant and equipment shall be the best of their respective kinds, and the Contractor shall, upon request of the Engineer, furnish him with proof to his satisfaction that they so comply.

This Specification and accompanying Drawings are copyright and are the property of the Engineer and must be returned to him whether a bona-fide tender is submitted or not.

2. **GREEN STAR RATING BUILDING COMPLIANCE**

Tenderers are to note that the project has **not** been registered with the Green Building Council of South Africa for accreditation according to the Green Star SA Rating System.

Tenderers shall however take note of the fact that the provision of energy efficient equipment and installation practices shall be adhered to as the case may be to ensure overall energy savings and shall ensure compliance with SANS 204 : 2011 (Edition 1) and SANS 10400-XA : 2011 Edition 1.

3. **ALTERNATIVE OFFERS**

Tenderers are recommended to tender in accordance with the Specification.

While Tenderers may offer alternative materials, brands of equipment, construction techniques, etc., which they believe will be advantageous, it is to be clearly understood that the main tender is to be in full compliance with this Specification. The total tender price entered on the Form of Tender, all prices entered in any Schedule of Quantities and the prices detailed in the Price Summary, must reflect the price to provide the plant and equipment and everything which is or may be necessary for the completion of the Works in complete accordance with this Specification, irrespective of any alternatives that may be offered which can be priced separately.

Where alternative offers are submitted, these shall comply in principle with all requirements of this Specification but shall be priced separately. Tenderers should note that should any accepted alternative subsequently be found not to meet this condition, the Contractor shall be liable for all costs incurred in making the necessary alterations to the alternative offer to ensure compliant requirements.

Should tenderers wish to offer alternative brands and types of equipment to those specified herein, the alternatives are to be listed separately in detail, complete with manufacturer, type, model number, pricing and further details in the Schedule of Departures from the Technical Specification. In cases where a Schedule of Quantities is applicable, the alternative pricing for each noted item must be submitted separately.

The Engineer shall have the right to accept any or all of the alternative offers as appropriate and must give his written acceptance of these prior to procurement orders being placed.

Failure to comply with the foregoing may result in the Contractor being compelled to meet the requirements of this Specification in full at the tendered price.

4. **SCHEDULES TO BE COMPLETED**

The Tenderer shall, unless relief is given elsewhere in this Specification, complete the Schedules of Sub-Contractors, Previous Contracts and Qualifications, Schedule of Particulars, Schedule of Quantities or of Price Variations, Schedule of Departures from the Technical Specification and the Price Summary, elsewhere herein. The tender will be considered incomplete and therefore may be disqualified if all of this information is not submitted with the tender.

5. **SPARE PARTS**

Tenderers shall state in the Schedule of Particulars the names of the accredited South African Agents from whom spare parts for all items of plant offered are obtainable and the nearest Centre to the Works at which such spare parts are available. Submission of a tender will be construed as confirmation that spare parts for all equipment offered are readily available, and the Contractor will be held responsible for any costs involved if this should prove to be otherwise.

6. **DELIVERY TIMES OF MANUFACTURED ITEMS**

The Tenderer shall, if required in the Schedule of Particulars, to state the times quoted by the Suppliers for both dispatch and delivery of major items of plant likely to contribute to an extension of time for completion.

The Contractor shall, during the continuance of the Contract, keep the Engineer well and sufficiently informed regarding the placing of all orders for materials and the progress of manufacture of any plant so as to ensure that no extension of the time for completion may be occasioned because of non-delivery of plant within the time specified for delivery of same. A delivery status report on each major item of plant shall be submitted by the 7th of every second month.

7. **PACKING AND DELIVERY**

Plant shall be carefully packed and protected to avoid mechanical or other damage during transport and off-loading. The Contractor shall be held responsible for any damage occurring to systems or equipment prior to its installation on site and acceptance in writing by the Employer.

Every item of plant is to be clearly labelled with its description and with the Contract number.

All consignments shall be addressed to the Contractor on Site and he shall make prior arrangements for receipt and storage upon arrival. The Employer will not accept delivery of items of plant for the Contractor unless the Contractor has made prior arrangements to this effect with the Employer. The Contractor will be required to make all arrangements for off-loading since no equipment for this will be available on Site unless specifically stated to the contrary elsewhere herein.

The Contractor shall make all arrangements for the recycling of discarded packaging materials once equipment and plant have been unpacked on site. The discarded packaging materials are to be recycled according to the Waste Management Program of the Main Contractor which will require that the materials be recorded by mass or by volume and the recycling agent responsible for receiving the waste materials acknowledges the receipt thereof in writing which shall be filed for recycling compliance purposes along with the materials record mentioned above.

8. **LAYOUT OF INSTALLATION**

The layouts shown on the Engineer's Drawings shall be strictly adhered to in principle, only alterations to suit specific plant being provided being acceptable. The Engineer's Drawings show general arrangements of layout but the Contractor is required to prepare detailed shop drawings of pipework, fabricated plant, machine and plant rooms, ductwork, switchboards, transformers, sub-stations, etc. The position of services detailed by the Engineer shall not be altered unless approval has been obtained in writing from the Engineer & the Architect.

All architectural and structural dimensions shown on the drawings are approximate and must be verified by the Contractor on Site. All measurements specially marked on the drawings in connection with engineering services shall be strictly adhered to.

If tenderers require alterations to structures, these must be described at the time of tendering. Minor structural alterations which might be required to facilitate the work can be arranged with the Engineer and/or Architect as the work progresses, but no claims will be entertained for alteration of any part of the Works constructed before the necessary dimensions and details have been verified.

Before work on any particular section is commenced, the position of all control equipment and plant shall be approved in writing by the Engineer.

9. **DRAWINGS, CERTIFICATES AND OPERATING INSTRUCTIONS**

9.1 Tenderers shall submit with their tender, outline drawings and pamphlets showing principal dimensions of the plant offered together with a general description of proposed operation.

9.2 The Contractor shall within one month of the Contract being let, submit duplicate copies of their detailed shop drawings to the Engineer for approval. A further two copies of the finally approved drawings shall subsequently be supplied to the Engineer. The following drawings shall be submitted, as appropriate:

General arrangement details of all items of plant.

Shop drawings, schematic and wiring diagrams of all switchboards and control systems.

Detailed layout drawings of all pipework, ducting, cable racking etc.

Detailed layouts, sections and elevations of all plant rooms.

Rating plate details of all plant including maximum : kW rating, speed, environmental temperature limitations, no-load voltage, full load current, percentage impedance, etc.

Cable termination arrangements of all transformers, switchboards, motors etc.

Detailed drawings of all plinths, foundations or bases.

Failure to comply with this requirement may result in the Engineer instructing the Contractor to place the order for the specific item of plant with another Manufacturer or replacing personnel as the case may be. Where failure of the Contractor to ensure that the proposed equipment and personnel complies with this requirement necessitates the above action being taken, no increase in price will be considered.

9.3 The Contractor shall, within one month of the Contract being let, or earlier if so required, submit duplicate copies of type test certificates issued by an approved testing station in respect of all items of plant for which such certificates are required by the Engineer.

9.4 After completion of manufacture, all test certificates called for in Parts 4 & 5 hereof shall be provided in duplicate.

- 9.5 Prior to the issue of the Taking-over Certificate, the following documents shall be provided, as appropriate, in duplicate, bound in a durable folder bearing the contract title and number:

Pre-Commissioning Completion Certificates required by CIBSE Commissioning Code L.

Commissioning Completion Certificates as required by CIBSE Commissioning Code L.

Test certificates relating to tests done after completion of the installation as called for in Parts D & E hereof.

"As built" drawings, including layouts, sections, wiring and control diagrams and plant schematic diagrams. These are to show in detail the positions of cables, joints, sleeves, ducts, conduits, pipes, expansion joints, electrical meters, fixed equipment and all other pertinent items of plant. In the case of buried services, the route of such services and location of all cables, sleeves, cable joints, access manholes and sizes to be dimensioned relative to permanent and fixed objects. These drawings must depict the complete installation as finally commissioned.

In addition, one complete set of Engineer's Drawings clearly marked up to indicate all alterations made to the original drawings must be provided.

The Contractor shall note that the Taking-over Certificate will not be issued until the above has been complied with.

10. **STANDARDS AND CODES OF PRACTICE**

The installation shall completely comply and be commissioned in accordance with the following, and all amendments thereto, as appropriate and as confirmed by the Engineer :-

SANS 10400 : National Building Regulations.

SANS 10400-XA : 2011 Edition 1 - The application of the National Building Regulations.

SANS 204 : 2011 Edition 1 – Energy Efficiency in Buildings.

SANS 10142 Code of Practice for the Wiring of Premises, as appropriate (referred to herein as the Wiring Regulations).

SANS 10139 Fire Detection & Alarm Systems for Buildings.

SANS 10114-1: Interior Lighting : 2005.

CIBSE Lighting Guide 7 (Office Lighting) : 2005.

CIBSE Commissioning Code L : Lighting

The Occupational Health and Safety Act (OHS Act 1993).

City of Cape Town : Standard Electricity Supply By-Law and appropriate Additional By-Law or Regulations.

Any further Specification, Regulation or Code of Practice stated elsewhere in this Specification.

All items of plant supplied and/or installed, whether expressly specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate South African Bureau of Standards Specifications and addenda thereto, or, if no such Specification exists covering any one or more of these requirements, with the relevant requirements of the appropriate British Standard Specifications and addenda thereto, except where elsewhere required by this Specification or approved by the Engineer. Where the South African Bureau of Standards has issued a licence for the use of its Mark on products complying with any of its Specifications, only such products which carry the Mark shall be supplied.

Preference will be given to plant and equipment manufactured in South Africa.

11. **WORKMANSHIP**

All work shall be carried out by qualified artisans or registered apprentices or, only where appropriate, labourers under the constant supervision of a qualified artisan. At no stage during the construction programme shall any work be carried out without a qualified artisan being on site. If the Electrical Contractor fails to comply with this requirement, the Engineer has the right to authorise the expulsion of the Electrical Contractor. All costs incurred in so doing shall be to the expense of the Electrical Contractor.

12. **CO-ORDINATION OF SERVICES ON SITE**

The Electrical Contractor will be required to work in close co-operation with the Main Contractor and Specialist Sub-Contractors to ensure that no conflict arises between the various services, and to plan the progress of the various aspects of his work. It is imperative that such close liaison continues throughout the duration of the Main Contract.

13. **INTERRUPTION OF EXISTING SERVICES**

No interruption of existing services will be permitted without the express written permission of the Client or his representative given as a result of written notification by the Electrical Contractor of the date, time and duration of such interruption. Any costs arising from the un-planned interruption of any service without such permission shall be for the Electrical Contractor's account. Where existing services are present, the Electrical Sub-Contractor shall notify in writing and make the Main Contractor aware of the relative positions of these services to avoid damage when work is carried out by the various sub-contractors on site.

14. **BUILDER'S WORK**

All builder's work as detailed in other Parts of this Specification has been allowed for in the Principal Contract. The onus shall be on the Electrical Sub-Contractor to ensure that all work carried out by the Main Contractor in this respect is to the Electrical Sub-Contractors satisfaction.

The Electrical Sub-Contractor shall notify the Main Contractor prior to building work being commenced of the positions where holes, cuts and recesses will be required and shall ensure that each is correctly located and that heavy-gauge draw-wires are supplied and installed in all sleeves. Again, the possibility of the presence of any existing services are to be identified and the Main Contractor notified thereof in writing to avoid unnecessary damage and costs to repair existing services.

15. **APPROVAL OF DRAWINGS**

All layout drawings, shop drawings, wiring and schematic diagrams prepared by or on behalf of the Electrical Contractor for submission to the Engineer in terms of the requirements of this Specification shall have been thoroughly checked, corrected where necessary and signed as approved by the Electrical Contractor, prior to such submission.

16. **VALUE ADDED TAX**

The attention of Tenderers is drawn to the Value Added Tax Act (Act 89 of 1991) and any amendments thereto. All tenders submitted shall indicate the net tender price, the amount of VAT and the gross tender price carried to the Form of Tender as provided for in the Price Summary. The amount stated in the Form of Tender will be taken as being inclusive of any tax due in terms of the said Act and no claims whatsoever in this respect will be considered. The amount of VAT on the total contract value shall be inserted in the Form of Tender.

17. **VARIATION ORDERS**

The Electrical Contractor shall note that all variation orders issued to him must be fully priced and returned to the Engineer within one week of the date of issue indicated on the variation orders.

Should this requirement not be complied with and no correspondence is received by the Engineer within the specified time-period giving good and fair reason why the Electrical Contractor has failed to submit fully priced variation orders, the Engineer will price the variation orders without reference to the Electrical Contractor and the price thus calculated will be taken as final and no further correspondence will be entered into.

18. **PRIME COST, PROVISIONAL AND CONTINGENCY SUMS**

All sums set out in the Sub-Contract which shall be stated to be Prime Cost (PC) items, Provisional, or Contingencies and shall be used only at the direction and discretion of the Engineer and if not used either wholly or in part by the Employer or separate Contract with others, who shall not be Sub-Contractors, the said sums shall then not form part of the Principal Contract.

19. **OPERATING, MAINTENANCE AND SERVICING PROCEDURES**

The Electrical Contractor shall instruct the Employer's appointed Representative/s in routine operating, maintenance and servicing procedures of all items of plant supplied under this Sub-Contract, and shall ensure that the Employers appointed Representative/s fully understand the documents provided in terms of Clause 9.5 hereof.

The Electrical Contractor shall complete an attendance register listing all the Employer's appointed Representative/s and detailing the instruction and training given to these individuals and shall record their acknowledgement by way of the representatives' signatures that they have understood and accepted the training received. This attendance register shall form part of the Operation & Maintenance Manuals.

20. **MAINTENANCE**

During the latent defects liability period after "initial" Commissioning, the Electrical Contractor shall, if required by Part E Section 1 hereof, to carry out full maintenance operations specifically recommended by the suppliers of any item of plant used in the Electrical Sub-Contract Works to maintain it in full and correct operation. Such maintenance shall include all attention necessary to comply with the suppliers' recommendations and shall include the provision of all necessary consumable items. The Electrical Contractor will also be required to make any adjustments necessary during this maintenance and building "tuning" period to ensure the optimum efficiency and satisfactory operation of the plant equipment and systems installed.

On completion of each such building maintenance visit, the Electrical Sub-Contractor shall submit to the Engineer a brief report and schedule detailing the work done, countersigned by the Employer's representative, whereupon a certificate will be issued for moneys due, in respect of the particular maintenance service, as included in the original Tender Price. A quarterly report shall also be submitted outlining any adjustments carried out and the results achieved along with defective items still to be addressed or optimised.

Allowance for all costs in relation to the above must be made in the Tender Price. It shall be noted that the Employer reserves the right to omit partly or wholly the prices submitted for the maintenance of the Sub-Contract Works, should the installation not be adequately maintained within the stipulated maintenance period.

Mutually agreeable conditions will be negotiated by the Engineer with the Electrical Contractor should the Electrical Sub-Contract Works not be put into operation immediately on issue of the Certificate signifying completion.

21. **OHS ACT CONSTRUCTION REGULATIONS**

The contractor shall be responsible for compliance with the requirements of the OHS Act No. 85 of 1993 Construction Regulations (published February 2014) pertaining to Contractors and in the case of Direct Contracts, Principle Contractors. In particular, tenders shall make due allowance for the provision of a Health and Safety Plan, Risk Assessment and on-going compliance with the requirements of these.

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PART D

GENERAL SPECIFICATION

SECTION 2

STANDARD TECHNICAL SPECIFICATION

1. **DEFINITION**

In this Part, the term "Contractor" means the person, firm or company whose tender has been accepted for the work specified in the document of which it forms a part.

2. **ELECTRICAL SUPPLY AND PHASE ROTATION**

The electrical power supply details relative to fault levels, voltage and phase rotation are given elsewhere in this Specification and shall be as per City of Cape Town Electrical Department specifications and requirements.

The phase rotation specified shall be maintained on all overhead lines, cables, transformers, switchgear and distribution equipment. Where existing connections are to be reconnected to a new system, the phase rotation is to be checked before disconnection and the reconnection made to maintain the same phase rotation.

3. **SWITCHING OF POWER SUPPLIES**

Any switching of existing power supplies shall be pre-arranged with the appropriate Authority. All possible preparation shall be made in advance, to minimise the time required for re-energising the system. All such switching shall be carried out by the "responsible person" unless such authority has passed that responsibility to the Contractor by informing the Contractor in writing and the Contractor agreeing to and confirming such responsibility in writing and also confirming their responsible person appointed for this task also in writing.

4. **EARTHING AND BONDING**

4.1 **Resistance Values**

While every effort shall be made to obtain an earth resistance value of 1,0 ohm or less, the maximum values of earth electrode resistance acceptable, unless stated to the contrary elsewhere in this Specification, are 10 ohm at any minisub or transformer, 15 ohms at any indoor or outdoor switchboard or HV gang links and 20 ohms at cradle earthing points, lightning arrestors or other pole mounted equipment. In the case of the earthing of LV feeder and overhead line neutrals the combined resistance to earth of all systems shall not exceed 10 ohms.

Transformer neutral earthing shall comply with the sub-Clause "Transformer Earthing" below.

19. **OPERATING, MAINTENANCE AND SERVICING PROCEDURES**

The Electrical Contractor shall instruct the Employer's appointed Representative/s in routine operating, maintenance and servicing procedures of all items of plant supplied under this Sub-Contract, and shall ensure that the Employers appointed Representative/s fully understand the documents provided in terms of Clause 9.5 hereof.

The Electrical Contractor shall complete an attendance register listing all the Employer's appointed Representative/s and detailing the instruction and training given to these individuals and shall record their acknowledgement by way of the representatives' signatures that they have understood and accepted the training received. This attendance register shall form part of the Operation & Maintenance Manuals.

20. **MAINTENANCE**

During the latent defects liability period after "initial" Commissioning, the Electrical Contractor shall, if required by Part E Section 1 hereof, to carry out full maintenance operations specifically recommended by the suppliers of any item of plant used in the Electrical Sub-Contract Works to maintain it in full and correct operation. Such maintenance shall include all attention necessary to comply with the suppliers' recommendations and shall include the provision of all necessary consumable items. The Electrical Contractor will also be required to make any adjustments necessary during this maintenance and building "tuning" period to ensure the optimum efficiency and satisfactory operation of the plant equipment and systems installed.

On completion of each such building maintenance visit, the Electrical Sub-Contractor shall submit to the Engineer a brief report and schedule detailing the work done, countersigned by the Employer's representative, whereupon a certificate will be issued for moneys due, in respect of the particular maintenance service, as included in the original Tender Price. A quarterly report shall also be submitted outlining any adjustments carried out and the results achieved along with defective items still to be addressed or optimised.

Allowance for all costs in relation to the above must be made in the Tender Price. It shall be noted that the Employer reserves the right to omit partly or wholly the prices submitted for the maintenance of the Sub-Contract Works, should the installation not be adequately maintained within the stipulated maintenance period.

Mutually agreeable conditions will be negotiated by the Engineer with the Electrical Contractor should the Electrical Sub-Contract Works not be put into operation immediately on issue of the Certificate signifying completion.

21. **OHS ACT CONSTRUCTION REGULATIONS**

The contractor shall be responsible for compliance with the requirements of the OHS Act No. 85 of 1993 Construction Regulations (published February 2014) pertaining to Contractors and in the case of Direct Contracts, Principle Contractors. In particular, tenders shall make due allowance for the provision of a Health and Safety Plan, Risk Assessment and on-going compliance with the requirements of these.

4.2 **General Earth Systems**

Unless specified elsewhere in this document, the earth systems for distribution transformers, mini sub-stations and ground or pole mounted switchgear, lightning arrestors, etc. shall generally comprise two earth electrodes with 1,5m long earth spikes located 6,0m apart, linked with 70mm² bare copper conductor. They are to be located adjacent to pole structures or plinth ends in the case of mini sub-stations and shall be located at least 1,0m there from.

In the case of transformer earthing, if the neutral earth system resistance is not 1,0 ohm or less, two systems as above are to be installed, one for the LV neutral and the other for the tank and associated equipment, in which case they are to be kept at least 6,0m apart and at opposite sides of the transformer position.

The earth system is to be connected with 70mm² insulated earth conductor to the earth bar or transformer tank earth stud as appropriate.

Immediately after installation and before livening up the equipment the Contractor shall test the earth resistance of the earth system, using the respective earth bar or termination as the reference point. If the required value is not obtained, each earth spike, if installed in a sidewalk, shall be increased in length by driving in a further length of 1,5m but where located in open ground, two additional spikes are to be installed. These latter spikes are to be perpendicular to the original two, in line with the spike at the point of connection of the insulated earth conductor and each 6,0m there from. After installing the additional spikes the earth resistance shall again be determined. The Contractor shall submit a report in duplicate confirming the values measured, including the first set if appropriate, to the Engineer.

Where the number of spikes called for does not achieve the required values, the Engineer is to be advised and will give further instructions for the improvement of the values obtained. Where more spikes are necessary to obtain the required value, these shall not be installed within 6,0m of any other spike.

The common leg of the secondaries of CT's, other than the secondaries of summation transformers, shall be effectively earthed to the main earth system.

4.3 **Earth Spikes**

Earth spikes shall comprise 16mm sectional steel cored rods with a minimum of 0,25mm pure copper coating molecularly bonded thereto, complying with SABS 1063, and of "Cadweld" or equivalent manufacture. The top of earth spikes and the interconnecting conductors are to be 1,0m below finished ground level.

Under no circumstances are earth spikes to be located closer than 1,0m to any structure or plinth nor are they to be installed in pole holes.

The connection to earth spikes shall be by means of at least two phosphor bronze mechanical clamps of an approved type for this duty or a "Cadweld" joint. The clamps shall not be attached to the rod but must be installed so that the bolt face is in contact with the rod. Brazing will not be accepted. The connection must be wrapped with two layers of "Denzo" tape.

A cable marker as described elsewhere in this Part shall be installed above each spike and shall be labelled "Earth Spike".

4.4 **Earth Continuity Conductors**

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Earth conductors shall be hard drawn bare copper wire complying with SABS 182 or bi-coloured green/yellow PVC covered, the PVC being UV stabilised complying with SABS 1411 Part 2, as elsewhere specified herein. The conductor sizes shall be such that they can carry the short circuit current likely to be imposed upon them but generally shall be half the area of the phase conductors with a maximum size of 70mm² or in accordance with the appropriate Regulations, unless specific sizes are given elsewhere in this Specification.

Bare earth continuity conductors shall be run with all cables constituting a low voltage distribution system except in the case of township reticulation where an earth system as described in the sub-Clause "Neutral Earthing" above shall be installed at kiosks, etc.

A single conductor may be used where two or more cables run together, provided that the conductor cross-sectional area is based on the largest size cable in the run, and that branch earth wires are solidly connected to the main earth conductor using only "Cadweld" connections or equivalent connections approved by the engineer. Earth continuity conductors shall be connected to main earth bars.

Un-insulated earth conductors shall not be less than 500mm below ground level. Above this level all earth conductors shall be green insulated carried in a PVC / HDPE conduit or sleeve except where galvanised conduit is specified elsewhere herein.

A terminal lug shall be crimped onto the end of the main earth conductor for bolting to the main earth bar of a substation or minisub or other outdoor equipment. Two mechanical clamps shall be used for connection onto cradles or other equipment, as appropriate.

Earth connections must not be carried through metal conduits or sleeves, except in the special cases specified elsewhere herein.

Earth connections shall be so made that in the event of any connections being removed the earth connection to the rest of the equipment will not be affected.

4.5 **Bonding Generally**

All metallic parts of the installation are to be bonded to the earth system as required by the appropriate Regulations.

All iron roofs, gutters, down pipes, water and waste pipes, as well as all steel structures, are to be bonded to earth. The maximum resistance of any such point to the earthed end of the earthing lead shall not exceed 0,2 ohm.

4.6 **Bonding of Equipment**

Where equipment is bolted together, as in the case of an HV or LV switchgear panel, there is to be a 32mm x 4mm copper earth strap extending the whole length of the equipment. All earth bars shall be run in one continuous length as far as possible and shall not be bent or formed in any way that requires hammering or severe distortion.

Any joints shall be lapped with at least two bolts with nuts and washers of suitable size. The lapped ends shall be pre-tinned. If multiple straps are used, they shall be bolted and fixed together at not more than 750mm intervals. All connections shall be made using brass or stainless steel bolts, nuts and washers, together with a star lock washer, on all kiosks, fused feeder panels, mini-sub and outdoor equipment. Connections to indoor equipment may be made with cadmium plated steel bolts, nuts and washers, with a steel spring washer.

All steelwork on a pole is to be bonded using 25mm² solid copper conductor. This requirement applies to cross-arms, all insulator supports and any other hardware. Where equipment is also mounted on the pole, the bonded metal is to be earthed to an earth spike as elsewhere specified herein, using a 50mm² bare copper conductor.

4.7 **Supplementary Requirements for Building Services**

The main earth system is to comply with the Supply Authority's requirements. Earth spikes, mats and conductors shall be installed as early as possible in the building programme, and the onus is on the Contractor to arrange this with the Building Contractor so as to avoid later disturbance of completed construction. Before proceeding, however, the attention of the Engineer is to be drawn to the exact proposals and approval obtained.

Bare earth conductors complying with the requirements of the Wiring Code shall, unless otherwise specified elsewhere in this Specification, be drawn into conduits together with the current carrying conductors, between all main, sub-main and sub-distribution boards. Ends of earth conductors shall be terminated in lugs securely bolted to earth bars, switchboard frames or trays.

Unless otherwise specified elsewhere in this Specification, bare copper earth wires complying with the Wiring Code shall be run with all socket outlet, water heater, stove and other power outlets. Insulated earth wires shall also be run in all ceiling and skirting trunking to bond all light fittings, socket outlets and the trunking lengths themselves. Such conductors shall also be run in all non-metallic conduits. In aluminium or PVC trunking, the earth wire shall be insulated with green PVC.

Earth conductors run outside flexible tubing, where this has been permitted, shall be run neatly along the tubing and shall be held in place by approved cable ties. Such conductors shall not be wound around the tubing.

5. **MAIN DISTRIBUTION SWITCHBOARDS**

These are defined as boards controlling the main supplies, either incoming and/or outgoing, by air break or moulded case circuit breakers, or the outgoing supplies with fused-switch units. Where elsewhere specified, the incoming supplies may be controlled by isolators. Such boards may be termed main or sub-main distribution boards. The boards are to comply with BS 5486, with particular regard to testing.

Where Specialist Manufacture of boards is called for elsewhere in this Specification, under no circumstances will such boards be accepted unless supplied by a Manufacturer who uses components, the majority of which have been designed and tested by his own firm, and carry approved Testing Authority Certificates relating to the performance of such components. Relief from this condition will only be given by the Engineer in extreme circumstances, and must be in writing. Such relief must be obtained before submission of a tender.

The switchboards shall be suitable for the supply voltage, frequency and phase arrangement as detailed elsewhere in this Specification and shall be of the flush fronted cubicle type, floor mounted and arranged for back access, built up of standard factory made units to form an easily extensible board. The cubicles shall comprise a welded or bolted framework of steel sections with minimum 1,6mm thick steel panel cladding. The panels shall be either hinged or removable for ease of access. Securing of panels shall be by means of square key latches with bottom locating pins in the case of fixed panels. The edges of all doors and removable panels shall be so constructed that they can readily accept a rubber gasket, should dust and damp proofing be required.

All equipment shall be mounted behind removable fascia plates, only switch toggles, etc., protruding. Doors over the toggles shall only be provided when asked for elsewhere in this Specification.

Air break or moulded case circuit breakers shall comply with the Clause "LV Circuit Breakers" elsewhere in this Part. All incoming circuit breakers of 1,000A or larger shall be withdraw able pattern. All incoming and outgoing switches shall be provided with means for padlocking in the "OFF" position. Three maximum demand reading ammeters and a

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voltmeter and selector switch, as specified in the Clause "Instruments, Meters and Protection Relays" elsewhere in this Part, are to be provided for each incoming supply circuit breaker.

No board shall exceed 2,4m in height nor shall any operating handle, button or switch be mounted higher than 1,8m. No part of any equipment shall be mounted closer than 300mm to the floor.

The busbars shall be mounted at the top of the board, enclosed by the removable full height panels at the back, removable top panels and removable front panels covering the busbar section only. Droppers from the enclosed busbar chamber shall pass through insulating barriers located as necessary. Where busbars are exposed in cubicles requiring access for operation or maintenance, they shall be shrouded with a suitable insulating material.

The busbars shall be of high conductivity copper bar of adequate section for the current and short circuit rating. The current density shall not be more than 185A per square centimetre at the current rating specified. Bars shall have a minimum spacing of 32mm between bars and 25mm to earth.

Where multiple bars are used, the air gap between bars shall be the same as the bar thickness. Busbars shall be securely supported by insulators of a size and so spaced that they will prevent busbar distortion under maximum short circuit conditions. Equipment shall be arranged to connect to the busbars with solid copper connections of adequate section to resist short circuit stresses imposed by faults up to the maximum breaking capacity of the associated switchgear. Joints between busbars and the equipment shall be tinned and connected using phosphor bronze or stainless steel nuts and washers above a fault level of 20kA or cadmium plated steel below this rating. Flat washers shall be provided on both sides of the connection and spring lock-washers beneath the nuts. Bus-bars shall be pre-drilled and tinned at both ends for future extensions and removable plates shall be fitted at either end of the busbar chamber to enable such extensions to be made. Suitably drilled and tinned fishplates for later coupling of the bars shall be provided.

Air-break fused-switch units shall be provided with best quality dust and damp-proof ironclad cases, arranged for flush mounting. The switch shall be of the double break type, with the speed of operating being independent of the operator. In the case of tiered construction, insulating barriers are to be installed between all fused-switch units. The doors of the fused-switch units shall be hinged and interlocked with the mechanism so that the case cannot be opened with the switch closed or the switch closed with the case open. With the case open, no live parts shall be exposed. Switches shall have definite "ON" and "OFF" positions, which shall be clearly marked. All switches shall be provided with means for padlocking in the "OFF" position. The number of poles shall be as specified on the drawings. The current rating shall not be less than the current rating of the fuses as specified on the drawings, except that 160A HRC fuses may be fitted into 150A fused-switch units.

Fuse holders shall be of the shrouded type and shall comply with SABS 173.

Fuses shall be of the HRC type and shall comply fully with SABS 172. The breaking capacity shall be AC20 and the fusing factor Class Q1. The current ratings shall be as elsewhere specified. Six (6) spare HRC fuses for each switch used in the switchboard shall be supplied and the value included in the tender price, except that a maximum of 6 spare fuses of any one size are required per switchboard. All such spares shall be mounted in stainless steel clips in a special compartment attached to the board, this being marked "Spare fuses". The metal clad covers of the fused-switches shall be provided with labels indicating their purpose. Where retractable type units are used, both the carriage and the panel are to be labelled.

Cabling arrangements shall be such that outgoing feeder ends can be made off with the board live at all times. This shall be provided for by means of a 2mm galvanised gland plate in close proximity to the outgoing terminals of the switchgear. All gland plates shall be bonded to the earth bar by means of a 70mm² bare copper conductor fixed with minimum 10mm size cadmium plated bolts and nuts.

The underside of the board shall be rendered vermin proof by means of similar plates to the gland plates above.

The outgoing connections from tiered equipment are to be brought out to separate terminals behind each switch for ease of making the outgoing connections.

The whole switchboard is to be suitable to control the circuits shown on the drawings, but the actual arrangement of the board is left to the Tenderer so that the most economical arrangement for the type offered will be obtained. Space shall be left to allow access to the rear of the board. The board must be designed to fit into the space available and be of suitable dimensions to enter through the door-ways provided. The board must be suitably located to permit future extension at either end and must be bolted to the floor.

Provision must be made for the future addition of further outgoing switches to the switchboards. The board must be so designed as to allow space for the addition of these units. Unless otherwise specified elsewhere in this Specification the number to be allowed for shall be the nearest whole number above 20% of the number of each type of switch unit actually supplied on each board. The current rating to be allowed for each future unit shall be the same as that of the largest outgoing switch of which more than one is actually supplied on each board.

A continuous earth bar sized to match the specified fault rating of the board but of not less than 25mm x 6,3mm cross-section shall be run along the entire length of the board and shall be provided with a minimum 10mm cadmium plated bolt for connection of the earth conductor.

All metal surfaces of the boards shall be epoxy powder coated to a thickness of 70 microns to SABS 1274 and of an approved quality and colour. No hammertone or similar finishes will be acceptable and the final colour of the board shall be a standard SABS colour. Before painting, all boards shall be bonderised or given some similar rustproof treatment to approval. It is the Contractor's responsibility to ensure that when handed over, the board finish is in first class condition. Under no circumstances will boards be accepted if not finished to a first class standard at hand-over.

6. **MCB MAIN AND SUB-DISTRIBUTION BOARDS AND CONTROL PANELS**

In general, such boards shall comply with SABS 1180 where applicable, or alternatively with BS 5486, and in particular, with the requirements of this Clause.

Larger MCB distribution boards and motor control panels shall be floor standing and arranged for front access unless elsewhere stated in this Specification. Such boards shall be bolted in position. No board shall exceed 2,4m in height nor shall any meter scale, operating handle, button or switch be mounted higher than 1,8m or lower than 600mm from the floor. No part of any equipment shall be mounted closer than 300mm to the floor.

Minor types of main and sub-distribution boards and control panels shall consist of sheet metal trays, suitably built in or secured on the surface in the positions shown on the Engineers drawings.

All structural elements of main and sub-distribution boards and the complete construction of motor control panels shall be of minimum 2,0mm thick material. Non-structural elements shall be of 1,6mm material. Minor bonding trays shall be of 1,2mm material and all bonding trays shall be galvanised. All boards to be mounted outside or specified as being weatherproof shall be constructed of 2,0mm 3CR12 sheet, epoxy powder coated to a thickness of 70 microns to SABS 1274.

The boards shall be of the minimum sizes to accommodate all the equipment specified plus future circuit breakers. Where single phase breakers are used in three phase boards, these must be arranged in three vertical rows, one for the breakers in each phase. Space for the

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nearest whole number above 20% of each type of circuit breaker installed is to be provided for unless otherwise specified. Unless made specifically to clip in from the front, blanking plates shall be fixed with short cadmium plated bolts and nuts. All openings for future equipment shall be covered with blanking plates fixed on the inside of the opening. Sufficient outgoing terminals shall be provided for the future equipment. Cognisance must be taken of the heat dissipated by equipment and adequate ventilation be provided.

Copper busbars are to be provided for each phase and are to be mounted on suitable insulators or fixed to the terminals of the miniature circuit breakers, and be of sufficient length to accommodate future breakers. Busbar and other connections shall be made using cadmium plated steel (or brass in Coastal areas) bolts, nuts, flat and spring washers.

Copper bars are to be used on MCB type main boards. The main neutral feed to the busbar shall be connected by a lug bolted to the bar, as described above. In sub-distribution boards the neutral busbars shall be solid brass with two per-way pinching screws and sufficient ways for the feed and all the circuits connected, including spare ways to the same number as the spare circuits.

HRC fuses are to comply with SABS 172 and fuse holders, which shall be shrouded, with SABS 173. A spare set of HRC fuses for each switch-fuse unit or set of fuse holders installed shall be supplied and the value included in the tender price, except that a maximum of 6 spare fuses of any one size is required. All spares shall be handed to the Employer's representative at the time of the handover inspection.

The equipment on these boards shall be mounted on chassis behind sheet metal panels with operating handles, toggles and control buttons, etc., only protruding through slots cut in the panels. The isolating device for all motors situated remote from the control panel shall be lockable in the "OFF" position. The panels shall be either hinged or removable for ease of access to the wiring, etc. Securing of panels shall be by means of square key latches with vertical locating pins in the case of fixed panels. Sub-distribution board fascia panels shall have moulded knobs for ease of removal of the panel.

The interior of the boards shall be arranged for easy access to all wiring and components. Transformers for low voltage supplies and all low voltage wiring shall be separated by metal barriers from the medium voltage circuits. Positions of transformers are to be indicated by labels attached to the face of the board.

All equipment on the boards shall be back-connected and no wire or cable shall be visible from the front. PVC insulated wiring shall be used throughout, the current rating being not less than the rating of the circuit breaker or aggregate rating of the bank of circuit breakers which it connects.

Wiring of the boards shall comply generally with the Clause "Control Equipment and Wiring" elsewhere in this Part.

Distribution boards shall be at least 115mm in depth unless otherwise approved. A maximum of two rows of conduit shall enter the horizontal edges of boards and the width of the board must be sufficient to accommodate all conduits so entering. Where boards are installed in 115mm walls, they shall be provided with expanded metal fixed to the entire back of the board. The trays of flush boards shall be built in or suitably secured to the brickwork in the specified places, and shall be installed in good time to prevent delay to the Principal Contractor. Each shall be mounted with the upper edge at a height of 2,0m above floor level, unless otherwise specified.

Unless otherwise specified elsewhere in this Specification, boards contained in cupboards shall be surface mounted and all conduit shall drop into them neatly, vertically and evenly spaced, in a single row, if possible. Metal doors shall only be fitted if so specified.

Unless otherwise specified elsewhere in the Specification, surface and flush boards shall be provided with doors. All control panel doors shall be fitted with dust and damp proof seals.

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All instruments, meters, pilot lights, etc., and the main isolator must be operable with the doors closed unless otherwise specified. Flush boards in walls shall be provided with a separately attached metal frame and door which is adjustable so that it may be set plumb. This is to be positioned only after preliminary wall finishes adjacent to the board are complete. Doors shall be secured by a neat flush catch. Boards with a width of 600mm or greater shall be fitted with double doors, the left hand door to be secured with brass barrel bolts, top and bottom, which are readily accessible. Hinges shall be "Barker and Nelson" or "Perana" or equal approved by the Engineer in writing.

All metal surfaces of the boards shall be epoxy powder coated to a thickness of 70 microns to SABS 1274 and of an approved quality and colour. No hammertone or similar finishes will be acceptable and the final colour must be readily matchable. Before painting, all boards shall be bonderised or given some similar rustproof treatment to approval. It is the Contractor's responsibility to ensure that when handed over, the board finish is in first class condition. Under no circumstances will boards be accepted if not finished to a first class standard at hand-over.

In the case of MCB Main Boards cabling arrangements shall be such that outgoing feeder ends can be made off with the board live at all times. This shall be provided for by means of a 2,0mm galvanised gland plate in close proximity to the outgoing terminals of the switchgear. All gland plates shall be bonded to the earth bar by means of a 70mm² bare copper conductor fixed with min. 10mm cadmium plated bolts and nuts.

The underside of the board shall be rendered vermin proof by means of similar plates to the gland plates above.

Where boards are to be mounted in damp situations or where otherwise specified elsewhere in this Specification, black heat anti-condensation heaters are to be fitted. The heaters are to have a separate protective device and are to be so constructed and fitted that they cannot be inadvertently touched. The heater rating is to be such that it will maintain the board at a suitable temperature to prevent the occurrence of condensation while not rising to an excessive temperature.

Boards shall be labelled in accordance with the Clause "Labels and Notices" elsewhere in this Part.

7. **LV CIRCUIT BREAKERS**

7.1 **General**

The supply voltage, normal current, fault capacity and type, as well as any special characteristics required of circuit breakers, shall be as stated elsewhere in this Specification.

All main circuit breakers shall be equipped with adjustable instantaneous magnetic and inverse time delay thermal overload releases on each phase and shall be arranged for flush mounting. They shall be connected to the busbars with solid copper connections of adequate section to resist short circuit stresses that may be imposed by faults up to the maximum rupturing capacity of the breaker.

Where circuit breakers are used to control supply taken directly from the Supply Authority, they shall be of a make approved by that Authority, and shall be set to trip within the specified limits laid down by that Authority.

7.2 **Moulded Case Circuit Breakers**

Moulded case circuit breakers shall comply with SABS 156 with time delay tripping on low overloads and high speed tripping on short circuit. Except where larger rupturing capacity MCB's are elsewhere specified, these shall be Class 5kA 240V or 415V, as applicable, and where various current and breaking capacities are required, all MCB's are to be of one make

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throughout the installation. All MCB's are to carry the SABS Mark to ensure that they comply with Compulsory Specification VC 8036.

The Engineer will not accept a mixture of circuit breakers from various Manufacturers to meet the various duties required.

In the case of motor control, all MCB's shall be supplied with "slow" tripping curve (Curve D or Curve 1) except that those MCB's controlling motor starters located in the same control panel shall not have overcurrent trip elements, this feature being provided by the adjacent starter overload device, magnetic high current protection only being required.

Where MCB's are required to be connected to cables larger than 70mm², the terminals shall be of the stub busbar or rear connecting stud types. For all other cables, box type terminals shall be provided. Three phase MCB's shall be fitted with suitable phase barriers.

MCB's shall be fitted with purpose made terminal shrouds where no fascia plate is provided.

8. **SUPPLY AUTHORITY METERS**

Supply Authority meters will be supplied by that Authority and shall be installed in accordance with their requirements for the type of tariff involved. All other meters not specifically detailed as Supply Authority's are to be supplied and installed by the Contractor.

Where Supply Authority meters are specified as being installed in a metering cubicle, this cubicle shall be supplied and installed by the Contractor and shall form a part of the appropriate board. The cubicle shall be completely separated from the rest of the board and shall have its own door, which shall be sealable. Where the Supply Authority has requirements for standard metering cubicles, these shall be provided.

9. **CONTROL EQUIPMENT AND WIRING**

9.1 **Time Switches**

All time switches shall be mounted in an accessible position for ease of adjustment, and shall be provided with re-chargeable nickel cadmium batteries to provide up to 200 hours of memory backup operation should a power failure occur.

9.1.1 **Motor Control:**

Time switches shall be fully programmable to a maximum of 300 programmable switching points permitting hourly, daily and weekly settings. The shortest switching interval shall be 1 (one) second. The units shall include a manual override facility. They shall be suitable for wall or DIN-rail mounting. Protection shall be at least to IP42 and the units shall operate satisfactorily in the temperature range - 5°C to + 55°C. A suitable time switch would be "Hager" type EG403E.

9.1.2 **General Purpose:**

Time switches shall have a digital display interface and be able to perform 56 operations per day with a minimum interval of 1 minute. A manual override facility must be provided. A suitable time switch would be "Hager" type EG103B.

9.2 **Low Voltage Transformers**

Bell and other low voltage transformers shall be of the double wound type having the secondary voltage specified and shall have an adequate capacity for the duty required but,

in any case, not less than 50VA on short-circuit rating. The transformers shall comply with SABS 743 and shall have one end or the centre point of the low voltage winding earthed.

9.3 **Contactors**

Contactors shall, unless otherwise specified, comply with BS 775 for current making and breaking Category AC1 for non-inductive loads and Category AC3 for inductive loads.

9.4 **Earth Leakage Protection Units**

Earth leakage protection units shall be single or three phase, as indicated, with a sensitivity of 30mA, unless stated to the contrary elsewhere in this Specification or on the drawings. The unit shall actuate a shunt trip isolator or MCB as specified. The earth leakage units shall comply with SABS 767 and shall carry the SABS Mark to ensure that they comply with Compulsory Specification VC 8035 promulgated in Government Gazette No 10987.

9.5 **Day / Night Switch Controls**

Photo-electric day / night switches shall be of the type comprising a photo-sensitive resistor with a time integrating operating delay to make it insensitive to short duration changes in light levels and a change-over relay switch mechanism, all housed within a tough, translucent, IP 68 weatherproof and ultra-violet resistant cover. The operating level shall be factory preset to switch on at approximately 50 lux and off at approximately 100 lux. The response time after sudden changes in light level shall be not less than 15 seconds. Integral protection against voltage surges shall be provided. A suitable unit would be the "National" type ZS-20AR.

10. **SLEEVES**

Sleeves for cables shall be either HDPE with single socket joints complying with SABS 791 (heavy duty) or fibre cement complying with SABS 1223 in the case of 50mm and 110mm sleeves (in compliance with SABS 0198 : Part VIII) or with SABS 819 for larger sleeves, the sizes being as indicated on the drawings. Sleeves shall be nominal 110mm diameter unless otherwise specified. Pitch fibre sleeves shall NOT be used.

The sleeves shall extend at least 1,0m beyond each side of a road crossing and shall be effectively sealed at the ends. Each sleeve shall be provided with a draw-wire. At least one spare sleeve shall be provided at each crossing.

All sleeves shall be laid in accordance with SABS 1200 (LC) and at a depth of 900mm unless otherwise indicated. The radius of the bends used in the sleeves shall not be less than six times the diameter of the sleeve, and the sleeve not be less than twice the cable diameter unless otherwise specified.

Sleeves shall be laid on a 100mm compacted layer of selected bedding material or, if this is not available, on a 100mm sand bedding. The cover layer shall be hand compacted completely around the sleeves and to a cover of 150mm above the top of them. The sleeves shall be supported along their entire length by the bedding. A further 100mm layer of selected bedding material shall be added and this shall be compacted using four to six passes of a vibration pan compactor. Thereafter, the trench shall be back-filled and compacted as specified in the sub-Clause "Compaction" elsewhere in this Part.

Both ends of all sleeved crossings shall be marked by means of cable markers as elsewhere specified, labelled "cable sleeve".

The Contractor shall make all necessary arrangements with the appropriate Authorities for closing sidewalks and/or half the roadway at a time, and he shall comply fully with any Statutory requirement applicable and any requirements the Authorities deem necessary.

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The surfaces shall be made good to the satisfaction of the Authorities and the Engineer, but where tarring or paving is to be laid or re-laid, this shall not be done until the Engineer has given the necessary approval.

Where the HV or main LV cables cross over or pass under other services such as water or drain pipes, they shall be run in sleeves. Where these crossings present a particular hazard to the cable, the Contractor shall draw the attention of the Engineer to any such crossing requiring special attention.

All sleeves for Telkom cables will be 110mm diameter HDPE, supplied by the Civils Contractor, unless otherwise specified. These sleeves are to be laid under this Contract and must be kept at a minimum of 0,6m horizontally from and 0,3m vertically above any power cable sleeve. They are to be laid at a depth of 800mm and one end is to be provided with a marker labelled "Telkom".

11. **CABLES**

11.1 **Description**

PVC insulated cables for LV shall be to SABS 1507 and shall consist of PVC insulated conductors, PVC bedding, galvanised steel wire armouring and a PVC sheath. The abbreviation for this type of cable is PVCAS.

Paper insulated cables shall, unless otherwise specified elsewhere in this Specification, be of the screened type suitable for use on an earthed system and complying with SABS 97.

They shall be lead sheathed, bedded with two bituminised paper tapes and one layer of fibrous material and preferably armoured with two layers of steel tape or alternatively with a single layer of galvanised steel wires, both served with bituminised fibrous material. Such cables shall comply with Table 19 of SABS 97 and shall be non-draining. They shall have a sheath of lead alloy 'E' and/or be PVC served only if called for elsewhere in this Specification.

The abbreviation for this type of cable is PILCA

Cross-linked polyethylene cables shall be Type A suitable for use on an earthed system and complying with SABS 1339, being individually screened and armoured, unless otherwise called for elsewhere in this Specification.

The abbreviation for this type of cable is XLPE Service cables may be multi-core PVC insulated and wire armoured and PVC served (PVCAS), concentric neutral or "Airdac" as specified elsewhere in this Specification.

Concentric neutral cables shall be XLPE insulated complying with SABS 1268. "Airdac" cables shall be XLPE insulated with copper conductors, the phase conductor being contained within a radial band of insulated neutral and bare earth conductors, the whole being XLPE served. All cables are to be installed in compliance with the Manufacturer's recommendations.

The sizes indicated are for cables with copper conductors unless otherwise specified. For LV systems aluminium conductor cables may be offered as an alternative, if a price advantage can be shown. In such cases both the resistance and current carrying capacity of the aluminium cables offered must compare suitably with the sizes of copper conductor indicated. Where cables offered are other than those specified, Scheduled Rates for the supplying, laying, jointing and termination of the cable shall be entered in "Departures from the Specification".

The Contractor will be responsible for advising equipment suppliers of the type of cable termination required if a cable other than that specified is accepted.

11.2 **Cable Lengths**

All scheduled cable lengths are for tendering purposes only and the Contractor shall measure the actual lengths required before ordering.

The length of all cables will be re-measured after installation and the lengths indicated in the Schedule of Quantities will be adjusted accordingly. The Contractor will be paid for the actual lengths measured on site and any allowance for snaking, joints or ends must be incorporated in the unit price.

11.3 **Handling of Cables**

Particular care shall be taken in handling drums of cable. Cable drums shall not be dropped or allowed to roll unchecked. The drums shall, under no circumstances, be rolled in any direction other than that indicated by arrows thereon.

When running cable off a drum, it shall be properly and securely mounted so as to rotate without difficulty and the spindle supporting it shall be straight, horizontal, supported at both ends and of adequate strength. Cable shall only be removed from the drum by rotating the drum. The inner end of the cable shall be released before running any cable off the drum.

Care is to be taken to ensure that each length of cable is run off the drum sequentially so that a crossed core situation does not arise at joints.

No cable shall be bent to a radius less than 12 times the overall diameter of the cable. Bending or straightening shall be done slowly. PILCA cable shall not be laid if the temperature falls below 10°C.

Should a cable inadvertently become damaged or the lead sheath or end cap punctured, this fact shall be brought to the notice of the Engineer immediately, who shall decide what further action is to be taken. The Engineer shall also be notified immediately should there be any suspicion of moisture having entered a PILCA or XLPE cable.

11.4 **Cables fixed to Surface**

Where cables enter flush boards from cable sleeves, the sleeve shall turn up to floor level and a duct shall be formed in the wall to accommodate the cable. Care shall be taken to ensure that the bending tolerance of the cable is not exceeded in drawing the cable into the sleeve. The duct shall be of sufficient size to accommodate the cables. The edges of the duct are to be lined with timber battens to which a bevel edged metal cover is to be screwed, using countersunk headed screws and cup washers.

Wherever cable saddles or any other items are to be fixed to structural components, the use of dry plugs of wood will not be permitted. 'Rawl plugs' or other plugs to approval only shall be used. Surface mounted cable protection pipes shall be galvanised and shall be fixed with saddles of 32mm x 3mm galvanised strap bolted to the wall using bolts grouted in, 'Rawlbolts' or similar. All cables rising on the outside of buildings or on poles shall be protected by such pipes to a height of 2,0m above ground level. Where a cable is installed fixed to a pole, it shall be attached to the pole using stainless steel "Bandit" strap or equal. Care shall be taken to ensure that the straps are tightened correctly and that they do not distort or indent the cable sheath.

11.5 **Cables in Sleeves**

Cables shall pass in and out of buildings and under roadways and pavements in sleeves. In addition, where cables cross or run along a boundary between two plots, these cables shall, where called for, be installed in sleeves. All sleeves shall be installed in accordance with the Clause "Sleeves" elsewhere in this Part.

11.6 **Cables laid in Trenches**

HV cables shall generally be laid 800mm and LV cables at 500mm below ground level. Where two HV cables are run in the same trench, they shall be laid a minimum of 300mm apart with separate cable slabs over each cable. Where HV and LV cables are laid in the same trench, the HV cable shall be located on the road side and the LV cables on the plot side of the trench. A horizontal distance of not less than 400mm shall be maintained between the cables of different voltage groups. Where a number of LV cables are run in the same trench, they shall be laid with a minimum separation of 100mm. This applies to feeder cables only and not street lighting and service cables which shall be only 25mm apart. Cables shall not cross each other.

Where cables run across erven parallel to lateral boundaries, they shall be located 1,0m from the boundary at a depth of 1,0m. If so specified they shall be run in sleeves, otherwise both HV and LV cables shall be protected by cable slabs and a PVC sheet marker laid 300mm above them.

The trench bottom shall be cleared of all sharp or protruding stones. The trench is then to be refilled with 150mm of soft material and compacted. A further layer of soft material shall be installed after the cables are laid to provide 200mm cover for the cable when compacted. Protective cable slabs a minimum of 50mm thick x 230mm wide shall then be laid in the case of HV cables, and PVC sheet cable marker strip 450mm wide with indelibly printed warnings every 150mm along its length, in the case of LV cables. In cases where HV and LV cables run in the same trench, 100mm of soft bedding for the LV cables shall be situated above the protective cable slabs. Where LV service cables or street lighting cables only are installed, a clean trench bottom and soft material back-fill only is required, and no PVC sheet marker.

The soft material described above may be either sand or backfill material sifted through a 3,0mm mesh grid. Where the bottom of the trench consists of only soft sandy material, the bedding underneath the cable shall be omitted and the cable shall be laid on the trench bottom at the correct depth. Permission must be obtained from the Clerk of Works or the Engineer for the cable bedding to be omitted in such instances. Where sand has to be brought to site, the quantity must be measured and confirmed by the Engineer or Clerk of Works.

The balance of the trench is to be back-filled with excavated material from which all stones, etc. greater than 100mm in size have been extracted. All such material is to be removed from site.

Cable route markers shall be provided for all HV and main LV feeder cables at road, culvert and Telkom cable crossings, at all changes of direction, at joints and at intervals not exceeding 60 metres along the straight. Cable route markers shall comprise concrete blocks in the shape of truncated pyramids 300mm high, 150mm x 150mm at the top and 225mm x 225mm at the base. An aluminium plate 3,0mm thick minimum, with four rods 75mm minimum, welded to it on the underside, shall be cast into the top of the concrete block, and the plate shall have stamped on it the cable data and direction arrows, and at a crossing, the crossing shall be indicated.

The cable route markers shall be placed over the cable, in the trenchway, and shall protrude 25mm above the finished ground level but not where they are likely to cause an obstruction or be in the way of moving traffic. Joint markers shall indicate as such. The Contractor shall ensure that the ground under and around the cable marker is properly compacted.

11.7 **Laying of Cables with other Services**

Where cables are laid in trenches containing water and other pipes, etc., the Contractor shall arrange with the Civil Engineering Contractor and Engineer, to lay the electrical cables along one edge of the trench with the other services occupying the other edge. The cables shall be laid not less than 600mm from such service unless otherwise approved by the Engineer.

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At road and services crossings, sleeves as described elsewhere herein shall be provided, one for each HV cable and a separate sleeve for other cables, unless otherwise indicated on the drawings.

At Telkom cable crossings, power cables shall cross 300mm below and at right angles to all such cables or sleeves for future cables. The power cables shall be enclosed in asbestos cement split sleeves with cable slabs over, both of which shall extend 1,0m either side of the crossing. The two sections shall be firmly fastened together with robust stainless steel straps. The full length of all such sleeves shall be covered by cable slabs installed 150mm above the sleeve. No power cable running parallel with a Telkom cable shall be laid within a distance of 1,0m measured horizontally from the Telkom cable. Wherever existing buried Telkom cables are encountered, strict precautions and care shall be taken and close supervision given. Any damage to, or disturbance of Telkom cables whatsoever shall be immediately reported and confirmed in writing to the Engineer.

11.8 **Labelling of Cables**

All cables shall be labelled with 3mm high letters punched onto aluminium tape attached to the cable with aluminium wire. The label shall state the cable size and number of cores. All main feeder cables shall also be labelled to state from whence they are supplied. The labels shall be so installed that they are easily readable.

12. **CABLE TRAYS**

These consist of two basic types, i.e. perforated and folded or wire mesh comprising Light, Medium and Heavy Duty. The actual type and duty required, and the finish if not as set out below, are specified elsewhere in this Specification.

12.1 **Perforated and Folded Trays**

Light duty 'Marine' tray shall be manufactured from pre-galvanised perforated sheet steel. The minimum material thickness shall be 1,0mm for tray widths not exceeding 150mm and 1,2mm for widths not exceeding 300mm. Turned-up edges shall not be less than 12mm for tray widths not exceeding 230mm and 20mm for widths not exceeding 300mm. Maximum spacing between supports shall be 1000mm.

Medium duty 'Standard' or Marine tray shall be manufactured from 1,2mm thickness perforated sheet steel with turned-up edges of not less than 12mm for tray widths not exceeding 100mm, and 19mm for tray widths not exceeding 600mm. The tray shall be hot-dip galvanised after manufacture. Maximum spacing between supports shall be 1200mm.

Heavy duty 'Heavy Duty' tray shall be manufactured from 2,5mm thickness perforated sheet steel and shall have turned-up edges of not less than 75mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 2400mm.

12.2 **Wire Mesh Trays**

Medium duty tray shall be manufactured from 4,0mm wire and shall have turned-up edges of not less than 50mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 1500mm.

Heavy duty tray shall be manufactured from 4,0mm wire and shall have turned-up edges of not less than 75mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 1500mm.

Splicing pieces, bends and tee pieces shall be provided to suit the cable tray system. These shall be of an approved make conforming to the width and quality specification of the particular cable tray being used.

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Trays are to be installed in accordance with the Manufacturer's recommendations, supported in such a way that they are carried on cross members cantilevered from a vertical support so that cables do not have to be threaded between the supports. Trays on walls are either to be carried horizontally on right angled brackets or fixed vertically to the wall. All hardware, support brackets, etc., shall be hot-dipped galvanised. Support brackets shall be spaced so that a sag of 1/200 is not exceeded with the tray fully loaded. Further, the maximum spacing limit specified above shall not be exceeded.

Where trays are likely to be damaged because of their proximity to a working area and could therefore be stepped on or similarly abused, they are, if at all possible, to be installed out of the way of such abuse. Where this is not possible, only heavy duty tray is to be used and additional longitudinal support in the way of angle iron of suitable size is to be installed.

Where the width of cable trays is unspecified elsewhere in this Specification, they shall be sized to accommodate 20% more cables than the number presently to be installed on the basis that the future cables will be of the same average size.

Unless otherwise specified, all cables over 16mm² are to be spaced at least 12mm apart. Where cables are laid flat on trays, fixing is required for all cables larger than 16mm² using heavy duty nylon cable ties. Where fixed in the vertical plane, all cables are to be strapped to the trays using stainless steel strapping applied with an approved tool. This also applies to single cables fixed to trusses or other parts of the structure and to all cables fixed to cable trays in a physically vulnerable situation.

13. **CABLE JOINTS AND TERMINATIONS**

13.1 **General**

Cable jointing and termination shall be carried out by a qualified cable jointer using only approved standard methods for the particular type of cable. Proof of his training may be required.

Joints in all cables shall only be made at full drum length intervals, but where necessary and when approved by the Engineer cable through joints may be used in other approved positions.

Where a cable has steel wire armouring all strands of armouring shall be through jointed.

13.2 **Connections**

Cable connections shall be made by means of crimped or sweated lugs, firmly bolted, one plain and one lock washer being placed under the nut, so that the plain washer is against the lug and there shall be no washer between the lug and the terminal. A plain washer is also required under the bolt head. Alternatively, sweated stems fitting into clamp connections will be acceptable.

Crimped lugs shall be fitted using manual tools up to 70mm² and hydraulic tools from this size upwards. Approved tools are to be used in both cases. An hydraulic tool is to be used on all sizes of aluminium cable. Where a single point hydraulic crimping tool is used, the lug shall be crimped in three places. Where a hexagonal die is used, this shall extend the full length of the lug.

Where aluminium cored cables are to be connected to circuit breakers, the aluminium cable lug shall be bolted to a copper tag or tail which is to be connected to the circuit breaker. The Contractor shall ensure that sufficient Densal paste is installed on the faces of the lugs.

Where an aluminium cable is to connect to copper, the lug shall be a bi-metal type lug with a copper spade and an aluminium ferrule friction welded to the spade.

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Cable connections shall be made using brass bolts, nuts and washers, together with a star lock washer, on all kiosks, fused feeder panels and minisubs and with cadmium plated steel bolts and nuts on all indoor equipment. All bolted joints shall be taped with self-vulcanising (not adhesive) tape.

Where cable connections are required to the HV and LV terminals of transformers, these shall be made off as follows:-

Red Phase to Terminal A

White Phase to Terminal B

Blue Phase to Terminal C

All transformer connections shall be kept in strict phase rotation and where two or more units are to operate in parallel, the respective connections are to be checked for phase rotation and polarity. In the case of cable terminations to transformer bushings the cable itself shall be clamped substantially to a post adjacent to the transformer, connections to the bushings being puttied and taped.

All connections are to be colour coded.

13.3 **LV Cable Terminations**

PVCAS cables shall be made off using adjustable mechanical glands. Care shall be taken to ensure that armour wires are correctly seated in the gland and that all parts are properly tightened. Outdoors, in damp situations and in all minisubs and kiosks, neoprene waterproofing shrouds are to be fitted over all glands.

Where cable connections from minisubs and kiosks to consumers and street lighting are excluded from this Contract, the Contractor shall, nevertheless, ensure that sufficient space is left on the gland plate for the future cables.

Wherever PVCAS cables are terminated to overhead lines a suitable moulded heat shrinkable glove to effect a watertight seal at the crotch shall be used, in accordance with the Manufacturer's instructions. Alternatively, a PVC cable cap may be used.

14. **WIRING IN CONDUIT**

PVC insulated wire to SABS 1507 and SABS 1574 shall be used and shall be from full coils of fresh stocks delivered to site with the original packing or seals undisturbed. Lighting circuits shall be wired with 1,5mm², socket outlet circuits with 2,5mm² and heater and water heater circuits with 4mm² wire unless otherwise specified. All other circuits shall be wired with the sizes indicated or in accordance with the Wiring Code, as appropriate. All phase conductors shall be coloured red and neutral conductors black.

The ends of all wires, whether single or looped, which have to be connected to the connecting terminals of switches, plugs, holders, fittings and distribution boards, are to be tightly twisted together. Cutting away the wire strands will not be allowed.

The loop-in system is to be adopted throughout any conduit installation and joints will be permitted only in special circumstances and subject to the approval of the Engineer. Such joints shall be made only with approved connectors in approved boxes.

The circuit wiring for different services, e.g. lighting and power, shall be run in separate conduits.

Where switches fed from different phases are mounted adjacent, they must be mounted in separate boxes or a single box with a fixed metal barrier between each switch. Where such switches are on the same circuit, multiple switches in a single box shall be used.

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Metal conduit shall be heavy gauge solid lap welded steel to SABS 1065, screwed or plain-end and black enamelled or galvanised, both as specified elsewhere in this Specification. All metallic conduit shall be manufactured from mild-steel with a minimum thickness of 1,6mm in respect of screwed and 0,9mm for plain-end conduit except that when used in concrete slabs, plain-end conduit shall have a minimum wall thickness of 1,2mm and when laid in screed on top of concrete slabs, 1,6mm.

Non-metallic conduit shall not be used on this contract.

All conduit fittings for steel conduit shall be malleable iron or pressed steel except for brass bushes. Conduit fittings shall comply with SABS 1065 as appropriate. The use of inspection tees or elbow pieces and internally screwed solid bends will not be permitted. However, internally screwed solid bends for 40mm and 50mm Ø conduit may be accepted in certain circumstances if approved by the Engineer.

All conduit shall, wherever possible, be concealed by being cast in concrete slabs, chased in, built in or run in roof spaces. When run in surface beds conduit is to be galvanised and is to be laid in concrete on the surface bed so that it is completely covered.

Conduit cast in concrete shall be fixed at intervals to the formwork, if such formwork is of wood or, if of steel plates, to the steel reinforcing.

Where hollow tile slabs are being used in the structure, as indicated elsewhere in this Specification, back entry conduit boxes shall be used. All outlet boxes for lighting points shall be of the long spout, deep type. Where additional depth of box is required, standard conduit box extension rings, firmly screwed to the box, shall be used.

Where structural expansion joints occur, conduits shall, as far as possible, be laid to avoid crossing the joint. When crossings are unavoidable, the following arrangement shall be made. From a draw box, or the nearest outlet within 4,0m of the joint, conduit of one size larger than necessary for the wire sizes, shall be run straight, and at right angles to the joint, finishing at the joint. Conduit of the required size shall then be passed into this from the other side of the joint, bushed inside the draw-box, but not mechanically connected otherwise. Care shall be taken to prevent concrete from entering the end of the larger conduit. The conduits approaching from both sides of the expansion joint shall be wrapped with two layers of corrugated cardboard from a point 1,0m from the joint. A bare earth wire of the same size as the wiring in the conduit shall be run from the draw box to the next outlet, connecting firmly and solidly to each box. Care shall be taken to exclude the ingress of dirt or moisture to partially completed runs, and all open ends shall be plugged temporarily while work is not actually in progress. The plug may consist of a conduit socket with brass ET plug or conduit fishtail, or purpose made tightly fitting plastic sealing caps. Wooden or paper plugs will not be acceptable.

The Contractor shall take all possible precautions during the construction stages of the building to prevent damage to projecting conduits, etc. In vulnerable positions projecting conduits shall be painted in a bright colour or, if necessary, shielded by a large covering. A responsible workman shall be present at all times during casting of concrete containing conduit work to ensure that the conduit work is not disturbed by the casting or vibration of the concrete.

Conduit in false ceiling spaces shall be run surface. The conduit into the space shall either extend through the decking or shall be terminated in a back entry box with a coupling inside the box to enable the conduit to be extended when shuttering is removed.

In roof spaces all conduit runs shall be parallel or at right angles to trusses and joists. Where conduits run along trusses and joists they shall not be run or fixed on the top but on the side. Conduit shall lead into and out of back entry conduit boxes at all fitting positions. All such boxes shall be finished flush with the underside of the ceiling and the lighting fittings shall be screwed directly onto the box. Where necessary additional fixing of a fitting and conduit box shall be provided.

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At ceiling positions where conduit runs do not have to continue to the next truss (e.g. last point in a row), the conduit shall be extended beyond the box to the next truss. This conduit extension shall be plugged.

Where conduit is run on the surface, it shall be fixed with stand-off saddles, multiple spacer saddles being used for conduits run together. The maximum distance between the saddles shall not exceed 1,5m. Where a conduit box carries a lighting fitting it shall be fixed within 100mm on either side of the box.

Where conduits have to run adjacent to gas or cold water pipes, communication or data circuits, they shall be prevented by spacing or other means from coming into contact with these other services under any condition.

Under canopies, outlets for future signs, etc., which have been terminated in round conduit boxes, are to be blanked off with 75mm diameter galvanised cover plates finished with a zinc plumbate primer. These are to be fitted prior to painting and are to be fixed using cheese head brass machine screws.

Where conduit enters boards, trays, etc., all burrs around holes shall be removed before insertion. Locknuts shall be used inside and outside, with female bushes inside. Couplings and male bushes shall not be used. The same arrangement shall be used wherever possible for entry into switch boxes, control gear, etc., provided with clearance holes. Where this arrangement does not allow sufficient wiring space, however, couplings and hexagonal male bushes may be used, but must be very tightly screwed up. In the case of multiple back entries into a conduit box, male bushes and couplings are to be used. Care must be exercised when laying conduit in the vicinity of distribution boards of any type to ensure that conduits radiate from these points in order. Under no circumstances are more than two conduits to cross at any point where cast in concrete and a space of at least 20mm must be left between all conduits both vertically and horizontally after emerging from the distribution point. Careful planning of conduit work can prevent a mass of conduit in the slab, and any re-arrangement necessary to provide an acceptable layout will be at the Contractor's own expense.

Drops to switch and other high level outlets shall be from ceiling while conduit to low level outlets shall be run in the floor unless specified to the contrary. In basements and ground floor areas which are below natural ground level, all conduits to any type of outlet shall drop from ceiling level.

No draw boxes which are not, in themselves, outlets shall be permitted except with authority from the Engineer. Notwithstanding the Wiring Code, if it proves necessary to draw conductors round more than two 90° bends, or the equivalent, or on very long straight runs, draw boxes shall be installed. The maximum length of straight runs between draw boxes shall not exceed 30m. Such draw boxes shall be provided with oversize flat covers fitted flush with the ceiling, fixed with cheese-headed screws.

The Contractor is responsible for checking with the Building Contractor by reference to the drawings on site, of the positions where panelling, tiling, tile edging or dados, etc., may affect the exact positioning of outlets. No allowance for extras will be allowed if boxes have to be moved to comply with the above unless the details are altered after completion of the conduit work. Exact positioning in general means centring outlets on panels, fitting box edges to tile edges, and dropping or raising switch points below or above dados as close to the specified position as possible. Where any doubt arises the Engineer shall be consulted before installation of the outlet. The same requirement applies to the positioning of lighting outlets in false ceilings, with particular regard to fixing fittings to correspond to ceiling panel modules.

Ceiling light points are normally either on a centreline between walls and/or beams or spaced evenly with half a unit between wall or beam and the first point. Where outlet positions deviate from this scheme the scaled dimensions to the centre of the symbol are to be taken as the centre of the outlet.

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All setting of conduit shall be done with approved tools. No kinks will be accepted. Where necessary boxes with special configurations shall be used to avoid the necessity for too many sets in conduit work.

The conduit shall be run or erected as far as possible in straight or symmetrical lines, with easy sets or bends. Care shall be taken when installing conduit that cut ends are completely free from burrs and sharp edges which might damage the conductors. All open ends shall be fitted with brass bushes. Composition bushes will not be accepted. All bushes are to be fitted prior to wiring. All running joints shall be fitted with lock-nuts, and lock-nuts shall be provided wherever necessary to ensure that all conduit joints in the installation are tight.

Where flexible conduit connections are required, only "Kopex" or "Adapterflex" flexible conduit or similar approved shall be used. Sprague conduit will not be accepted.

Where conduit only is required, draw-wires shall be left in each such conduit, irrespective of the service for which it is required. Draw-wires shall be minimum 1,6mm Ø hot dipped galvanised steel.

Conduit run on the surface within ducts shall be painted an approved colour under this Contract. Conduit in false ceilings and roof spaces is not to be painted, except as hereunder. Painting shall be carried out by a qualified Painter. Any exposed screw threads or areas where the galvanising or enamel has been damaged shall be painted after erection with two coats of anti-corrosive paint, and, where installed in concrete, before casting, unless otherwise approved by the Engineer.

The Contractor must ensure that, prior to final completion, all openings left at the conduit exit from switch rooms or between floors in rising ducts, are made good.

15. **WIRING TRUNKING**

This shall be used where indicated elsewhere in this Specification and shall be of the type specified. Where trunking is to be fabricated of sheet metal, this shall be of 1,0mm minimum thickness. Each length shall be so constructed that it matches identically with the other lengths and the lengths shall be joined by splicing sections inside the trunking. All trunking shall be provided with covers of the type and material elsewhere specified in this Specification.

All trunking shall be finished by degreasing, suitably primed and painted with two coats of high quality enamel, unless otherwise specified. Where galvanising is specified, this shall mean fabrication from pre-galvanised plate unless hot-dip galvanising is specifically called for. Electro-galvanising will not be accepted.

"Unistrut" or equivalent trunking shall be provided to the catalogue number indicated, otherwise shall be of appropriate size for the purpose. The standard cover shall be of PVC of a colour to match the trunking. Other types of cover required will be specified elsewhere in this Specification.

All trunking shall be installed straight and level and shall incorporate all recommended fixings when of Proprietary makes. Plastic clips shall be installed at not more than 1200mm centres to hold wiring in place when covers are removed.

Earth wires shall be run in all wiring trunking and these shall be bonded to all equipment fed by wiring carried in the trunking and to the trunking lengths themselves.

When trunking is cast into structures it shall be taped to prevent the ingress of slurry and it will be the Contractor's responsibility to ensure that the trunking runs true. Where trunking is fitted to pre-formed slots in the structure or built into brickwork, the trunking shall be adequately braced to prevent deformation of the sides during plastering, resulting in the bowing of the cover when finally fitted.

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Where light fittings cross ceiling trunking, the cover strip shall be cut square to abutt the fittings, and the raw edges, if of metal, shall be painted to match the applied finish.

Skirting trunking shall be as specified elsewhere in this Specification, the general remarks above being deemed to apply.

16. **FLAT TWIN AND EARTH AND SURFIX**

Where flat twin and earth (ABB T & E) or surfix is called for, the Electrical Contractor will be required to supply all cable and cable glands required, and complete the installation in accordance with the following requirements. All cable shall be installed and ends made off by persons experienced in the use of this type of cable. The engineer shall have the right to call for a demonstration to prove this experience if considered necessary.

Cable sizes shall be as specified or shown on the drawings, lighting circuits being in 1.5mm² cable, unless specified to the contrary. Cables shall consist of copper conductors, PVC insulated and laid up with a bare copper earth-continuity-conductor between them, PVC sheathed 300/250V to SABS 150/1970. (T & E) or copper conductors, PVC insulated laid up with a bare copper earth wire in contact with aluminium foil tape, and overall PVC sheathed 300/500V or 600/1000V to SABS 1507/1990 (surfix).

Cables shall not be bent to radii less than six times the diameter of the cable without the prior consent of the engineer. Where this consent is given, re-straightening of sharper bends will not be permitted.

All cables shall be free from kinks and dents and shall be run straight and true, all cable shall be properly handled to prevent damage. All unsightly or poorly finished work will be rejected.

Cables shall be fixed with single, purpose made clips or multiple saddles attached with screws at the following spacings. When run vertically the distance between saddles may be one and one half the distance specified.

These are maximum acceptable spacings but where neatness is of particular importance the spacings are to be halved.

Cable Size

2 Core and Earth

Spacing

1,5mm ²	500mm
2,5mm ²	500mm
4mm ²	600mm
6mm ²	600mm
10mm ²	700mm
16mm ²	700mm

Conductors larger than 4mm² are usually stranded.

Where cables are run on cable trays they shall be strapped to the cable tray at the above spacings.

Plaster depth installations will not be permitted unless expressly stated in the particular specification. In general all installations shall be re-wirable, and all cabling to flush mounted outlets such as switches, switch socket outlets and outlet boxes etc., shall be drawn through conduits or wireways concealed within the structure. Where ceilings are provided as part of the structure conduits or wireways need only be provided between the actual outlet and the ceiling void. Once within the ceiling void cabling therein shall be carried out as previously described above. The installation of conduit and wireways shall be carried out as elsewhere specified.

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Where cables are to be installed underground these shall be drawn through sleeves the sizes of which shall be as specified or shown on the drawings. Sleeves shall be at a depth of not less than 600mm.

Where the particular specification expressly permits plaster depth installations, the cables shall be fixed to the wall in the same manner as described above. The length of cable shall be correctly cut for each run and no cable looped to lose length will be accepted. All cable from switches, socket outlets, etc., shall run vertically to the ceiling for ease of future location. Under no circumstances are cables, on reaching the ceiling, to turn directly perpendicular to the wall to cross the ceiling but they are to be turned horizontally along the wall and against the ceiling, for a short length, before turning out onto the ceiling.

Plaster depth switches, socket outlets, etc., to be supplied and installed, are to be in accordance with the requirements of the particular specification. All such equipment is to comply with the SABS specifications.

Ceiling outlets shall be in the form of plaster depth ceiling outlet boxes.

Where the particular specification expressly permits plaster depth installations in blocks of flats, etc., where there are many identical layouts, pre-assembled cable units shall be used. In this case one of each of the typical sections is to be installed in the normal manner and then each length of cable for each section measured to enable all lengths to be manufactured by a specialist, off the site. Such cable units are all to be complete and labelled to a schedule that will indicate their purpose and position. All such cables shall be tested before despatch and prior to installation.

Cable ends shall be made off using suitably sized purpose made adjustable glands with lock nuts which shall be effectively fitted and tightened. All tails shall be phase coloured with neoprene or similar sleeving. The use of insulation tape will not be accepted.

When terminating at motors mounted on slide rails the cable shall be saddled at the specified distances up to a point adjacent to the motor. At this point the cable is to be terminated into a standard round conduit box adequately supported. Final connections between the conduit box and the motor shall be carried out using single core conductors in 'Kopex' or similar flexible tubing or alternatively with PVC SWA cable and glands. Where motors are not provided with means of altering their positions, they may be connected directly with the cable. However, prior to entering the motor the cable must be formed into an unsupported loop to minimise the effect of vibration.

Where cables are installed in vulnerable positions they are to be protected by either the use of channel iron sections or kick pipes fixed to the structure.

All cabling is to be tested prior to being made alive and in the case of plaster depth work, before and after plastering. All cables and terminations are to have an insulation resistance of infinity when tested with a 500 volt insulation tester between conductors and earth.

Cable failure resulting from the installation being carried out with the use of incorrect tools, bad workmanship or neglect will result in the Electrical Contractor having to replace the entire length of cable and meet any other consequent costs incurred in the making good damage to work of any other trades that may result from such replacement.

17. **SWITCHES, SOCKET OUTLETS, PLUGS AND BOXES**

Switches shall comply with SABS 163 and shall be reasonably silent in operation. They shall be of 16A rating unless otherwise specified. Socket outlets shall be to SABS 164. Samples of all switches and socket outlets shall be approved by the Engineer before installation.

Cover plates shall comply with SABS 1084. For flat type plates minimum 1,6mm thick metal and for pressed shaped plates minimum 1,0mm shall be used, the thick plates being finished in white, unless otherwise specified elsewhere in this Specification. They shall be fixed

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perpendicularly, and the tops of groups of plates shall be level. Plates for multiple switch positions shall be of the same style and type as for single switch positions. Samples of all plates are to be submitted before ordering.

Submersible (WT/S) switched socket outlets are to comprise "Cee-form" or approved equivalent surface mounted units complying with IP67 of the sizes elsewhere specified in this Specification so installed that the action of removing the plug does not dislodge the fixed portion. A minimum of two plugs shall be provided, any further plugs required being as elsewhere specified.

Watertight (WT) switch socket outlets are to be as for Submersible above, but to IP65.

Weatherproof (WP) socket outlets are to comprise a socket outlet with aluminium plate and non-ferrous screws set into a "York" model S15 fibreglass box with sliding cover.

Weatherproof (WP) switches are to be "Wallsall" square pattern flush type or "Lewden" No.PD 145.

Weatherproof and watertight switches and socket outlets are to be semi-recessed in a manner to be discussed with the Engineer to ensure their acceptable mounting, especially in the case of facebrick walls.

Where industrial pattern switches or socket outlets are called for, the components are to comply with the foregoing requirements and are to be mounted in approved metal casings. All switch toggles are to be protected. Where flush conduit work is required, the industrial units are to be semi-recessed up to the back of the cover section. Care is to be taken that the boxes are adjusted to suit the finished plaster work and close co-operation with the Plasterer is necessary to achieve an acceptable result.

Flush switches shall be mounted vertically in standard hot dip galvanised mild steel boxes 100mm x 50mm x 50mm complying with SABS 1085, socket outlets being in standard 100mm x 100mm x 50mm boxes, unless otherwise specified or approved. Attention is drawn to the Clause "Wiring in Conduit" elsewhere in this Part with regard to the configuration required for multiple switches on the same or different circuits. Up to three switches in a vertically mounted 100mm x 50mm x 50mm box will be acceptable if designed for such mounting. The Contractor is to ensure that the Plasterer covers right to the edge of various boxes since gaps between plates and plaster will not be accepted, and it is deemed the Contractor's responsibility to ensure that no such gaps are visible.

Switches shall be mounted at 1400mm, socket outlets at 350mm above finished floor level, except in hospitals where socket outlets shall be at 450mm, unless otherwise specified. Where shown adjacent to walls on the same wall as the doors, switches shall be situated with the centre line between 125mm and 230mm from the edge of door frames except where wall nibs are smaller than 250mm wide, in which case they shall be positioned centrally. Heights above finished floor are taken to the underside of rectangular boxes or to the centre of circular boxes. The scaled dimensions to the centre of the symbol are to be taken as the centre of the outlet in the absence of specified dimensions on the drawings.

18. **LIGHT FITTINGS**

18.1 **General**

Allowance shall be made for the supply and installation of light fittings as specified elsewhere in this Specification with the exception of those fittings for which PC Sums are allowed. Allowance for the installation only of these PC fittings shall be made.

Each light fitting shall be supplied with a lamp of the wattage specified on the drawings complying with SABS 56 and Compulsory Specification VC 8043.

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Allowance shall also be made for appropriate lamps for High Pressure Sodium, Mercury Vapour or Metal Halide fittings. The size of each fitting must suit the wattage of the lamp specified. In the case of PC fittings, these shall be supplied with lamps.

Fittings to be installed at each point are detailed on the drawings according to the code types set out elsewhere in this Specification. Supply of fittings marked PC is covered by a PC amount in the Price Summary. Catalogue numbers refer to fitting type only, not necessarily to size, which is to suit the wattage shown.

Fittings shall be directly fixed to ceiling or structure in addition to being fixed to the conduit box.

18.2 **Incandescent Fittings**

No Incandescent Light fittings shall be used on the project.

18.3 **Fluorescent Fittings**

Fluorescent fittings and their components shall comply with all the SANS Specifications relating to them.

Bodies are to be constructed of cold rolled sheet steel, bonderised or similarly treated for the inhibition of rust, treated with anti-corrosion undercoats of paint followed by high quality white baked enamel. No patched up scores or other damage to enamelling will be accepted. Nuts, screws, washers, etc., are to be non-ferrous or plated to prevent rusting. No equipment is to be rivetted to the bodywork, all equipment being easily removable. The back plate is to be free of all protruding screw heads. All such screws are to be countersunk headed.

Recessed fittings shall be provided with a raceway cover over control gear, thus preventing control gear from accidentally falling onto the diffuser. Capacitors used in such fittings shall be so manufactured that in the event of failure, they do not present a fire hazard.

Fluorescent fittings are to be removable and not held in position by bolts shot through the back plate. If this system is used, the fittings will have to be removed and remounted at the Contractor's expense.

The fittings are to be wired throughout and wiring brought to terminal strips or connectors close to the conduit entry. Each of the incoming terminals shall be large enough to accommodate two 1,5mm² wires without difficulty.

Lamp holders are to be mounted on rigid material and so spaced apart that any natural expansion of the lamp will not exert horizontal forces on the holder. Each fitting is to be supplied with 3500 Kelvin cool white tubes, unless otherwise specified.

Low loss, high power factor electronic control gear approved by SANS which at least provide the minimum values laid down by the SANS shall be employed. Electronic control gear shall be of best quality self-contained metal clad type, suitable for operation on 220/250V 50Hz supplies. The voltage ratings at each connection of the ballast terminal block shall be clearly and indelibly marked. Electronic control gear shall be silent in operation and shall be power factor corrected to not less than 0,9 lagging and shall operate at a frequency of no less than 40 kHz to eliminate perceived flicker or stroboscopic effects. Operation shall not cause radio or television interference.

Where ECG's bearing the SANS Mark of Approval are available for a particular type of lamp and associated circuit, ECG's of that category which do not bear the Mark will not be accepted.

18.4 **LED Fittings**

LED light fittings shall be used extensively on the project and shall be of the latest proven quality technology with an expected life span of upwards of 20,000 hours MTBF.

All LED type light fittings shall be equipped with high quality current controlled ECG's, RFI suppressed to CE and EN acceptable standards RFI suppression.

LED light fittings shall be fitted with suitable and sufficient heat sinking to allow for adequate cooling of the LED chip light sources contained within the fitting to avoid any thermal degradation and consequent premature failure of the LED light source contained within the fitting.

19. **WATER HEATERS**

Where called for, water heaters are to be supplied and the electrical connections made under this Contract, but the erection of the heaters and the plumbing connections will be carried out by others. The Contractor is to ensure that the heaters are supplied in good time, and is to discuss their exact location with the Plumber to ensure that the termination point is suitably located.

Water heaters are to comply with SABS 151 1462 Part 1 or SABS 1356 as appropriate. The types and sizes are to be as given elsewhere in this Specification.

All water heaters are to be controlled by a local double pole isolator and by a combined single pole and neutral MCB mounted on the appropriate sub-distribution board, as generally indicated on the drawings.

The final connection to water heaters shall generally be by means of flexible conduit as specified elsewhere in this Part. Final connections to water heater terminals shall be carried out with silicon covered wire from pinching screw porcelain connectors in the conduit box.

20. **MISCELLANEOUS ELECTRICAL CONNECTIONS**

Connections shall be made to all electrical equipment as detailed elsewhere in this Specification. The following provisions shall apply in general.

Control panels supplied by others will be installed by them and will be complete with an integral main isolator. This Contract covers the connecting of the main supply and cable gland. Wiring from control panels to equipment is a part of this Contract, unless otherwise specified.

All motors shall be provided with an isolator adjacent where indicated on the drawings. This isolator is to be mounted on a suitable floor stand if it is not possible or practical to mount it on the machine. Final conduit connections to motors are to be through flexible conduit as specified elsewhere in this Part, or alternatively with PVCAS cable.

Domestic stoves shall be connected in accordance with the recommended method of the local Supply Authority for the particular area. A 1,5m length of flexible conduit as specified elsewhere in this Part shall be allowed for the final connection between the outlet and stove.

Allowance shall be made for connecting all stoves unless otherwise specified elsewhere in this Specification.

In cold rooms the light circuit shall preferably be wired in "Surfix" but if PVC insulated wire is used, this shall be in galvanised conduit directly secured to the fitting. The point of entry shall be silicon sealed. Any thermostats, fan or other connections to be made within the cold room as specified elsewhere in this Specification, are to be made using "Surfix" run along the same general route as the refrigeration pipes and sealed as above.

21. **TELEPHONES**

All telephone outlets and distribution boards, etc., shall be located as shown on the drawings. The telephones will be supplied and installed by others.

Distribution boards shall comprise galvanised metal bonding trays of the sizes indicated, mounted flush in the position shown. The doors shall be carried on a separately mounted and adjustable architrave and the construction shall comply generally with the Clause "MCB Main and Sub-Distribution Boards and Control Panels" elsewhere in this Part. All such boards shall be provided with a 16mm thick timber backing board which shall be "lumber-ply" or similar.

In the case of the main Telkom board, this shall be divided vertically in half by a metal plate provided with 2x50mm bushed holes. The incoming sleeve and outgoing conduits to Public telephone, Fax, Telex, Modem and other direct Telkom service points are to be terminated to the left hand section of the board, all outgoing conduits to switchboard, PABX and telephone points being from the right hand side.

It is the Contractor's responsibility to supply and install conduit and boxes of the sizes shown, in the positions indicated on the drawings, from the point of entry to the building to distribution points and individual outlets and skirting ducts. Where no outlet sizes are shown, 100mm x 100mm x 50mm flush boxes shall be provided. When mounted adjacent to socket outlets, the plates shall be in line and 25mm apart.

Conduit shall conform to the particulars laid down elsewhere in this Part, all bends being large radius. Draw boxes are to be of the sizes indicated and are to be of galvanised construction with overlapping bevel-edged covers primed with self etching primer followed by one coat of grey matt enamel. The final coat is to match the wall finish unless otherwise specified. Screws are to be counter-sunk headed, brass or stainless steel. No draw-in boxes on telephone circuits will be permitted in roof spaces. However, if essential and approval is obtained from the Engineer, draw-in boxes shall be mounted in a suitably positioned wall, not higher than 1,8m above floor level. 1,6mm min. diameter galvanised draw-wires are to be left in all conduit. All draw boxes are to be labelled.

The Contractor shall be responsible for the supply and installation of blank cover plates to all boxes. These shall be of exactly matching finish to the cover plates specified for switches and socket outlets. Where both internal and external telephones are installed on the same project, the plates shall be engraved 'Telkom' and 'I/C' respectively.

All distribution boards shall be appropriately labelled in accordance with the Clause "Labels and Notices" elsewhere in this Part.

The incoming telephone cable entry sleeve shall be PVC positioned as shown on the drawings and terminated in a bend of not less than 600mm radius beneath the main Telkom board. The other end of the sleeve is to be 750mm below ground level, its position being indicated by a marker peg. All underground telephone cable sleeves between buildings shall be Pentathene Class 'C' of the sizes indicated on the drawings. The sleeves shall be laid 500mm below the ground and shall pass through fibre cement sleeves beneath roadways and where crossing other services. Galvanised 1,6mm draw wires are to be left in all such sleeves. Joints are to be made using exterior couplings.

22. **PADLOCKS**

Unless stated to the contrary elsewhere in this Specification, all padlocks shall be provided under this Contract.

In the case of extensions to existing installations, all padlocks shall match the existing with the same combinations. Where available, padlocks with stainless steel shackles shall be provided. In all other cases padlocks shall be 38mm of "Viro" or equal manufacture fitted with stainless steel shackles. They shall operate with a master key in addition to the

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individual key. Where special combinations are required these will be stated elsewhere in this Specification. Padlocks and keys shall be stamped with the combination number. Three (3) sets of keys for each combination shall be provided. These keys shall be handed to the Employer's authorised Representative and a receipt obtained.

The following equipment shall be fitted with padlocks:

Combination No. 1.

Outdoor substation gates.

Transformer tap-change switches.

HV switches and isolators.

Minisub HV compartment doors.

Combination No. 2.

Minisub LV compartment doors.

Distribution kiosk doors.

Fused feeder panel doors.

Combination No. 3.

Doors of compartments containing consumer meters.

23. **HOT DIP GALVANISING**

Where hot dip galvanising is called for, it shall conform to SABS 763, the required coating thickness being in accordance with Table 1. Unless the galvanised part is to be painted, the coating is to be passivated immediately. Where later painting is required, a suitable primer shall be applied at the galvanising works.

Before galvanising, all cutting, drilling, welding, etc., shall be complete. Bolt threads shall be suitably undercut and nut threads over tapped to ensure the correct fit after galvanising.

All galvanised parts shall be stored under cover and in stacks such that no part is resting on another and there is sufficient ventilation to prevent condensation occurring. No galvanised parts shall be stored directly on the ground but on pallets or similar protection. Any damaged parts or parts attacked by white rust will be rejected.

Any galvanised surface that is subsequently damaged shall, if the Engineer does not require replacement, be touched up in the manner specified in the Clause "Painting" elsewhere in this Part.

24. **PAINTING**

Any metal work which is not galvanised or painted at Works shall be degreased using a solvent and thoroughly cleaned with a wire brush. If rust is present, this shall be removed by grinding. A red oxide self etching primer shall be applied, followed by a white undercoat and thereafter a coat comprising a mixture of 50% undercoat and 50% finishing coat. The final coat shall comprise oil based outdoor type enamel.

All equipment that is delivered to site painted shall, after installation, and as near as possible to handover, be lightly rubbed down, all damaged paintwork be touched up and thereafter

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the whole given one coat of oil based outdoor type enamel of the same colour as the original.

Where any galvanised or zinc coated surface has been damaged or cut, this shall be touched up using an organic zinc rich epoxy primer (containing min. 90% zinc) after thorough cleaning with a solvent and grinding away all rust. This is to be followed by a self-etching primer suitable for use on zinc coated surfaces and then an undercoat and two top coats as described above.

25. **LABELS AND NOTICES**

The Contractor shall arrange for the labelling of all equipment, instruments, meters, relays, cables, etc., as indicated below.

Where identical items of equipment can be removed from their housings, e.g. circuit breaker carriages, plug-in relays etc., both the fixed and withdrawable portion are to be labelled identically.

All labels shall be "Traffolite" or other back engraved white on black labels of the sizes indicated. They are to be located in purpose made holders or otherwise are to be screwed or riveted into position. "Dymo" tape or similar labels will not be accepted nor will labels which are glued in position only.

Labels on poles shall comprise an aluminium plate with the designated number. These labels shall be nailed to the pole 1,5m above ground level. Nails shall be electro-galvanised clout nails.

Prior to any equipment being labelled, the Contractor shall request the Engineer to provide a complete labelling schedule for all items of equipment. Under no circumstances is equipment to be labelled in accordance with the tender drawings since any description thereon is for identification purposes during construction only and is unlikely to apply to the completed Works.

The following list indicates the general labelling requirements but does not limit the extent of labelling required, which shall encompass the full extent of the equipment supplied, or in the case of existing equipment, any such which is affected by this Contract.

50mm high lettering:-

Substation and minisub designation.

Outdoor switchgear designation. Transformer designation.

Distribution kiosk and fused feeder panel designation.

20mm high lettering:-

Main or sub-main board designation. Control panel designation.

Indoor switchgear designation.

10mm high lettering:-

Individual switches on switchgear.

Cubicles.

Sub-distribution board designation.

Poles for OH lines.

5mm high lettering:-

Minisub feeder breakers and isolators.

Distribution kiosk feeder breakers and isolators.

General distribution switchgear.

Meters, instruments and relays.

Multiplying factors.

3mm high lettering:-

This size shall be used to designate the conductor size and number of cores of each cable installed under this Contract. In addition, all feeder cables shall be labelled to state from whence they are fed.

All switchboards shall be provided with a label in both official languages reading "In case of leakage or accidental contact, put off main switch immediately".

All substations, minisubs, kiosks, transformer rooms and switchrooms shall be provided with notices as required by the Occupational Health and Safety Act. All doors to such locations shall be fitted with the appropriate notices. In the case of minisubs, these shall comprise at least two 190mm x 190mm design WW7 in accordance with SABS 1186 externally and $H^{V/s}$ and $L^{V/s}$ respectively on the inside of all doors, while kiosk doors shall meet the LV requirements only. For all other substations, enclosures etc: "Kontra" Safety Signs as supplied by Mine Safety Appliances or approved equivalent are to be provided, Nos.KM115 and KO711 being used externally and KM112, KO706 and KO710 internally.

Where more than one similar item of equipment is fed from the same board or control panel, the item itself shall be labelled, this being fixed in a permanent position, i.e. not attached to motors, pumps, etc., but to bases or adjacent thereto. The lettering shall be 50mm high.

26. **DISMANTLING**

Where dismantling of existing parts of the installation is called for, all components including wire, insulators, poles, cable, switchgear, transformers, etc., are to be removed and handed to the appropriate Authority or recycled under the Green Star Rating compliance management plan. Under no circumstances is any material or equipment to be taken over by the Contractor. In the case of reclamation of conductor, this is to be done after removing the binding wires on intermediate insulators so that full strain lengths are recovered. All such material is to be neatly coiled, packed, etc., as appropriate and audit records made available for Green Star Rating compliance auditing.

Extreme care is to be taken in dismantling all such equipment, since it will be re-used by the Employer. If, in the opinion of the Engineer, unnecessary damage is done, the cost of replacing such equipment will be debited to the Contractor's account.

A receipt detailing all equipment and materials delivered in accordance with the above must be obtained and a copy submitted to the Engineer.

27. **INSPECTION, TESTING AND COMMISSIONING**

The Engineer shall have access at all reasonable times to such parts of the Works or the Contractor's premises or the premises of the Manufacturer of component parts, as may be necessary for the purpose of inspecting, examining and testing the materials, workmanship and performance of any plant or equipment specified for the Works.

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The Contractor shall ensure that all equipment such as switchboards, transformers, minisubs, kiosks, etc., are inspected and tested at the Manufacturers premises, in the presence of the Engineer.

All wiring is to be subjected to a test voltage of 2kV for one minute without insulation failure. A Megger test is to be applied with a 500V instrument immediately thereafter to prove the insulation resistance better than 20 mega-ohms. All meters are to be injection tested to ensure correct operation. All control circuits including motor overloads, relays, etc., are to be operated to ensure the correct functioning of the entire control system.

All equipment to enable the necessary tests to be carried out shall be provided and shall include, inter alia:

Phase rotation meter	500A primary injection test set
Avometer	25A secondary injection test set
500V megger	2kV DC test set

After completion of manufacture, the following test certificates, signed by the Contractor and the firm executing the tests, shall be provided in duplicate:

Transformer test certificate to SABS.

Test certificate stating that all LV switchboards and control boards have been inspected and their wiring subjected to 2000V DC for 1 minute.

Test certificate stating that all HV switchboards have been inspected and their internal wiring subjected to 2000V DC for 1 minute and HV components to the appropriate voltage as laid down in the applicable SABS or BS Specification.

Any other test certificate for routine tests as laid down in relevant SABS or BS Specification or Codes of Practice applicable to the item in question.

Test certificate in respect of any special tests called for elsewhere herein.

The Contractor shall arrange for any Statutory Government and/or Supply Authority inspection of the installation prior to testing and final commissioning by the Engineer.

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, commissioning shall be carried out by the Contractor, and any tests the Engineer deems necessary shall be conducted. The Contractor shall supply all equipment necessary for the testing and commissioning procedures.

Prior to commissioning of any transformer, the oil shall be tested and, if necessary, shall be dried out by the Contractor. Should this be necessary, the Engineer must be advised that it is suspected the transformer is damp before any work is undertaken. Transformer wheels shall be solidly chocked. No transformer shall be commissioned without the consent of the Engineer.

During commissioning, all tap change switches are to be correctly set and locked. All wedges and packing in switches and relays shall be removed and each switch and each relay circuit operated.

All protection and small wiring shall be tested with a 500V megger and injection currents passed through the secondaries of every circuit to check the proper operation of relays, instruments and protection.

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The Contractor shall supply all equipment necessary for the testing and commissioning procedures. The test equipment required at Site shall include, inter alia:

Phase rotation meter

Suitable cable test set

11 000V phasing sticks

500V megger

5 000V megger

Avometer

Earth resistance test set

25A secondary injection test set

After completion of the commissioning tests the Contractor shall provide duplicate test certificates relating to cable tests, current injection tests of all instruments, meters and relays and results of earth mat tests.

The Contractor shall give the Engineer at least 14 days notice of the date of any testing or commissioning so that he may be present if he so wishes. Where the Engineer does not himself, or through his Representative, attend to witness the tests, then the Contractor may proceed with the tests, duly forwarding to the Engineer certified copies of the results obtained. In such cases, the test shall be deemed to have been made in the presence of the Engineer.

In the event of the equipment or installation not passing the tests, the Employer shall be at liberty to deduct from the Contract Price, all reasonable expense incurred by him or by the Engineer in repeating the tests.

28. **COMPLETION OF WORKS**

Before completion of the Contract any damage which may have been done in the process of the installation shall be repaired and made good, trench or excavation work shall be left in a clean and tidy state and all accumulated debris shall be removed from the Site by the Contractor, to the satisfaction of the Employer and Engineer.

All defects found are to be rectified within one month of written notice of such defects. A penultimate certificate reducing the retention amount to the amount stated elsewhere in this Specification will only be issued upon submission of As-built Drawings and Operating Manuals as called for elsewhere herein, after completion of all notified defects and once all test certificates called for in the Clause "Inspection, Testing and Commissioning" elsewhere in this Part have been submitted and accepted by the Engineer.

An appropriate Certificate shall acknowledge practical completion of the Works and the commencement of the period during which the Contractor will be responsible for any defects that may become apparent, and of Maintenance as detailed under the Clause "Maintenance" in Section A of this Part, where applicable.

The Contract will not be deemed to be finally complete until the Engineer's final payment certificate is issued.

SECTION C4.1**PART E****TECHNICAL SPECIFICATION****SECTION 1****GENERAL INFORMATION APPLYING TO THIS INSTALLATION****1. SCOPE AND TYPE OF CONTRACT**

The Main Contract, which is the Principal Contractor's responsibility, comprises the modification and upgrading of the South African Revenue Services Warehouse located on the Ground Floor Level of Customs House, Foreshore, Cape Town.

The Electrical Sub-Contract will be let as a Domestic Sub-Contract to the Principal Contractor and comprises the supply, delivery to site, off-loading, storage, installation, testing, commissioning and handing over in good working order and twelve months guarantee of all items of equipment, materials and workmanship as further specified in this document and on the drawings.

Tenderers are to include for all items necessary whether specified in detail or not, to complete the installations to a satisfactory, operational & compliant standard. The installation is to comply with all the relevant regulations & shall be to the satisfaction of the Engineer. Installations or part thereof which are not deemed to be compliant or to the satisfaction of the Engineer shall be rectified at the Electrical Sub-Contractors (or their appointed specialist Sub-Contractors) own cost.

2. CONDITIONS OF CONTRACT

The Electrical Sub-Contract will be let as a Domestic Sub-Contract to the Principal Contractor. The Conditions of Contract are available on request from the Principal Contractor.

3. ENGINEER'S DRAWINGS

The Engineers Drawings pertaining to this installation are:

6352/E/SCH/00 :	Overall Electrical Distribution Block Diagram.
6352/E/SCH/01 :	Electrical Sub-Distribution Board G3 Schematic.
6352/E/SCH/02 :	Electrical Sub-Distribution Board G4 Schematic.
6352/E/SCH/03 :	Electrical Sub-Distribution Board G5 Schematic.
6352/E/SCH/04 :	Electrical Sub-Distribution Board Computer Server Room Schematic.
6352/E/01 :	Warehouse & Offices Lighting Layout.
6352/E/02 :	Warehouse & Offices Power, Data & Telephone Layout.
6352FD/01 :	Warehouse & Offices Fire Detection & Public Address Layout.

The above drawings are sufficiently accurate for tendering purposes but all dimensions must be verified on site prior to manufacture. No extras will be considered where work has been carried out without such prior verification or approval.

4. **BUILDER'S WORK**

Builder's Work associated with the electrical installation, to be carried out by the Main Contractor will be limited to:

- (i) Plastering and painting over chases and openings etc
- (ii) The provision of HDPE sleeves 75mm, 110mm diameter and larger, with suitable draw wires, beneath existing surfaces and penetrating manhole chambers including making good of the penetrations.
- (iii) Excavation, installation, construction and completion of manholes complete for electrical and data reticulation services as necessary.

The Electrical Sub-Contractor shall, however, be responsible for ensuring that all necessary work carried out by the Main Contractor / Building Sub-Contractor is correct and to the Electrical Contractor's satisfaction.

The Electrical Sub-Contractor shall be responsible for all other work including cutting all holes & slots for outlet boxes & conduit work where indicated as flush mounted & for first fix plastering. Holes for conduit work shall be made by drilling with masonry drill bits.

The cost of repair of any damage caused to face brickwork and surfaces due to the Electrical Sub-Contractor not taking due care whilst cutting, chasing or drilling, shall be for the Electrical Contractors account.

Chasing will not be permitted in face brickwork, where present.

5. **ELECTRICITY SUPPLY**

The Supply Authority for the area is the City of Cape Town : Electrical Department.

The warehouse is served by existing Sub-Distribution Boards fed by Low Voltage supplies from the local Main Electrical Distribution Board. The Department of Public Works meters the Low Voltage(LV) supplies to the South African Revenue Services at the Main Low Voltage Switch Room. The Electrical Sub-Contractor shall liaise closely with the Department of Public Works and the Client (South African Revenue Services) when planning any electrical shut downs for any purpose to ensure that switching of the electrical supply to the facility is carried out timeously and satisfactorily.

(Please note that it is not anticipated that any planned switching of MV electrical supply will be required under this contract with the exception of maintenance inspection of the MV Switchgear by others.)

The Low Voltage electricity supply will be nominal 400V, 3 phase, 4 wire, 230V single phase, 50Hz. All apparatus and equipment shall be suitable for these conditions as applicable

6. **PROGRAMME OF WORK**

A detailed programme will be drawn up by the Principal Contractor and the Electrical Sub-Contractor shall comply with any reasonable programme laid down and shall co-ordinate their work so that the installation is complete and commissioned at least two (2) weeks before the building completion date.

7. **LIAISON**

It is essential that the Electrical Sub-Contractor maintains a close liaison with all other parties at all times. The Electrical Sub-Contractor will be held responsible if, through a lack of liaison, the electrical Sub-Contractor causes delays or increased costs to another Contractor.

8. **CONTRACT PRICE ADJUSTMENTS**

The contract price shall not be subject to contract price adjustment provisions.

9. **ACCESS TO SITE AND STORAGE**

Tenderers shall note that space on the site is limited and that it will not be possible to store large quantities of materials and equipment on site. Arrangements for the storage of material on site shall be made with the Principal Contractor.

10. **PAYMENT FOR MATERIALS**

Tenderers shall note that no payment will be made for materials stored off site and that payment for unfixed materials stored on site will only be made strictly in accordance with the conditions relating to the Principal Contract.

11. **DRAWINGS**

The Tenderer's attention is drawn to Part C4.1 - D, Section 1 Clause 15 of this Document.

12. **IDENTIFICATION OF CONTRACTOR'S PERSONNEL**

The Electrical Sub-Contractor must ensure that all personnel, including any casual labour, which may be employed, are clearly identifiable at all times whilst working on the site.

13. **VALUE ADDED TAX**

The tender shall be inclusive of Value Added Tax as set out and indicated in the Price Summary.

Tenderers should note that the rates quoted in the Schedules of Quantities of this document must be **Net** prices **excluding** VAT.

14. **MINIMUM CLAIM**

Claims submitted by the Sub-Contractor shall not be less than 5% of the Sub-Contract Price.

15. **NAME BOARD**

It is the Principal Contractor's responsibility to supply and erect a project notice board, which will bear the names of the Sub-Contractors. No individual notice boards of Sub-Contractors will be allowed on site.

16. **GUARANTEE-DEFECTS LIABILITY PERIOD**

The Sub-Contractor shall guarantee the material, apparatus and equipment delivered by him for a period of twelve months, commencing from the date of practical completion / first commissioning completion in terms of the Main Contract. This period is otherwise referred to as the "Defect Liability Period". The period for the replacement of fluorescent lamps shall be six months.

17. **CERTIFICATE OF COMPLIANCE**

The Electrical Sub-Contractor shall be required to issue a Certificate of Compliance for the whole of the electrical installation including those portions of the installation that are to be retained and/or reused. He shall allow for inspection and testing of those portions of the existing installation to be retained in accordance with Clause 8 of the SANS 10142-1: 2007 - the Wiring of Premises.

He shall submit a list to the engineer of essential work, if any, that will need to be done in order for a Certificate of Compliance to be issued to ensure that the building will comply with the requirement of the Act.

He shall also submit a list of work of a **maintenance nature**, if any, for further issue to the Employer.

18. **INSPECTION, TESTING AND COMMISSIONING**

The Electrical Sub-Contractor shall arrange for all inspections, testing and commissioning of the completed installation and any costs thus involved shall be borne by him and shall be deemed to have been included in the tender price.

19. **OCCUPATIONAL HEALTH AND SAFETY ACT**

Tenderers shall make sure they have made adequate allowance in the tenders to fulfil their obligations as set out in Part C4.1 Section D1 of this document.

SECTION C4.1

PART E

TECHNICAL SPECIFICATION

SECTION 2

DETAILED TECHNICAL SPECIFICATION

1. **STANDARD TECHNICAL SPECIFICATION**

This section of the Specification shall be read in conjunction with the Standard Technical Specification, Parts A, B, C, D1, D2 and E1 and the electrical installation shall comply with the relevant clauses thereof.

2. **ELECTRICITY SUPPLY**

The electricity supply to Customs House, Foreshore, Cape town is provided by the City of Cape Town at Medium Voltage to a local Medium Voltage Switch Room powering the building with existing transformers. Bulk metering of the site is carried out at Medium Voltage by the City of Cape Town Municipality : Electrical Department.

The existing low voltage supplies for the electrical Sub-Distribution Boards in the Warehouse are taken from the local Main Electrical Distribution Board located in the adjacent Low Voltage Distribution / Switch Room on the Ground and Basement Levels and shall be retained. Sub-Distribution Board electrical supply circuit breakers shall be replaced as necessary and where practical as the existing switchgear is dated and has been in service for many years.

Labelling shall be installed to the Main Electrical Distribution Board identifying each electrical supply feeding the Sub-Distribution Boards to the SARS Warehouse Area.

3. **STANDBY GENERATOR**

There is presently a Standby Generator which is used by the complete building for emergency lighting and other essential services. It will be the clients intention to install a future Standby Generator to provide dedicated electrical power to the SARS Warehouse area at a later date.

Presently there will be no further requirement for Standby Generator backup power or the installation thereof at this stage until further instruction by the client.

4. **MAIN DISTRIBUTION BOARD (MDB)**

The existing Main Electrical Distribution Board shall be retained and re-used in its present state. Repairs & maintenance improvements shall be carried out to ensure proper compliance and continued reliable operation for the electrical sub-distribution to the SARS Warehouse Area Sub-Distribution Boards only. These shall include but not be limited to circuit breaker setting verification & testing, re-termination of loose or poor connections, checking of busbar fixings & terminations, neatening of untidy cabling, insulation of terminations and proper cable & circuit breaker labelling as indicated (all subject to approval by the Engineer and Department of Public Works in writing).

E2.2

Tenderers are advised that the entire low voltage switching system is a cascading system and that the equipment supplied for the MDB and downstream distribution boards must be suitable for the prospective fault levels indicated and shall match existing equipment with regards to co-ordination.

Local electrical metering of some sub-tenanted areas is present with existing mechanical meters installed. Electrical metering where necessary shall be replaced with modern electronic metering with the meter type installed being dependent on the application (either billing or energy monitoring).

5. **NEW SUB-DISTRIBUTION BOARDS (SDB's)**

The Electrical Sub-Contractor shall decommission, make safe & remove the existing Sub-Distribution Boards where necessary, taking care not to damage the existing distribution supply cables and local circuit single and multi-core cables which are to be re-used and re-terminated after insulation testing verification and recording of results. Cabling which in the opinion of the engineer and the client is either under sized or fails insulation testing shall either be repaired or replaced as determined and instructed in writing by the engineer.

Where existing cabling is too short or impractical to be re-terminated in the new electrical sub-distribution boards, cabling shall under no circumstances have extra lengths joined or extended. The engineer shall be informed and the length of cabling to the first field termination point shall be replaced as necessary and as determined and instructed in writing by the engineer to enable sufficient slack to be realised within the new electrical sub-distribution board for neat and suitable re-termination purposes.

The following new Sub-Distribution Boards shall be supplied and installed as replacements to the existing electrical distribution boards. The Sub-Distribution Boards (SDB's) shall comply fully with the requirements of Part D2 of this document and as further detailed on the drawings 6352/E/SCH01 through to 6352/E/SCH 04. All boards shall have minimum rupturing capacity shown on the diagrams (Main DB 25kA). Where no rupturing capacity is shown, it shall be a minimum of 5kA.

SDB - G3	(Surface Wall Mounted with Doors)
SDB - G4	(Surface Wall Mounted with Doors)
SDB – G5	(Surface Wall Mounted with Doors)
SDB – Computer Server Room	(Surface Wall Mounted with Doors)

All Miniature Circuit Breakers (MCB's) feeding air-conditioning and ventilation equipment shall be "slow" curve and shall satisfy the air-conditioning equipment manufacturers requirements.

Sub-Distribution Boards shall be clearly and properly labelled on completion and shall also contain cable labels indicating the cable and earth wire size of the incoming power feed and any sub-distribution cables as well as the distribution board of origin. All live and neutral conductors shall be numbered using a proprietary branded cable marking system approved by the engineer.

Unless otherwise specified, the boards shall be finished in the following colours:

Frame – electric orange or white as specified
Normal Supply Panel Covers – Electric Orange
Essential Supply Panel Covers – Red
Uninterruptible Power Supply Panel Covers – Blue

Tenderer's are to note that the sub-distribution boards are designed for a cascading system and that circuit breakers tendered are to correspond accordingly.

A separate insulated earth bar shall be provided in SDB's feeding dedicated socket circuits.

All circuits shall be listed and described in a sufficiently large text font and high quality laser printed text on a durable legend card which shall be installed in a purpose made legend card holder fixed to the inside of the door. The printed legend card shall be laminated in plastic to ensure durability on completion of the project. The legend card shall be created to fit securely in the holder and shall not be of a loose fit which can be easily removed.

Cabling shall be neatly secured within the distribution board and shall have sufficient slack to enable relocation and / or re-termination within the confines of the distribution board. Jointing or ferruling of single core cables inside the distribution board shall not be accepted.

Certificates of Compliance for the Sub-Distribution Boards shall be provided by the Electrical Sub-Contractor and handed to the Engineer at the time of final commissioning and inspection of the distribution boards.

The existing site Sub-Distribution Boards shall upon removal be itemised, packaged and handed to DPW Electrical Maintenance Department for their use or disposal or as otherwise advised in writing by the Department of Public Works.

The Electrical Contractor shall submit the required documentary proof to the Main Contractor for their audit records proving such delivery or disposal has taken place.

6. **LV DISTRIBUTION CABLING**

The electrical supply distribution cables existing on site are presently in operational condition. The scope of works for the electrical distribution supply cables to each Sub-Distribution Board shall include the disconnection (when replacing the electrical Sub-Distribution Boards), insulation testing and continuity testing of each core of each cable and the recording of these results. Should any electrical supply distribution cable fail the tests or be deemed to be out of specification, the cable shall either be repaired or replaced as determined and instructed in writing by the engineer.

The Electrical Sub-Contractor shall inform the Main Building Contractor of the existing cable routes and positions (existing overhead cable trays and / or sleeves) so that any disturbance of these cables is avoided.

The Electrical Sub-Contractor shall instruct the Main Contractor to advise all parties that work in these areas is to be carried out carefully and that damage to existing cables may necessitate the removal and complete replacement of any damaged electrical cables.

All new cabling shall be PVCAS copper cores as indicated in the Cable Schedule included on the drawings. LV cables shall be labelled where they terminate at switchboards.

Generally, all distribution cabling within the building shall be run in exposed hot dip galvanised wire mesh medium duty cable tray or HDPE sleeves fixed to the concrete slabs or cut or cast into the floors or walls as necessary. Insulated copper earth wires shall be run with all LV cables.

7. **CABLE TRAYS**

Hot-dip galvanised wire mesh medium duty cable tray of the widths as indicated in the bills of quantities shall be installed to the extent required for LV cables and Electronic / Data Services as necessary to areas where cable management is required.

Cable trays shall be surface mounted and fixed to the structural steelwork, masonry or concrete by means of hot dip galvanised threaded rod hangers with uni-strut supports or fixed to the concrete down stand beams.

Cable trays and all accessories as well as the installation thereof shall comply with Part D2 of this document.

Cables shall be secured at regular intervals to designated cable tray by means of approved nylon cable ties (or Velcro ties for electronic and data cabling) and cables shall be secured in straight lines and labelled at regular intervals of ten (10m) metres. Cables shall also be labelled at the entry point and exit point of wall / floor penetrations with suitable permanent printed cable marking arrangement using a proprietary branded cable marking system approved by the engineer.

Hardware used for the installation of the cable trays and wiring channels shall be suitably corrosion protected. Electro-plated fasteners are not considered corrosion protected and the use of "cold-galv" to protect exposed metal parts will also not be accepted.

8. **SUB-CIRCUIT ARRANGEMENT**

Electrical power points and plug socket outlets are present and in most cases in working condition.

Each circuit to be re-connected to the new electrical Sub-Distribution Boards in each area shall be surveyed, insulation tested and polarity / continuity / earth leakage tested at the socket outlets to determine the number and condition of socket outlets or power points connected to each circuit, their location and wiring sequence documented by means of red line marked up floor layout drawings (paper copies to be supplied by the engineer) which shall be returned to the engineer to create up to date "As-Built" floor layout drawings including circuiting numbering and wiring sequencing to reflect the completed "As-Built" status. The engineer will then use these "As-Built" drawings to test and verify the installation per Sub-Distribution Board for commissioning and final hand over purposes. Labelling of all power socket outlets and power points in the field shall be carried out according to the labelling and numbering method as instructed in writing by the engineer.

Where wiring and/or power socket outlets are found to be in non-compliant, corroded or un-serviceable condition, the complete circuit and all power outlets shall be replaced as necessary. All surface wiring shall be stripped out and where feasible and necessary, new concealed conduits shall be installed or chased into new walls as and where required to replace surface exposed wiring or corroded wire ways as applicable and as instructed in writing by the engineer. Where concealed conduits are not feasible, surface mounted conduit installations shall be carried out on approval by the Engineer. Testing and certification of these particular replaced circuits shall be carried out in the presence of the engineer or witnessed by his appointed representative.

The Electrical Contractor shall decommission, make safe, disconnect and strip out all existing non-compliant circuit wiring noting conduit routes which are existing and are suitable for re-use and pulling draw wires into these routes for future use. Removed cabling shall be re-cycled as per Green Star Rating Compliance requirements whereby scrapped cabling is taken to a suitable re-cycling vendor and documentation confirming the quantity and mass of re-cycled material delivered to and accepted by the vendor is produced by the Contractor for record purposes.

E2.5

New sub-circuit distribution wiring shall be carried out using PVC insulated single core conductors drawn into uPVC conduit, galvanised powder coated steel skirting and galvanised steel trunking. Unless otherwise specified, uPVC conduits shall run in ceiling spaces and roof voids, chased and concealed within brick walls or cut and concealed into floors as allowed and advised by the Architect. Sub-distribution uPVC conduits, wiring and outlets shall comply with Part D2 of the standard documentation.

Conduits installed within ceiling spaces shall be arranged in neat parallel rows, run either parallel or at right angles to passage walls. Conduits installed parallel to concrete down stand beams shall, where possible, be saddled neatly to the beams. Conduits installed at right angles to roof trusses or concrete beams shall be supported by uni-strut and saddled to uni-strut supports. The Electrical Contractor shall arrange for such additional supports as may be necessary to be supplied and installed by the Main Contractor.

The Electrical Contractor shall furthermore co-ordinate common routes for power, lighting and Electronic / Data services conduits and cables in order to minimise the quantity of additional supports required. The co-ordination process shall be done in consultation with the Architect and Electrical Engineer at an early stage of construction.

Wiring between conduit boxes and recessed light fittings shall be via 6A, 3 pin sockets, plug tops and 3m long, 3 core, PVC double insulated flexible cord.

Conduit and wiring to surface mounted light fittings on concrete or false ceilings shall be looped via back entry conduit boxes. These shall be located as close to the positions shown on the lighting layout drawing and Architect's ceiling layout. The Contractor shall liaise closely with the Electrical Engineer and Architect in connection with the positioning of all light fittings before proceeding with installation should setting out detail be unclear.

Conduit and wiring to socket outlets, power points shall also be via the loop-in method as described for surface mounted light fittings.

Where flush mounted socket outlets, telephone and data outlets are shown in similar positions on the various layout drawings, these shall be mounted at the same level and side by side with a gap of 50 mm between covers. Individual outlet boxes may be pre-joined to ensure level installation and equal spacing thereof or multi-gang boxes may be used to ensure neatness and conformity if power skirting is not used.

The mounting heights of flush light switches and socket outlets shall be as instructed by the engineer and the Architect to match existing site installation.

If any doubt arises concerning the positions of any items, or the method to be employed in installing any equipment or materials, or the type of material or equipment to be used, the Engineer's advice shall be sought before proceeding with the installation.

Insulated earth wires shall be run with all circuit wiring and to all power and lighting outlets.

9. **POWERSKIRTING**

Two compartment Z275 galvanised steel epoxy powder coated skirting shall be supplied and installed, to the extent indicated on the drawings. The power skirting final colour shall be standard off the shelf option but final standard colour shall be approved by the Engineer and the Architect before procurement of placing of orders.

Standard 16A 3-pin and Dedicated 16A 3-pin power socket outlets in the two compartment power skirting shall be of the flush mounting type.

E2.6

The upper compartment of the two compartment skirting duct shall be for power circuits and the lower compartment for telephone and data cabling.

Conduits feeding power skirting shall terminate into 100x100x50mm draw boxes, flush mounted with the internal face of the brickwork, directly behind the respective compartment of the power skirting. A neat cut out at the back of the power skirting shall expose the draw box for the drawing in of conductors. Alternatively should space allow and termination direct into the power skirting be demonstrated to be sufficiently neat and tidy to the Engineer, direct termination of conduit into the power skirting shall be allowed.

16A 3 pin standard and red dedicated socket outlets shall be fitted into the power compartment of power skirting at the approximate positions shown on the layout drawing. Approximately 2,500mm of slack wiring shall be allowed for at each power outlet to allow for the minor repositioning thereof.

All outlets indicated for installation on the power skirting shall be positioned above one another.

No power skirting covers shall be cut and installed until the actual positions of the outlets positioned therein have been finalised in consultation with a representative of the client.

10. **NEW LIGHTING & POWER OUTLETS**

These shall be provided to the extent indicated and as instructed in writing by the engineer based on the results of the Electrical Sub-Contractors findings regarding the power and lighting circuit and outlets testing and verification.

Should the majority of socket outlets per area require replacement, the engineer shall decide in conjunction with the Architect whether to instruct the Electrical Sub-Contractor (in writing) to replace all socket outlets to a particular floor area with new types to ensure continuity of socket outlet type per area. All existing socket outlets removed are to be carefully packed and retained for possible re-use elsewhere if necessary.

All 6A lighting socket outlets present are to be removed and replaced under instruction and confirmation of the engineer.

16A light switches and switch socket outlets shall be of the flush mounted type approved for use by the Department of Public Works, unless otherwise specified and shall be fitted with white cover plates.

16A 3-pin dedicated switch socket outlets, with half-round earth pins, shall have red coloured switch toggles and cover plates.

Double Pole and Triple Pole isolators shall be provided for supplies to water heaters, ventilation units, air conditioning units and similar to the extent indicated by the engineer per area. After the position has been finalised, the electrical Sub-Contractor shall supply and install the required isolators and carry out the final connections to water heaters and ventilation/air conditioning isolators.

IP65 rated rotary isolators shall be supplied and installed by the Electrical Sub-Contractor for the air-conditioning units and fresh air / extract fans located outdoors. Cabling shall be made off on the Isolator shroud using suitable IP 68 rated cable glands as approved by the engineer. Cabling to outdoor Isolator points shall terminate to the bottom side of the Isolator Weatherproof Housing only and never to the top or sides of the housing. This shall be enforced to ensure proper cable sealing integrity and waterproofing of the cable junction into the Isolator housing and constitutes good installation practice.

11. **EMERGENCY LIGHTING SYSTEM**

Maintained fittings shall be supplied and installed as instructed by the engineer.

Further non-maintained fittings shall be circuited as an emergency lighting system and shall be supplied and installed to the extent indicated by the engineer and shall be fed from the essential supply circuits as depicted on the schematic wiring diagrams.

12. **LIGHT FITTINGS**

The Tenderer shall include in their tender price for the supply, installation, connection and commissioning of light fittings, including lamps complete to all area. The lighting levels of the installed fittings shall be measured in accordance with the CIBSE Commissioning Code L at time of first commissioning and again at the final commissioning after the twelve month building guarantee and maintenance period. Tenders are to allow for the full commissioning on both occasions of the lighting systems as specified in this code and for any adjustment to the installation as necessary.

The tender is to be priced using the cost of the specified fittings only and all fittings shall be supplied with high efficiency, high frequency electronic “switched mode” type control gear only. No wire wound conventional transformers or “magnetic” control gear will be accepted as this equipment will constitute energy inefficient practice.

Tenderers are at liberty to offer any suitable light fittings provided these comply with Department of Public Works Specifications and bear the SANS 60598-1 Safety Mark and that any light fitting required to comply with a specified IP (Ingress Protection) Rating is certified to SANS 60598-2-1 and an SABS Test Report is produced on request by the Engineer in this regard confirming compliance. Full details of alternative light fittings offered, including make and model numbers, illustrations, photometric data and price, shall accompany the tender if these are to be considered for the tender submission.

The Tenderer's attention is drawn to Clause 2 of the Part D1 - 'Preliminary and General Information' which will be strictly applied in respect of any alternatives considered.

Schedule of Light Fittings

Type A	- 2 x 18W Surface Mounted IP66 Rated Round Bulkhead Fitting with Flat Opal Diffuser (Genlux Venus 26320).
Type B	- 1 x 18W Surface Mounted IP66 Rated Round Bulkhead Fitting with Flat Opal Diffuser (Genlux Venus 26315).
Type C	- LED Wide Beam IP66 Floodlight (15,000 lumen output) complete with stirrup mounting bracket & control gear. (Beka LEDflood-midi 136W)
Type E	- Battery Backed Emergency LED Exit Sign with 1 Hour Battery Backup.
Type F1	- 2 x 28W Cool White T5 Surface Fluorescent (1,200mm) with Prismatic Acrylic Diffuser fitted with Colour 840 Tubes (Lascon M6N-228-ELB).
Type F2	- 2 x 28W Cool White T5 IP65 Rated Vapour Proof Fluorescent (1,200mm) fitted with Colour 840 Tubes (Lascon C10-228-ELB).
Type F3	- 2 x 28W Cool White T5 IP66 Intrinsically Safe (Ex emd II T4 Zone 1) Rated Vapour Proof Fluorescent (1,200mm) fitted with Colour 840 Tubes (Nordland NLE 228).
Type F4	- 4 x 54W Cool White T5 1.2m x 0.6 m Surface T-Bay Fluorescent fitted with Colour 840 Tubes (Lascon T-BAY-454-ELB).
Type F5	- 3 x 28W Cool White T5 1.2m x 0.6m Recessed Hinged Prismatic Diffused Fluorescent fitted with Colour 840 Tubes (Lascon FM90-328-ELB / AR27).

13. **CABLING & WIREWAYS FOR TELEPHONE AND DATA RETICULATION**

Sleeves and conduit links, outlets with blank covers, etc. shall be supplied and installed to the extent indicated and as instructed in writing by the engineer. In some instances, existing Indoor and Outdoor Telephone cabling and termination boxes are existing along with Category 5 data network cabling. Redundant telephone cabling and obsolete data cabling shall be removed and disposed of under written instruction by the engineer. All spare conduits and outlets are to be documented (redlined) on paper layout drawings (provided by the engineer) and returned to the engineer to create "As-Built" layout drawing records of the telephone and data wire ways for future reference. Draw wires are to be provided in all new and existing (cleared out) conduits.

The Electrical Contractor shall install 100 x 100 x 50mm conduit boxes where outlets are shown to be flush in the wall, with dual module blank cover plates. The data outlets are to be populated in future by others. This arrangement is subject to approval by the Client and the Engineer in writing before installation proceeds.

Populating and wiring of the Data Outlets will be carried out by the Data Cabling Specialist under instruction by the Client.

14. **FIRE DETECTION & PUBLIC ADDRESS**

The existing Fire Detection system consists of an overall building Ziton (ZP3) Analogue Addressable Fire Detection System shared throughout the building (Dept of Public Works & SAPS occupancy areas) with detection to the SARS Warehouse Area as well.

The existing shared Fire Detection to the SARS Warehouse Area is to be decommissioned and stripped out. A new and dedicated Analogue Addressable Fire Detection System is to be installed to SARS Warehouse Areas so that the Client can be fully in control of their own portion of the building. The new and dedicated Analogue Addressable Fire Detection System is however to be linked to the existing Customs House Fire Detection System for reasons of Fire Safety and to raise the alarm within the rest of the building as necessary.

The fire detection specialist is to provide a download listing from the existing Fire Detection Control Panel covering the SARS Warehouse Area (Ziton Planner) in printable format (Adobe Acrobat *.pdf files acceptable) so that the extent of the existing devices to be removed and decommissioned from the existing Fire Detection System can be determined.

All the existing fire detection devices are then to be stripped out, packaged and handed to the Dept. Of Public Works : Maintenance Department for their purposes.

Conduit wire ways (Galvanised Bosal) shall be installed by the Electrical Sub-Contractor where existing wire ways are not feasible for re-use.

The Fire Detection specialist shall then proceed to install the new Fire Detection System as per the layout drawings.

All new smoke detectors shall be addressed in sequence according to the wiring routing and shall be labelled with the manufacturer supplied printed self adhesive labels.

Smoke detection is to be installed to ensure compliance with SANS 10139 coverage requirements. Furthermore there is a requirement to fit fire detection to the Hazardous Areas which will require the supply and installation of Intrinsically Safe Galvanic Isolation Barriers and Intrinsically Safe Point Detectors (either conventional smoke detectors along with Addressable / Conventional Zone Monitors and Intrinsically Safe Galvanic Isolation Barriers OR Intrinsically Safe Analogue Addressable Smoke Detectors along with suitable Intrinsically Safe Galvanic Isolation Barriers). The configuration will depend on the fire detection equipment being offered.

On completion, the new address lines and devices are to be connected, commissioned and programmed onto the new Fire Detection Control Panel according to the room designations and descriptions and zoning as instructed by the engineer.

Each addressable fire detection device to be connected to the Fire Detection Control Panel shall be labelled and location, wiring sequence, line address and device type documented by means of red line marked up floor layout drawings (paper copies to be supplied by the engineer) which shall be returned to the engineer to create up to date "As-Built" floor layout drawings to reflect the completed "As-Built" status. The engineer will then use these "As-Built" drawings for verification of the installation for commissioning and final hand over purposes. Labelling of all devices in the field shall be carried out according to the manufacturers labelling and numbering standard and shall be designated a text message and zone allocation as instructed in writing by the engineer. Any devices mis-labelled or incorrectly designated or zoned shall either be correctly re-labelled or the text message and zone re-programmed on the Fire Detection Control Panel.

Zoning of Fire Detection devices will be reviewed in detail as well as programming of the Gas Control Unit for the Computer Server Room. The complete gas Control installation shall be checked and tested with extensive "double knock" activation of zones and end to end discharge trigger testing shall be carried out to ensure proper and reliable operation of the Gas Controlled area.

All line devices are to be properly labelled and accurate "As-Built" drawings shall be produced for the purposes of simplified servicing and future maintenance and fault finding.

Sleeves and conduit links, outlets with blank covers shall be supplied and installed as determined and instructed on site during the contract by the engineer. Draw wires are to be provided in all conduits. The conduits for the Fire Detection System and related services shall be minimum 25mm diameter or as instructed in writing by the engineer.

A new Public Address / Evacuation System shall be supplied and installed to the extent indicated on the layout drawings and as specified in the Bills of Quantities.

Wiring, installation and commissioning of all the above mentioned Fire Detection & Public Address Systems shall be carried out by the Fire Detection Specialist as priced in the Bills of Quantities.

15. **MATV SATELLITE SIGNAL DISTRIBUTION SYSTEM**

No requirement for MATV Satellite signal distribution system is present in this contract scope of works although some surface wiring is existing and shall be relocated to new flush mounted wire ways and re-connected as part of the contract to ensure that all surface, unsightly and redundant cabling is removed and disposed of.

16. **WIREWAYS FOR AUDIO VISUAL EQUIPMENT**

Conduit links, drawboxes and outlets with blank covers, etc. shall be supplied and installed in the Boardrooms / Meeting Rooms and elsewhere to the extent shown on the layout drawings. Draw wires are to be provided in all conduits. The minimum size of conduits for these services shall be diameter 25mm, and shall be routed as required for these services.

The Electrical Contractor shall install 100 x 100 x 50mm conduit boxes where outlets are shown to be flush in the wall, with blank cover plates, or short blank sections in the power skirting.

Wiring of the systems will be carried out by an Audio Visual systems specialist under separate contract to the client.

17. **HOT WATER CYLINDERS**

The Electrical Sub-Contractor shall install 25A Double Pole (IP 65 Rated) surface isolators in the positions as shown on the layout drawings. The Electrical Sub-Contractor shall ensure that the outlet points are suitably located and access thereof not impeded by the installation of the copper pipes terminating into the cylinder. The final connection to each water heater shall be by means of heat resistant wiring in flexible conduit. Tenderers are to note that Solar water heaters are to be used and that electrical supplies are to be sized and cabled to provide power merely for the Solar water heating system circulation pumps where necessary.

18. **MECHANICAL VENTILATION SYSTEMS**

Air conditioning and ventilation units will be supplied and installed by the Air-Conditioning Sub-contractor. The positions of the power points shown on the layout drawing are provisional and must be finalised in consultation with the Air Conditioning Contractor, prior to installation.

A permanent label (Engraved UV stabilised plastic types or similar approved by the engineer) shall be screwed to the wall adjacent to each power point isolator stating the Air Conditioner number, power point number and DB from which it is fed. The Isolator shall also have permanent label (as above approved by the engineer) fixed to the Isolator housing in a manner that does not affect the Ingress Protection (IP) Rating and reflecting the power point number.

Extract ventilation fans installed within the kitchens and male and female toilets shall be supplied via surface mounted 25A Double Pole isolators attached to the underside of the steel / wooden roof supports, in positions accessible via removable ceiling tiles or purpose made hatches to be agreed with the Architect, the Mechanical and Electrical Engineers. Switching of extract and fresh air fans shall be via Sub-Distribution Board mounted contactors (with suitably sized Thermal Overloads) and shall be switched using the field mounted occupancy sensors, the contacts of which are to be cabled back to the Sub-Distribution Boards for control distribution purposes.

19. **DEDICATED EARTH SYSTEM**

Besides the normal earthing requirements, all dedicated switched socket outlet circuits shall be connected via PVC insulated earth wires to insulated earth bars in each of the sub-distribution boards. The insulated earth bars shall be linked to the general earth bars in each SDB.

A dedicated earth mat is proposed for installation to the foundations at the Ground Floor and shall be used for dedicated “clean” earth systems for the Network Distribution Room and the Security Equipment Room.

20. **ACCESS CONTROL & CCTV SECURITY SYSTEMS**

Conduits shall be installed for Category 6 Data Cabling (Cabling and equipment to be installed later by Client appointed Data Specialist) and Power Outlet boxes shall be provided for the Access Controlled Doors to the extent indicated on site and as instructed and confirmed in writing by the engineer and the Client.

The Electrical Contractor shall install conduits and dedicated socket outlets at the Access Control positions and conduits to the Access Control Door as per sketch details. The Electrical Sub-Contractor shall ensure that the conduit outlet points and the power points are suitably located in conjunction with the specialist Access Control Sub-Contractor if available.

The minimum diameter of conduit for the access system shall be 25mm unless agreed otherwise in writing.

21. **EARTHING**

The Electrical Sub-Contractor shall test the existing earth to the Main Electrical Distribution Boards to ensure compliance with the SANS 10142 Standard and that the safety of the available earthing arrangement is satisfactory.

22. **INSPECTION, TESTING AND COMMISSIONING OF THE COMPLETE INSTALLATION**

The Tenderer shall complete and issue all Electrical Certificates of Compliance if required, as part of his Sub-Contract, prior to testing and final inspection by the Engineer.

On completion of the entire installation, or any particular section thereof, as may be decided by the Engineer, tests shall be carried out in accordance with the appropriate Regulations, in the presence of the Engineer.

All defects found at the first delivery inspection are to be rectified within one month of written notice of such defects.

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.
BILL NO: 9

COLLECTION SHEET SUMMARY

ITEM	DESCRIPTION	SUB TOTAL R c
1	Preliminary and General (Total of BoQ 1)	
2	Main & Sub Main Electrical Distribution (Total of BoQ 2)	
3	Electrical : Lighting Installation (Total of BoQ 3)	
4	Electrical: Power Installation (Total of BoQ 4)	
5	Electrical: Telephone & Data (Total of BoQ 5)	
6	Electrical : Fire Detection Installation (Total of BoQ 6)	
7	Electrical : Public Address Installation (Total of BoQ 7)	
8	Electrical : Access Control & CCTV Security System (Total of BoQ 8)	
	TOTAL PROJECT SUM	

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 1

PRELIMINARY & GENERAL ITEMS

COLLECTION SHEET

ITEM	DESCRIPTION	MATERIAL	LABOUR
		R c	R c
1.1	Sub-Totals from:		
	BoQ.Page 1.1		
	SUB TOTALS		
	SUB TOTAL MATERIAL		
	SUB TOTAL LABOUR		
	TOTAL TO FINAL SUMMARY		

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 2

ELECTRICAL : MAIN AND SUB-MAIN DISTRIBUTION

COLLECTION SHEET

ITEM	DESCRIPTION	MATERIAL R c	LABOUR R c
	Sub-Totals from:		
1.1	BoQ.Page 2.1		
1.2	BoQ.Page 2.2		
1.3	BoQ.Page 2.3		
1.4	BoQ.Page 2.4		
	SUB TOTALS		
	SUB TOTAL MATERIAL		
	SUB TOTAL LABOUR		
TOTAL TO FINAL SUMMARY			

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 3

ELECTRICAL: LIGHTING INSTALLATION

COLLECTION SHEET

[illegible]

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 4

ELECTRICAL: POWER INSTALLATION

COLLECTION SHEET

[illegible]

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 5

ELECTRICAL: TELEPHONE & DATA INSTALLATION

COLLECTION SHEET

[illegible]

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 6

ELECTRICAL: FIRE DETECTION INSTALLATION

COLLECTION SHEET

[illegible]

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 7

ELECTRICAL: PUBLIC ADDRESS INSTALLATION

COLLECTION SHEET

ITEM	DESCRIPTION	MATERIAL	LABOUR
		R c	R c
1.1	Sub-Totals from:		
	BoQ.Page 7.1		
	SUB TOTALS		
	SUB TOTAL MATERIAL		
	SUB TOTAL LABOUR		
	TOTAL TO FINAL SUMMARY		

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 8

ELECTRICAL: ACCESS CONTROL & CCTV SECURITY SYSTEM

COLLECTION SHEET

ITEM	DESCRIPTION	MATERIAL	LABOUR
		R c	R c
1.1	Sub-Totals from:		
	BoQ.Page 8.1		
	SUB TOTALS		
	SUB TOTAL MATERIAL		
	SUB TOTAL LABOUR		
	TOTAL TO FINAL SUMMARY		

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO : 1****PRELIMINARY AND GENERAL ITEMS**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	Allow for costs for provision of Surety or Letter of Guarantee to cover 10% of Electrical Contract Amount.	Sum	1				
2	Allow for premium costs incurred for insurances and sureties.	Sum	1				
3	Allow for transport & travelling.	Month	8				
4	Allow for First Commission Testing & Hand Over Training of the installation as detailed in the Specification.	Sum	1				
5	Allow for 12 month guarantee of Site Installation as per Specification.	Sum	12				
6	Allow for Final Commission Testing & Hand Over on 12 Month Guarantee Period Completion per Specification.	Sum	1				
7	Allow for co-ordination & planning for scaffolding, lifting gear, cranes, etc. to be provided by Main Contractor where required for stripping of existing electrical services, positioning, installation & commissioning of new electrical services at high level to the site.	Sum	1				
8	Allow for costs incurred for provision of Surety to cover payment for any unfixed materials on site as per main contract conditions.	Sum	1				
9	Allow for liaison with Client to arrange access, shut-down and all things necessary for electrical supply modifications to be carried out where	Sum	1				
10	Operate and maintain site facilities:						
10.1	Office / Ablutions / Storage	Month	8				
11	Allow for compliance with OHS Act Construction Regulations.	Month	8				
12	Survey, document, label & maintain existing conduit and cabling for re-use. Architectural drawings provided for redline mark up recording purposes at no additional cost.	Sum	1				
13	Strip out & remove redundant electrical equipment, packaging & handing over all removed equipment to Dept. Public Works.	Sum	1				
TOTALS BILL 1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 2****ELECTRICAL : MAIN AND SUB-MAIN DISTRIBUTION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>MAIN DISTRIBUTION BOARD</u>						
1.1	De-commission, make safe, strip out & remove existing Circuit Breakers to SARS Area in MDB complete. Package & deliver to Dept. Of Public Works or as agreed in writing.	Sum	3				
1.2	Test & Certify Existing MDB Earth & Submit Report.	Sum	1				
2	<u>SUB-DISTRIBUTION BOARDS - STRIP & REMOVE</u>						
	De-commission, make safe, strip out & remove existing electrical Sub-DB's & equipment complete and deliver to Dept. Of Public Works or as agreed in writing :-						
2.1	SDB-G3 Ground Floor (Flush - Existing)	Sum	1				
2.2	SDB-G4 Ground Floor (Flush - Existing)	Sum	1				
2.3	SDB-G5 Ground Floor (Flush - Existing)	Sum	1				
2.4	Direct On Line Motor Starter Units	No	6				
2.5	Removal of add-hoc items from other electrical distribution boards as necessary as follows:-						
2.5.1	Make Safe, Strip & Remove 5A SP MCB	No.	2				
2.5.2	Make Safe, Strip & Remove 10A SP MCB	No.	6				
2.5.3	Make Safe, Strip & Remove 15A SP MCB	No.	8				
2.5.4	Make Safe, Strip & Remove 10A TP MCB	No.	1				
2.5.5	Make Safe, Strip & Remove 40A TP MCB	No.	1				
2.5.6	Make Safe, Strip & Remove 60A TP MCB	No.	1				
2.5.7	Make Safe, Strip & Remove 100A TP MCB	No.	1				
2.5.8	Make Safe, Strip & Remove 150A TP MCCB	No.	1				
2.5.9	Make Safe, Strip & Remove Contactor	No.	12				
2.5.10	Strip & Remove Circuit Cabling, Conduit, Outlet Boxes, Isolators etc.in Warehouse associated with above removed and redundant power and control equipment.	Lot	42				
Totals to collection: Bill 2.1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 2****ELECTRICAL : MAIN AND SUB-MAIN DISTRIBUTION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
3	<u>SUB DISTRIBUTION BOARDS - NEW</u> Supply, installation, connection, commissioning & certification of Sub-DB's complete as follows:-						
3.1	SDB-G3 Ground Floor (Refer 6352/E/SCH01)	Sum	1				
3.2	SDB-G4 Ground Floor (Refer 6352/E/SCH02)	Sum	1				
3.3	SDB-G5 Ground Floor (Refer 6352/E/SCH03)	Sum	1				
3.4	SDB-Computer Server Room Ground Floor (Refer 6352/E/SCH04)	Sum	1				
3.5	Supply & install new equipment to add-hoc electrical distribution boards and areas. (Existing - Selected new internals to be installed complete with suitable flexible cable tails, ring lugs or ferrule ends and busbar connections complete as necessary as follows:-)	Sum	1				
3.5.1	5A / 10A / 16A 6kA Rated (Curve 2) Single Pole MCB.	No.	12				
3.5.2	20A 6kA Rated (Curve 1) Single Pole MCB	No.	2				
3.5.3	63A 6kA Rated Single Pole & Neutral Earth Leakage Unit with Overload.	No.	4				
3.5.4	10A 6kA Rated (Curve 1) Triple Pole MCB	No.	2				
3.5.5	50A 6kA Rated (Curve 1) Triple Pole MCB	No.	2				
3.5.6	100A 6kA Rated (Curve 1) Triple Pole MCB.	No.	3				
3.5.7	100A 25kA Rated (Mixed Load) Triple Pole Moulded Case Circuit Breaker.	No.	3				
3.5.8	12A AC3 Rated Triple Pole Contactor.	No.	4				
3.5.9	Thermal Overload (0.37kW - 0.55 kW	No.	4				
3.6	Earthing & Bonding of SDB's complying with the requirements of SANS10142.	Sum	4				
3.7	Issue Certificate of Compliance for each SDB in compliance with SANS10142.	No.	4				
3.8	Labelling of electrical supply cable to each electrical sub-distribution board at origin and termination points to Dept. Public Works Electrical Specification.	No.	8				
Totals to collection: Bill 2.2						Section No. C4.1	
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SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 2

ELECTRICAL : MAIN AND SUB-MAIN DISTRIBUTION

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
4	<u>LV ARMOURED CABLES & TERMINATIONS</u> Supply, install, connect & lable at required intervals the following multi-core pvc insulated steel wire armoured cables specified:-						
4.1	<u>LV Stranded Copper Cables</u>						
4.1.1	95 mm ² x 4 core	m	50				
4.1.2	25 mm ² x 4 core	m	500				
4.1.3	16 mm ² x 4 core	m	60				
4.1.4	10 mm ² x 4 core	m	400				
4.2	<u>LV Cable Terminations including Cable Glands</u>						
4.2.1	95 mm ² x 4 core	No.	2				
4.2.2	25 mm ² x 4 core	No.	8				
4.2.3	16 mm ² x 4 core	No.	4				
4.2.4	10 mm ² x 4 core	No.	20				
5	<u>EARTH CONDUCTORS & TERMINATIONS</u> Supply, install and connect up the following PVC insulated earth conductors with cables measured above.						
5.1	<u>Earth Conductor</u>						
5.1.1	25 mm ²	m	200				
5.1.2	16 mm ²	m	180				
5.1.3	10 mm ²	m	500				
5.1.4	6.0 mm ²	m	460				
5.2	<u>Earth Conductor Terminations</u>						
5.2.1	25 mm ²	No.	4				
5.2.2	16 mm ²	No.	6				
5.2.3	10 mm ²	No.	22				
5.2.4	6.0 mm ²	No.	24				
Totals to collection: Bill 2.3							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.

BILL NO: 2

ELECTRICAL : MAIN AND SUB-MAIN DISTRIBUTION

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
7	<u>CONDUIT & WIREWAYS</u> Supply and install u-PVC conduit surface mounted, cast in concrete or chased in brickwork with allowance for wastage, off-cuts, bends, sets, saddles, adaptors, etc.						
7.1	<u>Installed Surface</u>						
7.1.1	32 mm Diameter	m	40				
7.1.2	40 mm Diameter	m	60				
7.1.3	50 mm Diameter	m	90				
7.2	<u>Chased in brickwork</u>						
7.2.1	32 mm Diameter	m	60				
7.2.2	40 mm Diameter	m	60				
7.2.3	50 mm Diameter	m	80				
7.3	<u>Excavated & Buried to 500mm Depth</u>						
7.3.1	32 mm Dia.	m					
8	<u>Welded Wire Mesh Tray & Accessories</u> Welded Wire Mesh hot dipped galvanised cable tray (50mm a 100mm pitch) supplied and installed complete with all mounting brackets, hangers, supports, etc.						
8.1	<u>Cable Tray</u>						
8.1.1	200mm Wide Medium Duty	m	30				
8.1.2	150mm Wide Medium Duty	m	90				
8.1.3	100mm Wide Medium Duty	m	60				
8.2	<u>Horizontal Bends</u>						
8.2.1	200mm Wide Medium Duty	No	4				
8.2.2	150mm Wide Medium Duty	No	4				
8.2.3	100mm Wide Medium Duty	No	6				
9	<u>Dedicated Earth</u> Supply & install dedicated earthing arrangement for Computer Server Room :-						
9.1.1	Earth Mat sufficient for earth resistance of 1.0 ohm or less.	No.	1				
9.1.2	Earth Bar 20mm x 5mm x 200mm Mounted on Insulators with 9 off M6 threaded fixing holes.	No.	1				
Totals to collection: Bill 2.4							
TOTALS BILL 2							
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SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 3****ELECTRICAL : LIGHTING INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>LIGHTING INSTALLATION</u> Supply and install light fittings, as specified, complete with lamps and electronic control gear.						
1.1	Type A (Surface 2 x 18W IP66 Rated Bulkhead)	No	12				
1.2	Type B (Surface 1 x 18W IP66 Rated Bulkhead)	No	14				
1.3	Type C (IP66 Rated LED Wide Beam Floodlight 15,000 Lumen)	No	4				
1.4	Type E (LED Exit Sign 60 minute battery backup)	No	14				
1.5	Type F1 (Surface 2 x 28W Fluorescent Prismatic)	No	30				
1.6	Type F2 (Vapor Proof IP65 2 x 28W Fluorescent)	No	66				
1.7	Type F3 (Vapour Proof IP66 2 x 28W Fluorescent - Ex emd II T4 Zone 1 Certified)	No	6				
1.8	Type F4 (Surface 4 x 54W T Bay Fluorescent)	No	90				
1.9	Type F5 (Recessed 3 x 28W T5 Fluorescent Hinged Prismatic (1,200mm x 600mm)	No	28				
1.2	Supply & install flush mounted light switches (Crabtree Classic), c/w 100 x 50 x 50 galvanised steel drawbox, cover plate and chasing in of boxes as required.						
1.2.1	16A single lever 1 way	No	20				
1.2.2	16A dual lever 1 way	No	4				
1.2.3	16A single lever 2 way	No	4				
1.3	6A Unswitched Lighting Socket Outlet installed in Roundbox.	No	118				
1.4	Wall Mounted Outdoor IP 67 Photocell	No	2				
1.5	Occupancy Sensor (Legrand DT-355 or equal)	No	8				
1.6	Identify existing Lighting Circuits : Extent of Circuit Wiring, Wiring Size & Condition, Number & Location of Outlet Points to Warehouse Area.	Sum	1				
1.7	Document Lighting Circuits : Location, Circuits, Wiring Sizes, Outlets to Warehouse Area on supplied paper drawings.	Sum	1				
1.8	Remove Lamps / Light Fittings & Insulation Test existing Lighting Circuits (including Earth Wire) & Outlets & Confirm Results in Typed Report.	Sum	1				
Totals to Collection: Bill 3.1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 3****ELECTRICAL : LIGHTING INSTALLATION**

				MATERIAL		LABOUR	
2	<u>CONDUIT & WIREWAYS</u> Supply & install uPVC conduit surface or chased in brickwork with allowance for wastage, off-cuts, bends, sets, adaptors, etc. (Outlet boxes measured elsewhere).						
2.1	<u>Surface Mounted</u>						
2.1.1	20mm Dia.	m	1600				
2.1.2	25mm Dia.	m	340				
2.2	<u>Chased in brickwork</u>						
2.2.1	20mm Dia.	m	180				
2.2.2	25mmDia.	m	120				
2.3	Supply & install galvanised steel trunking c/w snap-on galvanised steel cover, threaded suspension rods & strirrup / saddles, colour identifier band Red at 3m intervals & at penetrations.						
2.3.1	P2000 Trunk suspended from concrete slab or surface c/w covers	m	600				
2.3.2	90 Degree Elbow Bend	No	12				
2.3.3	90 Degree Inside / Outside Bend	No	6				
2.3.4	T-Piece	No	12				
2.3.5	P2000 End Cap	No	18				
3	<u>Supply and install conduit boxes</u>						
3.1	Round Bosal box flush mounted in wall for light fittings including chasing.	No	28				
3.2	Round Bosal box surface mounted in ceiling space for light fittings or 6A socket outlets.	No	148				
4	<u>WIRING</u>						
4.1	Supply & install PVC insulated copper conductors drawn into wireways measured elsewhere.						
4.1.1	1.5mm ²	m	9000				
4.1.2	2.5mm ² 3 Core Cu PVCAS	m	540				
4.1.3	1.5mm ² Insulated Earth Wire	m	4500				
4.1.4	4mm ² x 3 Core Cu PVCAS	m	168				
Totals to Collection: Bill 3.2							
TOTALS BILL 3						Section No. C4.1 Page 327 of 339	

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 4****ELECTRICAL: POWER INSTALLATION**

			QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>POWER INSTALLATION</u> Supply & install power outlets,(Clipsal S2000 Range), including 100x100x50 flush mounted uPVC draw box and chasing in, or surface mounted uPVC box, with cover plates.						
1.1	16A normal single switched socket outlet - flush	No	24				
1.2	16A double switched socket outlet - flush	No	8				
1.3	16A single Shuko 2 pin switched socket outlet - flush	No	2				
1.4	16A combination single switched socket outlet & Shuko switched socket outlet - flush	No	4				
1.5	16A single switched socket outlet - surface	No	12				
1.6	16A double switched socket outlet - surface	No	2				
1.7	16A dedicated single switched socket outlet - flush	No	4				
1.8	16A dedicated double switched socket outlet - flush	No	2				
1.9	16A dedicated switched socket outlet - on powerskirting	No	24				
1.10	16A dedicated single switched socket outlet - surface	No	12				
1.11	32A DP Flush Mounted Isolator	No	2				
1.12	63A DP Flush Mounted Isolator	No	1				
1.13	16A DP Surface Mounted Rotary Isolator IP65 Rated	No	12				
1.14	32A DP Surface Mounted Rotary Isolator IP65 Rated	No	2				
1.15	63A DP Surface Mounted Rotary Isolator IP65 Rated	No	1				
1.16	16A TP Surface Mounted Rotary Isolator IP65 Rated	No	14				
1.17	32A TP Surface Mounted Rotary Isolator IP65 Rated	No	6				
1.18	63A TP Surface Mounted Rotary Isolator IP65 Rated	No	1				
1.19	32A Industrial Single Phase Switched Socket Outlet supplied with Matching Plug to fit	No	4				
1.20	16A Outdoor Switched Socket Outlet in IP66 Enclosure (Legrand Part No. 6846 38 or Equal Approved) & Socket Complete	No	4				
1.21	Identify existing Power Circuits : Extent of Circuit Wiring, Wiring Size & Condition, Number & Location of Outlet Points based on drawings made available.	Sum	1				
1.22	Document Power Circuits : Extent & Location of Circuit Wiring, Wiring Sizes, Number & Location of Outlet Points on supplied drawings.	Sum	1				
1.23	Insulation Test existing Power Circuits (including Earth Wire) & Outlets & Confirm Results in Typed Report.	Sum	1				
Totals to Collection: Bill 4.1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 4****ELECTRICAL: POWER INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
2	<u>CONDUIT & WIREWAYS</u> Supply and install uPVC conduit surface mounted, cast in concrete or chased in brickwork with allowance for wastage, off-cuts, bends, sets, adaptors, etc. (Outlet boxes measured elsewhere).						
2.1	<u>Cast in Concrete</u>						
2.1.1	20mm Dia.	m	48				
2.1.2	25mm Dia	m	154				
2.1.3	32mm Dia.	m	154				
2.2	<u>Chased in brickwork</u>						
2.2.1	20mm Dia.	m	420				
2.2.2	25mm Dia	m	340				
2.2.3	32mm Dia.	m	290				
2.3	<u>Surface Mounted</u>						
2.3.1	20mm Dia	m	560				
2.3.2	25mm Dia	m	300				
2.3.3	32mm Dia.	m	600				
3	Spare conduit boxes flush mounted in wall with blank cover plate, including chasing as required						
3.1	100x50x50 mm	No	44				
3.1	100x100x50 mm	No	26				
4	<u>Powerskirting</u> Galvanised Steel 2 Compartment Power Skirting (Cabstrut N8 / P801) powder coated Motorcraft Grey (to be confirmed by Architect) supplied & installed complete with covers, etc.						
4.1	2 Compartment Power Skirting & Covers	m	129				
4.2	2 Compartment Inside / Outside Bend	No.	28				
4.3	2 Compartment Power Skirting End Cap	No.	16				
4.4	Under-Desk Powerset Box ELEC-PB-01 & 2 x 3m Flyleads (Design4 GRID Range or MULTIBOX POWER SET to SARS Specification)	No.	4				
4.5	Under-Desk Powerset Box ELEC-PB-02 & 2 x 3m Flyleads (Design4 GRID Range or MULTIBOX POWER SET to SARS Specification)	No.	2				
4.6	Under-Desk Powerset Box ELEC-PB-03 & 2 x 3m Flyleads (Design4 GRID Range or MULTIBOX POWER SET to SARS Specification)	No.	12				
Totals to Collection: Bill 4.2							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 4****ELECTRICAL: POWER INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
5	<u>Welded Wire Mesh Cable Tray and Accessories</u>						
	Welded Wire Mesh hot dipped galvanised cable tray supplied and installed complete with all mounting brackets, hangers, supports, etc.						
5.1	<u>Cable Tray</u>						
5.1.1	200mm Wide Medium Duty	m	36				
5.1.2	150mm Wide Medium Duty	m	120				
5.1.3	100mm Wide Medium Duty	m	90				
5.1.4	50mm Wide Medium Duty	m	60				
5.2	<u>Horizontal Bends</u>						
5.2.1	200mm Wide Medium Duty	No	4				
5.2.2	150mm Wide Medium Duty	No	6				
5.2.3	100mm Wide Medium Duty	No	4				
5.2.4	50mm Wide Medium Duty	No	6				
5.3	<u>T-Piece</u>						
5.3.1	200mm Wide Medium Duty	No	2				
5.3.2	150mm Wide Medium Duty	No	6				
5.3.3	100mm Wide Medium Duty	No	6				
5.3.4	50mm Wide Medium Duty	No	4				
5.3	Supply & install galvanised steel trunking c/w snap-on galvanised steel cover, threaded suspension rods & strirrup / saddles, colour identifier bands Red or Blue at 3m intervals & at penetrations.						
5.3.1	P9000 Trunking complete with covers	No	60				
5.3.2	90 Degree Elbow Bend	No	4				
5.3.3	90 Degree Inside / Outside Bend	No	2				
5.3.4	T-Piece	No	4				
5.3.5	P9000 End Cap	No	6				
Totals to Collection: Bill 4.3							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 4****ELECTRICAL: POWER INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
6	<u>WIRING</u>						
6.1	Supply and install PVC insulated single core copper conductors drawn into uPVC Conduit, Powerskirting and P9000 Trunking measured elsewhere.						
6.1.1	2.5mm ²	m	4480				
6.1.2	4.0mm ²	m	2800				
6.1.3	6.0mm ²	m	1200				
6.1.4	10.0mm ²	m	800				
6.2	Supply and install PVC insulated single core copper Earth Wire drawn into uPVC conduit, measured elsewhere.						
6.2.1	1.5mm ²	m	3640				
6.2.2	2.5mm ²	m	400				
6.2.3	4mm ²	m	200				
7	<u>LV CABLES AND TERMINATIONS</u>						
	Supply, install & connect the following multi-core cable with solid copper conductors as specified:						
7.1	<u>LV Cables</u>						
7.1.1	4mm ² x 4 core	m	488				
7.1.2	2.5mm ² x 4 core	m	1280				
7.2	<u>Cable Terminations</u>						
7.2.1	4mm ² x 4 core	No	12				
7.2.2	2.5mm ² x 4 core	No	26				
8	<u>EARTH CONDUCTORS AND TERMINATIONS</u>						
	Supply, install and connect up the following earth conductors with cables measured above.						
8.1	<u>Earth Conductor</u>						
8.1.1	2.5mm ²	m	488				
8.1.2	1.5mm ²	m	1260				
8.2	<u>Earth Conductor Terminations</u>						
8.2.1	2.5mm ²	No	12				
8.2.2	1.5mm ²	No	26				
Totals to Collection: Bill 4.4							
TOTALS BILL 4							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.
BILL NO: 5
ELECTRICAL: TELEPHONE & DATA

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>EXISTING TELEPHONE & DATA INSTALLATION</u>						
1.1	Identify existing Data & Telephone Points : Routing of Point Wiring, Wiring Type & Condition, Number & Location of Outlet Points to Warehouse & Offices Areas based on drawings made available.	No.	32				
1.2	Document Data & Telephone Point : DP Box of Origin, Routing of Point Wiring, Wiring Types, Number & Location of Outlet Points to Warehouse & Offices on supplied drawings.	No.	32				
1.3	Strip out and remove redundant and damaged Data & Telephone Cabling from wire ways and install draw wires for future use.	No.	32				
2	<u>CONDUIT WORK</u>						
	Supply and install uPVC conduit surface mounted, cast in concrete or chased in brickwork with allowance for wastage, off-cuts, bends, sets, adaptors, etc. (Outlet boxes measured elsewhere).						
2.1	<u>Surface Mounted</u>						
2.1.1	25mm Dia.	m	380				
2.1.2	32mm Dia.	m	240				
2.2	<u>Chased in brickwork</u>						
2.2.1	25mm Dia	m	62				
2.2.2	32mm Dia.	m	38				
2.3	<u>DRAW WIRES</u>						
2.3.1	1,6mm Dia. Galvanised draw wires installed in wire ways (new & existing) above.	m	720				
3	<u>TERMINATION BOX OUTLETS</u>						
	Supply & install conduit boxes complete with chasing & Single or Dual module blank cover plates						
3.1	100x50X50 Flush Mounted	No	10				
4	<u>TELKOM DISTRIBUTION BOXES</u>						
	Supply & install the following Telkom Standard Termination / Distribution Board						
4.1	600mm x 600mm x 200mm (IP 65) Enclosure	No	1				
4.2	600mm x 600mm x 16mm wooden backboard complete with 100mm stand off mountings	No	1				
4.3	300A Profile Telephone Enclosure	No					
Totals to Collection: Bill 5.1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 5****ELECTRICAL: TELEPHONE & DATA**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
5	<u>NETWORK DISTRIBUTION ROOM</u>						
	Supply & install the following equipment in the Network Distribution Room, complete with labelling, earthing and all necessary fastening materials, cage nuts, adjustments and fittings to ensure a complete & functional Network Distribution						
5.1	19" 20U Floor Standing Rack (600mm x 800mm Depth) with castors & glass door to accommodate Fibre Termination Cassette, Network Switches, Data & Telephone Cabling Terminations. (MODRAC or equal approved in writing by Engineer & Client)	No					
5.2	300mm Slack Rack Extension for above Rack	No					
5.3	10 Way Metal Power Outlet Rail	No					
5.4	4 Way Silent Fan Unit (Complete)	No					
5.5	Modem Shelf to above Rack	No					
5.6	1U Brush Panel	No					
5.7	24 Way Patch Panel fitted complete with CAT 6 RJ45 Keystones	No					
5.8	CAT 6 Patch Lead 2.5m Length	No					
5.9	CAT 6 Keystone Termination Port Labelling	No					
5.10	Test CAT 6 field cable including test result printout & certification	No					
5.11	50 Way Voice Patch Panel	No					
5.12	10 Way Krone Block	No					
5.13	10 Pair Telephone Cable	m					
Totals to Collection: Bill 5.2							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 5****ELECTRICAL: TELEPHONE & DATA**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
6	<u>NETWORK FIELD CABLING</u> Supply & install CAT 6 certified cabling and equipment reticulated in wire ways provided and costed previously.						
6.1	CAT 6 Cable (Solid Conductor)	m					
6.2	RJ 45 CAT 6 Single Socket Outlet Module	No					
6.3	RJ 45 CAT 6 Dual Socket Module	No					
6.4	Terminate CAT 6 Cable to RJ45 Data Outlet	No					
6.5	Label CAT 6 Data Outlet	No					
6.6	CAT 6 Data Flylead (3.0m Length)	No					
7	<u>NETWORK FIELD FIBRE</u> Supply & install Equipment to Rack & Fibre reticulated in wire ways provided & costed previously.						
7.1	12 Core OM3 Fibre (Multi-Mode)	m					
7.2	24 Port LC Multi-Mode Fibre Patch Panel	No					
7.3	Multi-Mode Un-Jacketed Fibre Optic Pig Tail	No					
7.4	Fusion Splice Pig Tail to Fibre Optic Cable	No					
7.5	LC Multi-Mode Mid-Coupler mounted to Fibre Patch Panel	No					
7.6	Test Fibre Core with Test Result Print Out	No					
7.7	Brush Panel	No					
7.8	LC to LC Fibre Patch Lead	No					
8	<u>NETWORK DOCUMENTATION</u>						
8.1	Rack Layout Drawing (As Built)	Sets					
8.2	Copper Test Results (As Built - Bound)	Sets					
8.3	Fibre Test Results (As Built - Bound)	Sets					
8.4	Network Certification & Guarantee Documents	Sets					
Totals to Collection: Bill 5.3							
TOTALS BILL 5							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 6****ELECTRICAL: FIRE DETECTION INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>FIRE DETECTION HEAD END</u> The following actions to be carried out on the Fire Detection Control Panel existing in Customs House & submitted to the Engineer for approval:-						
1.1	List existing Devices to SARS Warehouse & Office Areas with Text Descriptions & Configuration Programming if present (Ziton Planner Download & Submit in printable electronic format)	Sum	1				
1.2	Audit Test each device existing to SARS Warehouse & Offices Areas & submit itemised device report listing address, room number, test result & if address label visible & present.	Sum	NIL	NIL		NIL	
1.3	Program New Custom Text & Configuration to New Fire Panel as approved by Engineer.	Sum	1				
1.4	Test & Commission New Field Devices with Engineer present.	Sum	1				
1.5	Analogue Addressable Control Panel 2 - Loop (New Supply & Install)	No	1				
1.6	7Ah SLA Battery	No	2				
1.7	Text & Configuration Programming.	Sum	1				
1.8	LCD Repeater Panel	No	2				
1.9	7Ah SLA Battery	No	4				
1.10	RS 485 Cable (Dekaron 1.0mm ² 2-Pair Instrument Cable Individual & Overall Screened).	m	180				
1.11	Existing Addressable Point Detectors & Manual Call Points (Strip, Package & Hand to Dept. Public Works : Maintenance Dept.)	No	74				
Totals to Collection: Bill 6.1							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 6****ELECTRICAL: FIRE DETECTION INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
2	FIRE DETECTION FIELD DEVICES Supply and install field devices complete with mounting bases, backboxes, address lables, wiring terminations, crimp on wire end ferrules, heat shrink sleeving and cable markers as necessary.						
2.1	Optical Smoke Detector (Addressable)	No	86				
2.2	Ionisation Smoke Detector (Addressable)	No	4				
2.3	Heat Detector (Addressable)	No	2				
2.4	Manual Call Point Unit (Flush Mounted) with Glass Element, Tamper Cover & Seal.	No	2				
2.5	Manual Call Point Unit (Surface Mounted) with Glass Element, Tamper Cover & Seal.	No	8				
2.6	Loop Isolator & Base	No	10				
2.7	Loop Powered Sounder / Strobe Combination	No	10				
2.8	Interface Input Unit	No	2				
2.90	Interface Relay Output Unit	No	2				
2.10	Addressable Gas Control Unit	No	1				
2.11	24V DC 3A Power Supply for GCU	No	1				
2.12	12V 7Ah Sealed Lead Acid Battery	No	2				
2.13	Combination Siren / Strobe 24V DC	No	1				
2.14	Fire Alarm Bell 24V DC for GCU	No	1				
2.15	Fire Alarm Strobe 24V DC for GCU	No	1				
2.16	Intrinsically Safe Isolation Barrier (Conventional	No	2				
2.17	Intrinsically Safe Point Detector Isolation Barrier (Addressable / Protocol Translator)	No	2				
2.18	IP 65 Rated Enclosure suitably sized for Isolation Barrier & Interface (if required) complete with cable glands & DIN Rail.	No	2				
Totals to Collection: Bill 6.2							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 6****ELECTRICAL: FIRE DETECTION INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
2	<u>FIRE DETECTION FIELD DEVICES</u> <u>(Continued)</u>						
2.19	IS Rated Optical Smoke Detector (Addressable)	No	2				
2.2	IS Rated Optical Smoke Detector (Conventional)	No	2				
2.21	IS Rated Heat Detector (Addressable)	No	2				
2.22	IS Rated Heat Detector (Conventional)	No	2				
2.23	DIN Rail Mount Addressable / Conventional Zone Interface Unit.	No	2				
3	<u>CABLING</u> Cabling to be drawn into wireways provided:-						
3.1	1 Pair 1.0mm Stranded PH30	m	1800				
4	<u>CONDUIT & WIREWAYS</u> Supply and install Galvanised Bosal conduit surface mounted or chased in brickwork with allowance for wastage, off-cuts, bends, sets, adaptors, etc. (Galvanised Bosal Outlet boxes measured seperately below).						
4.1	<u>Surface Mounted</u>						
4.1.1	25mm Dia.	m	1300				
4.2	<u>Chased in brickwork</u>						
4.2.1	25mm Dia.	m	120				
4.3	<u>SUPPLY & INSTALL CONDUIT BOXES</u>						
4.3.1	Round Box, fixed surface for device.	No	130				
4.3.2	Round Box. Dome Lid & 25mm Sprague Conduit for device installed on ceiling tile	No	12				
4.3.3	Break Glass Unit Back Box, flush incl. chasing.	No	10				
Totals to Collection: Bill 6.3							
TOTALS BILL 6							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 7****ELECTRICAL: PUBLIC ADDRESS INSTALLATION**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>PUBLIC ADDRESS HEAD END</u>						
1.1	19" 6U Wall Mount Swing Rack Complete	No	1				
1.2	Amplifier VM2240 Unit & Rack Brackets	No	1				
1.3	Speaker Line Surveillance Unit (TOA SV-200M for 5 Zones)	No	1				
1.4	Message Unit (TOA EV-200M)	No	1				
1.5	Remote Microphone Console (RM 200M)	No	2				
1.6	Power Supply for RM 200M	No	2				
1.7	Cat 6 STP Cabling for RM 200M	m	120				
2	<u>PUBLIC ADDRESS FIELD DEVICES</u> Supply and install field devices complete with mounting bases, backboxes, zone labels, wiring terminations, crimp on wire end ferrules, heat shrink sleeving and cable markers as necessary.						
2.1	Ceiling Flush Mounted Fire Resistant Speaker Complete (TOA PC 1867F)	No	12				
2.2	Horn Loudspeaker (TOA SC 610)	No	18				
3	<u>CABLING</u> Cabling to be drawn into conduit, trunking and wireways provided as follows:-						
3.1	1 Pair 1.0mm Stranded PH30	m	600				
3	<u>CONDUIT & WIREWAYS</u> Supply and install Galvanised Bosal conduit surface mounted, cast in concrete or chased in brickwork with allowance for wastage, off-cuts, bends, sets, adaptors, etc. (Galvanised Bosal Outlet boxes measured separately below).						
3.1	<u>Surface Mounted</u>						
3.1.1	25mm Dia.	m	640				
3.2	<u>Chased in brickwork</u>						
3.2.1	25mm Dia.	m	48				
3.3	<u>SUPPLY & INSTALL CONDUIT BOXES</u>						
3.3.1	Round Box, fixed surface for device.	No	36				
3.3.2	Dome Lid & 25mm Sprague Conduit for device installed on ceiling tile	No	6				
Totals to Collection: Bill 7							
TOTALS BILL 7							

SARS WAREHOUSE UPGRADE : CUSTOMS HOUSE, FORESHORE, CAPE TOWN.**BILL NO: 8****ELECTRICAL: ACCESS CONTROL & CCTV SECURITY SYSTEM**

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
1	<u>CONDUIT WORK</u> Supply & install uPVC conduit with allowance for wastage, off-cuts, bends, sets, adaptors, drawwires etc. (Outlet boxes measured elsewhere).						
1.1	<u>Surface Mounted</u>						
1.1.1	25mm Dia.	m	340				
1.2	<u>Chased in brickwork</u>						
1.2.1	25mm Dia	m	60				
2	<u>DRAW WIRES</u>						
2.1	1,6mm Dia. Galvanised draw wires installed in conduits measured above.	m	400				
3	Conduit boxes flush mounted in wall with blank cover plate, including chasing as required						
3.1	100x50x50 mm	No	12				
3.2	100x100x50 mm	No	4				
3.3	Round Box, fixed surface for device.	No	10				
3.4	Round Box & 25mm Sprague Conduit (2.5m Length) for device installed on ceiling tile	No	4				
4	Supply & install galvanised steel trunk c/w steel cover, threaded suspension rods & stirrup / saddles, colour identifier band Yellow at 3m intervals & at penetrations.						
5.3.1	P9000 Trunking	No	12				
5.3.2	90 Degree Elbow Bend	No	2				
5.3.3	90 Degree Inside / Outside Bend	No	1				
5.3.4	T-Piece	No	2				
5.3.5	P9000 End Cap	No	6				
Totals to Collection: Bill 8.1							
TOTALS BILL 8							

C4.2

HVAC Installation Bills of Quantities and Specifications

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
	<u>Refer to Technical Specifaction:</u>				
	2190315-Mechanical hvac Specification				
	<u>Refer to Dwgs:</u>				
	2190315-HVAC-02				
	2190315-HVAC-03				
	2190315-HVAC-04				
1	<u>Section 1</u>				
1.1	Item 6: Provide all scaffolding, lifting and plant equipment needed for the durantion of the contract	item			
1.2	Item 12: Provide all drawings as specified	item			
1.3	Item 13: Provide operation and maintenance manuals as specified	item			
1.4	Item 14: Provide maintenance and guarantee as specified	item			
1.5	Item 20: Commissioning as specified and required	item			
1.6	Item 21: Training as specified	item			
Total general technical items carried forward to summary					
	<u>Section 2:</u>				
2	<u>FAF-S-01 fan system</u>				
2.1	Weather cowl, galvanised sheet metal flanged with bird mesh screen	no	1		
2.2	Filter, 495x395x50 WP77 washable pleated complete with housing, frame, clips and side sliding access	no	1		
2.3	Attenuator, inlet side, flanged, 850 long, complete with galvanised steel mounting brackets	no	1		
2.4	Attenuator, outlet side, flanged, 1,100 long, complete with galvanised steel mounting brackets	no	1		
2.5	Fan, FAF-S-01 complete with mounting brackets flanged and hard connected to attenuators	no	1		
2.6	Flexible connection, connecting outlet attenuator to transformation piece	no	1		
2.7	Transformation piece, galvanised sheet metal - attenuator size to 300x300	no	1		
2.8	Transformatioin piece, galvanised sheet metal ducting, 250x200 to 200x200	no	1		
2.9	Bend, galvanised sheet metal, 300x300	no	2		
2.10	Bend, galvanised sheet metal, 200x200	no	7		
2.11	Bend, galvanised sheet metal, 250x200	no	1		
2.12	Ducting, galvanised sheet metal, 300x300	m	4		

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
2.13	Ducting, galvanised sheet metal ducting, 200x200	m	35		
2.14	Ducting, galvanised sheet metal, 250x200	m	11		
2.15	Ducting, galvanised sheet metal circular ducting, Ø125	m	3		
2.16	Reducer, galvanised ducting, 250x200 to 200x200	no	1		
2.17	Flexible ducting, Ø125	m	3		
2.18	Saddle, galvanised sheet metal, 200x200 connected to 300x300 ducting	no	1		
2.19	Saddle, galvanised sheet metal, 250x200 connected to 300x300 ducting	no	1		
2.20	Saddle, galvanised sheet metal, 200x200 connected to 250x200 ducting	no	2		
2.21	Fire damper, with sleeve, 300x300	no	1		
2.22	Fire damper, with sleeve, 250x200	no	1		
2.23	Fire damper, with sleeve, 200x200	no	3		
2.24	Double deflection supply air grille, SAG-1 complete with shoe connection piece and obd	no	8		
2.25	Double deflection supply air grille, SAG-2 complete with shoe connection piece and obd	no	2		
2.26	Disc valve, SAV-1 complete with 1m Ø125 flexible connection	no	2		
2.27	Door grilles, DG-1, complete	no	5		
	<u>Electrical installation</u>				
2.28	Isolator, weather proof, within 1m of fan	no	1		
2.29	Conduit, galvanised Ø25 complete with saddles	m	2		
2.30	Electrical wiring, isolator to fan	m	2,5		
2.31	Timer, electronic 7-day timer suitable for switchboard mounting	no	1		
Total for FAF-S-01 fan system carried forward to summary					
3	<u>FAF-S-02 fan system</u>				
3.1	Weather louvre, WL-2 galvanised steel with bird mesh screen, 800x400	no	1		
3.2	Filter, 625x392x50 WP77 washable pleated complete with housing, frame, clips and side sliding access	no	1		
3.3	Attenuator, inlet side, flanged, 850 long, complete with galvanised steel mounting brackets	no	1		
3.4	Attenuator, outlet side, flanged, 850 long, complete with galvanised steel mounting brackets	no	1		
3.5	Fan, FAF-S-02 complete with mounting brackets flanged and hard connected to attenuators	no	1		
3.6	Flexible connection, connecting fan & attenuator combination to ducting, both sides	no	2		
3.7	Transformation piece, galvanised sheet metal, 800x400 to attenuator size	no	1		

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
3.8	Transformation piece, galvanised sheet metal, attenuator size to 400x300	no	1		
3.9	Ducting, galvanised sheet metal, 400x300	m	5		
3.10	Fire damper, FD-02 complete with screen on both sides of damper, including galvanised steel wall sleeve, 400x400	no	2		
3.11	Double deflection supply air grille, SAG-1, 350x250 complete with shoe connection piece and obd	no	4		
	<u>Electrical installation</u>				
3.12	Isolator, weather proof, within 1m of fan	no	1		
3.13	Conduit, galvanised Ø25 complete with saddles	m	2		
3.14	Electrical wiring, isolator to fan	m	2,5		
3.15	Isolator within 1m of FD-02	no	2		
3.16	Conduit, galvanised Ø25 complete with saddles - isolator to FD-02	m	2		
3.17	Electrical wiring, isolator to FD-02	m	5		
Total for FAF-S-02 fan system carried forward to summary					
4	<u>EAF-EX-01 fan system</u>				
4.1	Weather louvre, WL-1 galvanised steel with bird mesh screen, 400x400, complete with galvanised steel wall sleeve	no	1		
4.2	Weather louvre, WL-2 galvanised steel with bird mesh screen, 800x400, complete with galvanised steel wall sleeve and flanged connection for fire damper	no	1		
4.3	Fan, EAF-EX-01 complete with mounting brackets	no	1		
4.4	Transformation piece, galvanised sheet metal, Fan discharge to 400x400 weather louvre	no	1		
4.5	Balancing Damper, 400x400	no	1		
4.6	Fire damper, FD-01, 800x400, complete with screen on inside, flanged, with motorised drive to class II	no	1		
	<u>Electrical installation (class II)</u>				
4.7	Isolator, within 1m of equipment (fan and FD-01)	no	2		
4.8	Conduit, galvanised Ø25 complete with saddles	m	4		
4.9	Electrical wiring, isolator to equipment	m	5		
Total for EAF-EX-01 fan system carried forward to summary					
5	<u>EAF-EX-02 fan system</u>				
5.1	Weather louvre, WL-1 galvanised steel with bird mesh screen, 400x400, complete with galvanised steel wall sleeve	no	1		
5.2	Fan, EAF-EX-02 complete with mounting brackets	no	1		
5.3	Transformation piece, galvanised sheet metal, Fan discharge to 400x400 weather louvre	no	1		

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
5.4	Balancing Damper, 400x400	no	1		
	<u>Electrical installation (class II)</u>				
5.5	Isolator, within 1m of equipment	no	1		
5.6	Conduit, galvanised Ø25 complete with saddles	m	2		
5.7	Electrical wiring, isolator to equipment	m	2,5		
Total for EAF-EX-02 fan system carried forward to summary					
6	<u>EAF-EX-03 fan system</u>				
6.1	Weather louvre, WL-1 galvanised steel with bird mesh screen, 400x400, complete with galvanised steel wall sleeve	no	1		
6.2	Weather louvre, WL-2 galvanised steel with bird mesh screen, 800x400, complete with steel wall sleeve and flanged connection for fire damper	no	1		
6.3	Fan, EAF-EX-03 complete with mounting brackets	no	1		
6.4	Transformation piece, galvanised sheet metal, Fan discharge to 400x400 weather louvre	no	1		
6.5	Fire damper, FD-01, 800x400, complete with screen on inside, flanged, with motorised drive to class I	no	1		
6.6	Balancing Damper, 400x400	no	1		
	<u>Electrical installation (Class I)</u>				
6.7	Isolator, within 1m of equipment (fan and FD-01)	no	2		
6.8	Conduit, galvanised Ø25 complete with saddles	m	4		
6.9	Electrical wiring, isolator to equipment	m	5		
Total for EAF-EX-03 fan system carried forward to summary					
7	<u>EAF-EX-04 fan system</u>				
7.1	Weather louvre, WL-1 galvanised steel with bird mesh screen, 400x400, complete with steel wall sleeve	no	1		
7.2	Fan, EAF-EX-04 complete with mounting brackets	no	1		
7.3	Transformation piece, galvanised sheet metal, Fan discharge to 400x400 weather louvre	no	1		
7.4	Balancing Damper, 400x400	no	1		
	<u>Electrical installation (Class I)</u>				
7.4	Isolator, within 1m of equipment	no	1		
7.5	Conduit, galvanised Ø25 complete with saddles	m	2		
7.6	Electrical wiring, isolator to equipment	m	2,5		
Total for EAF-EX-04 fan system carried forward to summary					

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
8	<u>SAF-S-01 Smoke extract fans</u>				
8.1	Removal of entire existing smoke extract system (6 fan installations) and hand over to client	no	1		
8.2	Weather louvre, galvanised steel with bird mesh screen, complete with galvanised steel wall sleeve	no	1		
8.3	Fan, SAF-S-01 complete with mounting brackets	no	1		
8.4	Transformation piece, steel, fan discharge to weather louvre sleeve	no	1		
8.5	Bellmouth inlet, steel with inlet screen	no	1		
	<u>Electrical installation</u>				
8.6	Isolator, within 1m of equipment	no	1		
8.7	Conduit, galvanised Ø25 complete with saddles	m	2		
8.8	Electrical wiring, isolator to equipment	m	2,5		
Total for SAF-S-01 smoke extract fan carried forward to summary					
9	<u>SAF-S-02/03/04/05/06/07/08 Smoke extract fans</u>				
9.1	Weather louvre, galvanised steel with bird mesh screen, complete with steel sleeve sealed against window frames	no	7		
9.2	Fan, SAF-S-02/03/04/05/06/07/08 complete with mounting brackets	no	7		
9.3	Transformation piece, steel, fan discharge to weather louvre sleeve	no	7		
9.4	Bellmouth inlet, steel with inlet screen	no	7		
9.5	Fire/smoke curtain as specified. Item complete	Item	1		
	<u>Electrical installation</u>				
9.6	Isolator, within 1m of equipment	no	1		
9.7	Conduit, galvanised Ø25 complete with saddles	m	2		
9.8	Electrical wiring, isolator to equipment	m	2,5		
Total for SAF-S-02/03/04/05/06/07/08 smoke extract fan carried forward to summary					
	<u>Section 4:</u>				
	<u>Electrical installation</u>				
10	<u>DB-01</u>				
10.1	DB-01, <u>Smoke Fans DB/Control Panel</u> , complete as specified with making off supply power cable and fire detection signal	no	1		
10.2	Cable trays, 200 wide, galvanised, wall mounted with all bends, T-junctions, from DB to fan isolators	m	100		

SARS WAREHOUSE CAPE TOWN

Mechanical hvac installation: boq

Item no.	Description	Unit	Quantity	Rate	Amount
10.3	Power supply cables to smoke extract fans, neatly tied to cable ladder, connected to DB on one side and isolator on other side	m	314		
10.4	Protecting power distribution cables from DB to fan isolators and fan with in-tumescent paint	no	1		
10.5	Power cables to fire / smoke curtain, complete with cable trays and isolator/s	item	1		
10.6	Remote control panel for smoke fans; complete with wiring and cable trays	item	1		
Total for electrical installation, DB-01 Smoke Fans DB/Control Panel carried forward to summary					
11	<u>DB-02</u>				
11.1	DB-02, <u>Fan DB/ Control Panel</u> , complete as specified with making off supply power cable and fire detection signal	no	1		
11.2	Cable trays, 200 wide, galvanised, wall mounted with all bends, T-junctions, from DB to outside wall (running below slab) in hazardous material lobby	m	35		
11.3	Power supply cables to EAF-EX-01/02/03/04; FAF-S-02; FD-02 (two off); FD-01 (two off), neatly tied to cable ladder, connected to DB on one side and isolators on other side, all to the specified insulation class	m	210		
11.4	Protecting power distribution cables from DB to equipment isolators with in-tumescent paint	no	1		
Total for electrical installation, DB-02 Fans DB/Control Panel carried forward to summary					

SARS WAREHOUSE CAPE TOWN
Mechanical hvac installation: Summary boq

Item no.	Description	Unit	Quantity	Rate	Amount
1	Total general technical items carried over from boq				
2	Total for FAF-S-01 fan system carried over from boq				
3	Total for FAF-S-02 fan system carried over from boq				
4	Total for EAF-EX-01 fan system carried over from boq				
5	Total for EAF-EX-02 fan system carried over from boq				
6	Total for EAF-EX-03 fan system carried over from boq				
7	Total for EAF-EX-04 fan system carried over from boq				
8	Total for SAF-S-01 smoke extract fan carried over from boq				
9	Total for SAF-S-02/03/04/05/06/07/08 smoke extract fan carried over from boq				
10	Total for electrical installation DB-01 Smoke Fans DB/Control Panel carried over from boq				
11	Total for electrical installation DB-02 Fans DB/Control Panel carried over from boq				
Total for mechanical hvac installation carried forward to main boq					

SECTION 1: GENERAL**1. GENERAL**

This technical specification shall be read in conjunction with the project drawings.

Conflicts, errors or discrepancies found in this specification or drawings shall be brought to the Engineer's attention for resolution before tender stage.

Any deviations from the specifications, drawings and/or equipment specified shall be listed together with the alternatives offered and shall be submitted as part of the tender. If no deviations are listed, it will be assumed that the Tender comply with all the relevant technical parts of this specification.

All installations shall be complete in all respects and the Contractor shall allow for the completion and successful operation of the complete installation, irrespective of whether every separate item is specified or not.

2. THE SITE

The site is situated in Cape Town.

Tenderers are advised to visit the site and acquaint themselves with the nature and extent of the work involved before submitting their tenders.

3. COMPLETION DATE

The Contractor will be required to keep up with the main contract in accordance with the main Contractor's program and to complete the mechanical installation concurrently with the main contract.

4. PROGRAM

Directly after acceptance of his tender, the Contractor shall submit time schedules for each activity for which he is responsible to the Main Contractor, for the inclusion thereof in the Main Contractor's program.

The following items shall be programmed in consultation with the Main Contractor:

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- Ducting installation
- Piping installation
- Approval of first fix
- Plant equipment installation
- Second fix
- Electrical installation
- Commissioning and testing

- Inspection for practical completion
- Remedial work
- As built information; operating and maintenance manuals

A copy of the program shall be submitted to the Engineer well within time. The program shall be regularly updated and circulated to all affected parties.

5. FINISHING AND TIDYING

In view of the intense concentration of construction activities likely to be experienced during the contract period, progressive and systematic finishing and tidying will form an essential part of this contract. On no account must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of other and in the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant works in the area(s) concerned without prejudicing the rights of others to institute claims against the Contractor on the ground of unnecessary obstruction.

Finishing and tidying must be done on a daily basis and not simply be left to the end of the contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole.

6. SCAFFOLDING, LIFTING AND PLANT EQUIPMENT

All scaffolding, lifting and plant equipment required for the execution of the contract shall be supplied by the Contractor under this contract.

7. SUPERVISORY STAFF

At all times while on the premises, all artisan and labourer members of the mechanical Contractor's and Subcontractor's staff shall wear clothing adequately marked with the relevant Contractor's name.

The work shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trade.

8. QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged and free from rust or other defects. Only material of the best quality, which has been approved by the Engineer, shall be used.

The Contractor shall, upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the material are of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and /or other standards as specified in the technical specifications.

The installation shall be carried out according to the latest modern engineering practices.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Contractor.

9. RATING OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment to be installed under this contract to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer's ratings. Where applicable, the Contractor shall de-rate all equipment for site specific conditions.

10. SPACE REQUIREMENTS AND ACCESS

The Contractor shall ensure that the equipment offered by them can be installed in the available space as shown on the drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Contractor's account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

Tenderers shall also ensure that the equipment offered by them will pass through available building openings. Large equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of equipment or to change the make of equipment in order to allow access shall be for the account of the Contractor.

11. REGULATIONS AND STANDARDS

The equipment, installation, commissioning and maintenance shall in all respects comply with the following regulations:

- a) The Occupational Health and Safety Act, Act No. 85 of 1993.
- b) Local Municipal Regulations, by-laws and Ordinances.
- c) Local Electrical supply authority regulations.
- d) Fire Department Regulations.
- e) Code of Practice for the Wiring of Premises, SANS 10142 as amended.
- f) The Application of the National Building Regulations, SANS 10400.
- g) Standard Specification for Air-Conditioning Ductwork, SANS 1238.
- h) Code of Practice for Refrigeration systems including plants associated with air-conditioning systems, SANS 10147 as amended.
- i) The Installation, Testing and Balancing of Air-conditioning duct work, SANS 10173.
- j) BS EN 12101

All losses, costs or expenditures, which may arise as a result of negligence to comply with any regulation applicable to this contract shall be for the account of the Contractor.

Where trade names and references to catalogues are found in the specification, the intention is to set a particular standard of equipment. Where "other approved" equipment is specified, the Contractor shall obtain written approval from the Engineer before he may deviate from the specified equipment. This approval must be obtained at tender stage.

12. DRAWINGS

The dimensions and positions of equipment shown on the Engineer's drawings are schematic and for tender purposes only. The drawings are not suitable for manufacturing purposes. The responsibility for dimensional and

layout accuracy remains with the Contractor. The following drawings shall be submitted by the Contractor to the Consulting Engineer for approval, within 3 weeks of acceptance of the tender:

1. Builder's work drawings

All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Contractor.

2. Mechanical layout drawings

These are equipment layout drawings required for the manufacture and installation of equipment, showing detailed dimensions.

3. Electrical drawings

These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules.

Any work done by the Contractor without an approved drawing shall be at the Contractor's own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Contractor.

The approval of drawings by the Consulting Engineer shall not relieve the Contractor of his responsibilities to carry out the work in terms of the contract documents.

The mechanical and electrical drawings shall be updated during the contract period and shall be included in the operating manuals at the end of the contract period as "As Built drawings".

13. OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

The Contractor shall submit three copies of operating and maintenance manuals to the Engineer. Manuals shall consist of:

- a) Comprehensive literature of the different components of the installation.
- b) Paper prints of all approved drawings and diagrams where applicable.
- c) Start-up and shutdown procedures.
- d) Commissioning data of all equipment in tabulated form.
- e) Prescriptions for routine tests, which shall be performed by the user together with the time when such tests shall be performed.
- f) Schedule of apparatus and equipment complete with model numbers, optional extras, modifications, electrical requirements, etc.
- g) Detailed monthly, quarterly, bi-annual or annual preventative maintenance procedures where applicable.
- h) Manufacturer's catalogues.
- i) List of spares for all equipment.
- j) Suppliers telephone numbers and addresses.
- k) Wiring diagrams.
- l) Test certificates.

The operating manuals shall be bound in strong hard cover format. Material in the manual shall be clear, legible and well-arranged and provided with an index.

Manuals shall be available three weeks before practical completion of the installation and no handover shall be considered without these manuals.

14. MAINTENANCE AND GUARANTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Contractor is responsible for all material and labour during this period.

The Contractor shall visit the installation on a monthly basis and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within 5 days from the visit.

In case of a breakdown, the Contractor shall react within reasonable time and repair the installation to the satisfaction of the Engineer. Should the Contractor, in the discretion of the Engineer, not react within reasonable time, the Engineer shall commission another Contractor and the cost thereof shall be recovered from the defaulting Contractor.

15. PAYMENT CLAIMS

In addition to the conditions of contract, the Contractor shall attach to his application for payment an explanation of material cost and labour cost. The following information is required with respect to material and labour:

- Estimated percentage delivered/completed at date of the previous claim.
- Estimated percentage delivered/completed at date of current claim.
- Total cost claimed at date of previous claim.

16. PAINTING

Where painting is specified, the following shall apply:

Steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

Galvanized surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use and shall be approved by the Engineer. Equipment shall be painted according to the National colour standards for paint, SANS 1091.

17. PROTECTION OF WORKS

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held responsible for any damage of equipment during transport and installation as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an "as-new" condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged.

18. BUILDING WORK AND REMOVAL OF EQUIPMENT

The following work shall be carried out by the builder/main Contractor.

- a) Drilling and cutting of necessary holes in the concrete, brickwork, ceilings and wooden doors, including making good to match original finish.
- b) Removal and re-installation of suspended or plastered ceilings.
- c) Cutting of ceiling or floor panels for installation of air terminals.
- d) Concrete plinths for installation of equipment.
- e) Waterproofing of roof penetrations and plinths.
- f) Water supply points and drain points for a/c equipment.

Existing HVAC equipment, which has been removed from an existing building, shall be handed over to the Client. Removal and disposal of replaced equipment shall be coordinated by the Consulting Engineer.

19. TESTING

The plant shall be tested and operated to meet the performance figures and duties specified. All safety features and interlocks shall be tested.

Pressure tests for chilled water, condenser water and hot water piping shall be done at a test pressure of 1.5 times the maximum working pressure at the lowest point in the system, but not less than 700 kPa. All instrumentation, which could be damaged during the test, shall be removed from the pipe system.

The system shall be filled with water and all high points shall be vented at least 24 hours before the test. The duration of the pressure test shall be 2 hours, after which no water leaks shall be visible and no pressure drop shall occur after corrections have been made for changes in ambient temperature during the test period.

Pressure tests shall be completed prior to insulating or covering piping. If leaks are found, welded connections shall be cut out and re-welded. Rectified piping shall be retested.

20. COMMISSIONING

The installation shall be commissioned in accordance with the following codes or any other recognised commissioning procedure or code approved by the Consulting Engineer:

- a) Air distribution systems - SANS 10173: Code of Practice for Installation, Testing and Balancing of Air Conditioning Ductwork.
- b) Refrigeration systems - CIBSE Commissioning Code: Code R: Refrigeration systems.
- c) Control systems - CIBSE Commissioning Code: Series C: Automatic Controls.

The Contractor shall submit a commissioning program to the Consulting Engineer at least two weeks prior to the commencement of commissioning and shall at the same time notify the Consulting Engineer of the code or procedure to which the plant will be commissioned.

The results of all checks and measurements shall be recorded in writing during the commissioning period. Commissioning records shall be handed over to the Consulting Engineer prior to the first acceptance of the plant. The commissioning records shall also be included in the operating manuals.

21. TRAINING

The Contractor shall train the Client's site staff after commissioning has been completed. The site staff shall receive enough instructions to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training.

SECTION 2: VENTILATION SYSTEMS**1. SCOPE**

The following installations shall be specified under this section of the technical specification:

- Fresh air supply systems: FAF-S-01; FAF-S-02
- Extract air systems: EAF-EX-01; EAF-EX-02; EAF-EX-03; EAF-EX-04
- Smoke extract fan systems: SAF-S-01; SAF-S-02; SAF-S-03; SAF-S-04; SAF-S-05; SAF-S-06; SAF-S-07; SAF-S-08
- Smoke extract louvres and fire dampers for hazardous material stores

2. DESIGN CRITERIA

DESIGN DATA	
Outdoor summer temperatures	30,6 °C Db/ 19,4 °C Wb
Outdoor winter temperatures	3,3 °C Db/ -0,1 °C Wb
Altitude above sea level	42 m

3. GENERAL

The combination of fan and attenuators shall be such as to satisfy the specified noise levels.

Fans shall be selected to operate at or as near to maximum efficiency as possible.

Attenuators shall be mounted directly onto the fan casing with flexible connections between the ducts and attenuators.

Fans shall be fitted with the manufacturer's nameplates permanently fixed to the casing in a prominent position, clearly indicating manufacturer, model number, size, speed, maximum operating speed, maximum power absorbed and serial number.

Fan air in/outlets not connected to ducting or equipment shall be protected with easy removable safety wire mesh screens.

Indicating arrows for both direction of rotation and direction of airflow shall be provided on fan casings.

All fans shall be installed in accordance with the manufacturer's requirements and recommendations.

All fans shall be mounted on anti-vibration mountings or supported from anti-vibration hangers.

Bearings shall be of the ball or roller type and shall be quiet in operation.

Belt guards shall be arranged to permit lubrication and use of speed counters with the guards in position. Belt guards shall have adequate ventilation for belt cooling.

4. FRESH AIR SUPPLY SYSTEMS

4.1 FANS

The duties of the fans shall be as follows:

Fan reference number	Flow rate in ℓ/s	Static Pressure
FAF-S-01	455 ℓ/s	330 Pa
FAF-S-02	600 ℓ/s	255 Pa

The fans shall be of the Donkin rectangular inline centrifugal type or similar and approved, non-overloading, and directly driven by totally enclosed motors to IP55 or as specified.

Flow and rotation direction arrows on fan casings shall be easily visible from the access positions to the fans.

Motors shall be fitted with thermal overload protection, and have sealed ball or roller bearings, lubricated for life.

Fans shall be installed with suitable sound attenuators to ensure noise levels as specified.

4.2 SHEETMETAL DUCTWORK

Sheetmetal ductwork shall be manufactured in accordance with SANS 1238, and installed, balanced and tested as set out in SANS 10173.

Low velocity, low pressure and medium pressure ductwork shall be manufactured from galvanized sheetmetal and shall be rectangular in cross-section, except where otherwise specified.

The first dimension given on the drawings for rectangular ductwork shall be read as the width on plan and the depth on section, and the second dimension shall be read as the depth on plan and the width on section.

All final dimensions shall be checked on site, or verified by means of architect's working drawings and structural drawings, before the fabrication of the ducting. Air velocities in ducts shall be such as to ensure quiet operation.

Where beams, stanchions or other obstructions interfere with the straight running of ducts, suitable offsets shall be provided or changes in the section of the duct made. Aspect ratios in excess of 3:1 in rectangular ductwork shall be avoided.

Ducting shall be air tight and mechanically strong and sturdy. Long radius elbows shall generally be used and the inner surfaces of ducting shall be smooth.

Adjustable opposed blade dampers, sound attenuators, duct splitters and turning vanes shall be provided where shown on the drawings.

Flexible connections shall be provided between all fans, sound attenuators and ducting. Flexible connections exposed to weather shall be provided with protecting galvanized sheet steel cover strips. Flexible connections shall be made of fireproof fabric, reinforced, air-tight material attached both sides with approved galvanized steel collars or frames.

As an alternative to transverse joints specified in SANS 1238, other flanged joints such as MEZ-flanges will also be considered provided that they meet the SANS requirements. MEZ-flanges or equivalent products shall be manufactured from cold rolled steel and hot-dip galvanized after manufacture.

An approved sealant shall be applied to longitudinal and transverse joints prior to assembly of such joints.

Galvanized ducting shall not be erected using components made of copper or copper alloys, unless the contact surfaces are isolated so that electrolysis cannot occur. Ducting shall always be installed in such a way, that, especially in plant rooms, maximum height between the floor and the underside of ducting is achieved.

The thickness of sheet metal to be used for drive-in slip joints shall be the same as that used for the ducting itself. All sides of ducting shall be cross-broken for stability. All joints, seams, and duct stiffeners shall be supplied and installed according to SANS 1238.

Radiused bends shall be manufactured with a throat radius of equal to or greater than 0,75 times the width of the duct. Where space limitations exist, a minimum radius of 100 mm will be allowed, provided splitters according to SANS 1238 are installed.

Access doors in ducting shall be large enough to allow for the removal of the necessary equipment during maintenance. Access doors shall be hinged with at least two hinges, two latches and one handle.

Overhead hangers for horizontal rectangular ducts shall be of the steel strap (up to 450 mm only) or trapeze type with steel rod supports. Hanger sizes and spacing for horizontal rectangular ductwork shall be as follows:

	Wider side of duct in mm	Hanger steel rod, Ø mm	Steel strap dimension mm	Angle dimension mm	Maximum spacing m
For low pressure ductwork	Up to 450	10	25x2,0	25x25x3	3
	451-800	10	-	25x25x3	3
	801-1600	10	-	40x40x3	2,5
	1601-2000	10	-	50x50x3	2,5
For medium and high pressure ductwork	Up to 450	10	-	40x40x3	3
	451-800	10	-	40x40x4	2,5
	801-1600	10	-	50x50x5	2,5
	1601-2000	10	-	50x50x6	2

Overhead hangers for horizontal circular ducts shall be of the steel strap or band type. Hanger sizes and spacing for horizontal circular ductwork shall be as follows:

Diameter, mm	Hanger steel rod, Ø mm	Steel strap/ band dimensions mm	Maximum spacing			
			Low pressure ductwork		Med. & high pressure ductwork	
			Straight seamed ducts, m	Spiral seamed ducts, m	Straight seamed ducts, m	Spiral seamed ducts, m
Up to 200	10	25x3	2,0	3,0	1,8	3,0
201-450	10	25x3	2,5	3,5	2,5	3,5
451-800	10	25x3	2,5	3,5	2,5	3,5
801-1200	10	25x3	2,5	3,5	2,5	3,5

All hangers shall be treated against rust and painted.

Contractors shall make use of clamped joints where branch ducts, collars or spigots are attached to main ducts.

As an alternative, branches, collars and spigots may be attached to main ducts by means of return flanges with 1,6 mm galvanized sheet metal flanges which have been sealed and clamped by means of pop rivets spaced 150 mm apart. No other method shall be allowed unless approved by the Consulting Engineer.

Un-exposed ducting shall be left unpainted. It shall be ensured that the galvanized surface of the ducting is not damaged or marked in any way. The internal surface of plenums and ducting shall be painted black where necessary, to prevent visibility of the inside surface of the duct or plenum.

4.3 FLEXIBLE DUCTING

Flexible ducting between air terminals, diffusers, etc. and sheetmetal ducting shall be made from polyester/aluminium laminate with a heavy-duty steel helix core, similar to the Europair Euroflex or other approved.

Each flexible duct shall be connected to the air terminal and sheetmetal duct spigot by means of an airtight connection. Metal clamps shall be used for this purpose.

Flexible ducting connected to diffusers or terminals shall not exceed 1 m in length nor have more than the equivalent of one 90° bend. Bends shall be of the maximum possible radius without flattening distorting the flexible ducting. Flexible ducting shall be supported with sufficient and correct brackets that will ensure maintenance of shape.

Flexible ducting shall comply with SANS fire resistance requirements.

4.4 TESTING OF DUCTWORK

The total ductwork installation shall be tested for leakage as per SANS 10173.

Leakage rates in excess of 5% of the required air flow rate in any section of ductwork or in excess of the SANS permissible leakage, whichever is the smaller, will not be accepted.

4.5 GRILLES

Each grille shall be complete with opposed blade damper, plenum box and flexible connection.

Grilles shall be selected in accordance with the manufacturer's recommendations to be capable of passing the specified air quantity without creating excessive resistance, noise or local draughts.

During commissioning of the system, each grille shall be set to deliver the specified air quantity.

It is the Contractor's responsibility to check regenerated noise levels of grilles offered against the overall acoustic performance of the system required. Noisy grilles shall be replaced at the Contractor's account with more suitable types.

Supply air grilles shall be of the aluminium, double deflection blades type, in an epoxy finish with a colour to be approved by the Engineer. The blades and dampers shall be adjustable from the front of the grilles. The grilles shall be complete with opposed blade damper.

Door grilles shall be of the inverted V-blade type, manufactured from natural anodized aluminium and flanged on both sides of the door.

4.6 WEATHER LOUVRES

Weather louvres shall be manufactured of extruded aluminium sections and finished in a colour as approved by the Engineer. Louvres shall be of the AME type or other approved.

Weather louvres shall be constructed with drip edges to blades and rigid frames to enable building in.

Weather louvres shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3 m/s.

Galvanized expanded metal or wire mesh screens with 12 mm opening sizes shall be fitted behind the blades of each weather louver.

Top and bottom blades shall be fitted flush with the frame and smooth without grooves, channels or recess where dirt or water can collect.

The free area through the louver available for airflow shall be a minimum of 65 % of the nominal area of the louver.

FIXING OF WALL MOUNTED GRILLES AND LOUVRES

All wall mounted grilles and louvers shall be fixed to a hard wood frame. The timber frames shall be supplied with the grilles as part of this installation.

The timber frames shall be manufactured in such a way that the grilles fit into them and such that the flanges of the grilles extend past the outer edge of the frames by approximately 5 mm. The timber frames shall be provided with the necessary cleats with which to mount them in brick or concrete walls. The depth of the timber frames shall be similar to the walls in which they are fitted.

The frames shall be supplied to the builder in good time so that they can be built into the walls. Should the Mechanical Contractor fail to do this, the frames shall be let into the walls afterwards and all builder's work, making good and painting shall be for the account of the Mechanical Contractor.

4.7 DISC VALVES

Disc valves shall be supplied and installed where indicated and connected ducts by means of sheet metal spigots and flexible ducting.

The disc valves shall consist of a ring and central disc, which when rotated shall adjust the volume through the outlet. During commissioning of the system, each disc valve shall be set to exhaust the specified air quantity.

Disc valves in ceilings shall be of the polypropylene type, in a finish to match the ceiling colour. The valves shall be of the AME type or other approved.

4.8 VOLUME CONTROL DAMPERS

Volume control dampers shall be installed in branch ducting to ensure a balanced air flow to all duct sections.

Damper blades, links and damper frames shall be of rigid construction and manufactured from galvanized steel. Dampers shall comply with SANS 1238.

Dampers for positive volume control purposes shall be manual or electric actuator driven as specified. Dampers shall be of the Electrovent link or gear type or other approved.

A manually adjustable damper shall be fitted with an external adjusting lever in an accessible position. The lever shall be mounted on a square shaft and fitted with a locking mechanism that clearly indicates the current position of the blade. "Open", "Closed" and "Operating position" shall also be clearly marked on each damper.

The inside cross-sectional area of the damper shall be equal to that of the connecting ductwork, and shall conform to the same standards of airtightness as the rest of the ductwork system. The damper shall be fitted to the ducting in which it is installed by means of a flanged connection.

Dampers creating unacceptable vibrations and noise levels will be rejected and will need to be replaced at the Contractor's expense.

Multi-vane control dampers shall be of the opposed blade type.

4.9 FIRE DAMPERS

Fire dampers shall be of the Electrovent type or other approved and shall be installed where indicated on the drawings.

Fire/smoke control dampers shall comply with SANS 193 as amended, and shall be SABS marked with proven low leakage in the closed position.

Fire dampers shall be flanged both sides, and an access panel shall be provided in ducting at each fire damper, preferably on the upstream side of the damper.

Fire damper markings shall be as follows:

- a) Manufacturer's name or trade name or trade mark.
- b) Fire resistance rating, in hours.
- c) Vital instructions regarding installation, direction of airflow, mounting position.

The open or closed status of the damper shall be clearly indicated outside the casing for inspection purposes.

Fire dampers shall have at least a 2 hour resistance rating when tested in accordance with SANS 193.

Fire dampers shall be actuated by means of a motorised drive (power on: damper closes), when specified. A fusible link shall always be incorporated into the assembly to also provide normal closure in the event of increasing temperature within the duct. Damper drive and electrical connections shall be installed on the outside of the fire proof stores.

All actuators shall be housed within an enclosure. Open electrical connections will not be accepted.

Each fire damper shall be wired to the switchboard with a LED to signal if the damper has been closed. All fire dampers shall be clearly identified on a synoptic drawing at the control board as to indicate the installed position of each fire damper in the controlled area.

Dampers shall be sized so that the nominal free air area when in the open position is not less than the connected duct free air area.

Fire dampers shall be installed according to the manufacturer's and SABS requirements and recommendations. Fire dampers shall be installed as to form part of a continuous barrier to passage of fire when in a closed position. Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between the damper and the wall shall be of at least the same metal thickness and fire rating as the damper casing.

Dampers shall be self-supporting in case of duct destruction due to heat. Care shall be exercised that the supporting frame be installed so that the closing device is accessible.

Sheet metal sleeves shall be provided for housing the fire dampers where fire dampers are mounted in walls. These sleeves shall be built into the walls by the Building Contractor. Retaining angles shall be installed on the four sides

of the fire damper sleeve on both sides of the wall. The angles shall be fastened to the sleeves only, and not to the wall. The retaining angles shall lap the masonry by a minimum of 25 mm around the entire opening. Recommended minimum angle sizes are:

Largest Dimension of Fire Damper	Angles
Up to 1200 mm	38 x 38 x 3,2 mm
1200 mm to 1800 mm	44 x 44 x 3,2 mm
Over 1800 mm	51 x 51 x 4,8 mm

Clearance shall be provided between the sleeve and the masonry opening on the top and at the sides of the fire damper to allow for expansion. Allow a gap of 1 mm for each 100 mm of sleeve width or depth, but the gap shall not exceed 15 mm.

All fixing and installation materials, i.e. bolts and nuts, rawbolts and mortar works shall be as per fire damper manufacturer's specification and shall not affect the fire rating of the fire damper installation. Combustible materials such as plastic or similar rawbolts and plugs are not permitted.

4.10 AIR FILTERS

4.10.1 GENERAL

Air filters of the make, type and size as specified on the drawings shall be installed.

Filters installed close to exposed air inlets, shall be protected by means of weather louvres and wire mesh screen.

Filter holding frames shall be of approved manufacturer with standardized dimensions to enable replacement with equivalent filters of all recognized manufacturers.

Construction and manufacture of all components shall be such that under no circumstances any un-filtered air can by-pass filters or filter banks.

Sufficient space shall be allowed for in front or behind filters, to enable inspection and servicing.

Proper sealed access doors with closed cell rubber gaskets shall be fitted to filter service areas.

4.10.2 FILTER HOLDING FRAMES AND BOXES

Filter holding frames shall be the manufacturer's standard product installed and used in accordance with his recommendations. Frames shall be manufactured from at least 16 gauge galvanised or epoxy powder coated steel.

Holding frames may be bolted or riveted together and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions.

Fasteners shall be of the positive sealing type that clips in, with a minimum of four fasteners per filter. Fasteners shall match the particular filter, filter arrangement and frame.

Filter boxes shall be constructed and installed to ensure no un-filtered air by-pass the filter. Boxes shall be sealed with silicone sealer.

4.11 SOUND ATTENUATORS

This part of the specification shall be read together with section 3: sound control.

All sound attenuators shall be off the Donkin type or other approved. If sizes are not specified, sound attenuators shall be selected to comply with the noise levels as specified in Section 3: Sound Control.

4.12 ELECTRICAL

An electrical supply cable shall be provided by the electrical contractor to the distribution board / control panel to be provided under this contract. The mechanical contractor shall provide, under this contract, the power cables, cable trunking and isolators for the Fan DB/ Control Panel feeding FAF-S-02. Isolators shall be provided within 1m of the fan.

For FAF-S-01 the electrical contractor shall provide an isolator within 1m from the fan mounted on the roof slab. The mechanical contractor shall do the electrical installation from the isolator to the fan.

All switching and safety equipment shall be supplied and installed by the mechanical contractor.

Where applicable, Section 4: Electrical of this technical specification shall also apply to this section of the specification.

4.13 CONTROLS

4.13.1 SYSTEM FAF-S-01

The fan shall be switched on and off by means of a timer situated in the electrical switchboard feeding the fan. The timer shall be of the circuit breaker size type to be mounted next to the circuit breaker feeding the fan. The timer shall be of the electronic 7-day type and shall be fully programmable. The timer shall be supplied by the mechanical contractor to the electrical contractor.

4.13.2 SYSTEM FAF-S-02

The fan shall run continuously. On receiving a fire signal the fans shall switch off. The fire signal will be provided to the Fan DB/ Control Panel by the fire detection system installed by others.

5. EXTRACT AIR SYSTEMS

5.1 FANS

The duties of the fans shall be as follows:

Fan reference number	Flow rate in ℓ/s	Static Pressure
EAF-EX-01	140 ℓ/s	220 Pa
EAF-EX-02	140 ℓ/s	220 Pa
EAF-EX-03	140 ℓ/s	125 Pa
EAF-EX-04	140 ℓ/s	125 Pa

Fans EAF-EX-01 and EAF-EX-02 shall be of the Sodeca CPV-1020-4T ATEX plastic anticorrosive centrifugal type suitable for corrosive and explosive environments. The fans shall be non-overloading, and directly driven by explosion proof motors (Class II), with temperature tolerance class F and IP55 protection class. Fan and motors shall be ATEX certified. Fan speed shall be 1360 rpm. Fan noise levels shall not be more than 58 dBA.

Motors shall be fitted with thermal overload protection, and have sealed ball or roller bearings, lubricated for life.

Fans EAF-EX-03 and EAF-EX-04 shall be of the C-Series C30/4 T ATEX type suitable for explosive environments. The fans shall be non-overloading, and directly driven by explosion proof motors (Class I), with temperature tolerance class F and IP55 protection class. Fan and motors shall be ATEX certified. Fan speed shall be 1400 rpm. Fan noise levels shall not be more than 55 dBA.

Motors shall be fitted with thermal overload protection, and have sealed ball or roller bearings, lubricated for life

Fans shall be mounted on wall mounted brackets which shall be galvanised and painted with a suitable primer and a finishing polyurethane coat.

5.2 TRANSFORMATION PIECES

Transformation pieces shall be manufactured from 1.6mm thick steel and shall be galvanised and painted with a suitable primer and a finishing polyurethane coat.

5.3 WEATHER LOUVRES

Weather louvres shall be galvanised steel finished in a colour as approved by the Engineer.

Weather louvres shall be constructed with drip edges to blades and rigid frames to enable building in.

Weather louvres shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3 m/s.

Galvanized expanded metal or wire mesh screens with 12 mm opening sizes shall be fitted behind the blades of each weather louver.

Top and bottom blades shall be fitted flush with the frame and shall be smooth without grooves, channels or recess where dirt or water can collect.

The free area through the louver available for airflow shall be a minimum of 65 % of the nominal area of the louver.

BUILDING IN OF WEATHER LOUVRES

Weather louvres shall be fixed to a galvanised steel sleeve, built into the wall. The sleeves shall be supplied with the weather louvres as part of the installation.

The sleeves shall be provided with the necessary cleats with which to mount them in brick or concrete walls. The depth of the sleeves shall be similar to the walls in which they are fitted.

The sleeves shall be supplied to the builder in good time so that they can be built into the walls. Should the Mechanical Contractor fail to do this, the sleeves shall be let into the walls afterwards and all builder's work, making good and painting shall be for the account of the Mechanical Contractor.

5.4 VOLUME CONTROL DAMPERS

Volume control dampers shall be installed on the downstream side of each transformation piece to ensure all extract fans deliver the designed air flow rates.

Damper blades, links and damper frames shall be of rigid construction and manufactured from galvanized steel. Dampers shall comply with SANS 1238.

Dampers for positive volume control purposes shall be manual. Dampers shall be of the Electrovent link or gear type or other approved.

A manually adjustable damper shall be fitted with an external adjusting lever in an accessible position. The lever shall be mounted on a square shaft and fitted with a locking mechanism that clearly indicates the current position of the blade. "Open", "Closed" and "Operating position" shall also be clearly marked on each damper.

The inside cross-sectional area of the damper shall be equal to that of the connecting ductwork, and shall conform to the same standards of airtightness as the rest of the ductwork system. The damper shall be fitted to the ducting in which it is installed by means of a flanged connection.

Multi-vane control dampers shall be of the opposed blade type.

5.5 SMOKE EXTRACT LOUVRES

Two smoke extract louvres WL-2 shall be installed in the two hazardous material stores. These louvres shall be galvanised steel weather louvres.

Weather louvres shall be fixed to a galvanised steel sleeve, built into the wall. The sleeves shall be supplied with the weather louvres as part of the installation.

The sleeves shall be provided with the necessary cleats with which to mount them in brick or concrete walls. The depth of the sleeves shall be similar to the walls in which they are fitted.

The sleeves shall be supplied to the builder in good time so that they can be built into the walls. Should the Mechanical Contractor fail to do this, the sleeves shall be let into the walls afterwards and all builder's work, making good and painting shall be for the account of the Mechanical Contractor.

A motorised fire damper shall be fitted to the weather louver installation.

5.6 SMOKE CONTROL DAMPERS

Four fire dampers labelled FD-01 and FD-02 shall be installed where indicated on the drawings. Fire dampers shall be of the Electrovent type or other approved.

Fire/smoke control dampers shall comply with SANS 193 and BS EN 12101.

Fire dampers shall be flanged both sides, with a mesh cover fitted to the open ends of each fire damper.

Fire damper markings shall be as follows:

- a) Manufacturer's name or trade name or trade mark.
- b) Fire resistance rating, in hours.
- c) Vital instructions regarding installation, direction of airflow, mounting position.

The open or closed status of the damper shall be clearly indicated outside the casing for inspection purposes.

Fire dampers shall have at least a 2 hour resistance rating when tested in accordance with SANS 193.

Fire dampers shall be actuated by means of an electrical motor (FD-01: power on, damper opens; FD-02: power on, damper closes).

Each fire damper shall be wired to the Fan DB / Control Panel with a LED to signal if the damper has been opened / closed. All fire dampers shall be clearly identified on a synoptic drawing at the control board as to indicate the installed position of each fire damper in the controlled area.

Fire dampers shall be installed according to the manufacturer's and SABS requirements and recommendations. Fire dampers shall be installed as to form part of a continuous barrier to passage of fire when in a closed position. Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between the damper and the wall shall be of at least the same metal thickness and fire rating as the damper casing.

Dampers shall be self-supporting in case of duct destruction due to heat. Care shall be exercised that the supporting frame be installed so that the closing device is accessible.

Sheet metal sleeves shall be provided for housing the fire dampers where fire dampers are mounted in walls. These sleeves shall be built into the walls by the Building Contractor. Retaining angles shall be installed on the four sides of the fire damper sleeve on both sides of the wall. The angles shall be fastened to the sleeves only, and not to the wall. The retaining angles shall lap the masonry by a minimum of 25 mm around the entire opening. Recommended minimum angle sizes are:

Largest Dimension of Fire Damper	Angles
Up to 1200 mm	38 x 38 x 3,2 mm
1200 mm to 1800 mm	44 x 44 x 3,2 mm
Over 1800 mm	51 x 51 x 4,8 mm

Clearance shall be provided between the sleeve and the masonry opening on the top and at the sides of the fire damper to allow for expansion. Allow a gap of 1 mm for each 100 mm of sleeve width or depth, but the gap shall not exceed 15 mm.

All fixing and installation materials, i.e. bolts and nuts, rawbolts and mortar works shall be as per fire damper manufacturer's specification and shall not affect the fire rating of the fire damper installation. Combustible materials such as plastic or similar rawbolts and plugs are not permitted.

5.7 ELECTRICAL

An electrical supply cable shall be provided by the electrical contractor to the distribution board / control panel to be provided under this contract. The mechanical contractor shall provide, under this contract, the power cables, cable trunking and isolators for the Fan DB/ Control Panel feeding the four extract fans and the fire dampers. Isolators shall be provided within 1m of each fan.

All switching and safety equipment shall be supplied and installed by the mechanical contractor.

Where applicable, Section 4: Electrical of this technical specification shall also apply to this section of the specification.

The extract air systems mounted in the hazardous material storage areas shall be explosion proof as follows:

- EAF-EX-01/02: Class II (Combustible dusts)
- EAF-EX-03/04: Class 1 (Gases, Vapours)

5.8 CONTROLS

The extract fans shall run continuously. On receiving a fire signal from the smoke detection system, the fans shall switch off.

FD-01 shall normally be closed. On receiving a fire signal from the smoke detection system, the fire dampers shall open.

FD-02 shall normally be open. On receiving a fire signal from the smoke detection system, the fire dampers shall close.

6. SMOKE EXTRACT FANS

The smoke extract systems shall comply with SANS 10400-T: 2011 and BS EN 12101.

6.1 FANS

The duties of the fans shall be as follows:

Fan reference number	Flow rate in ℓ/s	Static Pressure
SAF-S-01	5,000 ℓ/s	120 Pa
SAF-S-02	5,000 ℓ/s	120 Pa
SAF-S-03	5,000 ℓ/s	120 Pa
SAF-S-04	5,000 ℓ/s	120 Pa
SAF-S-05	5,000 ℓ/s	120 Pa
SAF-S-06	5,000 ℓ/s	120 Pa
SAF-S-07	5,000 ℓ/s	120 Pa
SAF-S-08	5,000 ℓ/s	120 Pa

Fans SAF-S-01/02/03/04/05/06/07/08 shall be of the Donkin Fumax 710.20.D.4 cased axial type fans or other approved, rated for 2h at 300°C. Fans shall comply with BS EN 12101-3 and shall be supplied with compliance certificates.

6.2 TRANSFORMATION PIECES AND SUPPORT STRUCTURE

Transformation pieces, bell mouth inlet, weather louvre support sleeves shall be manufactured to conform to BS EN 12101.

All parts shall be hard connected with no flexible connections.

The fan installation shall be hung from the roof slab with threaded rods, minimum 12 mm thick.

Under no circumstances shall the fans or any part of the installation be supported by the windows or window frames.

6.3 FIRE / SMOKE CURTAIN

A fire curtain/s shall be installed where indicated on the dwgs. The fire curtain shall be rated for 2h at 300 ° C and shall be rolled/folded up in the closed position. On activation, the curtain shall deploy and shall provide a 3m deep barrier from the roof.

6.4 WEATHER LOUVRES

Weather louvres shall be aluminium, fixed to a steel sleeve / duct piece connected to the fan installation. The sleeves shall be supported on the building brickwork / concrete structure.

Weather louvres shall be constructed with drip edges to blades and rigid frames to enable building in.

Weather louvres shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3 m/s.

Galvanized expanded metal or wire mesh screens with 12 mm opening sizes shall be fitted behind the blades of each weather louver.

Top and bottom blades shall be fitted flush with the frame and smooth without grooves, channels or recess where dirt or water can collect.

The free area through the louver available for airflow shall be a minimum of 65 % of the nominal area of the louver.

6.5 ELECTRICAL

An electrical supply cable shall be provided by the electrical contractor to the smoke fans distribution board / control panel to be provided under this contract. The mechanical contractor shall provide, under this contract, the power cables, cable trunking and isolators for the smoke fan DB/ Control Panel feeding the eight smoke extract fans. Isolators shall be provided within 1m of each fan.

All switching and safety equipment shall be supplied and installed by the mechanical contractor.

Where applicable, Section 4: Electrical of this technical specification shall also apply to this section of the specification.

6.6 CONTROLS

The smoke extract fans shall normally be switched off. On receiving a fire signal from the smoke detection system, an alarm shall sound on the smoke fan control panel and a light shall illuminate indicating a fire condition. Fans shall manually be switched on and off by a push button start / stop.

On receiving the fire signal, the fire curtain/s shall automatically deploy.

SECTION 3: SOUND CONTROL

1. SCOPE

The general sound control for the air conditioning and ventilation installations are specified under this section of the technical specification.

2. GENERAL

The installation shall operate without causing undue noise and vibration. The Contractor shall take the necessary precautions to ensure that noise levels in occupied areas do not exceed the levels as specified below.

Environment	NC level
General offices	35
Private offices, libraries and lecture rooms	30
Cafeterias	40
Equipment rooms	45

Noise generating equipment such as fans, compressors, pumps, motors, etc. shall be selected to operate as close to the point of maximum efficiency as possible.

Where piping and ducting pass through plant room walls or slabs, the opening around the pipe, duct or sound attenuator shall be sealed with high density foam and galvanised flashing on both sides of the wall or slab. Shafts directly connected to plant rooms shall be considered as part of the plant room.

Equipment shall be provided with sound attenuators, enclosures, or sound attenuating cowls in order to meet the minimum sound levels specified below.

Noise levels on the outside of buildings due to air-conditioning and ventilation equipment shall not exceed the following values when measured at a distance of 10 m directly in front of the noise source (cooling tower outside air grille, etc.):

Environment	NC Value
Buildings in residential areas with 24 hour plant operation	25
Buildings in residential areas with 12 hour plant operation	30
Buildings in city centres adjacent to or across roads to flats, hostels, hotels, etc. with 24 hour plant operation	25
Building in city centres adjacent to or across roads to flats, hostels, hotels, etc. with 12 hour plant operation	30
Building in industrial areas with 24 or 12 hour plant operation	35

3. SOUND ATTENUATORS

Sound attenuators shall be provided and installed in positions as indicated on the relevant drawings.

The Contractor shall submit noise-estimating sheets for all systems as well as the insertion loss ratings of sound attenuators for approval before ordering.

Rectangular sound attenuators shall be of the splitter type, like Howden Donkin Series RAS or other approved.

Cylindrical sound attenuators shall be of the acoustic pod type, with length of 1.5 x diameter, like Howden Donkin Series Silax or other approved.

Sound attenuation shall be of the proprietary manufactured type. The sound attenuators shall be manufactured of pre-galvanised mild steel sheet. The acoustic infill material shall be moisture repellent, shall not support combustion and shall be guaranteed against surface erosion up to air velocities of 20 m/s.

Where sound attenuators are larger than the ducts, the joining duct sections shall be enlarged to the size of the attenuator. All sound attenuators shall be provided with flanged connections.

Sound attenuators in plant rooms shall be installed in or as close to the plant room wall as possible to prevent break-in of plant room noise into the duct after the sound attenuator. Where this is not feasible due to space limitations, the duct section between the sound attenuator and plant room wall shall be externally insulated and plastered with a suitable hard setting plaster at least 10 mm thick on all four sides. Where ducting passes through an external noisy area it shall be treated to prevent any noise transmission into the duct.

SECTION 4: ELECTRICAL INSTALLATIONS

1. SCOPE

The general electrical installations and mechanical control panels and distribution boards shall be specified under this section of the project specification.

2. GENERAL

The services of a qualified electrical contractor shall be employed by the mechanical contractor, who shall be responsible for the design engineering, documentation, supply, and installation and commissioning of the electrical installation for the hvac installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of Premises, SANS 0142-1 latest Edition. An electrical certificate of compliance shall be issued under this contract and after completion of the installation.

The electrical contractor shall supply a main supply cable to the position of the HVAC distribution boards. The supply cable shall be connected to the distribution board by the mechanical contractor.

The electricity supply shall be 400/230 V 50 hertz 3 phase plus neutral and all equipment shall be selected to operate at the appropriate 3 phase or single phase voltages.

The mechanical contractor shall supply and install all cables and galvanized cable trays from the DB's to all the equipment.

An electrical point in the form of a surface mounted isolator shall be supplied at each of the pieces of equipment by the mechanical contractor. The feed from the isolators to the units shall run in galvanised conduits, installed by the mechanical contractor, and shall be neatly connected to the units.

3. DISTRIBUTION BOARDS AND CONTROL PANELS

Two Distribution Boards / Control Panels shall be installed under this contract:

- DB-02: Fan DB/ Control Panel: supplying all fans and mechanical equipment in the hazardous material stores
- DB-01: Smoke Fans DB/ Control Panel: supplying all the smoke extract fans

3.1 DESIGN OF DISTRIBUTION BOARDS AND CONTROL PANELS

The DB Board / Control Panel shall be designed and manufactured by a specialist and reputable manufacturer.

Before starting manufacture, the contractor shall submit the following drawings and diagrams for approval by the engineer:

- Layout drawing of the DB's
- Diagrams indicating all electrical equipment to be mounted the DB's and control logic
- Drawing of the front panel of all DB's indicating switches, meters, indication lights, etc

Once the DB's has been manufactured, and before they leave the factory, a full functional test shall be done by the contractor. This test must be witnessed by the engineer.

3.2 GENERAL

Distribution boards and control panels shall be of the wall mounted type, robustly fabricated of mild steel sheet, with fascia plates behind lockable doors. The DB shall be totally enclosed, vermin and insect proof, drip proof, dustproof to class IP 55. The DB's shall be fire proof.

All metalwork shall be suitably treated against corrosion and shall be coated with a self-etching primer, two coats of metal primer, and finished, internally one coat, externally two coats, with a good quality hard gloss enamel of an approved colour.

DB's / control panels shall be complete with main isolator/s that can be operated without opening the doors. Access to equipment and wiring shall not be possible without switching off the main isolator.

Incoming power supply cables shall be provided by others to the DB / control panel, but must be terminated by the mechanical contractor under this contract.

Busbars are to be located in a separate chamber. The busbars shall be of solid copper, rated at 155 amps per square centimetre, and shall be spaced and mounted to withstand the short circuit current, equal to the rating of the main isolator. All busbars and conductors shall be fully insulated in the respective phase colours. Each board is to be provided with neutral and bare earth busbar, with one way for each circuit and for each conductor.

Each control panel shall have red alarm pilot lights to indicate any malfunction or operation of any safety device. Normal running conditions of fans, etc., shall be indicated with green pilot lights. All pilot lights shall have a "lamp test" facility. This can be done either collectively or singly by means of a push button switch.

All exposed equipment and pilot lights are to be clearly labelled by means of plastic engraved labels, mounted on the fascia panels by means of screws or channelling. Each item of equipment in the board is to be labelled to correspond to its reference number on the wiring diagram. All wiring connections to equipment are to carry numbered ferrules corresponding to the connection number on the wiring diagram. All wiring to external equipment is to terminate in a numbered terminal block, to which the external wiring is to be connected. The terminals are to be of suitable rating for each circuit. No deviation from these requirements will be permitted.

The grouping of equipment on panels will be logical and neat and shall be done on the following basis:

- i) main incoming breaker, main metering, and incoming cable access;
- ii) each motor circuit with sub-main breakers, starters, and Contactors;
- iii) plant room auxiliaries and general control circuits.

A wiring diagram of each control panel is to be mounted behind glass in a position adjacent to its respective panel.

3.3 DB-02: FAN DB / CONTROL PANEL

The DB / control panel shall provide power to and control the following equipment:

- Fan FAF-S-02
- Fan EAF-EX-01
- Fan EAF-EX-02
- Fan EAF-EX-03
- Fan EAF-EX-04

- Two of fire dampers FD-02
- Two of Fire dampers FD-01

The Incoming power cable shall be from emergency power and shall be provided by others to the top of the DB. The incoming fire signal shall be provided by others to the top of the DB. The DB shall have three sections:

1. Incoming section

- Main isolator
- Voltmeter with selector switch for different phases
- Ammeter with selector switch for different phases

2. Outgoing section

- Circuit breakers for each piece of equipment

3. Control section

- Green run and red stop indication lights for all fans, individually labelled
- Green indication lights indicating normal position of all fire dampers, individually labelled
- Red indication lights indicating emergency position of all fire dampers, individually labelled
- Emergency stop pushbutton
- Lamp test pushbutton
- Fault Indication lamp and siren. Faults to include all common motor failures and/or any of the mechanical equipment not functioning as intended

Controls shall be as follows:

	Normal Operation	Emergency Operation (on receipt of fire detection signal)
FAF-S-02	running continuously	off
EAF-EX-01	running continuously	off
EAF-EX-02	running continuously	off
EAF-EX-03	running continuously	off
EAF-EX-04	running continuously	off
FD-02	open	closed
FD-01	closed	open

3.4 DB-01: SMOKE FANS DB /CONTROL PANEL

The DB / control panel shall provide power to and control the following equipment:

- Fan SAF-S-01/02/03/04/05/06/07/08
- Fire curtain/s

The Incoming power cable shall be from emergency power and shall be provided by others to the top of the DB. The incoming fire signal shall be provided by others to the top of the DB. The DB shall have three sections:

4. Incoming section

- Main isolator
- Voltmeter with selector switch for different phases
- Ammeter with selector switch for different phases

5. Outgoing section

- Circuit breakers for each fan
- Circuit breaker for fire curtain/s
- Fan start delay timers to ensure fans do not start simultaneously.

6. Control section

- Individual START / STOP pushbuttons for each fan
- Red light indicating a fire condition, labelled
- Green fan running indication lights, individually labelled
- Red fan fault indication lights, individually labelled
- Green light indicating fire curtain deployed, labelled
- Emergency stop pushbutton
- Lamp test pushbutton
- General fault Indication lamp. Faults to include all common motor failures and/or any of the mechanical equipment not functioning as intended

Controls shall be as follows:

	Normal Operation	Emergency Operation (on receipt of fire detection signal)
SAF-S-01/02/03/04/05/06/07/08	Fans off	Light illuminating, indicating fire condition; fans manually switched on/off
Fire / smoke curtain	Curtain rolled / folded up	Automatically deploy

The DB shall be installed where indicated on the drawings with a remote control which shall be installed behind the reception desk.

4. MOTORS

Motors shall comply with BS.2613: 1957 and dimensioned to B.S.S. 2960 as amended and be suitable for 380/220 volt, 3 phase, 50 cycle A.C. supply, unless otherwise specified and shall be continuously rated for operation at the required attitude, and ambient conditions.

The motors shall be suitably insulated to a minimum of class E, the speed not to exceed 1 500 r.p.m. and should suit the speed of the plant offered.

The motors shall be of the approved squirrel cage type with a low starting current.

Frames shall generally be of the standard protected type, but in dirty and damp installations they shall be totally enclosed, fan cooled. Where operating in moist air conditions, motor windings shall be specially treated.

The motors shall be protected against overheating by three temperature sensing devices incorporated in the stator windings. The devices shall be connected and wired in such a manner that the power supply to the motor will be interrupted when the temperature in the windings exceeds the manufacturers rating.

Motors shall be able to start satisfactorily at a voltage of 10 % below nominal voltage, as measured immediately after the starter is switched on. Motors shall be run up to full speed in the time given in Appendix E of B.S.S. 587 : 1957 with the voltage reduced by 10 % as above. Acceleration shall be smooth throughout the starting period with no signs of hesitation or "crawling".

Motors shall have a rated brake horse power at least 15 per cent in excess of the maximum horse power required to drive the unit when working under normal maximum load.

The motors shall be provided with approved watertight cable glands to accommodate the cables to be supplied with the equipment.

On completion at the manufacturer's works all motors shall be subjected to routine and type tests in accordance with B.S. 2613: 1957, and test certificates shall be submitted for approval before delivery to site is undertaken.

Tenderers shall supply wiring diagrams and efficiency, power factor and starting current curves of the motors at the time of tendering.

Where any motor is remote from, or obscured from view, from the DB, a separate isolator shall be provided for it. In the case of equipment, which is located out of doors, weatherproof lockable isolators are to be supplied. Alternatively lockable type isolators shall be provided at the DB.

5. STARTERS

The starters or switches for starting the electric motors shall be so designed to limit the amount of current when starting and accelerating to the current values set out below:

1,5 kW to 3,7 kW: four times full load current

4,5 kW to 11,0 kW: twice full load current

11,5 kW to 18,5 kW :one and three quarters full load current

over 18,6 kW: one and a half times full load current

Starters are to be of the same manufacture.

Starters are to be of the magnetically operated type, preferably with thermal overload protection in each phase. For motors above 37 kW thermal overloads are to be of the bi-metal indirectly heated type. Either type of starter is to be such that with correct overload settings, the starter will trip within 45 seconds when the motor is single phasing. Where this latter requirement cannot be met, separate single phasing preventers are to be fitted on all 3 phase motors.

On starters for motors above 75 kW, protective relays shall be installed for overload, under and over-voltage, negative phase current, phase imbalance etc.

After commissioning, the full load current of each circuit is to be measured and the overloads set to suit this loading.

All starters are to be suitable for a minimum of 15 operations per hour.

All starters are to incorporate at least two auxiliary contacts that can be arranged as either normally open or closed and shall be suitable for adding further contacts if required.

They shall be suitable for both local and automatic operation.

In the case of star delta or reversing starters, only units comprising both electrical and mechanical interlocks will be accepted.

Where starting resistors are used these shall be mounted above or remote from the control panel, or starter enclosure in the case of large drives, to allow for adequate heat dissipation. The resistance banks shall be protected against overheating by thermal sensors.

The starters shall be automatic and shall have "start" and "stop" push buttons and shall be provided with reset buttons for the overload and over temperature trips.

The starters shall be fitted with approved terminal boxes and glands of ample dimensions to suit the cables to be supplied with this equipment. Provisions shall be made for easy access by means of doors to the starters for maintenance purposes.

An approved earth terminal shall be provided on the frame of each starter housing gear and provision shall be made for earthing each starter in accordance with the requirements of local regulations.

On completion at the manufacturer's works, the starters shall be subjected to the routine and type tests in accordance with clause 83-93 of B.S. 587: 1957 and test certificates should be submitted for approval before delivery to site is undertaken.

6. CONTACTORS

All contactors shall be of highest quality and shall have easily removable contact and coils, such as Sprecher Shuh, Cutler Hammer or other approved.

All contactors shall have adequately rated contacts and continuously rated coils with a drop-off value of not more than 80 % of rated voltage.

7. SWITCHGEAR

All switchgear shall be rated for the anticipated load and the maximum rupturing capacity of the particular system.

i) Main isolators

All control panels shall be provided with a suitably rated Main Isolator, which is to be of the "on-load" type, and can be operated without opening the door. This isolator shall be mechanically interlocked so that no live components are exposed without the isolator being in the off position.

ii) Miniature and moulded case circuit breakers

Heinemann circuit breakers to SANS 156 shall be used with magnetic inverse time overcurrent tripping and in addition with magnetic instantaneous tripping on excessive overcurrent or short circuit, of 250 volt rating for single and double pole and 380 volt rating for three pole, and shall be of the ampere rating and class of breaking capacity specified or shown on drawings. Where not otherwise specified or shown on drawings the breaking capacity shall be class C.

iii) Miniature isolators

Miniature isolators shall be micro-gap type manually operated air break switches suitable for flush mounting and shall be to SANS 60947. Where individually mounted they shall be in galvanised steel boxes with brass dished cover plates finished to match switch cover plates.

iv) Fused switches

The fuse-switch units shall be of the three phase and neutral arrangement having double break moving contacts supporting H.R.C. fuses, all housed in a robust metal toggle mechanism. Interlocks shall be provided to ensure that the cover cannot be opened when the switch is in the closed position.

The fuses shall be of the H.R.C. type and shall comply fully with B.S. 88/1947 category of duty A.C. 4.

One set of spare fuses of each rating used in the switchboards shall be supplied and handed to the representative at the site.

8. METERING AND INDICATION EQUIPMENT**i) kWh Meters**

The meters shall be individually tested and shall comply with SANS 1607.

The scale shall be of the cyclometer type and definition down on 1/10 th of a unit shall be provided for.

ii) Maximum demand ammeters

Moving iron ammeters suitable for 5 Amp secondary current transformers shall be used.

Ammeters shall indicate the instantaneous current and have a separate indication for a 15 minute average value, preferably of bi-metal element type.

The scale shall be clearly calibrated in black on a white background and both instantaneous and maximum demand readings shall be on concentric scales by means of different coloured pointers.

Meters shall be over-scaled with a suppressed over range corresponding to the starting current and where current transformers are used, the ratio of such transformers shall preferably be indicated on the ammeter fascia.

iii) Voltmeters

The instrument shall be a moving iron type, suitable for horizontal as well as vertical flush mounting.

The scale shall be clearly calibrated in black on a white background.

Calibration shall be up to 120 % of rated voltage and a suppressed scale at the zero reading shall be preferable.

The instrument shall comply with B.S.S. 89 of 1964 and shall have an Industrial Grade accuracy.

iv) Voltmeter switches

Voltmeter switches shall have one "off" and six measuring positions and shall be suitable for panel mounting in such a way that only the handle and labelling plate extends to the front of the panel.

The fascia inscriptions on the labelling plate shall be clearly marked.

The switch terminals shall be suitable for lug connections and shall be clearly marked.

The contact movement shall have a rolling or wiping action.

The voltage rating shall be suited to the installation.

v) Voltmeter fuses

The fuse base shall have a voltage rating suited to the particular installation and shall be suitable for either flush or projection mounting.

Cartridge type fuses shall be used with a nominal rating of 2 amp at 380 Volts 50 Hz and a rupturing capacity of 20 000 amps.

vi) Current transformers

Current transformers shall be of the cooled type and shall have mounting facilities.

Split core current transformers shall not be acceptable.

Current transformers shall comply with BS 3938 and IEC 185 with an accuracy of 50 for indicating instruments, and for measuring instrument up to 200 amp 1.0, 250 - 600 amp 0,5 and 800 amp and above 0,2.

Transformation ratios, primary and secondary terminals and polarity of windings shall be clearly marked.

9. CABLE

Electrical cables shall be polyvinyl chloride (PVC) insulated steel wire armoured to SABS 150 - 1957.

Cables shall be continuous and not joined between the DB's and equipment isolators.

Electrical cables from DB-01 and DB-02 to all equipment shall be of the Aberdare Fyrgard type or other similar and approved fire retardant cables suitable for the application.

In addition to the above, electrical cables shall be painted with in-tumescant paint.

10. EARTHING

All motors, starters, switchboards and cable armouring are to be connected to earth by means of separate PVC covered stranded copper conductor the same size as the cable conductors, run alongside cables and strapped thereto. Earthing conductors shall be fitted with sweated lugs at ends and are to be solidly bonded to each other, to the electrical plant and equipment and to earth.

The Contractor shall provide and install a suitable earth mat which must be connected to the switchboard and shall be responsible for the supply of all material for earthing the electrical gear to be supplied and installed under this contract.

11. RADIO AND TV INTERFERENCE

The electrical installation shall comply with Government and Local Government Laws and Regulations in respect of radio and television interference suppression. Interference suppression components shall not be used in any part of the circuit in such a way that their failure might cause an unsafe condition.

12. EARTH LEAKAGE PROTECTION

Earth leakage protection shall be provided and shall comply with the relevant SANS specifications.

13. TESTING

The following tests will be carried out on the installation in the presence of the Engineer or his representative.

- i) insulation resistance test using 500 volt insulation tester (megohmmeter);
- ii) earth continuity test;
- iii) test for correct direction applied to every motor;
- iv) earth resistance test;
- v) prove the correct connection and rotation of any energy meters;
- vi) settings of all overload and other adjustable protective devices shall be set to the requirements of the equipment.

14. DRAWINGS AND INSTRUCTION BOOKS

The Contractor shall supply the following information:

- i) plant room layout drawings showing the main items of equipment as well as all cable and wiring runs;
- ii) switchboard and control board outline and equipment layout drawings and details of manufacturing;
- iii) single line and wiring diagrams detailing all control, metering and indication circuits;
- iv) instruction and maintenance books for all major items or equipment.

C4.3

Fire Protection Installation Bills of Quantities and Specifications

**TENDER DOCUMENT
FOR
SOUTH AFRICAN REVENUE
SERVICES
WAREHOUSE UPGRADE
FORESHORE, CAPE TOWN**

***PART C4.3
FIRE PROTECTION
INSTALLATION***

September 2015

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PART A

GENERAL SPECIFICATION

SECTION 1

PRELIMINARY AND GENERAL INFORMATION

1. **PREAMBLE**

This Part of the Specification deals with general requirements to be met and standards for plant and workmanship which shall be observed in the execution of the Contract covered by this Specification. "Plant" is defined as machinery, apparatus, materials, articles and things of all kinds to be provided under the Contract other than Constructional Plant.

This Specification is indexed at the beginning hereof. Pages are numbered and Tenderers must check that all pages are included. In the event of any material omission, discrepancy, or otherwise occurring, the attention of the Engineer must be directed thereto at the time of tendering. If this is not done, it will be taken that the Tenderer is in possession of a complete copy and is aware of the contents thereof.

When the requirements of this Part are at variance with any detailed requirement of any other Part hereof or the Drawings, such detailed requirements shall take precedence. All items of plant which are specified in this Specification or by nature of the installation are required, shall comply with this Part, unless stated otherwise elsewhere in this Specification. In the event of ambiguity the Engineer shall be asked for his clarification prior to submission of the Tender.

Any reference herein to "elsewhere in this Specification" shall be deemed to mean in any of the other Parts of this Specification or on the Drawings.

This Specification covers major items required for this installation but shall not limit the Sub-Contractor's responsibility to provide everything necessary to complete the Contract. The works shall be carried out with best quality items of plant and to a high class of workmanship. All items of plant shall be the best of their respective kinds, and the Sub-Contractor shall, upon request of the Engineer, furnish him with proof to his satisfaction that they so comply.

This Specification and accompanying Drawings are copyright and are the property of the Engineer and must be returned to him whether a bona-fide tender is submitted or not.

2. **ALTERNATIVE OFFERS**

Tenderers are recommended to tender in accordance with the Specification.

While Tenderers may offer alternative materials, makes of equipment, construction techniques, etc. which they believe will be advantageous, it is to be clearly understood that the main tender is to be in full compliance with this Specification. The total tender price entered on the Form of Tender, all prices entered in any Schedule of Quantities and the prices detailed in the Price Summary, must reflect the price to provide the plant and everything which is or may be necessary for the completion of the Works in complete accordance with this Specification, irrespective of any alternatives that may be offered.

Where alternative offers are submitted, these shall comply in principle with all requirements of this Specification. Tenderers should note that should any accepted alternative subsequently be found not to meet this condition, the Contractor will be liable for all costs incurred in making the necessary alterations.

Should tenderers wish to offer alternative makes and types of equipment to those specified herein, the alternatives are to be listed separately in detail, complete with make, type No., price etc.: in the Schedule of Departures from the Technical Specification. In cases where a Schedule of Quantities is applicable, the alternative price for each noted item must be submitted.

The Engineer shall have the right to accept any or all of the alternative offers as he thinks appropriate and must give his written acceptance of these prior to orders being placed.

Failure to comply with the foregoing may result in the Sub-Contractor being compelled to meet the requirements of this Specification in full at the tendered price.

3. **SCHEDULES TO BE COMPLETED**

The Tenderer shall, unless relief is given elsewhere in this Specification, complete the Schedules of Sub-Contractors, Previous Contracts and Qualifications in Part C hereof and the Schedule of Particulars, Schedule of Quantities or of Price Variations, Schedule of Departures from the Technical Specification and the Price Summary, elsewhere herein. The tender will be considered incomplete and therefore may be disqualified if all of this information is not submitted with the tender.

4. **SPARE PARTS**

Tenderers shall state in the Schedule of Particulars the names of the accredited South African Agents from whom spare parts for all items of plant offered are obtainable and the nearest Centre to the Works at which such spare parts are available. Submission of a tender will be construed as confirmation that spare parts for all equipment offered are readily available, and the Sub-Contractor will be held responsible for any costs involved if this should prove to be otherwise.

5. **DELIVERY TIMES OF MANUFACTURED ITEMS**

The Tenderer shall, if required in the Schedule of Particulars, Part C, Section Three. hereof, state the times quoted by the Suppliers for both dispatch and delivery of major items of plant likely to contribute to an extension of the time for completion.

The Sub-Contractor shall, during the continuance of the Contract, keep the Engineer well and sufficiently informed regarding the placing of all orders for materials and the progress of manufacture of any plant so as to ensure that no extension of the time for completion may be occasioned because of non-delivery of plant within the time specified for delivery of same. A delivery status report on each major item of plant shall be submitted by the 7th of every second month.

6. **PACKING AND DELIVERY**

Plant shall be carefully packed and protected to avoid mechanical or other damage during transport and off-loading. The Sub-Contractor will be held responsible for any damage occurring prior to its acceptance in writing by the Employer.

Every item of plant is to be clearly labelled with its description and with the Contract number.

All consignments shall be addressed to the Sub-Contractor on Site and he shall make prior arrangements for receipt and storage upon arrival. The Employer will not accept delivery of items of plant for the Sub-Contractor unless the Sub-Contractor has made prior arrangements to this effect with the Employer. The Sub-Contractor will be required to make all arrangements for off-loading since no equipment for this will be available on Site unless specifically stated to the contrary elsewhere herein.

7. **LAYOUT OF INSTALLATION**

The layouts shown on the Engineer's Drawings shall be strictly adhered to in principle, only alterations to suit specific plant being provided being acceptable. The Engineer's Drawings show general arrangements of layout but the Sub-Contractor is required to prepare detailed Drawings of pipework, fabricated plant, machine and plant rooms, ductwork, switchboards, transformers, sub-stations, etc. The position of services detailed by the Engineer shall not be altered.

All architectural and structural dimensions shown on the drawings are approximate and must be verified by the Sub-Contractor on Site. All measurements specially marked on the drawings in connection with engineering services shall be strictly adhered to.

If Tenderers require alterations to structure these must be described at the time of tendering. Minor structural alterations which might facilitate the work can be arranged with the Engineer and/or Architect as the work progresses, but no claims will be entertained for alteration of any part of the Works constructed before the necessary dimensions and details have been verified.

Before work on any particular section is commenced, the position of all control equipment and plant shall be approved by the Engineer.

8. **DRAWINGS, CERTIFICATES AND OPERATING INSTRUCTIONS**

8.1 Tenderers shall submit with their tender, outline drawings and pamphlets showing principal dimensions of the plant offered together with a general description of its operation.

8.2 The Sub-Contractor shall within one month of the Contract being let, submit duplicate copies of his detailed drawings to the Engineer for approval. A further two copies of the finally approved drawings shall subsequently be supplied to the Engineer. The following drawings shall be submitted, as appropriate:

General arrangement details of all items of plant.

Schematic and wiring diagrams of all switchboards and control systems.

Detailed layout drawings of all pipework, ducting, cable racking etc.

Detailed layouts, sections and elevations of all plant rooms.

Rating plate details of all plant including inter alia- max.: kW rating, speed, temperature limitations, no-load voltage, full load current, percentage impedance, etc.

Cable termination arrangements of all transformers, motors etc.:

Detailed drawings of all plinths, foundations or bases.

Failure to comply with this requirement may result in the Engineer instructing the Sub-Contractor to place the order for the specific item of plant with another Manufacturer. Where failure of the Sub-Contractor to ensure that the proposed Manufacturer complies with this requirement necessitates the above action being taken, no increase in price will be considered.

8.3 The Sub-Contractor shall, within one month of the Contract being let, or earlier if so required, submit triplicate copies of type test certificates issued by an approved testing

station in respect of all items of plant for which such certificates are required by the Engineer.

8.4 After completion of manufacture, all test certificates called for in Parts 4 and/or 5 hereof shall be provided in duplicate.

8.5 Prior to the issue of the Taking-over Certificate the following documents shall be provided, as appropriate, in duplicate, bound in a durable folder bearing the contract title and number:

Test certificates relating to tests done after completion of the installation as called for in Parts 4 and/or 5 hereof.

Catalogue extracts of all major items of plant with performance curves marked to show operating duties.

List of spare part numbers and local Agents for these parts.

"As built" drawings, including layouts, sections, wiring and control diagrams and plant schematic diagrams. These are to show in detail the positions of poles, stays, cables, joints, sleeves, ducts, heating and cooling coils, dampers, pipes, control and regulating valves, air release valves, expansion joints, fixed equipment and all other pertinent items of plant. In the case of buried services, the route of such services and location of all cables, pipes, joints, valves, tees, access manholes, etc. are to be dimensioned relative to permanent and fixed objects. These drawings must depict the complete installation as finally commissioned.

Detailed instruction manual covering the operation, maintenance and servicing of each item of major plant provided under this Contract and, where the complete plant has been supplied under this Contract, the operation of the plant as a whole.

In addition, one complete set of Engineer's Drawings clearly marked up to indicate all alterations made to the original drawings must be provided.

The Sub-Contractor shall note that the Taking-over Certificate will not be issued until the above has been complied with.

9. **STANDARDS AND CODES OF PRACTICE**

The installation shall comply with the following, and all amendments thereto, as appropriate:-

SANS 10142 Code of Practice for the Wiring of Premises, as appropriate (referred to herein as the Wiring Regulations).

The Occupational Health and Safety Act and Regulations. (OHS Act 1993)

The Post Office Act.

The Local Authorities : Standard Electricity Supply By-Law and appropriate Additional By-Law or Regulations.

Any further Specification, Regulation or Code of Practice stated elsewhere in this Specification.

All items of plant supplied and/or installed, whether expressly specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate South African Bureau of Standards Specifications and addenda thereto, or, if no such Specification exists covering any one or more of these requirements, with the relevant requirements of the appropriate British Standard Specifications and addenda thereto, except where elsewhere required by this Specification or approved by the Engineer. Where the South African Bureau of Standards has issued a licence for the use of its Mark on products complying with any of its Specifications, only such products which carry the Mark shall be supplied.

Preference will be given to plant manufactured in South Africa.

10. **WORKMANSHIP**

All work shall be carried out by qualified artisans or registered apprentices or, only where appropriate, labourers, under the constant supervision of a qualified artisan. At no stage during the construction programme shall any work be carried out without a qualified artisan being on site. If the Sub-Contractor fails to comply with this requirement, the Engineer has the right to authorise the expulsion of the Sub-Contractor. All costs incurred in so doing shall be to the expense of the Sub-Contractor.

11. **CO-ORDINATION OF SERVICES ON SITE**

The Sub-Contractor will be required to work in close co-operation with the Principal Contractor and Specialist Sub-Contractors to ensure that no conflict arises between the various services, and to plan the progress of the various aspects of his work. It is imperative that such close liaison continues throughout the duration of the Principal Contract.

12. **INTERRUPTION OF EXISTING SERVICES**

No interruption of existing services will be permitted without the express permission of the Employer or his representative given as a result of written notification by the Sub-Contractor of the date, time and duration of such interruption. Any costs arising from the interruption of any service without such permission shall be for the Sub-Contractor's account.

13. **BUILDER'S WORK**

All builder's work as detailed in other Parts of this Specification has been allowed for in the Principal Contract. The onus shall be on the Sub-Contractor to ensure that all work carried out by the Principal Contractor in this respect, is to his satisfaction.

The Sub-Contractor shall notify the Principal Contractor at a minimum of five working days prior to building work being commenced of the positions where holes, cuts and recesses will be required and shall ensure that each is correctly located and that heavy-gauge draw-wires are supplied and installed in all sleeves.

14. **APPROVAL OF DRAWINGS**

All Drawings, circuit or schematic diagrams prepared by or on behalf of the Sub-Contractor for submission to the Engineer in terms of the requirements of this Specification shall have been thoroughly checked, corrected where necessary and signed as approved by the Sub-Contractor, prior to such submission.

15. **VALUE ADDED TAX**

The attention of Tenderers is drawn to the Value Added Tax Act (Act 89 of 1991) and any amendments thereto. All tenders submitted shall indicate the net tender price, the amount of VAT and the gross tender price carried to the Form of Tender as provided for in the Price Summary. The amount stated in the Form of Tender will be taken as being inclusive of any tax due in terms of the said Act and no claims whatsoever in this respect will be considered.

The amount of VAT on the total contract value shall be inserted in the Form of Tender.

16. **VARIATION ORDERS**

The Sub-Contractor shall note that all variation orders issued to him must be fully priced and returned to the Engineer within one week of the date of issue indicated on the variation orders.

Should this requirement not be complied with, and no correspondence is received by the Engineer within the specified time-period giving good and fair reason why the Sub-Contractor has failed to submit fully priced variation orders, the Engineer will price the variation orders without reference to the Sub-Contractor and the price thus calculated will be taken as final and no further correspondence will be entered into.

17. **PRIME COST, PROVISIONAL AND CONTINGENCY SUMS**

All sums set out in the Sub-Contract which shall be stated to be Prime Cost (PC) items, Provisional, or Contingencies, shall be used only at the direction and discretion of the Engineer, and if not used either wholly or in part by the Employer or separate Contract with others, who shall not be Sub-Contractors, the said sums shall then not form part of the Principal Contract.

18. **OPERATING, MAINTENANCE AND SERVICING PROCEDURES**

The Sub-Contractor shall instruct the Employer's appointed Representative in routine operating, maintenance and servicing procedures of all items of plant supplied under this Sub-Contract, and shall ensure that he fully understands the documents provided in terms of Clause 8.5 hereof.

19. **MAINTENANCE**

During the latent defects Liability period after Completion the Sub-Contractor shall, if required by Part Five Section A hereof, carry out full maintenance operations specifically recommended by the Suppliers of any item of plant used in the Sub-Contract Works to maintain it in full and correct operation. Such maintenance shall include all attention necessary to comply with the Suppliers' recommendations and shall include the provision of all necessary consumable items. The Sub-Contractor will also be required to make any adjustments necessary during this period to ensure the satisfactory operation of the plant.

On completion of each such maintenance visit the Sub-Contractor shall submit to the Engineer a schedule detailing the work done, which schedule shall have been countersigned by the Employer's representative, whereupon a certificate will be issued for moneys due, in respect of the particular maintenance service, as included in the original Tender Price.

Allowance for all costs in relation to the above must be made in the Tender Price. It shall be noted that the Employer reserves the right to omit partly or wholly the prices submitted for the maintenance of the Sub-Contract Works, should the installation not be adequately maintained within the stipulated maintenance period.

Mutually agreeable conditions will be negotiated by the Engineer with the Sub-Contractor should the Sub-Contract Works not be put into operation immediately on issue of the Certificate signifying completion.

20. SAFETY

In terms of the Occupational Health and Safety Act Construction Regulations, the Principal Contractor is to provide a Health and Safety Plan for this particular project. The Subcontractor shall also be required to provide a Health and Safety Plan in respect of the ventilation installation. The safety plan shall include all safety issues including the following:

- Due care shall be taken to ensure the safety of personnel when installation work is to be carried out at roof-level or high level, and adequate fall-protection should be implemented.

SECTION C4.3

PART A

GENERAL SPECIFICATION

SECTION 2

STANDARD SPECIFICATION FOR ELECTRICAL WORK

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STANDARD SPECIFICATION FOR ELECTRICAL WORK**CARRIED OUT IN CONNECTION WITH MECHANICAL INSTALLATIONS****1 GENERAL**

This Specification deals with general requirements for materials and standards of workmanship to be observed for electrical work carried out under this contract and forms an integral part of the Particular Specification for this service.

All equipment and materials required for the installation shall comply with this Specification unless specifically stated elsewhere in the Particular Specification.

Although certain items may not have been specified herein the Tenderer shall provide everything which is or may be necessary for the completion and successful operation of a first-class installation.

2 EQUIPMENT AND MATERIALS

All equipment and materials shall comply with the appropriate current SABS, IEC or BS Specifications.

Where equipment complies with a SABS Specification it shall bear the SABS mark.

Preference will be given to equipment and materials manufactured in South Africa.

3 CODES OF PRACTICE

The installation shall comply with the following, as appropriate:-

- SANS 10142 Code of Practice for the Wiring of premises as amended.
- The Occupational Health and Safety Act, Act No 85 of 1993 as amended.
- The Mines and Works Regulations, Government Notice No R 1609 of 1962 as amended.
- The Local Authority's Electricity Supply By-Laws and any additional Guidelines for Electrical Installations.
- The Local Fire Regulations.
- The Regulations of the Post Office.
- This Standard Specification.
- The Particular Specification and Drawings.

In the case of any query arising as to the interpretation of any Regulation, the Engineer's advice should be sought.

4 ELECTRICAL SUPPLY

Full details of the electrical power supply relating to voltage, fault levels, etc. are given in the Particular Specification and the Tenderer must ensure that all equipment offered is suitable for these conditions as applicable.

5 SWITCHBOARDS, CONTROL PANELS AND MIMIC AND INDICATOR PANELS

5.1 General

Switchboards and panels shall be of the flush fronted type suitable for wall or floor mounting as applicable and shall be arranged for front access unless otherwise indicated. Generally, panels for indoor applications shall be of the sheet steel type whilst outdoor weatherproof panels may be hot dip galvanised or be constructed of 3CR12 steel, stainless steel, UV stabilised polycarbonate, fibreglass, etc. The type of material preferred for panels required under this contract is detailed in the Particular Specification.

All structural elements of switchboards and motor control panels shall be of minimum 2,0mm thick material. Non-structural elements shall be of 1,6mm thick material. Minor bonding trays shall be of 1,2mm thick material and all bonding trays shall be galvanised.

The use of self-tapping screws will not be permitted in the construction of boards and panels.

Full details of the panels offered must be submitted with the tender.

5.2 Size

The boards shall be of sufficient size to accommodate all the equipment specified as well as space for future equipment if indicated in the Particular Specification and/or on the drawings.

Where external dimensions are specified these shall be strictly adhered to. Should difficulties arise in the setting out of equipment in the boards due to restricting the external dimensions, this should be brought to the Engineer's attention prior to the manufacture of the boards.

Consideration must be given to the overall dimensions and mass of boards, with particular reference to space available, transportation and for manoeuvring into position on site. Where appropriate, boards shall be manufactured in modular sections which are bolted together at wiring stage, separated for transportation, and reassembled at site. Removable lifting eyes shall be fitted to each panel section for ease of handling.

No board shall exceed 2,3m in height nor shall any operating handle, button or switch be mounted higher than 2,0m.

With the exception of earth bars cable glands and cable termination plates, no part of any equipment shall be mounted closer than 300mm to the floor.

Where "external" panels are fitted with hinged doors, nylon restraining stays shall be provided on each door to prevent damage by the wind, together with hooks, or similar devices, to retain each door in its open position.

5.3 Equipment Panels

All equipment shall be mounted behind hinged or removable panels or fascia plates with only the operating handles, push buttons, pilot lights, etc. protruding.

Removable panels and fascia plates shall be fixed by means of locating pins below and chrome-on-brass knurled or coin slot captive screws above. Alternatively triangular or square key latches may be used. The use of studs with loose dome head nuts and washers for fixing of panels and fascia plates will not be accepted.

Control equipment shall be mounted in the upper section of the board in a separate panel, hinged on one side and fitted with captive screws, on the other side, to permit easy access to terminals, etc., at the rear of the panel.

Low voltage AC or DC, equipment must either be mounted in a separate panel or be shrouded by means of internal metal barriers.

5.4 Dust, Damp and Vermin Proofing

The edges of all doors, where fitted, and hinged and removable panels shall be so constructed that they can readily accept a rubber, neoprene or PVC gasket, should dust and damp proofing be required.

The boards shall be so constructed as to be vermin proof.

During installation the boards shall be protected against damage and the penetration of moisture, dust and vermin.

5.5 Busbars

Busbars of high conductivity copper bar of adequate section for the specified current rating of the main switch controlling the board, shall be provided. Each bar shall be supported on insulators of adequate physical strength and so spaced as to withstand the short circuit fault rating of the electrical system, without damage. Where modular panel sections require busbar sections to be bolted together with fish-plates, care shall be taken to ensure that the busbars are adequately supported, and fish-plate nuts and bolts spaced so as to avoid flash-over under rated fault conditions.

The bars shall be located in the upper section of the board. Where they are installed behind control equipment panels, they shall be separated by removable covers so as to prevent inadvertent contact.

Busbars shall be colour coded with the appropriate phase colours by means of heat shrink or similar material, at regular intervals along their full length.

5.6 Neutral Bars and Earth Bars

Neutral and earth bars shall be of appropriately sized copper bar mounted on insulators as specified for the phase busbars.

On smaller type boards and panels the neutral and earth bars may (with the Engineer's prior consent) be solid brass with two per way pinching screws and sufficient ways for the supply and all the circuits connected, including spare ways to the same number as spare circuits.

The connection of more than one wire into any one terminal of the neutral and earth bars will not be permitted.

5.7 Internal Wiring

All internal main and control circuit wiring within the boards shall be carried out using suitably rated phase colour coded PVC insulated wire.

All internal wiring shall be ferrule numbered at terminations and numbers shall correspond to those on the appropriate wiring diagrams prepared by the board manufacture.

All wiring shall be neatly arranged and strapped with plastic buckle clips or hard nylon "loom formers" or alternatively run in plastic trunking, with lids, installed within the board.

All low voltage wiring AC, or DC, for control circuits, etc. shall be separated by metal barriers from the medium voltage circuits throughout the board.

Where wiring is run to equipment mounted on hinged doors the wiring shall be carried in a special protective loom which is so installed that the wiring is not strained with the door fully opened.

Where control wiring is required to pass from panel to panel, appropriate DIN-rail terminal blocks shall be provided in each of the adjacent panels permitting wiring to be looped between terminal blocks, and not connected directly to the panel component. Neoprene grommets shall be provided at all interconnecting holes where wiring is passed from panel to panel.

The colour of all panel wiring shall comply with the following:-

Colour of Wire	Circuit Particular_____
Red, White and Blue	Phase connections in current and voltage transformer circuits and in all three phase circuits.
Green	Insulated earth wires
Black	Neutral connections
Grey	Control connections
White	Connections in DC alarm circuits.

All control circuits shall have 5A HRC fuse protection.

5.8 **Terminals**

All main terminals shall be connected in strict phase rotation.

All terminals are to be numbered to match the wiring diagrams. Spare terminals are to be provided to accommodate all spare control cable cores.

For ease of Testing and Commissioning the control system terminals shall be the disconnect, fused or test socket type, as appropriate to the circuit.

All terminals for wires smaller than 16mm² shall be of the pressure plate type and no more than two wires shall be connected to each terminal.

5.9 **Finish**

The boards and panels shall be finished in baked enamel or powder coat spray finish of a colour specified in the Particular Specification. No hammer tone or similar finishes will be accepted.

5.10 **Labels**

All switchboards and panels as well as all control equipment, both within the panel and projecting are to be fully labelled.

Any device which can be unplugged is to be labelled at the base and on the device.

Labels shall be ivory, or similar, engraved black on white labels, with suitable size lettering to ensure legibility, fixed in position by means of 2,5mm (min.) brass bolts and nuts and washers.

6 CONTROL EQUIPMENT

6.1 Time Switches

All time switches shall be mounted in an accessible position for ease of adjustment, and shall be provided with re-chargeable nickel cadmium batteries to provide up to 72 hours of operation should a power failure occur. The type and/or operational requirements for the time switches shall be as detailed in the Particular Specification or, where no special requirements are given therein, as detailed below.

6.1.1 Motor Control:

Time switches shall be fully programmable to a maximum of 168 switching points with 24 memory addresses permitting hourly, daily and weekly settings. The shortest switching interval shall be 1,0 minute. The units shall include a manual override facility. They shall be suitable for wall or DIN-rail mounting. Protection shall be at least to IP42 and the units shall operate satisfactorily in the temperature range - 5°C to + 55°C. A suitable time switch would be "Sauter" type Memotime Z5D 7.

6.1.2 General Purpose:

Time switches shall have a crystal controlled stepping motor and be able to perform 48 operations per day with a minimum interval of 30 minutes. A manual override facility must be provided. A suitable time switch would be "Heinemann" type SAT-R.

6.2 Contactors

Contactors shall, unless otherwise specified, comply with BS 5425 for continuously rated current making and breaking category AC1 for non-inductive and AC3 for inductive loads.

6.3 Earth Leakage Units

Should earth leakage units be required, these shall comply with SABS 767 and be single or three phase, as indicated, with a sensitivity of 30mA unless otherwise stated.

6.4 Motor Starters

Each motor and starter is to be protected by a moulded case circuit breaker except where HRC fuses are required due to fault level considerations. Care is to be taken that the starter is not subjected to a higher fault current than that for which it is suited.

HRC fuse protection must be provided, if necessary, in which case the MCCB is to be replaced by an on-load isolator or combination fused switch unit. MCCB's, isolators and fused switched units are to be lockable in the "OFF" position where motors are situated remote from the control panel.

The starters for all motors shall comprise magnetically operated contactors. They shall be of robust design, operate without undue noise and vibration and comply with BS 587 or BS 4941 as appropriate. Unless otherwise stated, they shall be of continuous rating, and Category AC3.

Contactors shall be of the hold-in type capable of operating satisfactorily without overheating for a period of 10 minutes if the supply voltage falls to two thirds nominal. Contactors shall not chatter when opened at two thirds voltage, or at a frequency 10% below nominal. Low voltage release shall be inherent in the operating coil. All starters are to be equipped with voltage free auxiliary change-over contacts to provide a "RUN" signal during operation.

No motor control gear shall have a continuous rating of less than 15A. Contactors shall be capable of making and breaking the starting current of the motor and of carrying this current without damage for a period of one minute. They shall also be capable of withstanding, without damage, the passage of the maximum fault current of the circuit until such time as the fault can be cleared by the operation of the back-up protection.

Overloads are to be of the thermal type matched to the motor ratings and are to be manually reset. The overloads are to be so set that the motor will trip within 30 seconds of a single phase condition arising when the motor is hot and operating at 80% of full load current. If the starter is not capable of this, then single phase protection devices are to be fitted with a voltage free auxiliary change over contact to provide a "tripped" signal. If this facility is not available on the device offered, an auxiliary relay is to be provided to perform the same function. Such a relay must be energised upon an overload trip occurring.

Starters are to be of first class quality and shall be of Cutler-Hammer, Siemens, Klockner-Moeller, Telemecanique or Sprecher Schuh manufacture. All starters are to be of the same make. Star Delta starters are to be provided with both electrical and mechanical interlocks.

Where anti-condensation heaters are fitted, these must be disconnected by the starter main switch. A white indicator lamp shall be provided on each starter panel to show that the anti-condensation heater is on. At the motor heater terminal box (preferably separate from the main motor terminal box) a warning label shall be provided to warn that the heater circuit may be alive.

Ammeters shall be provided, suitable for the full load current of the motor. Unless otherwise specified these are to be fitted in the centre phase and are to be supplied with a suppressed overscale to indicate starting currents. They are to read accurately to 120% rated current.

6.5 Pilot Lights

Pilot lights are to be either neon, transformer or resistor reduced wattage type of Cluster LED's. Under no circumstances will 220V pilot lamps, except in the case of neon, be accepted. Care shall be taken to select pilot lights which can be easily seen in daylight. Where pilot lights are connected to remote equipment by multi-core control cables, neon lamps shall not be used because of the inductive effect of the control cores. 100% spare lamps are to be provided for all pilot lights.

All control panels shall be provided with facilities to test pilot lights without removing them from their normal sockets. This lamp test facility shall comprise push button controlled circuit/s designed to energise pilot lamps while the button/s are held in the operated position.

6.6 Hour Meters

Unless otherwise specified hour meters shall be of the non-resettable digital type reading up to 99999 hours. They shall be suitable for 220/250V, 50Hz., AC operation or as otherwise indicated.

6.7 Duty Selector Switches

The control of all items of equipment which can act as standby to each other must include a duty selector switch to enable the lead duty to be selected as well as second and third preference, i.e. 1,2,3; 2,3,1; 3,1,2 for a three motor system.

6.8 Hand/Off/Auto Switches

A hand/off/auto switch shall be fitted to each starter subject to automatic control. The hand control circuit, which shall comprise stop-start push buttons, shall be fed from a fuse or circuit breaker other than that for the automatic control system.

6.9 Phase Failure Relays

All phase failure relays shall provide phase failure and phase reversal protection. The relay shall initiate control circuits to trip running motors and to prevent any motors starting. The relay is to be so arranged with an adjustable timer that it will only initiate a trip upon a single phase or phase reversal condition occurring and not upon restoration of power to normal condition. Provision is to be made to ensure that a trip occurs irrespective of which phase is lost.

6.10 Alarm System

Unless otherwise specified the alarm system, when called for, shall comprise an alarm bell mounted outside the respective equipment room, a nickel cadmium battery and matched charger. The battery and charger shall be mounted within the control panel from which its supply is taken. The battery shall be capable of operating the bell for 15 minutes, continuously. The alarm circuit shall have "Cancel" and "Reset" facilities. When "cancelled" the audible alarm only shall be silenced but the fault indicator light on the panel shall remain energised. After repair of the fault, operation the "Reset" shall reinstate the alarm circuit to a fully operative condition. However, should the fault remain, operating the "Reset" shall again trigger the audible as well as the visual alarms.

A "battery low/battery failure" indication shall be provided on the panel with the facility of extending the alarm to a remote position.

The alarm bell shall be 100mm diameter and shall be of the weatherproof type when exposed to the weather.

6.11 Relays

All relays and timing relays shall be of the plug-in type, of Sprecher and Schuh, Telemecanique, Klockner-Moeller, or approved equivalent manufacture. Each relay is to be numbered and this number must appear on both relay and adjacent to its respective base. All adjustable timing relays must be labelled with their function.

6.12 Emergency Push Button Stations

At each motor forming part of the mechanical installation an emergency red twist-to-release, mushroom-head, lock-stop push-button station shall be installed. This may be wall mounted 1000mm AFF where a wall is not further than 2m from the motor and is easily accessible. Alternatively it shall be mounted adjacent to the motor on a suitably robust, hot dip galvanised, post or pedestal 1000mm high. The lock-stop shall isolate the control circuit of the motor starter. It shall require a twist of the button to release the lock-stop, and manual resetting at the control panel to restart the motor.

7 CONDUITS, CONDUIT FITTINGS AND CONDUIT INSTALLATION

7.1 Metal Conduits

Unless otherwise specified all metal conduits shall be heavy gauge solid lap welded steel of the following types and as further specified in the Particular Specification.

- Screwed-end black enamelled
- Screwed-end galvanised
- Plain-end galvanised

All conduits shall comply with SABS 1065 or 1007, as applicable.

7.2 Non-Metallic Conduit

Where the use of non-metallic conduit is permitted by the Engineer these conduits shall comply with SABS 950.

The installation of non-metallic conduit shall be in accordance with Amendment No 2 of SABS 950 Appendix C.

Only plastic saddles and compatible fittings shall be used.

7.3 Flexible Conduit

Where flexible conduit connections are required indoors, only "Kopex" flexible conduit and fittings or similar approved shall be used. For exterior use "Adaptorflex" type SPL liquid tight flexible conduit and fittings or similar approved shall be used. Flexible conduit runs exceeding 750mm will not be permitted. All flexible conduit runs in excess of 300mm shall be fixed in position at least once along its length (excluding terminations).

7.4 Conduit Fittings

All conduit fittings shall be malleable iron or pressed steel except for brass bushes.

The use of inspection tees or elbow pieces and internally screwed solid bends will not be permitted. However, internally screwed solid bends for 40mm and 50mm dia. conduit may be accepted if approved by the Engineer.

7.5 Conduit Tools

The Contractor must ensure that the correct tools are used for the installation of the conduit systems.

All setting of conduit shall be done with suitable curved bending tools. No kinks will be accepted.

A reaming tool shall be used to ensure that all cut conduit ends are complete free from burrs and sharp edges which might damage the conductors.

7.6 Conduit Installation

7.6.1 Conduit in roof spaces

In roof spaces all conduit runs shall be parallel or at right angles to trusses and joists. Where conduits are run along trusses and joists they shall be fixed in such a position so as to minimise sets and bends and be neat in appearance.

7.6.2 Conduit on the surface

Where conduit is run on the surface, it shall be fixed with stand-off saddles, multiple spacer saddles being used for conduits run together. The maximum distance between saddles shall not exceed 1,5m.

Where conduits have to be run adjacent to gas or cold water pipes, sound or telephone circuits they shall be installed in such a position and in such a manner as to prevent contact with the other services.

7.6.3 Draw boxes

No draw boxes which are not in themselves outlets will be permitted except with authority from the Engineer. Such authority shall be sought if it proves necessary to draw conductors round more than two 90° bends, or the equivalent, or on very long straight runs exceeding 20m.

Draw boxes, where authorised, shall be provided with metal covers matching the standard cover plates installed under the electrical contract.

7.6.4 Lock-nuts and bushes

Open ends of all conduits shall be fitted with female brass bushes.

All running joints shall be fitted with lock-nuts. Lock-nuts shall be provided wherever necessary to ensure that all conduit terminations in the installation are tight.

All conduit terminations into boards, panels, etc. shall be through neatly drilled round, burr free holes. Each conduit shall be fitted with locknuts and a female bush. Couplings and male bushes shall not be used. The same arrangement shall be used, for entry into equipment, control gear, etc.

7.7 Neatness of Conduit Work

The conduits shall be installed in straight and symmetrical lines with easy sets or bends.

Care must be exercised when installing conduits from control panels and boards to ensure that conduits radiate from these points in a neat and orderly fashion.

Careful planning of conduit work can prevent an untidy installation and any re-arrangement necessary to provide an acceptable layout will be at the Contractor's own expense.

8 WIRING IN CONDUIT

PVC insulated wire to SABS 150 shall be used for all power and control wiring circuits.

All circuits shall be wired with the wire sizes indicated or in accordance with the Wiring Regulations, as appropriate.

Unless otherwise specified all phase conductors for three phase circuits shall be coloured in their respective phase colours and neutral conductors black. All "live" conductors in single phase circuits shall be coloured red and neutral conductors black.

The ends of all wires, whether single or looped, which have to be connected to the connecting terminals of boards, control panels and equipment, are to be tightly twisted together.

Cutting away the wire strands at terminations will not be permitted.

The loop-in system is to be adopted throughout and joints will only be permitted subject to the approval of the Engineer. Such joints shall be made only with approved connectors in approved boxes.

The circuit wiring for different circuits shall be run in separate conduits.

Irrespective of the type of conduit used, bare copper earth wires are to be drawn-in together with the wiring for all circuits required under this contract.

9 CABLES

9.1 Cable Lengths

Where cable lengths are given on the drawings or in the schedules these are for tendering purposes only. The Contractor shall measure the actual lengths required before ordering and will be paid for the actual lengths measured on site.

9.2 Types of Cables

Unless otherwise specified all cables shall be to SABS 150 and shall consist of PVC insulated conductors, PVC bedding, galvanised steel wire armouring and PVC sheath. The abbreviation for this type of cable is PVCAS.

Where the use of "Surfix" type cable is specified or permitted by the Engineer these cables shall be to SABS 150/70. The cables shall consist of solid un-tinned copper PVC insulated cores in a PVC bedding with a tinned bare copper earth wire in contact with a longitudinal aluminium foil tape and overall PVC sheath. The cables shall be suitable for indoor or outdoor use as applicable and must be neatly installed using the correct accessories such as glands, saddles, etc.

9.3 Handling of Cables

To avoid damage cables shall be handled strictly in accordance with the Manufacturer's instructions.

No cable shall be bent to a radius of less than 12 times the overall diameter of the cable. Bending or straightening shall be done slowly.

9.4 Cables fixed on Surface

Where cable saddles or other items are to be fixed to walls, concrete, etc., the use of dry plugs of wood will not be permitted. "Rawl Plugs" or other plugs to approval only shall be used.

Where cables are fixed to steel trusses or other parts of the structure, stainless steel strapping, applied with an approved tool, is to be used. Care shall be taken to ensure that the straps are tightened correctly and they do not distort or damage the cable sheath.

Permission must first be obtained from the Engineer before bolts are shot into, or any structural steel components are drilled for the fixing of cable saddles or other equipment.

9.5 Cables on Cable Trays

Cable trays shall be of the perforated metal or wire mesh type and shall be of the Standard, Medium or Heavy Duty type as specified. All cable trays shall be galvanised or stainless steel or as further specified in the Particular Specification.

Splicing pieces, bends, tee pieces, etc., where required shall be factory made conforming in width and quality to the particular cable tray specified.

Trays on walls shall either be carried horizontally on right angle brackets or fixed vertically to the wall.

All hardware, support brackets, etc., shall be hot dipped galvanised or stainless steel as specified in the Particular Specification.

Support brackets shall be spaced so that a sag of 12mm is not exceeded along the cable tray run, with all cables installed thereon.

Unless otherwise specified, all cables over 16mm² are to be spaced at least 12mm apart on the cable trays.

Where cables are laid flat on trays, PVC cable tie fixing is required for all cables.

Where cable trays are installed in the vertical plane all cables are to be secured to the trays. PVC cable ties may be used for fixing small diameter cables, but when the diameter of the cable exceeds 30mm diameter, stainless steel strapping, applied with an approved tool is to be used. The maximum spacing between cable ties and/or cable straps shall not exceed 600mm intervals.

Excess lengths of cable ties and/or fixing straps are to be trimmed after installation to present a neat appearance.

9.6 Cables in Ground Trenches

Where cables are required to be laid in ground trenches full details of trenching and back filling and compaction requirements will be given in the Particular Specification.

9.7 Cable Joints and Terminations

Joints will not normally be permitted in cables. However, if approved, joints shall be made by means of approved epoxy-resin pressure type jointing kits, such as "Scotchcast", strictly in accordance with the manufacturer's instructions.

PVCAS cables shall be made off using adjustable mechanical glands of suitable size for the cable concerned. Care shall be taken to ensure that the wire strands of the armouring are correctly seated in the gland and that all parts are properly tightened. Neoprene shrouds are to be fitted over all glands.

9.8 Cable Labels

All cable ends shall be labelled with 3mm high letters punched onto aluminium tape attached to the cable with aluminium wire. The labels shall be so installed that they are easily readable and shall indicate the cable number as per the cable schedule, point of origin, and the conductor size and number of cores.

10 INSPECTION, TESTING AND COMMISSIONING

10.1 General

The Engineer shall have access at all reasonable times to such parts of the Works or the Contractor's premises or the premises of the Manufacturer of component parts, as may be necessary for the purpose of inspecting, examining and testing the materials, workmanship and performance of any plant or equipment specified for the works.

10.2 **Factory Testing**

The Contractor shall ensure that all items of major equipment such as switchboards, control panels, etc., are inspected and tested at the Manufacturer's premises. He shall give the Engineer at least 7 days notice of the date and time for these tests to enable the Engineer or his authorised Representative to be present to witness the tests should they so require.

All wiring is to be subjected to a test voltage of 2kV for one minute without insulation failure. A Megger test is to be applied with a 500V instrument immediately thereafter to prove the insulation resistance better than 20 megohms. Injection currents are to be passed through the secondaries of all control circuits including instruments, motor overloads, relays, etc., to ensure the correct functioning of the entire control system. To enable the tests to be carried out all necessary equipment shall be provided by the Contractor and shall include inter alia:

- Phase rotation meter
- 500A Primary injection test set
- Avometer
- 25A Secondary injection test set
- 500V Megger 2kV DC test set.

After completion of manufacture, the following test certificates, signed by the Contractor and the firm executing the tests, shall be provided:

- Test certificate stating that all switchboards and control boards have been inspected and their wiring subjected to 2000V DC for 1 minute. The results of the subsequent Megger tests shall accompany the certificate.
- Any other test certificate for routine tests as laid down in relevant SABS or BS Specification or Codes of Practice applicable to the item in question.
- Test certificate in respect of any special tests called for elsewhere in the Particular Specification.

Test certificates, in duplicate, are to be submitted to the Engineer, prior to the delivery of the equipment to site.

10.3 **Site Testing and Commissioning**

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, commissioning shall be carried out by the Contractor, and any tests the Engineer deems necessary shall be conducted. The Contractor shall supply all equipment necessary for the testing and commissioning procedures.

Before the commencement of any tests or commissioning procedures, the Contractor is to ensure that all nuts and bolts are securely fastened, and that paintwork on all items supplied has been touched up where damage has occurred. The Contractor shall also satisfy himself that the works are complete in all respects, fully in accordance with the Specification and drawings as well as any variations passed during construction period. The Contractor shall then arrange for the final testing and commissioning of the installation to be carried out in the presence of the Engineer.

The Contractor shall give the Engineer at least 7 days notice of the date of any testing so that he can be present to witness the tests.

Site testing and commissioning shall demonstrate the correct working of the installation as specified and shall be completed successfully prior to arranging a mutually agreed date for handing over the installation to the Client. Should any items whatsoever be noted during the testing which may require attention or rectification, these must be attended to

without delay. Once all the outstanding items have been rectified, it will be necessary for the Contractor to arrange a further inspection. Handing over of the installation will only take place once the works are complete and accepted in every detail.

11 HANDOVER INSPECTION AND MAINTENANCE MANUALS

The handover inspection is to be arranged on a date and time that is acceptable to the Client, the Engineer and the Contractor. In order to arrange this, at least 7 days notice, in writing, shall be given by the Contractor to the Engineer.

At the handover inspection the Contractor will be required to demonstrate the plant to the Client and instruct his staff in the operation thereof.

Prior to the commencement of the handover inspection, a Maintenance Manual shall be compiled by the Contractor and handed to the Engineer for presentation to the Client. The manual shall contain all documentation as called for under the Occupational Health and Safety Act and Regulations and shall include, inter alia:

1. Complete sets of "as-built" layout and workshop drawings.
2. Complete sets of schematic wiring and function diagrams.
3. Sequence diagram and control function narrative for each control panel.
4. Schedule of protection and control settings.
5. Schedule of all cables installed.
6. Distribution Legend.
7. Operation and Maintenance Instructions for equipment.
8. Any guarantees ceded to the Client.
9. Detailed lists of equipment and suppliers.
10. Schedule of Contract Consultants and Contractors.

It is imperative that the Maintenance Manual be handed over timeously as, failing this, no handover inspection will be conducted. Should any amendments be required to be made to the Maintenance Manual, due to changes requested by the Client at the time of handover, the Contractor will be required to make the necessary changes and to resubmit the Manual within 30 days of the handover inspection. The Maintenance/Guarantee period, as stipulated in the Particular Specification, will only be deemed to commence once the revised Manual has been received by the Engineer.

SECTION C4.3

PART B

TECHNICAL SPECIFICATION

SECTION 1

GENERAL INFORMATION APPLYING TO THIS INSTALLATION

1. **SCOPE AND TYPE OF CONTRACT**

The Main Contract, which is the Principal Contractor's responsibility, comprises the modification and upgrading of the South African Revenue Services Warehouse located on the Ground Floor Level of Customs House, Foreshore, Cape Town.

The Fire Protection Sub-Contract will be let as a Domestic Sub-Contract to the Principal Contractor and comprises the supply, delivery to site, off-loading, storage, installation, testing, commissioning and handing over in good working order and twelve months guarantee of all items of equipment, materials and workmanship as further specified in this document and on the drawings.

Tenderers are to include for all items necessary whether specified in detail or not, to complete the installations to a satisfactory, operational & compliant standard. The installation is to comply with all the relevant regulations & shall be to the satisfaction of the Engineer. Installations or part thereof which are not deemed to be compliant or to the satisfaction of the Engineer shall be rectified at the Fire Protection Sub-Contractors (or their appointed specialist Sub-Contractors) own cost.

2. **CONDITIONS OF CONTRACT**

The Fire Protection Sub-Contract will be let as a Domestic Sub-Contract to the Principal Contractor. The Conditions of Contract are available on request from the Principal Contractor.

3. **ENGINEER'S DRAWINGS**

The Engineers Drawings pertaining to this installation are:

6352/S/01: Roof Level & Ceiling Sprinkler Layout.
6352/S/02: In-rack Sprinkler Layout.
6352/F/01: Fire Plan Layout.

The above drawings are sufficiently accurate for tendering purposes but all dimensions must be verified on site prior to manufacture. No extras will be considered where work has been carried out without such prior verification or approval.

4. **BUILDER'S WORK**

Builder's Work associated with the fire protection installation, to be carried out by the Main Contractor will be limited to:

- (i) Provisions of required plinths for the water storage tanks, piping, diesel driven pump set.
- (ii) Construction of plant room and valve chamber.
- (iii) Core drilling through down stand beams for sprinkler range pipes.

The Fire Protection Sub-Contractor shall, however, be responsible for ensuring that all necessary work carried out by the Main Contractor / Building Sub-Contractor is correct and to the Fire Protection Contractor's satisfaction.

The Fire Protection Sub-Contractor shall be responsible for all other work including the installation of the underground supply main between the basement and the water storage tanks.

5. **ELECTRICITY SUPPLY**

The Supply Authority for the area is the City of Cape Town: Electrical Department.

The Low Voltage electricity supply will be nominal 400V, 3 phase, 4 wire, 230V single phase, 50Hz. All apparatus and equipment shall be suitable for these conditions as applicable

6. **PROGRAMME OF WORK**

A detailed programme will be drawn up by the Principal Contractor and the Sub-Contractor shall comply with any reasonable programme laid down and shall co-ordinate their work so that the installation is complete and commissioned at least two (2) weeks before the building completion date.

7. **LIAISON**

It is essential that the Sub-Contractor maintains a close liaison with all other parties at all times. The Sub-Contractor will be held responsible if, through a lack of liaison, the Sub-Contractor causes delays or increased costs to another Contractor.

8. **CONTRACT PRICE ADJUSTMENTS**

The contract price shall not be subject to contract price adjustment provisions.

9. **ACCESS TO SITE AND STORAGE**

Tenderers shall note that space on the site is limited and that it will not be possible to store large quantities of materials and equipment on site. Arrangements for the storage of material on site shall be made with the Principal Contractor.

10. **PAYMENT FOR MATERIALS**

Tenderers shall note that no payment will be made for materials stored off site and that payment for unfixed materials stored on site will only be made strictly in accordance with the conditions relating to the Principal Contract.

11. **DRAWINGS**

The Tenderer's attention is drawn to Part D, Section 1 Clause 15 of this Document.

12. **IDENTIFICATION OF CONTRACTOR'S PERSONNEL**

The Sub-Contractor must ensure that all personnel, including any casual labour, which may be employed, are clearly identifiable at all times whilst working on the site.

13. **VALUE ADDED TAX**

The tender shall be inclusive of Value Added Tax as set out and indicated in the Price Summary.

Tenderers should note that the rates quoted in the Schedules of Quantities of this document must be **Net** prices **excluding** VAT.

14. **MINIMUM CLAIM**

Claims submitted by the Sub-Contractor shall not be less than 5% of the Sub-Contract Price.

15. **NAME BOARD**

It is the Principal Contractor's responsibility to supply and erect a project notice board, which will bear the names of the Sub-Contractors. No individual notice boards of Sub-Contractors will be allowed on site.

16. **MAINTENANCE AND DEFECTS LIABILITY PERIOD**

The Sub-Contractor shall maintain the installation, free of charge, for a period of twelve (12) months after successful handover of the installation. During this period he will be required to undertake all routine maintenance and servicing of the entire installation as required by ASIB and the Engineer.

The Sub-Contractor shall guarantee the material, apparatus and equipment delivered by him for a period of twelve months, commencing from the date of practical completion / first commissioning completion in terms of the Main Contract. This period is otherwise referred to as the "Defect Liability Period".

17. **CERTIFICATE OF COMPLIANCE**

The Sub-Contractor shall be required to issue a Certificate of Compliance for his portion of the electrical installation.

18. **INSPECTION, TESTING AND COMMISSIONING**

The Sub-Contractor shall arrange for all inspections, testing and commissioning of the completed installation and any costs thus involved shall be borne by him and shall be deemed to have been included in the tender price.

19. **OCCUPATIONAL HEALTH AND SAFETY ACT**

Tenderers shall make sure they have made adequate allowance in the tenders to fulfil their obligations as set out in Section A1 of this document.

SECTION C4.3

PART B

TECHNICAL SPECIFICATION

SECTION 2

DETAILED TECHNICAL SPECIFICATION

1. **GENERAL**

This Part of the Specification deals with the main item of material and equipment which it will be the Fire Protection Sub-contractor's responsibility to supply and install in accordance with this Document and the Drawings.

Sufficient information is provided in this Document and on the Drawings to enable the Tenderer to accurately price the work. Tenderers must allow for all items, whether specified in detail or not, required to complete the installation in a neat and workmanlike manner.

2. **DESCRIPTION OF INSTALLATION**

The Main Contract, which is the Principal Contractor's responsibility, comprises the modification and upgrading of the South African Revenue Services Warehouse located on the Ground Floor Level of Customs House, Foreshore, Cape Town.

The warehouse and offices are to be sprinkler protected to comply with National Building Regulations, Automatic Sprinkler Inspection Bureau (Pty) Ltd (hereinafter referred to as ASIB) and to the approval of the insurers. Category I-III goods will be stored in racks up to a height of 6m and sprinkler protection is to be provided in the racks.

The installation will consist of the following:

- Strip out existing ordinary hazard systems serving the warehouse and offices;
- Installation of new roof level sprinkler system serving the warehouse and new office areas;
- Installation of new in-rack sprinkler system in the warehouse;
- Installation of internal fire hose reel & fire hydrant installation;
- Installation of storage tanks and booster pumps in order to comply with ASIB requirements.

3. **DESIGN AND INSTALLATION STANDARDS**

Only the highest standards of materials and workmanship will be accepted.

The basis for the design and installation of the entire system is the Rules for Automatic Sprinkler Installations, 11th Edition, as amended at the time of tendering and as laid down by ASIB. The entire installation shall comply in every respect with these Rules.

At the time when the Sub-Contractor produces his shop drawings, the Sub-Contractor shall submit a list of any discrepancies between the Engineer's design and the ASIB Rules, but the tender must be based on the Engineer's design.

Any variation in cost as a result of such discrepancies will be calculated on the basis of the rates submitted in Part C of this Document.

Should any part of the completed installation not comply with ASIB Rules and thus not meet with ASIB's approval, the Contractor shall make good such defects free of charge, to the satisfaction of the Engineer and ASIB.

Where reference is made in this Document to the ASIB Rules, this shall be interpreted as referring to the relevant Clause in the 11th Edition of the Rules, as amended.

4. **APPROVAL AND INSPECTION**

In addition to obtaining approval from the Engineer, the entire installation shall also conform to the requirements of the Cape Town Municipality and ASIB.

5. **WATER SUPPLY**

The municipal water supply will not be capable of supplying the required flow and pressure needed for this installation. Therefore water storage tanks and supply pumps are required and will be elaborated upon further in this specification. The water storage tanks and supply pumps have been sized according to a demand of 4850 L/min at 490kPa at the valve chamber.

6 **PIPE WORK**

All pipe work shall be to SABS 62, Medium Grade, Heavy Grade, or to Schedule 40, AP15L.

Screwed pipe work may be medium grade up to 100mm, otherwise heavy grade or Schedule 40 pipes shall be used for large bore screwed pipe work.

Medium grade pipe work with weld on or "Klambon" type pipe fittings may be used for all pipe work between 65 and 150mm diameter.

All screwed pipe fittings shall be of first class quality and shall be of malleable cast iron to SABS 509. Imported fittings shall be either Tupy or Crane - no other make of imported fitting will be accepted and unions shall be Crane only.

Fittings on large bore pipe work shall be forged steel to ANSI B16 or BS 3799.

Flanged joints shall have Table E of BS10 : 1962 or SABS 1123 : 1977 equivalent flanges and fitted with preformed Klingrite gaskets.

Slip type couplings will not be permitted under any circumstances.

Fabricated type weld on pipe fittings will be permitted provided that the work is carried out strictly in accordance with ASIB requirements. All welding shall be carried out by coded welders only.

All pipe work and fittings shall be painted mild steel.

7. **PIPE SUPPORTS**

The Sprinkler Contractor shall supply and install all pipe supports, hangers, clamps, brackets, fasteners, etc., required to fix the sprinkler pipe work in position.

The layout and type of all pipe supports shall comply with the ASIB Rules.

All pipe support components shall be manufactured from corrosion resistant materials, or shall be hot dipped galvanised.

Where pipe supports are fixed to structural steel, Lindaptor, or equal, supports shall be clamped to the steel. No drilling of or welding to structural steel will be permitted under any circumstances.

8. **SPRINKLERS**

All sprinkler heads shall be of the 15mm / 20mm nominal orifice sealed glass bulb type, approved by ASIB.

The Sprinkler heads shall have the correct temperature rating for the application. Generally, 141°C heads shall be provided for the warehouse roof and 68°C for the office areas and racks.

Generally, all sprinklers shall be of the conventional type mounted either pendent or upright to achieve the required spacing below the slab or ceiling. Where sprinklers are installed under ceilings with hidden pipe work, they shall be fitted with stainless steel or aluminium escutcheon plates and swivel arm pipe assemblies where required.

The Rack sprinklers shall be of the fast response type. The Rack sprinklers (and any other sprinklers exposed to damage) shall be fitted with properly manufactured ASIB approved sprinkler guards and heat deflector shields.

9. **INSTALLATION CONTROL VALVE ASSEMBLIES**

The Sprinkler Contractor shall supply and install 1-off $\phi 150\text{mm}$ and 1-off $\phi 100\text{mm}$ installation control valve assemblies in the position indicated on the Drawings. The assemblies shall be complete and shall comply with ASIB requirements in every respect.

The Sprinkler Contractor shall provide all spares, straps and padlocks, block plan, and the required "Sprinkler Stop Valve Inside" signs.

All valves shall be of first class quality, Crane, or equal, or SABS approved. All valves shall be rated for 1600 kPa operation.

Each control valve shall be provided with a flow switch which will send a signal to the fire detection panel in the event of sprinkler operation.

10. **PAINTING**

All parts of the entire fire system shall be properly painted by the Sprinkler Contractor.

The paint specification shall be as laid down by Plascon or Dulux, but shall generally comprise degreasing, de-rusting and cleaning, followed by a primer, and one coat of gloss paint of approved colour. The primer coat shall be applied before installation of the pipes and after installation touching up **(WITH PRIMER)** and the gloss coat will be applied.

THE PAINT SPECIFICATION WILL BE STRICTLY ENFORCED, and will include such random testing as the Engineer considers necessary.

All components of pipe supports, unless of stainless steel, hot dipped galvanised or copper or brass construction, shall also be painted. This also applies to sheradised or plated components and especially hanger rods.

Pipe work running in the ceiling space will only be supplied with a primer coat.

11. **RESERVOIR**

The two water storage tanks shall have a combined nominal capacity of 500 kL and shall be supplied by GVTEC Cape Town.

The tanks shall have the following dimensions:

- Diameter Ø5.34m
- Overall Height 12.2m

The tanks shall be of stainless steel 304 construction and shall have a “ring polish” finish.

All gaskets, sealing compounds etc. shall be non-toxic for use with potable water and shall not dry out, shrink or become brittle with age.

Access shall be provided via a lockable access hatch.

Each tank shall be positioned on a concrete plinth.

Each tank shall have the following connections and accessories: (Refer to drawings)

- 1 x Level indicator with stop cocks
- 1 x 300mm dia suction connection
- 1 x 100mm dia make-up connection
- 1 x 150mm dia test pipe connection
- 1 x Electric Level sensor connection

12. **PUMPING INSTALLATION**

12.1 **General**

The pumps will be installed in the pump house, as indicated on the drawings.

The pumping system will consist of one diesel driven pump set being sized to handle the full design load of water. A jockey pump set, sized to maintain the system pressure under normal conditions shall also be provided.

The make up supply to the reservoir, all suction and delivery pipe work, test pipe work, engine cooling pipe work, drains, etc, shall be supplied and installed by the Fire Protection Contractor.

All fittings within the reservoir associated with the suction, make up, test return, level controls, etc. shall be supplied and installed by the Fire Protection Contractor. These include level control valves, suction pipe work and anti-vortex inhibitors, level indicator float equipment, etc.

Also included are the diesel fuel supply system, engine and control batteries, a fully automatic control panel as well as a remote alarm panel in the Gatehouse. The Pump house shall be sprinkler protected.

The requirements of a pumping installation to supply a sprinkler system are specified in detail in the ASIB Rules and these requirements are not repeated in this document. In addition to complying with ASIB requirements, however, the installation shall be to the Engineer's approval, and the items specified in the following paragraphs must be regarded as being additional to ASIB requirements. The entire installation shall be neatly finished and shall conform to generally accepted good engineering practice. Particular attention shall be paid to the proper support of all pipe work, and to the control and management of thrust loads.

12.2 Pump Sets

The following pump sets are required.

12.2.1 Diesel Driven Set (1 off).

Diesel Engine : Type	:	Compression Ignition, turbo-charged
Power	:	To suit pump characteristics
Cooling System	:	Heat exchanger as per ASIB
Pump	:	End suction, centrifugal
Duty	:	4850ℓ/m at 490kPa

12.2.2 Jockey Pump (1 off).

Motor	:	Electric, continuously rated, standard protected splash proof
Motor Supply	:	Three phase, four wire.
Pump Type	:	Vertical Multistage Centrifugal
Duty	:	55ℓ/m at 4950Pa

12.2.3 General Requirements

The diesel engine manufacturer must guarantee that the turbo charged engine will accept full load within the specified time. If this cannot be achieved, a naturally aspirated engine shall be supplied. A removable drip tray shall be provided under the diesel engine designed to catch any spillage or leakage from any part of the engine. If the tray cannot be removed it shall be provided with a plugged drain pipe. A simple means shall be provided to drain oil from the engine.

For the purposes of engine de-rating, the following conditions may be assumed on site :

Altitude – Sea Level
Maximum ambient temperature – 35°C

All pump couplings shall be of first class quality to the Engineer's approval.

The diesel engine exhaust pipe shall be lagged for its full length within the Pump house and shall discharge to outside. An effective silencer of the residential type is to be provided. A flexible connection shall be provided between the engine and the exhaust pipe.

A minimum of four sets of approved ear muffs shall be included with the engine spares and tools. The spares, tools, drawings, service manuals, etc, shall be installed in a purpose made wall mounted cabinet of first class construction. The cabinet may be of metal or timber construction, properly finished and lockable.

The cabinet shall be provided with all necessary shelves, pockets and brackets so that all items to be stored may be neatly and clearly housed.

The jockey pump control system shall incorporate an adjustable timer so that it will overrun for five minute until it has brought the system up to pressure. A bypass with a pressure relief valve must be provided.

12.3 **Pipe work, Valves and Fittings**

All pipe work within the Pump house shall be black steel. All pipe work external to the building shall be hot dipped galvanised after manufacture. Pipe work up to 150mm diameter shall be SABS 62, heavy grade, with SABS 509 malleable screwed fittings or AP15L Schedule 40 with ASTM A234 Butt-weld fittings. With the exception of the 300mm diameter suction piping, all piping over 150mm diameter shall be AP1 5L Schedule 40 with ASTM A234 Butt-weld fittings. The 300mm diameter suction pipe may be Schedule 20. BS or ANSI equivalent specifications will be accepted where applicable.

An orifice plate shall be provided to assist with the hydraulically balancing of the system.

Vortex inhibitors shall be fitted to the suction inlet in each reservoir. Great care shall be taken to adequately support the pipe work within the Pump house. All pipe supports shall be of robust construction and for the Engineer's approval. All delivery and test pipe work shall be properly anchored, particularly at each change in direction, to counter the effects of thrust. All components of pipe supports shall be hot dipped galvanised.

All valves shall be supplied with chains and padlocks to secure them in the open or closed position as required by ASIB. Padlocks shall be Viro or equal and must be master keyed. Butterfly valves (of the geared, wheel operated type) shall be installed on the suction, delivery, test, and reservoir make up pipes. All other valves shall be of the gate type except when they are required for flow regulating when Globe or Diaphragm valves are to be used.

All non-return vales shall be of a type which will minimize the effects of water hammer, and shall be "Rienzi" or equal.

The water level in the reservoirs shall be controlled by pilot operated level control valves. The pilot valves shall provide non-modulating, two position, on-off operation. Each reservoir shall be fitted with Clayton 100 Hytrol Globe Valves or Bermad or other approved equal with Clayton CFI or approved equal float controls.

12.4 **Fuel System**

The fuel tank shall be fitted with a low level alarm, arranged to provide an audible and visual alarm on the main and remote control panel when the fuel level drops below approximately one hour's run time.

A wing type diesel fuel pump shall be mounted in a convenient position on the wall inside the Pump house to facilitate filling of the fuel tank from a 210 litre fuel drum. A length of flexible hose shall be connected to the suction side of the pump and the delivery shall be permanently connected to the fuel tank.

12.5 **Control Panel Electrical Work**

The Fire Protection Contractor shall supply and install the pump control and alarm panel. The Electrical Contractor will connect the main electrical supply to the main isolator (by

the Fire Protection Contractor) on the panel. The Electrical Contractor will supply and install all lighting and small power in the building.

An hour meter, which will indicate the running time, shall be provided for each pump. The panel construction and all electrical work concerned with this installation shall comply with this Standard Specification for Electrical Work Carried out in connection with Mechanical Installation which forms Part A.2 of this document.

Allowance shall be made on the panel for remote "Pump Running" and "Pump House Fault" alarms to be taken to a remote alarm panel in the main Security Station. A 24 volt lamp, adequate to light up the control panel and powered from the control panel power supply shall be provided at the top of the panel. The light shall operate whenever either pump (NOT the jockey pump) is operating. The control panel shall be of modern design and PLC control will be preferred.

13. **FIRE PROTECTION IN THE PUMPHOUSE**

The Pump house shall be sprinkler protected as shown on the Drawings and in accordance with the requirements for sprinkler systems as specified elsewhere in this Document. Two 9kg capacity dry chemical powder hand fire extinguishers shall bear the SABS mark of approval and shall be wall mounted. The sprinklers in the pump house should also be linked to the fire detection panel via a flow switch.

SECTION C4.3**PART C****SECTION ONE****1.0 SCHEDULE OF PREVIOUS CONTRACTS**

The Tenderer shall state in the schedule below, the names of all Contracts of a similar/comparable nature with which he has been involved, and the nature of his involvement.

EMPLOYER	NATURE OF WORK	VALUE OF WORK	YEAR COMPLETED

DATE: _____

SIGNATURE: _____
(For the Tenderer)

2.0 SCHEDULE OF SUB-CONTRACTORS

The Tenderer shall state in the schedule below the names of all sub-contractors he wishes to employ on the Works and shall define their duties and outline their experience. No subsequent changes may be made without the express approval of the Engineer, in writing.

NAME OF SUB-CONTRACTOR	PROPOSED DUTIES	EXPERIENCE

DATE: _____ SIGNATURE: _____
(For the Tenderer)

C2.1

SECTION C4.3

PART C

SECTION TWO

SCHEDULE OF DEPARTURES FROM THE SPECIFICATION

Part No Departure	Reference	Clause No
----------------------	-----------	-----------

N.B. The Tenderer is required to give full details of any departure from the Specification and shall then sign this page officially. If there are no departures, the Tenderer must state NIL on this page and sign it. The Tender shall then be held to comply in all respect with the Specification.

Should there be insufficient space, the Tenderer may include separate sheets arranged in the same manner as above. Mere reference to a covering letter will not be regarded as compliance with this requirement.

DATE: _____

SIGNATURE: _____
(For The Tenderer)

SECTION C4.3**SECTION C****PART THREE****SCHEDULE OF PARTICULARS**

- NOTE:**
1. This Schedule must be completed for all items offered. Failure to comply with this requirement may render the Tender invalid.
 2. Information in amplification of that given below may be submitted in the form of a covering letter, published literature, etc.
 3. Acceptance of a tender, with this schedule complete, does not relieve the Tenderer of the responsibility of complying with the Specification for the items listed.

- | | | <u>DIESEL PUMP</u> | <u>JOCKEY SYSTEM</u> |
|----|-----------------------------|---------------------------|-----------------------------|
| 1. | <u>PUMPS</u> | | |
| | (a) Maker's name | ..... |  |
| | (b) Mode | ..... |  |
| | (c) Type | ..... |  |
| | (d) Capacity | ..... |  |
| | (e) Speed | ..... |  |
| | (f) Material : | ..... |  |
| | Casing | ..... |  |
| | Impeller | ..... |  |
| | Shaft | ..... |  |
| | (g) Type of shaft seal | ..... |  |
| | (h) Bearings | ..... |  |
| | (i) Motor Horsepower | ..... |  |
| | (j) Efficiency | ..... |  |
| 2. | <u>DIESEL ENGINE</u> | | |
| | (a) Maker's name | ..... |  |
| | (b) Model | ..... |  |
| | (c) Type | ..... |  |

(d) Shaft Horsepower

(e) Speed

(f) Make of Couplings

(g) Type of Cooling

(h) Type of Starting

3. **BATTERIES**

(a) Type

(b) Rated capacity

(c) Nominal Battery Voltage

(d) Guaranteed Life

4. **BATTERY CHARGER**

(a) Type

(b) Voltage

(c) Maximum current consumption

5. **CONTROL PANEL**

(a) Maker's name

(b) Make of all switchgear
Circuit breakers, etc

(c) Make of PLC and Mode

6. **REMOTE ALARM PANEL**

(a) Maker's name.....

7. **STEEL PIPES AND FITTINGS**

(a) Make of Piping

(b) Material and SABS or BS Standard

(c) Maximum Working Pressures.....

(d) Method of Jointing

(e) Make of Pipe Fittings

(f) Material and SABS or BS Standard of Fittings

8. **UNDERGROUND PIPES AND FITTINGS**

- (a) Make of Piping
- (b) Material and SABS or BS Standard
- (c) Maximum Working Pressures.....
- (d) Method of Jointing
- (e) Make of Pipe Fittings
- (f) Material and SABS or BS Standard of Fittings

9. **VALVES**

9.1 **Butterfly Valve**

- (a) Make and type
- (b) Material of Body
- (c) Material of Replacement Butterfly
- (d) Pressure rating

9.2 **Gate Valve**

- (a) Make and type
- (b) Material of Body
- (c) Material of Replacement Butterfly
- (d) Pressure rating

9.3 **Globe Valve**

- (a) Make and type
- (b) Material of Body
- (c) Material of Replacement Plug
- (d) Pressure rating

10. **NON-RETURN VALVES**

- (a) Make and type
- (b) Material of Body
- (c) Material of Replacement Seats
- (d) Pressure rating

11. **ALARM VALVES**

- (a) Make
- (b) Type.....

12. **WATER ALARM GONG**

- (a) Make
- (b) Type

13. **PRESSURE GAUGES**

- (a) Make
- (b) Type

14. **DIRECT READING FLOW METER**

- (a) Make
- (b) Range
- (c) Accuracy

15. **DIFFERENTIAL VALVES**

- (a) Make and type
- (b) Pressure Rating.....
- (c) Material of Replacement Disc.....

16. **FLOW SWITCH**

- (a) Make.....
.
- (b) Accuracy.....
..

17. **ROOF SPRINKLERS**

- (a) Maker's name.....
- (b) Type
- (c) Temperature Rating

18. **RACK SPRINKLERS**

- (a) Maker's name.....
- (b) Type
- (c) Temperature Rating

DATE: _____

SIGNATURE OF TENDERER: _____

NAME AND ADDRESS
OF TENDERER _____

SECTION C4.3

PART C

SECTION FOUR

SCHEDULE OF QUANTITIES

PREAMBLE

- 1.0 This Schedule of Quantities forms part of, and must be read in conjunction with the Specification. The Price Summary is to reflect the total price carried forward from the Schedule of Quantities, which itself need not be submitted with the tender documents.
- 2.0 The tender price must be based on the Schedule of Quantities. Any Tenderer requested to submit his priced Schedule of Quantities shall do so within 48 hours of such request.
- 3.0 No alteration, erasure or addition is to be made in the text of the Schedule of Quantities. Should any erasure or addition be made it will not be recognised but the original wording of the Schedule of Quantities will be adhered to.
- 4.0 The quantities in the Schedule are not to be considered as limiting or extending the amount of work to be done and materials to be supplied. All quantities and types equipment listed shall be confirmed in writing with the Engineer and the client prior to procurement. Any costs and liabilities for incorrectly ordered or procured equipment stock without official permission being granted by the Engineer and the client shall be covered by the Contractor.
- 5.0 Only major Items have been scheduled but the Tenderer shall nevertheless include for all things he considers necessary whether specified in detail or not to complete the work to specification.
- 6.0 No extra price will be considered for the provision of material or labour which should have been allowed for in order to provide the completed works unless set out in detail and submitted separately by the Tenderer with his tender.
- 7.0 The completed Schedule of Quantities shall detail the unit rate and total amount for material and labour respectively for each Item. Tenderers are advised to check their Item extensions and total additions since no claim for mathematical errors will be considered.
- 8.0 All Items are deemed to include supply, delivery, installation and connection where appropriate, unless specifically stated otherwise. The unit rate must include for all things necessary, whether specified in detail or not, including all components, small installation materials, allowance for off-cuts, wastage, etc. erection and fixings to complete the Item to Specification in a satisfactory and workmanlike manner in order to provide a complete and working system.

- 9.0 "Material Rate" shall include the supply and delivery of all items of material and equipment (plant) to the site including all incidentals necessary for the completion of each Item, plus the profit but shall exclude VAT which shall be added as a separate item in the Price Summary.
- 10.0 "Labour Rate" shall include the cost of all labour, both skilled and unskilled, including supervision and profit required to complete the installation of all material covered by each Item but shall exclude VAT which shall be added as a separate item in the Price Summary.
- 11.0 The Engineer will check the completed Schedule of Quantities and reserves the right to adjust any individual price and to rectify any discrepancy whilst the total tender price as quoted remains unaltered. Individual rates inconsistent with the pricing structure of the majority of the rates may be changed on the basis of the average ruling prices as determined by the Engineer for similar work in the industry in the area in which the work is situated. The method by which the average ruling prices are determined will be at the sole discretion of the Engineer.
- 12.0 Unless stated to the contrary in the Particular Specification, quantities, with the exception of cable, cable joints, trenches, bedding and cover sand, cable slabs, cable and joint markers and pole holes, will not be measured on site in which case the successful Tenderer shall, within 60 days of notification of acceptance of his tender, notify the Engineer in writing of any discrepancies between the drawings, Specification and the quantities of any Item in the Schedule of Quantities, listing each such discrepancy in detail. Where it is agreed by the Engineer that any such claims are valid, the contract price will be adjusted accordingly. No further claim will be entertained except where the Employer changes the requirements of the Contract, in which case such variations will be based on unit prices quoted, where applicable. Escalation costs will, where necessary, be made on the basis of unit rates.
- 13.0 Where alternative prices for equipment of different manufacture are offered, the lowest alternative price for equipment to specification must be included, against the relevant Item in the Schedule of Quantities. The remaining alternative prices must be furnished separately.
- 14.0 Where such equipment is found not to comply with the Specification, the Contractor will be required to provide equipment which does comply, without adjustment to the price in the Schedule of Quantities.
- 15.0 In certain instances prices are requested for Items which may be required during the progress of the work, but which are not included in the known quantities of material required. These Items are indicated by the designation "R/O" (rate only) in the "Quantity" column, and the price is to be noted in the "Rate" columns only and must not be carried forward.

DAY WORK RATES

The following Items are for work not covered by rates in the Schedule of Variation Rates.

LABOUR RATES, NORMAL TIME, PER HOUR

Artisan and Labourer R.....

Apprentice and Labourer R.....

Labourer R.....

LABOUR RATES, NORMAL OVERTIME, PER HOUR

Artisan and Labourer R.....

Apprentice and Labourer R.....

Labourer R.....

LABOUR RATES, SUNDAYS AND PUBLIC HOLIDAYS, PER HOUR

Artisan and Labourer R.....

Apprentice and Labourer R.....

Labourer R.....

MATERIALS

Percentage mark up on nett cost of materials R.....%

TRANSPORT

Private car or light delivery vehiclecents/km

3 tonne truckcents/km

5 tonne truckcents/km

10 tonne truckcents/km

DATE: _____

SIGNATURE: _____

(For the Tenderer)

BILL NO1: FIRE PROTECTION INSTALLATION

Item	Description	Unit	Quantity	Tarif	Amount
	All in accordance with the drawings and specification				
	SPRINKLER SYSTEM				
	Price given below shall be nett cost of equipment and materials supplied and installed on site and shall:				
a)	Include profit, overheads, financing, insurance and guarantee costs				
b)	Include engineering and management costs				
c)	Exclude VAT				
	Sprinkler installation control valve including all valve trim fittings and equipment such as alarm gong, flow switch and gauges.				
1	Ø200 (Sprinklers with Bypass arrangement)	No	1		
2	Ø200 mm Valve Manifold with 1 x Ø150 Control Valve & 1 x Ø100 Control Valve outlets.	No	1		
3	Flow proving arrangement	No	1		
	Fire pump room and valve room protection				
4	Ø 50 Flow switch	No	1		
5	Ø 50 Gate Valve	No	1		
6	Sprinkler protection to valve room (No of Heads)	No	1		
7	Sprinkler protection to pump room (No of Heads)	No	4		
	All Sprinkler mains complete supply & installation from ICV up to and including remote area of operation for each sprinkler array, excluding pump room supply and floor piping but including all piping, hangers fittings and supports and air relief valves (Purge Valves) & Pressure relief valves				
8	Ø 150 Mains	m	275		
9	Ø 100 Mains	m	200		
10	Ø 100 to canopies	m	30		
	Sprinkler Pump mains installation from pump house to manifold				
11	Ø200 Steel pipe 4.5mm wall	m	6		
12	Fire pump room piping: All piping from the water tanks to the fire pump delivery header including all valves, fittings for new pump sets.	Item			
13	Direct reading flow meter	No.	1		
14	Remote test valve, including valve, sight glass and 15 mm orifice, all fittings and equipment complete as shown on the tender drawings.	No	10		
	In-Fill Supply to tanks				
15	Ø 100 Supply Mains	m	150		
16	Ø 100 Underground Supply Mains u-pvc Class 16	m	45		
17	Ø100 Tank In-Fill including shut off valve, strainer check valve and flow control valve to new tank.	Item	1		
18	Trenching, Bedding & backfilling for tank infill piping.	m	45		
19	In-fill tank direct reading flow measuring apparatus.	Item	1		
	All Sprinklers K 8.0 Including all Ranges complete supply & installation including, hangers, fittings, painting and supports and air relief valves (Purge Valves)				
	Floor Piping installation, including Range piping, all fittings, hangers, supports, brackets, bracing, Trapeze bars,couplings and sprinkler heads complete per zone as follows (Based on cost per sprinkler head)				
20	Valve 1: Sprinklers to Roof - 141°C K8.0 (metric) Pendant Spray	No	679		
21	Sprinklers to Offices - 68°C K8.0 (metric) Pendant Conventional	No	25		
22	Sprinklers to Canopies - 68°C K8.0 (metric) Upright Conventional	No	50		
23	Valve 2: In-rack Sprinklers - 141°C K11.5 (metric) Pendant Spray	No	686		

BILL NO1: FIRE PROTECTION INSTALLATION

Item	Description	Unit	Quantity	Tarif	Amount
24	Water Storage tank (GV Tec Stainless Steel tanks) including all suction lines, valves, peripherals, fittings and accessories as specified, (2 x 250 m³ Tank capacity). ASIB approved and tested	No	1		
25	Diesel driven fire pump and day tank complete with all fittings and accessories as specified, starting arrangement etc To curve in specification. ASIB approved and tested	No	1		
26	Diesel driven fire pump controller and annunciator panel complete with all fittings and accessories as specified. ASIB approved and tested	No	1		
27	Jockey pump and controller complete with all fittings and accessories as required. ASIB approved and tested	No	1		
28	Operating and maintenance manuals and as built drawings	Item			
29	Plant room and valve room framed and laminated instruction block plans and schematics.	Item			
	Spare parts as listed below:				
30	Diesel pump manufacturers spares recommended	Sets	1		
31	Diesel Engine manufacturers spares recommended	Sets	1		
32	Valve Gaskets and seals (1 per valve)	Sets	1		
33	Pressure switches	No	1		
34	Flow switches	No	1		
35	Standard K 8.0 141°C Sprinklers (Spray)	No	12		
36	Standard K 8.0 68°C Sprinklers (Conventional)	No	6		
37	Standard K 11.5 141°C Sprinklers (Spray)	No	12		
38	Sprinkler Wrench	No	2		
39	Recommended other spares etc (List and detail)				
40	Training of staff	Item			
41	Any item not listed (Specify)				
TOTAL TRANSFERRED TO "SUMMARY OF TENDER BILLS" - ITEM 1					

BILL NO2: FIRE WATER INSTALLATION

Item	Description	Unit	Quantity	Tarif	Amount
	All in accordance with the drawings and specification FIRE HYDRANT & FIRE HOSE REEL SYSTEM Price given below shall be nett cost of equipment and materials supplied and installed on site and shall:				
a)	Include profit, overheads, financing, insurance and guarantee costs				
b)	Include engineering and management costs				
c)	Exclude VAT				
	Fire piping: Allow for connecting to the existing fire mains.				
1	Ø 100 Isolating Valve	No	1		0
	Fire Hose reel main piping in warehouse: including all fittings, hangers, supports, brackets, bracing, couplings and droppers to outlets				
2	Ø 100 galvanized Steel	m	150		0
3	Ø 65 galvanized Steel	m	70		0
4	Ø 32 galvanized Steel	m	10		0
5	Ø 25 galvanized Steel droppers	m	75		0
	Fire hydrants complete: Fire hydrant complete with brackets, unions and line pressure guage with proper vent cock.				
6		No	11		0
	Fire hose reel complete: Fire hose reel complete with mounting brackets, and mounting stands, valve and union and line pressure guage with proper vent cock.				
7		No	5		0
	Fire extinguishers complete with backing boards and holding clips				
8	- 4.5 kg DCP	No	2		0
9	- 9 kg DCP	No	48		0
10	- 5kg CO2	No	2		0
TOTAL TRANSFERRED TO "SUMMARY OF TENDER BILLS" - ITEM 2					0

BILL NO3: SCAFFOLDING AND ERECTION EQUIPMENT, PAINTING & REMOVAL OF OLD SPRINKLER SYSTEM.

Item	Description	Unit	Quantity	Tarif	Amount
1	SCAFFOLDING Allow for the provision, erection, use, dismantling and transportation of scaffolding in accordance with the requirements of the Occupational Health and Safety Act (Act 85 of 1993).	Item	1		0
2	ERECTION EQUIPMENT Allow for any additional erection equipment required for the installation of the system to all portions of the building as indicated on the tender drawings.	Item	1		0
3	Allow for the existing system to be removed in its entirety.	Item	1		0
4	Allow for 1 x shop coat of etch primer and 2 x coats of signal red enamel to all pipework.	Item	1		0
TOTAL TRANSFERRED TO "SUMMARY OF TENDER BILLS" - ITEM 3					0

[illegible]