CITY OF TSHWANE
IGNITING EXCELLENCE

TENDER REFERENCE: EEBU 13 - 2025.26

TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION: OVER A THREE YEAR PERIOD

VOLUME 1

A Tender for Category 9EP CIDB Registered Contractors

ISSUED BY:	**PREPARED BY:**
The Chief Financial Officer Financial Services Department Supply Chain Management 320 Madiba Street, Pretoria PO Box 440 Pretoria 0001 Tel: (012) 358 8100	Energy and Electricity Business Unit 252 Thabo Sehume Street, Pretoria PO Box 440 Pretoria 0001 Contact: Mr Neo Mokalila Tel: (012) 358 2898 Email: Neomok@tshwane.gov.za

Registered Name of Tenderer:	
Trading Name of Tenderer:	
Registration No. of Entity:	
Postal address of Tenderer:	
Contact Person:	CoT Vendor No:
Tel. No.:	E-mail Address:
Cell No.:	Fax No:
CIDB CRS Number(s) :	

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In compliance with THE CIDB standards for uniformity

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LIST OF ABBREVIATIONS

(in alphabetical order)

Abbreviation	Description
B-BBEE	Broad-Based Black Economic Empowerment
CIDB	Construction Industry Development Board
CLO	Community Liaison Officer
CoT	City of Tshwane
CPA	Cost Price Adjustment
EEBU	Energy and Electricity Business Unit
EP	Electrical Engineering Works (CIDB grading system)
EPWP	Expanded Public Works Programme
FAT	Factory Acceptance Test
ISO	International Organization for Standardization
kV	Kilo Volts (1000 V)
MVA	Mega Volt Ampere (1 000 000 VA)
OHSA	Occupational Health and Safety Act
O&MM	Operations and Maintenance Manuals
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SEIFSA	Steel and Engineering Industries Federation of Southern Africa


Wildebees 400/132kV
25°45'16.69"S
28°25'1.07"E
SKIRLEK SUPER SHOP & C
Wildebees 400/132kV
Kutumela-Molefi Intm. Farm School
Sunbird Aloes Wholesale Nursery, by...
Bronkhorstspruit Rd
Kuhle Lodge and Wedding Resort
R223
Google Earth
Image © 2025 Airbus
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PORTION 1: TENDER

PART T1: TENDER PROCEDURES

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T1.1 TENDER NOTICE AND INVITATION TO TENDER

EEBU 13 - 2025.26

CITY OF TSHWANE
ENERGY & ELECTRICTY BUSINESS UNIT
ELECTRICITY PLANNING AND DEVELOPMENT DIVISION

TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION

Tenders are hereby invited for the above work.

Tenderers should have a CIDB contractor grading designation of Category 9EP

THE TENDER DOCUMENTS WILL BE AVAILABLE ON CITY OF TSHWANE OFFICIAL WEBSITE (WWW.TSHWANE.GOV.ZA)

TENDER BRIEFING SESSION

Compulsory tender site meeting will be held on:

Date & Time: 28 January 2026 at 10H00

Venue: Mini Munitoria offices Council Chambers 400 J Letwaba Street Mamelodi West

Prospective tenderers must already be in possession of the tender document and be familiarised with the contents. ONLY TWO or less representatives of each prospective tenderer will be allowed to attend the meeting and site inspection.
The Municipality reserves the right to accept any tender as a whole or in part or no tender.

Tenders must remain valid for a period of **90 days** after the closing date for the submission of tenders, during which period a tender may not be amended or withdrawn and may be accepted at any time by the Municipality.

The closing time for receipt of tenders is **10H00am on 23 February 2026**. Tenders will be received on the closing date and time shown, must be enclosed in sealed envelopes bearing the applicable tender heading and reference number, as well as the closing time and due date, and must be addressed to the Divisional Head, SUPPLY CHAIN MANAGEMENT, PRETORIA, 0002 and must be submitted in the tender box situated at Tshwane House, 320 Madiba Street, Pretoria CBD. Tenders will be opened at the latter address at the time indicated.

ENQUIRIES:

Employers Agent:	**Mbebetsi J Mboyane**
Tel (Office):	**012 358 3790**
E-Mail:	**mbetsimb@tshwane.gov.za**

Mr Johann Mettler
City Manager
NOTICE 09 of 2025/26

T1.2 TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in **Annexure C** of **Standard for Uniformity in Construction Procurement (Board Notice Government Gazette No 42622 of 08 August 2019)**, bound into Section T1.3

The Standard Conditions of Tender makes several references to the Tender Data. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender to which it mainly applies.

CLAUSE NUMBER		TENDER DATA
C.1.1	Actions	The Employer is **City Of Tshwane Metropolitan Municipality**
C.1.2	Tender Documents	Volume 1: Tender Document **THE TENDER** **Part T1: Tendering Procedures** T1.1 – Tender notice and Invitation to tender T1.2 – Tender Data T1.3 – Standard Conditions of Tender **Part T2: Returnable documents** T2.1 – List of Returnable Documents T2.2 – Returnable Schedules **THE CONTRACT** **Part C1: Agreements and contract data** C1.1 – Form of Offer and Acceptance C1.2 – Contract Data C1.3 – Form of Guarantee C1.4 - Example Form of Guarantee C1.5 – Health and Safety Agreement **Part C2: Pricing data** C2.1 – Pricing Instruction C2.2 – Pricing Schedule **Part C3: Scope of work** C3.1 – Description of Works C3.2 – Health and Safety **Part C4: Site information** C4.1 – Locality Plans and Drawings
C.1.3 *C.1.3.4*	Interpretation	**Add** the following new clause: *The tender documents have been drafted in English. The contract arising from the invitation to tender shall be interpreted and construed in English*
C.1.4	Communication and Employer's Agent	Agent: **Mbebetsi J Mboyane** Tel: **012 358 3790** E-Mail: **mbetsimb@tshwane.gov.za**

<table>
<tr><th>CLAUSE NUMBER</th><th>TENDER DATA</th></tr>
<tr><td>C.2.1 Eligibility</td><td>Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contract grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with regulation 25(1B) or 25 (7A) of the Construction Industry Development Regulations for a 9EP class of construction work, are eligible to submit tenders</td></tr>
<tr><td></td><td>Joint Ventures are eligible to submit tenders provided that:

1. The combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor designation in accordance with the sum tendered for a 9EP class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations.

<u>CIDB JOINT VENTURE GRADING TABLE</u>

<table>
<tr><th>Designation</th><th>Deemed to satisfy joint venture arrangements</th></tr>
<tr><td>3</td><td>Three contractors registered in contractor grading designation 2</td></tr>
<tr><td>4</td><td>Three contractors registered in contractor grading designation 3</td></tr>
<tr><td>5</td><td>Two contractors registered in contractor grading designation 4
One contractor registered in contractor grading designation 4 ar
two registered in contractor grading designation 3</td></tr>
<tr><td>6</td><td>Two contractors registered in contractor grading designation 5
One contractor registered in contractor grading designation 5 ar
two registered in contractor grading designation 4</td></tr>
<tr><td>7</td><td>Two contractors registered in contractor grading designation 6
One contractor registered in contractor grading designation 6 ar
two registered in contractor grading designation 5</td></tr>
<tr><td>8</td><td>Three contractors registered in contractor grading designation 7</td></tr>
<tr><td>9</td><td>Three contractors registered in contractor grading designation 8</td></tr>
</table>
</td></tr>
<tr><td></td><td>Only those tenderers who meet the minimum criteria as set out in this bid will be evaluated in four stages, namely:

• Stage 1: Administration Evaluation
• Stage 2: Mandatory Requirements
• Stage 3: Functionality Scorecard
• Stage 4: Preference Points System</td></tr>
</table>

<table>
<tr><th>CLAUSE NUMBER</th><th>TENDER DATA</th></tr>
<tr><td></td><td>
STAGE 1: Administration Evaluation

Bidders shall be evaluated for administrative compliance as requested by the City of Tshwane's Supply Chain Management requirements.
<table>
<tr><th>Compulsory Returnable Documentation (Submission of these are compulsory)</th><th>Submitted (YES or NO)</th><th>Checklist (Guide for Bidder and the Bid Evaluation Committee)</th></tr>
<tr><td>a) To enable The City to verify the bidder's tax compliance status, the bidder must provide;
• Tax compliance status PIN.
or
• Central Supplier Database (CSD)</td><td></td><td>Tax status must be compliant before the award.</td></tr>
<tr><td>b) A copy of their Central Supplier Database (CSD) registration; or indicate their Master Registration Number / CSD Number;</td><td></td><td>CSD must be valid.</td></tr>
<tr><td>c) Confirmation that the bidding company's rates and taxes are up to date: Original or copy of Municipal Account Statement of the Bidder (bidding company) not older than 3 months and account must not be in arrears for more than ninety (90) days; or ,signed lease agreement or In case of bidders located in informal settlement, rural areas or areas where they are not required to pay Rates and Taxes a letter from the local councillor confirming they are operating in that area</td><td></td><td>Was a Municipal Account Statement, signed lease agreement or letter from the local councillor provided for the bidding company? The name and / or addresses of the bidder's statement correspond with CIPC document, Address on CSD or Company profile? Are all payment(s) up to date (i.e. not in arrears for more than 90 days?</td></tr>
<tr><td>d) In addition to the above, confirmation that all the bidding company's owners / members / directors / major shareholders rates and taxes are up to date: • Original or copy of Municipal Account Statement of all the South African based owners / members / directors / major shareholders not older than 3 months and the account/s may not be in arrears for more than ninety (90) days; or a signed lease agreement of owners / members / directors / major shareholders or In case of bidders located in informal settlement, rural areas or areas where they are not required to pay Rates and Taxes a letter from the local</td><td></td><td>Was a Municipal Account Statement, signed lease agreement or letter from the local councillor provided for the bidding company? The name and / or addresses of the bidder's statement correspond with CIPC document, Address on CSD or Company profile? Are all payment(s) up to date (i.e. not in arrears for more than 90 days?</td></tr>
</table>
</td></tr>
</table>

CLAUSE NUMBER	TENDER DATA		
	councillor confirming they are residing in that area		
	e) Duly Signed and completed MBD forms (MBD 1, 4, 5, 8 and 9) The person signing the bid documentation must be authorized to sign on behalf of the bidder. Where the signatory is not a Director / Member / Owner / Shareholder of the company, an official letter of authorization or delegation of authority should be submitted with the bid document. **NB: Bidders must ensure that the directors, trustees, managers, principal shareholders, or stakeholders of this company, declare any interest in any other related companies or business, whether or not they are bidding for this contract. *See Question 3.14 of MBD 4. Failure to declare interest will result in a disqualification***		All documents fully completed (i.e. no blank spaces)? All documents fully signed by (any director / member / trustee as indicated on the CIPC document, alternatively a delegation of authority would be required? Documents completed in black ink (i.e. no "Tippex" corrections, no pencil, no other colour ink, or **non-submission of the MBD forms**, will be considered)?
	f) Audited Financial Statements for the most recent three (3) years or Audited Financial Statements from date of existence for companies less than three years old. **NB**: The bidder must submit signed audited annual financial statements for the most recent three years, or if established for a shorter period, submit audited annual financial statements from date of establishment. If the bidder is not required by law to prepare signed annual financial statements for auditing purposes, then the bidder must submit proof that the bidder is not required by law to prepare audited financial statements.		Applicable for tenders above R10m in conjunction with MBD 5) Are Audited financial statements provided (Audited financials must be signed by auditor) Or proof that the bidder is not required by law to prepare audited financial statements.
	g) Joint Ventures (JV) – (Only applicable when the bidder tenders as a joint venture) Where the bidder bids as a joint venture (JV), the required or relevant documents as per (a) to (f) above must be provided for all JV parties. In addition to the above the bidder		If applicable. JV agreement provided? JV agreement complete and relevant? Agreement signed by all parties? All required documents as per (i.e. a

CLAUSE NUMBER	TENDER DATA		
	must submit a Joint Venture (JV) agreement signed by the relevant parties. **NB**: It is a condition of this bid that the successful bidder will continue with the same Joint Venture (JV) for the duration of the contract unless prior approval is obtained from the City.		to f) must be provided for all partners of the JV.
	h) Bidder attended a compulsory briefing session where applicable		A compulsory briefing register must be signed by the bidder. **Bidders will be disqualified should they fail to attend compulsory briefing session**
	i) Pricing schedule (All items must be quoted for in pricing schedule and if not, all items are quoted the bidder will be disqualified). Unless the tender is awarded per item or per section where the bidder only quoted the items or sections, they are interested in.		Incomplete pricing schedule results in totals being incomparable. Bidder must be disqualified. **Bidder will be disqualified should they make corrections on the price schedule without attaching a signature or initialising thereto.** **Bidder will be disqualified should they use tippex/ correction ink, on the price schedule.**

STAGE 2: Mandatory Requirements

a) CIDB Registration: Only contractors registered with the Construction Industry Development Board in category 9EP will be considered for acceptance. The bidders must submit proof of the CIDB registration with the tender.
b) An organogram with all staff that will be assigned to the project
c) Proposed Project Schedule and Cash Flow Projection
d) Safety, Health, Environmental and Quality Management plan (SHEQ)
e) Proof of the bidder's relevant experience (Contract appointment letters and completion certificates)
f) Qualifications of key personnel. The personnel must have the following minimum requirements :

CLAUSE NUMBER	TENDER DATA

	PROPOSED POSITION	Minimum Qualifications
1	Director/Senior Manager	BEng/BSc/BTech Degree in Electrical Engineering (NQF Level 7 Qualification)
2	Project Manager	BEng/BSc/BTech Degree in Electrical Engineering. ECSA Registration (NQF Level 7 qualification)
3	Site Supervisor	National Certificate, (NQF Level 6 Qualification)
4	Occupational Health and Safety Officer	SACPCMP Registration Mandatory

g) Schedule of Particulars & Guarantees (Part C2.1 – Pricing Instruction Section)

STAGE 3: FUNCTIONALITY SCORE CARD

The following criteria and weights will be applied when bids are assessed for **functionality.**

The maximum possible score that can be achieved for functionality is 100.

Bids that do not achieve a minimum score of 70 (out of 100) for functionality will not be evaluated further.

NO	CRITERIA	SUB-CRITERIA	SCALE	WEIGHT	HIGHEST POSSIBLE SCORE
1	TRACK RECORD AND TECHNICAL EXPERTISE Complete Form RD.C.1 and attach signed copies of contract appointment letters and project completion certificates for work successfully completed by the tenderer. The tenderer should only list completed projects	Appointment letters and completion certificates for two (2) completed substation projects	1		

CLAUSE NUMBER	TENDER DATA					
		which entailed the design, supply, delivery, installation, testing and commissioning of equipment for the construction of electrical substations with a minimum rated voltage of 88kV. The tenderer should only list and submit evidence for electrical substation projects with a minimum contract value of R60 million (Excl. VAT).	Appointment letters and completion certificates for three (3) completed substation projects	2	10	40
			Appointment letters and completion certificates for four (4) completed substation projects	3		
			Appointment letters and completion certificates for five (5) or more completed substation projects	4		
	2	EXPERIENCE OF KEY PERSONNEL The tenderer must have in his employee, personnel with the relevant experience in the design, construction, testing and commissioning of electrical substations with a minimum rated voltage of 88kV. It is compulsory for the tenderer to complete Form RD.D.3 and indicate the experience record of each key personnel pertinent to	Points will only be allocated for personnel with a minimum of five (5) years' experience in the design and construction of substations with a minimum rated voltage of 88kV. <5years, (0 points) >5years, (1 point) (Note: Points will be allocated and added for all key personnel)			
			Director/Senior Manager	1	10	30
			Project Engineer	1		

CLAUSE NUMBER	TENDER DATA					
		the construction of electrical substation projects.	Site Supervisor	1		
	3	FINANCIAL CAPABILITY **FINANCIAL CAPABILITY** The tenderer must provide Bank Rating not older than three months indicating their Bank Rating prior to the closing of the tender. NOTE: Only bank rating of a minimum amount of R60 000 000 will be considered. (Attach original copy of Bank Stamped Letter) It is compulsory for the tenderer to complete Form RD.C.11.	Bank Rating D	0	5	20
			Bank Rating C	2		
			Bank Rating B	3		
			Bank Rating A	4		
	4	QUALITY MANAGEMENT SYSTEM The tenderer must describe the construction quality system incorporated by the tenderer in his organisation and which will be applicable to this Contract (RD.D4) Evaluation schedule: Quality Management System form to be filled by the tender	Provide company's ISO 9001 quality compliance certificate	1	5	10
			Provide company's ISO 14001 compliance certificate	1		
		HIGHEST POSSIBLE SCORE				100
	STAGE 4: **Evaluation in terms of the 90/10 preference point system**					

CLAUSE NUMBER		TENDER DATA
		i. The service provider must comply to the Occupational Health and Safety Act 85 of 1993 and its regulation. OHS plan must be submitted with tender documents
C.2.2	Cost of Tendering	The employer **will not** compensate the tenderer for any costs incurred in attending interviews or making any submissions in the office of the employer.
C.2.7	Clarification meeting	The arrangements for a **compulsory** clarification meeting and site inspection are as stated in the tender notice and invitation to tender Confirmation of attendance will be recorded on site in the attendance register to be signed by all tenderers. Addenda will be issued to and tenders received from those tendering entities appearing on the attendance register. **Tender documents will not be made available at the clarification meeting**.
C.2.8	Seek clarification	*Request clarification of the tender documents, if necessary, by notifying the employer at least **5 (Five) working days** **before the closing time stated in the tender data.***
C.2.9	Insurance	*Accept that the submission of a tender shall be construed as an acknowledgement by the tenderer that he is satisfied with, where applicable, the insurance cover the employer will affect under the contract.*
C.2.12 C.2.12.3	Alternative offers	Alternative offers will only be considered if tenderer(s) have submitted a fully completed main offer. For alternative offers a complete separate detailed activity, quantities and bill/price schedule must be submitted as a separate document. Alternative tender offer will only be considered if the main offer is the winning tender.
C2.13. Submitting a tender offer C2.13.1 C2.13.2 C2.13.3 C2.13.4 C2.13.5		Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data described in the scope of work, unless stated otherwise in the tender data. Return all returnable documents to the employer after completing them in their entirety, by writing legibly in non- erasable ink. *Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.* *Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.* *Seal the original tender offer and each of the tender offer as separate packages marking the packages as ORIGINAL and COPY. Each package shall state on the outside of the employer's address and identification details stated in the tender data, as well as the tenderers name and contact address.*

CLAUSE NUMBER	TENDER DATA
	The identification details are: Tender Reference: **EEBU 13 - 2025.26** Tender Description*:* **TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION** *Closing Time: 10:00* *Closing Date: 23 February 2026* *Each tender shall be enclosed in a sealed envelope, bearing the correct identification details and shall be placed in the tender box located at:* ***PROCUREMENT ADVICE CENTRE*** ***(TENDER BOX AT)*** ***Tshwane House*** ***320 Madiba Street*** ***PRETORIA CBD*** ***0002*** *This address is 24 hours available for delivery of tender offers.*
C2.13.6	*Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked —financial proposal|| and place the remaining returnable documents in an envelope marked —technical proposal||. Each envelope shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.*
C2.13.7	*Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.*
C2.13.8	*Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated*
C2.13.9	*Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.* *Only authorised signatories may sign the original and all copies of the tender offer where required.* *In the case of a ONE-PERSON CONCERN submitting a tender, this shall be clearly stated.* *In the case of a **COMPANY** submitting a tender, include a copy of a **resolution by its board of directors** authorising a director or other official of the company to sign the documents on behalf of the company.* *In the case of a **CLOSE CORPORATION** submitting a tender, include a copy of a **resolution by its members** authorising a member or other official of the corporation to sign the documents on each member's behalf.*

CLAUSE NUMBER		TENDER DATA
		*In the case of a **PARTNERSHIP** submitting a tender, **all the partners** shall sign the documents, unless one partner or a group of partners has been authorised to sign on behalf of each partner, in which case **proof of such authorisation** shall be included in the Tender.* *In the case of a **JOINT VENTURE/CONSORTIUM** submitting a tender, include **a resolution of each company** of the joint venture together with a **resolution by its members** authorising a member of the joint venture to sign the documents on behalf of the joint venture.* ***Accept that failure to submit proof of authorisation to sign the tender shall result in the tender offer being regarded as non-responsive.***
C.2.14 Information and data to be completed in all respects		Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.
C.2.15	Closing time	The closing time for submission of tender offers is stated in the tender notice and invitation to tender.
C.2.16 *C.2.16.5*	Tender offer validity	The tender offer validity period is **90 days**. **Add** the following new clause *In the case of a Joint Venture/Consortium/Sub-contractors each party must submit a separate original Tax Clearance Certificate.*
C.2.18	Provide other material	The tenderer shall, when requested by the employer to do so, submit the names of all management and supervisory staff that will be employed to supervise the labour-intensive portion of the works together with satisfactory evidence that such staff members satisfy the eligibility requirements.
C.2.19	Inspection, tests and analysis	The tenderer shall, when requested provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.
C2.20	Submit securities, bonds, policies, etc.	The tenderer is required to submit with his tender a letter of intent from an approved insurer undertaking to provide the performance bond to the format included in Section C1.3 of this procurement document.
C2.23	Certificates	Refer to Part T2 of this procurement document for a list of the documents that are to be returned with the tender.
C2.24	Conditions Associated with the Granting of Preferences	**Add** the following new clause The Tenderer, undertakes to: a) engage one or more Targeted Enterprises / Targeted Labour in accordance with the provisions of the SANS 1914 as varied in the Procurement Section of the Scope of Works; b) deliver to the Employer, within 5 working days of being requested in writing to do so, a Targeted Enterprise Declaration Affidavit in respect of all Targeted

CLAUSE NUMBER		TENDER DATA
		Enterprises engaged at prime contract level to satisfy Contract Participation Goal requirements; c) Accept the sanctions set out in the Scope of Works should such conditions be breached.
C2.25	*Canvassing and obtaining of additional information by tenderers*	**Add** the following new clause *The Tenderer shall not make any attempt either directly or indirectly to canvass any of the Employer's officials or the Employer's agent in respect of his tender, after the opening of the tenders but prior to the Employer arriving at a decision thereon.* *The Tenderer shall not make any attempt to obtain particulars of any relevant information, other than that disclosed at the opening of tenders.*
C2.26	*Prohibitions on awards to persons in service of the state*	**Add** the following new clause *The Employer is prohibited to award a tender to a person -* *a) who is in the service of the state; or* *b) if that person is not a natural person, of which any director, manager, principal shareholder or stakeholder is a person in the service of the state; or* *c) a person who is an advisor or consultant contracted with the municipality or municipal entity.* ***In the service of the state** means to be -* *a) a member of:-* *• any municipal council;* *• any provincial legislature; or* *• the National Assembly or the National Council of Provinces;* *b) a member of the board of directors of any municipal entity;* *c) an official of any municipality or municipal entity;* *d) an employee of any national or provincial department;* *e) provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);* *f) a member of the accounting authority of any national or provincial public entity; or* *g) an employee of Parliament or a provincial legislature.* In order to give effect to the above, the questionnaire for the declaration of interests in the tender of persons in service of state in part T2 of this procurement document must be completed.
C2.27	*Awards to close family members of persons in the service of the state*	**Add** the following new clause *Accept that the notes to the Employer's annual financial statements must disclose particulars of any award of more than R2000 to a person who is a spouse, child or parent of a person in the service of the state (defined in clause C2.25), or has been in the service of the state in the previous twelve months, including -* *a) the name of that person;* *b) the capacity in which that person is in the service of the state; and* *c) the amount of the award.* In order to give effect to the above, the questionnaire for the declaration of interests in the tender of persons in service of state in part T2 of this procurement document must be completed.
		Add the following new clause

CLAUSE NUMBER		TENDER DATA
C2.28	*Vendor registration*	*The contractor will required registering as a supplier/ service provider on the City of Tshwane's vendor register before any payment can be done.* *If the tenderer is already registered as a vendor, it is required to record the vendor number in space provided on the cover page of this Tender document.* *Vendor registration documents and support is available from the Procurement Advice Centre or from https://vendorportal.tshwane.gov.za/ All parties of a joint venture or consortium submitting a tender shall comply with the requirements of this clause.*
C2.29	*Tax*	**Add** the following new clause *An original tax clearance certificate must be submitted with this tender document.* *In the case of a Joint Venture/Consortium the tax clearance certificates must be individual original tax clearance certificates for the members of the Joint Venture/Consortium are not acceptable.*
C.3.1 C.3.1.1	Respond to requests from the tenderer	The employer will respond to requests for clarification up to 5 **(seven) working days** before the tender closing time.
C.3.4	Opening of tender submissions	Tenders will be opened immediately after the closing time for tenders
C3.11.3	Scoring	The following criteria and weights will be applied when bids are assessed for functionality Quality shall be scored by not less than three evaluators in accordance with the following schedules contained in T2.2 Returnable Schedules: RD.C.1 Evaluation Schedule: Schedule of Tenderer's Experience RD.C.11 Evaluation Schedule: Financial Capability RD.D.3 Evaluation Schedule: Key Personnel Experience RD.D.4 Evaluation Schedule: Quality Management System

CLAUSE NUMBER		TENDER DATA
C.3.13	Acceptance of Tender Offer	Tender offers will only be accepted if: a.) the tenderer has complied in full with the all eligibility criteria b.) the tenderer is able to produce an original Tax Clearance Certificate issued by the South African Revenue Service; c.) the tenderer submits a letter of intent from an approved insurer undertaking to provide to provide the Performance Bond to the format included in Section C1.3 of this procurement document; d.) the tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation. e.) the tenderer is not in arrears for more than 3 months with municipal rates and taxes and municipal service charges; f.) the tenderer or any of its directors is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector; g.) the tenderer has not: i) abused the Employer's Supply Chain Management System; or ii) failed to perform on any previous contract and has been given a written notice to this effect. h.) the tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process and persons in the employ of the state are permitted to submit tenders or participate in the contract; i.) the tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer; j.) the employer is reasonably satisfied that the tenderer has in terms of the Construction Regulations, 2003, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.
C.3.17	Copies of Contract	**One** signed copy of contract shall be provided by the Employer to the successful Tenderer.

T1.3 STANDARD CONDITIONS OF TENDER

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C.1 General

C.1.1 Actions

C.1.1.1 The Employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in C.2 and C.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

C.1.1.2 The Employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the Employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

Note:

1) *A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.*

2) *Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.*

C.1.1.3 The Employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

C.1.2 Tender Documents

The documents issued by the Employer for the purpose of a tender offer are listed in the tender data.

C.1.3 Interpretation

C.1.3.1 The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

C.1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

C.1.3.3 For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation which:

i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfil his or her duties impartially;

ii) an individual or organisation is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or

iii) incompatibility or contradictory interests exist between an employee and the organisation which employs that employee.

b) **comparative price** means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;

c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the Employer or his staff or agents in the tender process;

d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the Employer, including collusive practices intended to establish prices at artificial levels;

e) **organization** means a company, firm, enterprise, association or other legal entity, whether incorporated or not, or a public body;

f) **functionality** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs

C.1.4 Communication and Employer's agent

Each communication between the Employer and a tenderer shall be to or from the Employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The Employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the Employer's agent are stated in the tender data.

C.1.5 Cancellation and re-invitation of tenders

C.1.5.1 An organ of state may, prior to the award of the tender, cancel the tender if-

(a) due to changed circumstances, there is no longer a need for the services, works or goods requested; or

(b) funds are no longer available to cover the total envisaged expenditure; or

(c) no acceptable tenders are received.

C.1.5.2 The decision to cancel the tender must be published in the CIDB website and in the Tender Bulletin for the media in which the original tender invitation as advertised.

C.1.6 Procurement procedures

C.1.6.1 General

Unless otherwise stated in the tender data, a contract will, subject to C.3.13, be concluded with the tenderer who in terms of C.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

C.1.6.2 Competitive negotiation procedure

C.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of C.3.4, the Employer shall announce only the names of the tenderers who make a submission. The requirements of C.3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

C.1.6.2.2 All responsive tenderers, or not less than three responsive tenderers that are highest ranked in terms of the evaluation method and evaluation criteria stated in the tender data, shall be invited in each round to enter competitive negotiations, based on the principle of equal treatment and keeping confidential the proposed solutions and associated information. Notwithstanding the provisions of C.2.17, the Employer may request that tenders be clarified, specified, and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

C.1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the Employer to make a fresh tender offer, based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

C.1.6.2.4 The contract shall be awarded in accordance with the provisions of C.3.11 and C.3.13 after tenderers have been requested to submit their best and final offer.

C.1.6.3 Proposal procedure using the two stage-system

C.1.6.3.1 Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The Employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

C.1.6.3.2 Option 2

C.1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The Employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

C.1.6.3.2.2 The Employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data and award the contract in terms of these conditions of tender.

C.2 Tenderer's obligations

C.2.1 Eligibility

C.2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with Employer.

C.2.1.2 Notify the Employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the Employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the Employer's written approval to do so prior to the closing time for tenders.

C.2.2 Cost of tendering

C.2.2.1 Accept that, unless otherwise stated in the tender data, the Employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

C.2.2.2 The cost of the tender documents charged by the Employer shall be limited to the actual cost incurred by the Employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

C.2.3 Check documents

Check the tender documents on receipt for completeness and notify the Employer of any discrepancy or omission.

C.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the Employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

C.2.5 Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

C.2.6 Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the Employer may issue, and if necessary, apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

C.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

C.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the Employer at least five working days before the closing time stated in the tender data.

C.2.9 Insurance

Be aware that the extent of insurance to be provided by the Employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

C.2.10 Pricing the tender offer

C.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes (except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable 14 days before the closing time stated in the tender data.

C.2.10.2 Show VAT payable by the Employer separately as an addition to the tendered total of the prices.

C.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

C.2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

C.2.11 Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the Employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

C.2.12 Alternative tender offers

C.2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

C.2.12.2 Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the Employer.

C.2.12.3 An alternative tender offer may only be considered if the main tender is the winning tender.

C.2.13 Submitting a tender offer

C.2.13.1 Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

C.2.13.2 Return all returnable documents to the Employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

C.2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the Employer.

C.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The Employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the Employer shall hold liable for the purpose of the tender offer.

C.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the Employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

C.2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked “financial proposal” and place the remaining returnable documents in an envelope marked “technical proposal”. Each envelope shall state on the outside the Employer’s address and identification details stated in the tender data, as well as the tenderer's name and contact address.

C.2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the Employer's address and identification details as stated in the tender data.

C.2.13.8 Accept that the Employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

C.2.13.9 Accept that tender offers submitted by facsimile or e-mail will be rejected by the Employer, unless stated otherwise in the tender data.

C.2.14 Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the Employer as non-responsive.

C.2.15 Closing time

C.2.15.1 Ensure that the Employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

C.2.15.2 Accept that, if the Employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

C.2.16 Tender offer validity

C.2.16.1 Hold the tender offer(s) valid for acceptance by the Employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

C.2.16.2 If requested by the Employer, consider extending the validity period stated in the tender data for an agreed additional period, but no longer than 12 weeks.

C.2.16.3 Accept that a tender submission that has been submitted to the Employer may only be withdrawn or substituted by giving the Employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted.

C.2.16.4 Where a tender submission is to be substituted, submit a substitute tender in accordance with the requirements of C.2.13 with the packages clearly marked as "SUBSTITUTE".

C.2.17 Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the Employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

Note: *Sub-clause C.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.*

C.2.18 Provide other material

C.2.18.1 Provide, on request by the Employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the Employer for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the Employer's request, the Employer may regard the tender offer as non-responsive.

C.2.18.2 Dispose of samples of materials provided for evaluation by the Employer, where required.

C.2.19 Inspections, test and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

C.2.20 Submit securities, bonds and policies

If requested, submit for the Employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

C.2.21 Check final draft

Check the final draft of the contract provided by the Employer within the time available for the Employer to issue the contract.

C.2.22 Return of other tender documents

If so instructed by the Employer, return all retained tender documents within 28 days after the expiry of the validity period stated in the tender data.

C.2.23 Certificates

Include in the tender submission or provide the Employer with any certificates as stated in the tender data.

C.3 The Employer's undertakings

C.3.1 Respond to requests from the tenderer

C.3.1.1 Unless otherwise stated in the tender data respond to a request for clarification received up to five working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

C.3.1.2 Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements.

b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or

c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

C.3.2 Issue addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who drew documents.

C.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

C.3.4 Opening of tender submissions

C.3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

C.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

C.3.4.3 Make available the record outlined in C.3.4.2 to all interested persons upon request.

C.3.5 Two-envelope system

C.3.5.1 Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

C.3.5.2 Evaluate functionality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the functionality evaluation more than the minimum number of points for functionality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any points claimed on BBBEE status level. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality

C.3.6 Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

C.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

C.3.8 Test for responsiveness

C.3.8.1 Determine, after opening and before detailed evaluation, whether each tender offer properly received:

a) complies with the requirements of these Conditions of Tender,

b) has been properly and fully completed and signed, and

c) is responsive to the other requirements of the tender documents.

C.3.8.2 A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer's opinion, would:

a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,
b) significantly change the Employer's or the tenderer's risks and responsibilities under the contract, or

c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation.

C.3.9 Arithmetical errors, omissions and discrepancies

C.3.9.1 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with C.3.11 for:

a) the gross misplacement of the decimal point in any unit rate;

b) omissions made in completing the pricing schedule or bills of quantities; or

c) arithmetic errors in:

i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or

ii) the summation of the prices.

C.3.9.2 The Employer must correct the arithmetical errors in the following manner:

a) Where there is a discrepancy between the amounts in words and amounts in figures, the amount in words shall govern.

b) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.

c) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

Consider the rejection of a tender offer if the tenderer does not correct or accept the correction of the arithmetical error in the manner described above.

C.3.10 Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

C.3.11 Evaluation of tender offers

C.3.11.1 General

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate them using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

C.3.11.2 Method 1: Price and Preference

In the case of a price and preference:

1) Score tender evaluation points for price
2) Score points for BBBEE contribution
3) Add the points score for price and BBBEE

C.3.11.3 Method 2: Functionality, Price and Preference

In the case of a functionality, price and preference:

1) Score functionality, rejecting all tender offers that fail to achieve the minimum number of points for functionality as stated in the Tender Data.
2) No tender must be regarded as an acceptable tender if it fails to achieve the minimum qualifying score for functionality as indicated in the tender invitation.
3) Tenders that have achieved the minimum qualification score for functionality must be evaluated further in terms of the preference points system prescribed in paragraphs 4 and 4 and 5 below.

4) **The 80/20 preference point system for acquisition of services, works or goods up to Rand value of R1 million:**

(a) The following formula must be used to calculate the points for price in respect of tenders (including price quotation) with a Rand value equal to, or above R 30 000 and up to Rand value of R 1 000 000 (all applicable taxes included):

(i) $P_s = 80 \times \left[1 - \left(\frac{P_t - P_{min}}{P_{min}}\right)\right]$

Where

P_s = Points scored for comparative price of tender or offer under consideration;
P_t = Comparative price of tender of offer under consideration; and
P_{min} = Comparative price of lowest acceptable tender or offer.

(ii) An Employer of state may apply the formula in paragraph (i) for price quotations with a value less than R 30 000, if and when appropriate.

(b) Subject to subparagraph 4)(c), points must be awarded to a tender for attaining the B-BBEE status level of contributor in accordance with the table below:

B-BBEE Status Level of Contributor	Number of Points
1	20
2	18
3	16
4	12
5	8
6	6
7	4
8	2
Non-compliant Contributor	0

(c) A maximum of 20 points may be allocated in accordance with subparagraph 4)(b)

(d) The points scored by tender in respect of B-BBEE contribution contemplated in subparagraph 4)(b) must be added to the points scored for price a calculated in accordance with subparagraph 4)(a).

(e) Subject to paragraph C.4.3.8 the contract must be awarded to the tender who scores the highest total number of points.

5) **The 90/10 preference points system for acquisition of services, works or goods with a Rand value above R1 million:**

(a) The following formula must be used to calculate the points for price in respect of tenders with a Rand value above R 1 000 000 (all applicable taxes included):

$$P_s = 90 \times \left[1 - \left(\frac{P_t - P_{min}}{P_{min}}\right)\right]$$

Where

P_s = Points scored for comparative price of tender or offer under consideration;
P_t = Comparative price of tender of offer under consideration; and
P_{min} = Comparative price of lowest acceptable tender or offer.

(b) Subject to subparagraph 5)(c), points must be awarded to a tender for attaining the B- BBEE status level of contributor in accordance with the table below:

B-BBEE Status Level of Contributor	Number of Points
1	10
2	9
3	8
4	5
5	4
6	3
7	2
8	1
Non-compliant Contributor	0

(c) A maximum of 20 points may be allocated in accordance with subparagraph 5)(b)

(d) The points scored by tender in respect of B-BBEE contribution contemplated in subparagraph 5)(b) must be added to the points scored for price a calculated in accordance with subparagraph 5)(a).

(e) Subject to paragraph C.4.3.8 the contract must be awarded to the tender who scores the highest total number of points.

C.3.11.6 Decimal places

Score financial offers, preferences and quality, as relevant, to two decimal places.

C.3.11.7 Scoring financial offers

Score the financial offers of remaining responsive tender offers using the following formula:

$$N_{FO} = W_1 \times A$$

Where N_{FO} is the number of tender evaluation points awarded for the financial offer

W_1 is the maximum possible number of tender evaluation points awarded for the financial offer as stated in the tender data.

A is a number calculated using the formula and option described in Table C.1 as stated in the tender data.

Table C.1: Formulae for calculating the value of A

Formula	Comparison aimed at achieving	Option 1[a]	Option 2[a]
1	Highest price or discount	$A = \left(1 + \frac{(P - P_m)}{P_m}\right)$	$A = P/P_m$
2	Lowest price or percentage commission / fee	$A = \left(1 - \frac{(P - P_m)}{P_m}\right)$	$A = P_m/P$
a	P_m is the comparative offer of the most favourable comparative offer. P is the comparative offer of the tender offer under consideration.		

C.3.11.8 Scoring preferences

Confirm that tenderers are eligible for the preferences claimed in accordance with the provisions of the tender data and reject all claims for preferences where tenderers are not eligible for such preferences. Calculate the total number of tender evaluation points for preferences claimed in accordance with the provisions of the tender data.

C.3.11.9 Scoring functionality

Score each of the criteria and sub criteria for quality in accordance with the provisions of the Tender Data.

Calculate the total number of tender evaluation points for quality using the following formula:

$$N_Q = W_2 \times S_O/M_S$$

Where S_O is the score for quality allocated to the submission under consideration;

M_S is the maximum possible score for quality in respect of a submission; and

W_2 is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data.

C.3.12 Insurance provided by the Employer

If requested by the proposed successful tenderer, submit for the tenderer's information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the Employer to provide.

C.3.13 Acceptance of tender offer

Accept the tender offer, if in the opinion of the Employer, it does not present any unacceptable commercial risk and only if the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the Employer's procurement,

b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,

c) has the legal capacity to enter into the contract,

d) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,

e) complies with the legal requirements, if any, stated in the tender data, and

f) is able, in the opinion of the Employer, to perform the contract free of conflicts of interest.

C.3.14 Prepare contract documents

C.3.14.1 If necessary, revise documents that shall form part of the contract and that were issued by the Employer as part of the tender documents to take account of:

a) addenda issued during the tender period,

b) inclusion of some of the returnable documents, and

c) other revisions agreed between the Employer and the successful tenderer.

C.3.14.2 Complete the schedule of deviations attached to the form of offer and acceptance, if any.

C.3.15 Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

C.3.16 Notice to unsuccessful tenderers

C.3.16.1 Notify the successful tenderer of the Employer's acceptance of his tender offer by completing and returning one copy of the form of offer and acceptance before the expiry of the validity period stated in the tender data, or agreed additional period.

C.3.16.2 After the successful tenderer has been notified of the Employer's acceptance of the tender, notify other tenderers that their tender offers have not been accepted.

C.3.17 Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the tender data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

C.3.18 Provide written reasons for actions taken

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

C.3.19 Transparency in the procurement process

C.3.19.1 The CIDB prescripts require that tenders must be advertised and be registered on the CIDB i.Tender system.

C.3.19.2 The Employer must adopt a transparency model that incorporates the disclosure and accountability as transparency requirements in the procurement process.

C.3.19.3 The transparency model must identify the criteria for selection of projects, project information template and the threshold value of the projects to be disclosed in the public domain at various intervals of delivery of infrastructure projects.

C.3.19.4 The client must publish the information on a quarterly basis which contains the following information:

- Procurement planning process
- Procurement method and evaluation process
- Contract type
- Contract status
- Number of firms tendering
- Cost estimate
- Contract title
- Contract firm(s)
- Contract price
- Contract scope of work
- Contract start date and duration
- Contract evaluation reports

C.3.19.5 The employer must establish a Consultative Forum which will conduct a random audit in the implementation of the transparency requirements in the procurement process.

C.3.19.6 Consultative Forum must be an independent structure from the bid committees.

C.3.19.7 The information must be published on the employer's website.

C.3.19.8 Records of such disclosed information must be retained for audit purposes.


Njala 275/132kV
25°50'53.16"S
28°17'25.45"E
Elephant and Friends - Moreleta Park, Pretoria
THE MEADOWS
MEADOW RIDGE
MEADOW HEIGHTS
Hesketh Dr
Cork Tree St
Hulsboom St
Lucky Bean Cres
Delmas Rd
M31
R50
Njala
Google Earth
Image © 2025 Airbus
N
600 m

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T2.1 LIST OF RETURNABLE DOCUMENTS

RD.A RETURNABLE DOCUMENTS FOR TENDER EVALUATION PURPOSES

Note: ***Failure to fully complete and submit the applicable documents will result in the tender offer being disqualified from further consideration***

Document Name	Reference	**Confirmation of Document Included** (Tenders may use this column to confirm documents have been completed and included in the tender)
Form of offer and acceptance	Section C1.1	
MBD 4: Declaration of interest	Form RD.A.1	
Copy/s of Municipal Account/s of the tenderer and each Director/Member of the company or where applicable a copy of the lease agreement	Must be submitted	

RD.B RETURNABLE DOCUMENTS REQUIRED FOR PREFERENTIAL PROCUREMENT EVALUATION PURPOSES

Note: ***Failure to submit the applicable documents will result in the tender offer being awarded 0 (zero) preference points***

Document Name	Reference	**Confirmation of Document Included** (Tenders may use this column to confirm documents have been completed and included in the tender)
Preference Points claim form in terms of the Preferential procurement regulations 2022	Form RD.B.1	
Valid B-BBEE Status Level of Contributor Certificate	Form RD.B.2	
B-BBEE Exempted Micro Enterprise – Sworn Affidavit	Form RD.B.3	
Promotion of local enterprises (Local Economic Participation)	Form RD.B.4	
Certified copy of Identity Document/s proof of ownership (Sworn affidavit for B-BBEE qualifying small enterprise or Exempt Micro Enterprises, CIPC registration or any other proof of ownership	Form RD.B.5	
Medical Certificate with doctor's details (Practice Number, Physical Address and contact numbers) proof of ownership (Sworn affidavit for B-BBEE qualifying small enterprise or Exempt Micro Enterprises, CIPC registration or any other proof of ownership	Form RD.B.6	

RD.C ADDITIONAL RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES

Document Name	Reference	**Confirmation of Document Included** (Tenders may use this column to confirm documents have been completed and included in the tender)
Tax clearance certificate	Must be submitted	
Schedule of Tenderer's experience	RD.C.1	
Schedule of Proposed Subcontractors	RD.C.2	
Schedule of Plant and Equipment	RD.C.3	
Compliance with OHSA (Act 85 of 1993)	RD.C.4	
Record of services provided to organs of state	RD.C.5	
Company information for tenders greater than R 10 million	RD.C.6	
Classification of Business	RD.C.7	
Certificate of Authority of Signatory	RD.C.8	
Status of Concern Submitting Tender	RD.C.9	
Proof of Registration with the CIDB 9EP or higher	As required	
Certificate of independent bid determination	RD.C.10	
Bank Rating Report	Form RD.C.11	
Copy/ies of Municipal Account/s of the tenderer and each Director/Member of the company or where applicable a copy of the lease agreement	Must be submitted	

RD.D ADDITIONAL RETURNABLE DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

Document Name	Reference	**Confirmation of Document Included** (Tenders may use this column to confirm documents have been completed and included in the tender)
Evaluation Schedule: Test Certificates for Electrical Equipment	RD.D.1	
Estimated Monthly Expenditure on Contract Works by Tenderer	RD.D.2	
Key-Personnel / Management and Supervisory Staff	RD.D.3	
Quality Management Systems	RD.D.4	

RD.E OTHER DOCUMENTS THAT WILL INCORPORATED INTO THE CONTRACT

Document Name	Reference	**Confirmation of Document Included** (Tenders may use this column to confirm documents have been completed and included in the tender)
Form of offer and acceptance	Section C1.1	
Data provided by the contractor	Section C1.2	
Activity Schedules / Bill of Quantities	Section C2	
Record of addenda to tender documents	RD.E.1	
Proposed amendments	RD.E.2	
Cost price adjustment (CPA) Local contents (SEIFSA)	RD.E.3	
Cost price adjustment (CPA) Imported content (FOREX)	RD.E.4	
SCADA operation verification	RD.E.5	
Verification of schedule of particulars & guarantees	RD.E.6P	

T2.2 RETURNABLE SCHEDULES

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FORM RD.A.1 MBD 4:

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state[1].

2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.

3. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

3.1 Full Name of bidder or his or her representative: ……

3.2 Identity Number: ……

3.3 Position occupied in the Company (director, trustee, hareholder[2]) ……

3.4 Company Registration Number: ……

3.5 Tax Reference Number: ……

3.6 VAT Registration Number: ……

3.7 The names of all directors / trustees / shareholders members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below.

3.8 Are you presently in the service of the state? **YES / NO**

3.8.1 If yes, furnish particulars. ……

……

[1] MSCM Regulations: "in the service of the state" means to be –
(a) a member of –
(i) any municipal council;
(ii) any provincial legislature; or
(iii) the national Assembly or the national Council of provinces;
(b) a member of the board of directors of any municipal entity;
(c) an official of any municipality or municipal entity;
(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);
(e) a member of the accounting authority of any national or provincial public entity; or
(f) an employee of Parliament or a provincial legislature.

[2] Shareholder" means a person who owns shares in the company and is actively involved in the management of the company or business and exercises control over the company.

3.9 Have you been in the service of the state for the past twelve months? **YES/NO**

3.9.1 If yes, furnish particulars. ……

……

3.10 Do you have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

3.10.1 If yes, furnish particulars. ……

……

3.11 Are you, aware of any relationship (family, friend, other) between any other bidder and any persons in the service of the state who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

3.11.1 If yes, furnish particulars. ……

……

3.12 Are any of the company's directors, trustees, managers, principle shareholders or stakeholders in service of the state? **YES / NO**

3.12.1 If yes, furnish particulars. ……

……

3.13 Are any spouse, child or parent of the company's directors trustees, managers, principle shareholders or stakeholders in service of the state? **YES / NO**

3.13.1 If yes, furnish particulars. ……

……

3.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether or not they are bidding for this contract. **YES / NO**

3.14.1 If yes, furnish particulars: ……

……

1. Full details of directors / trustees / members / shareholders.

FULL NAME	IDENTITY NUMBER	STATE EMPLOYEE NUMBER

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

MBD 6.1

FORM RD.B.1 PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 20229

---

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

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

1.2 To be completed by the organ of state

a) The applicable preference point system for this tender is the **90/10** preference point system.

1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:

(a) Price; and

(b) Specific Goals.

1.4 To be completed by the organ of state:

The maximum points for this tender are allocated as follows:

	Points
PRICE	90
SPECIFIC GOALS	10
TOTAL POINTS FOR PRICE AND SPECIFIC GOALS	**100**

1.5 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed.

1.6 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

(a) **"tender"** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation;

(b) **"price"** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;

(c) **"rand value"** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

(d) **"tender for income-generating contracts"** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and

(e) **"the Act"** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

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

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

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

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

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

3.2. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

3.2.1. POINTS AWARDED FOR PRICE

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

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

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

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmax = Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

4.1. In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as may be supported by proof/

documentation stated in the conditions of this tender:

4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—

(a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or

(b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,

then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.

***Note to tenderers: The tenderer must indicate how they claim points for each preference point system.*)**

Specific goals	**90/10 preference point system**	**Number of points claimed (90/10 system) (To be completed by the tenderer)**
BB-BEE score of companies • Level 1 • Level 2 • Level 3 • Level 4 • Level 5 • Level 6 • Level 7 • Level 8 • Non-compliant	 • 4 Points • 3.5 Points • 3 Points • 2.5 Points • 2 Points • 1.5 Points • 1 Point • 0.5 Points • 0 Points	
EME and/ or QSE	1 Point	
At least 51% of Women-owned companies	1 Point	
At least 51% owned companies by People with disability	1 Point	
At least 51% owned companies by Youth	1 Point	
Local Economic Participation • City of Tshwane • Gauteng • National	 2 Points 1 Point 1 Point	

N.B For points to be allocated as per above the tenderers will be required to submit proof of documentation as evidence for claims made. Any tenderer that does not submit evidence as stated in the bid document to claim applicable points will be allocated zero points.

DECLARATION WITH REGARD TO COMPANY/FIRM

4.3. Name of company/firm……

4.4. Company registration number: ……..

4.5. TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One-person business/sole propriety
- ☐ Close corporation
- ☐ Public Company
- ☐ Personal Liability Company
- ☐ (Pty) Limited
- ☐ Non-Profit Company
- ☐ State Owned Company

[TICK APPLICABLE BOX]

4.6. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

i) The information furnished is true and correct;

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;

iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have

(a) disqualify the person from the tendering process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution, if deemed necessary.

……

SIGNATURE(S) OF TENDERER(S)

SURNAME AND NAME: ……

DATE: ……

ADDRESS: ……

……

……

……

FORM RD.B.2 VALID B-BBEE STATUS LEVEL OF CONTRIBUTOR CERTIFICATE

Submit B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or a Registered Auditor approved by the Independent Regulatory Board of Auditors (IRBA) or an Accounting Officer as contemplated in the Close Corporation Act (CCA).

NOTE:

1. Attach original copy of B-BBEE Verification Certificate to this page.

2. In the case of a joint venture / consortium parties must each attach original copy of their B-BBEE Verification Certificates.

FORM RD.B.3 B-BBEE EXEMPTED MICRO ENTERPRISE – SWORN AFFIDAVIT

I, the undersigned

Full Name & Surname																
Identity Number																

Hereby declare under oath as follow:

1. The contents of this statement are to the best of my knowledge a true reflection of the facts.
2. I am a member / director / owner of the following enterprise and am duly authorised to act on its behalf.

Enterprise Name	
Trading Name	
Registration Number	
Enterprise Address	

3. I hereby declare under oath that:

- The enterprise is _____ % black owned;
- The enterprise is _____ % woman owned;
- The enterprise is _____ % owned companies by People with disability;
- The enterprise is _____ % owned companies by Youth;
- Based on the audited management accounts and other information available on the _____ financial year, the income did not exceed R 10,000,000 (ten million rands);
- Please confirm on the below the B-BBEE level contributor, by ticking the applicable box.

100% Black owned	**Level One** (135% B-BBEE procurement recognition)
More than 51% Black owned	**Level Two** (125% B-BBEE procurement recognition)
Less than 51% Black owned	**Level Four** (100% B-BBEE procurement recognition)

4. The entity is an empowering supplier in terms of the DTI Codes of Good Practice
5. I know and understand the contents of the contents of this affidavit and I have no objection to take the prescribed oath and consider the oath binding on my conscience and on the owners of the enterprise which I represent in this matter.
6. The sworn affidavit will be valid for a period of 12 (twelve) month from the date signed by the commissioner.

Deponent Signature: ……. Date: …….

Commissioner of oaths
(Signature and stamp)

1. Attach original or certified copy of CSD registration certificate to this page.

2. In the case of a joint venture / consortium (excluding consulting engineering partners) the joint venture / consortium must attach original or certified copy of their CSD registration certificate to this page.

FORM RD.B.4 PROMOTION OF LOCAL ENTERPRISES

The City of Tshwane has mandated the promotion of local enterprises. To comply with this the tenderer must provide proof of the type of business unit and whether the unit resides within the Tshwane and will be scored as follow:

If 90/10 preference point system applies:

	Promotion of local enterprises
No Response (score 0)	The tenderer did not respond or comply with this evaluation schedule. A score of 0 will also be awarded for any misrepresentation made in this regard,
Satisfactory (score 1)	The tenderer operates a head office or fully staffed office or his sole office outside the boundaries of Gauteng Province. (I.e. no business unit or office resides within the boundaries of Tshwane Metropolitan Municipality)
Good (score 1)	The tenderer's office resides within the boundaries of Gauteng Province. (I.e. no business unit or office resides within the boundaries of Tshwane Metropolitan Municipality)
Very good (score 2)	The tenderer's office resides within the boundaries of the Tshwane Metropolitan Municipality.

Municipal Rates & Taxes not older than three months from tender advertisement date or Valid Lease Agreement should be attached as evidence.

(If necessary the tenderer will be requested to present the office / business unit to officials of the City)

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.B.5 At least 51% Women owned companies and At least 51% owned companies by Youth

The City of Tshwane has mandate for the promotion At least 51% Women owned companies and At least 51% owned companies by youth. To comply with this the tenderer must provide Certified copy of Identity Document/s that proof that company is 51% owned by Women or youth

	promotion At least 51% Women owned companies and At least 51% owned companies by youth
No Response (score 0)	The tenderer did not respond or comply with this evaluation schedule. A score of 0 will also be awarded for any misrepresentation made in this regard,
Good (score 1	Certified copy of Identity Document/s that proof that company is 51% owned by Women and proof of ownership (Sworn affidavit for B-BBEE qualifying small enterprise or Exempt Micro Enterprises, CIPC registration or any other proof of ownership
Good (score 1)	Certified copy of Identity Document/s that proof that company is 51% owned by youth and proof of ownership (Sworn affidavit for B-BBEE qualifying small enterprise or Exempt Micro Enterprises, CIPC registration or any other proof of ownership

(If necessary the tenderer will be requested to present the office / business unit to officials of the City)

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.B.6 At least 51% owned companies by People with disability

The City of Tshwane has mandate for the promotion of At least 51% owned companies by People with disability. To comply with this the tenderer must provide Medical Certificate with doctor's details (Practice Number, Physical Address and contact numbers that proof that company is 51% owned by People with disability.

	Promotion of At least 51% owned companies by People with disability
No Response (score 0)	The tenderer did not respond or comply with this evaluation schedule. A score of 0 will also be awarded for any misrepresentation made in this regard,
Good (score 1)	Medical Certificate with doctor's details (Practice Number, Physical Address and contact numbers and proof of ownership (Sworn affidavit for B-BBEE qualifying small enterprise or Exempt Micro Enterprises, CIPC registration or any other proof of ownership

(If necessary the tenderer will be requested to present the office / business unit to officials of the City)

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

TAX CLEARANCE CERTIFICATE REQUIREMENTS

It is a condition of bid that the taxes of the successful bidder must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the bidder's tax obligations.

1. In order to meet this requirement bidders are required to complete in full the form TCC 001 "Application for a Tax Clearance Certificate" and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign bidders / individuals who wish to submit bids.

2. SARS will then furnish the bidder with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.

3. The original Tax Clearance Certificate must be submitted together with the bid. Failure to submit the original and valid Tax Clearance Certificate will result in the invalidation of the bid. Certified copies of the Tax Clearance Certificate will not be acceptable.

4. In bids where Consortia / Joint Ventures / Sub-contractors are involved, each party must submit a separate Tax Clearance Certificate.

5. Copies of the TCC 001 "Application for a Tax Clearance Certificate" form are available from any SARS branch office nationally or on the website www.sars.gov.za.

6. Applications for the Tax Clearance Certificates may also be made via eFiling. In order to use this provision, taxpayers will need to register with SARS as eFilers through the website www.sars.gov.za

Attach Tax Certificate/s to this page

FORM RD.C.1: SCHEDULE OF TENDERER'S EXPERIENCE

The following is a statement of similar work successfully executed by myself/ourselves.

Employer, contact person and telephone number	Description of contract	Value of work	*Date of appointment	**Date of completion

* Attach signed copies of contract appointment letters
** Attach signed copies of contract completion certificates
(Attach additional pages if more space is required)

FORM RD.C.1 EVALUATION SCHEDULE: SCHEDULE OF TENDERER'S EXPERIENCE

<table>
<tr><td rowspan="5">1</td><td rowspan="5">TRACK RECORD AND TECHNICAL EXPERTISE

The tenderer must submit a list, appointment letters and completion certificates of electrical substation projects successfully completed by the tenderer.

1.1 The tenderer should only list completed projects which entailed the design, supply, delivery, installation, testing and commissioning of equipment for the construction of electrical substations with a minimum rated voltage of 88kV.

1.2 The tenderer should only list and submit evidence for electrical substation projects with a minimum contract value of R60 million (Excl. VAT).

1.3 The tenderer should complete Form RD.C.1 and attach signed copies of contract appointment letters and completion certificates of projects successfully executed by the tenderer.</td><td colspan="4">Points will only be allocated for completed substation projects with a minimum contract value of R60 000 000.00 (Excl. VAT)</td></tr>
<tr><td>2 x Substation projects completed</td><td>1</td><td rowspan="4">10</td><td rowspan="4">40</td></tr>
<tr><td>3 x Substation projects completed</td><td>2</td></tr>
<tr><td>4 x Substation projects completed</td><td>3</td></tr>
<tr><td>5 or more Substation projects completed</td><td>4</td></tr>
</table>

FORM RD.C.2 SCHEDULE OF PROPOSED SUBCONTRACTORS

You, the client, are hereby notified that it is our intention to employ the following Subcontractors for work on this contract.

If we are awarded a contract, we agree that this notification does not change the requirement for us to submit the names of proposed Subcontractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.

	NAME AND ADDRESS OF PROPOSED SUBCONTRACTOR	NATURE AND EXTENT OF WORK
1.		
2.		
3.		
4.		
5.		

FORM RD.C.3 SCHEDULE OF PLANT AND EQUIPMENT

The following are lists of major items of relevant equipment that I/we presently own or lease and will have available for this contract or will acquire or hire for this contract if my/our tender is accepted.

1. Details of major equipment that is owned by and immediately available for this contract.

QUANTITY	DESCRIPTION, SIZE, CAPACITY, ETC.

(Attach additional pages if more space is required)

2. Details of major equipment that will be hired, or acquired for this contract if my/our tender is acceptable.

QUANTITY	DESCRIPTION, SIZE, CAPACITY, ETC.

(Attach additional pages if more space is required)

FORM RD.C.4 COMPLIANCE WITH OHSA (ACT 85 OF 1993)

Tenderers are required to satisfy the Employer and the Engineer as to their ability and available resources to comply with the above by answering the following questions and providing the relevant information required below.
(Tick applicable box)

1.	Is your company familiar with the OHSA (ACT 85 of 1993) and its Regulations? Do you have a copy available?	**YES**	**NO**
2.	Who will prepare your company's Health and Safety Plan? Provide a copy of the person/s curriculum vitae/s or company profile.		
3.	Does your company have a health and safety policy? If **YES** provide a copy.	**YES**	**NO**
4.	How is this policy communicated to your employees? Provide supporting documentation.	**YES**	**NO**
5.	Does your company keep record of safety aspects of each site where work is performed? If **YES** what records are kept?	**YES**	**NO**
6.	Does your company conduct monthly safety meetings? If **YES**, provide copies of the Minutes of the last 2 meetings held.	**YES**	**NO**
7.	Does your company have a safety officer in its employment, responsible for overall safety of your company? If **YES**, explain his duties and provide a copy of his CV (***only if not the same person as in question 2 above***). If **NO**, indicate who will be appointed as safety officer for this project and provide a copy of his/her CV.	**YES**	**NO**
8.	Indicate the total number of employees in the Company.	_____	
9.	Does your company have trained first aid employees? If **YES**, indicate who.	**YES**	**NO**
10.	Does your company have a safety induction training programme in place? If **YES**, provide a summary of topics covered in such induction training programme.	**YES**	**NO**

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.C.5 RECORD OF SERVICES PROVIDED TO ORGANS OF STATE

Tenderers are required to complete this record in terms of the Supply Chain Management Regulations issued in terms of the Municipal Finance Management Act of 2003.

Include only those contracts where the tenderer identified in the signature block below was directly contracted by the employer. Tenderers must not include services provided in terms of a sub-contract agreement.

Where contracts were awarded in the name of a joint venture and the tenderer formed part of that joint venture, indicate in the column entitled "Title of the contract for the service" that was in joint venture and provide the name of the joint venture that contracted with the employer. In the column for the value of the contract for the service, record the value of the portion of the contract performed (or to be performed) by the tender.

Complete the record or attach the required information in the prescribed tabulation

	ALL SERVICES COMMENCED OR COMPLETED TO AN ORGAN OF STATE IN THE LAST FIVE YEARS			
	Organ of state, i.e. national or provincial department, public entity, municipality or municipal entity.	**Title of contract for the service**	**Value of contract for service incl. VAT (Rand)**	**Date completed (State current if not yet completed)**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				

(Attach additional pages if more space is required.)

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.C.6 COMPANY INFORMATION FOR TENDERS GREATER THAN R10 MILLION

1. The tenderer is required by law to prepare annual financial statements for auditing and is therefore requested to provide audited annual financial statements:
   - for the past three years; or
   - since their establishment if established during the past three years.

   Indicate whether these have been included in the tender: ***YES / NO***

2. Does the tenderer have any undisputed commitments for Municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 30 days? ***YES / NO***

   If so, state particulars

   ……

3. Have any contracts been awarded to the tenderer by an organ of state during the past five years? ***YES / NO***

   If so, state particulars

   ……

4. Has there been any material non-compliance or dispute concerning the execution of such contract? ***YES / NO***

   If so, state particulars

   ……

5. Is any portion of the goods or services expected to be sourced out from outside the Republic? ***YES / NO***

   If so, state what portion and whether any portion of payment from the Municipality is expected to be transferred out of the Republic.

   ……

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.
Person authorized to sign the tender:
Full name (in BLOCK letters): _____
Signature: _____
Date: _____

FORM RD.C.7 CLASSIFICATION OF BUSINESS

1. The Small Businesses are defined in the National Small Business Act, 1996 (Act 102 of 1996).

2. Information furnished with regard to the classification of Small businesses

(a.) Indicate whether the company/entity is defined as a small, medium or micro enterprise by the National Small Business Act.

YES	NO

(Tick appropriate box)

(b.) If the response to 2.(a.) is **YES**, the following must be completed:

i. Sector/sub-sector in accordance with the Standard Industrial classification:

_____

ii. Size or class:

_____

iii. Total full-time equivalent of paid employees:

_____

iv. Total annual turnover:

_____

v. Total gross asset value (fixed property excluded):

_____

(A schedule indicating the different sectors is attached to this form.)

(c.) The tenderer should substantiate the information provided by submitting the following documentation:

i. A letter from the tenderer's auditor or an affidavit from the South African Police Services confirming the correctness of the abovementioned information,

ii. Company profile indicating the tenderer's staff compliment, and

iii. 3 year financial statement or since their establishment if established during the past 3 years.

SCHEDULE OF SECTORS

SIZE OF CLASS	THE TOTAL FULL-TIME EQUIVALENT OF PAID EMPLOYEES	TOTAL TURNOVER	TOTAL GROSS ASSET VALUE (FIXED PROPERTY EXCLUDED)
AGRICULTURE			
Medium	100	R 5 mil	R 5 mil
Small	50	R 3 mil	R 3 mil
Very Small	10	R 500 000	R 500 000
Micro	5	R 200 000	R 100 000
MINING AND QUARRYING			
Medium	200	R 39 mil	R 23 mil
Small	50	R 10 mil	R 6 mil
Very Small	20	R 4 mil	R 2 mil
Micro	5	R 200 000	R 100 000
MANUFACTURING			
Medium	200	R 51 mil	R 19 mil
Small	50	R 13 mil	R 5 mil
Very Small	20	R 5 mil	R 2 mil
Micro	5	R 200 000	R 100 000
ELECTRICITY, GAS & WATER			
Medium	200	R 51 mil	R 19 mil
Small	50	R 13 mil	R 5 mil
Very Small	20	R 5.1 mil	R 1.9 mil
Micro	5	R 200 000	R 100 000
CONSTRUCTION			
Medium	200	R 26 mil	R 5 mil
Small	50	R 6 mil	R 1 mil
Very Small	20	R 3	R 500 000
Micro	5	R 200 000	R 100 000
RETAIL AND MOTOR TRADE & REPAIR SERVICES			
Medium	200	R 39 mil	R 6 mil
Small	50	R 19 mil	R 3 mil
Very Small	20	R 4 mil	R 600 000
Micro	5	R 200 000	R 100 000
WHOLESALE TRADE, COMMERCIAL AGENTS AND ALLIED SERVICES			
Medium	200	R 64 mil	R 10 mil
Small	50	R 32 mil	R 5 mil
Very Small	20	R 6 mil	R 600 000
Micro	5	R 200 000	R 100 000
CATERING, ACCOMMODATION AND OTHER TRADE			
Medium	200	R 13 mil	R 3 mil
Small	50	R 6 mil	R 1 mil
Very Small	20	R 5.1 mil	R 1.9 mil
Micro	5	R 200 000	R 100 000
TRANSPORT, STORAGE & COMMUNICATIONS			
Medium	200	R 26 mil	R 6 mil
Small	50	R 13 mil	R 3 mil
Very Small	20	R 3 mil	R 600 000
Micro	5	R 200 000	R 100 000
FINANCE & BUSINESS SERVICES			
Medium	200	R 26 mil	R 5 mil
Small	50	R 13 mil	R 3 mil
Very Small	20	R 3 mil	R 500 000
Micro	5	R 200 000	R 100 000
COMMUNITY, SOCIAL AND PERSONAL SERVICES			
Medium	200	R 13 mil	R 6 mil
Small	50	R 6 mil	R 3 mil
Very Small	20	R 1mil	R 600 000
Micro	5	R 200 000	R 100 000

FORM RD.C.8 CERTIFICATE OF AUTHORITY OF SIGNATORY

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

_____

_____

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

Held at: (place) _____

On: (date) _____

RESOLVED that:

1. The enterprise submits a tender to the Tshwane Metro Municipality in respect of the following project:

Tender Number:	**EEBU 13-2025.26**
Tender Description:	**TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION: OVER A THREE YEAR PERIOD**

2. *Mr/Ms: _____

in *his/her capacity as _____

and who will sign as follow:

Proof signature	Proof signature

be, and is hereby authorised to sign the tender, and any and all other documents and/or correspondence in connection with and relating to the tender for the enterprise mentioned above

NAME	CAPACITY	SIGNATURE

Note: 1. *Delete which is not applicable. 2. IMPORTANT: This resolution must be signed by all the directors/members/ partners of the tendering enterprise. 3. Should the number of directors/members/partners exceed the space available above, additional names and signatures must be supplied on a separate page.	**Enterprise stamp**

CERTIFICATE OF AUTHORITY OF SIGNATORY FOR JOINT VENTURES AND CONSORTIA

This Returnable Document is to be completed by joint ventures. (*Attach additional pages if more space is required*.)

We, the undersigned, are submitting this tender in a *joint venture/consortium and hereby authorise *Mr/Ms _____ authorised signatory of the enterprise _____ acting in the capacity of lead partner to sign the tender, and any and all other documents and/or correspondence in connection with and relating to the tender for the *joint venture/consortium mentioned above.

Registered name of enterprise	Registration number	% of contract value	Address	Duly authorised signatory	Mark with (x) for lead partner

Note:

1. *Delete which is not applicable.
2. IMPORTANT: This resolution must be signed by all the parties of the joint venture/consortium and every duly authorised signatory for each party to the joint venture/consortium must complete a Form RD.C.15.
3. Should the number of directors/members/partners exceed the space available above, additional names and signatures must be supplied on a separate page.

FORM RD.C.9 STATUS OF CONCERN SUBMITTING TENDER

1. General

State whether the tenderer is a company, a closed corporation, a partnership, a sole practitioner, a joint venture/consortium or a co-operative

Public Company	
Private Company	
Closed Corporation	
Partnership	
Sole Proprietary	
Joint Venture / Consortium	
Co-operative	

(Mark the appropriate option)

2. Information to be provided

If the Tendering Entity is a:		**Documentation to be submitted with the tender**
1	Closed Corporation, incorporated under the Close Corporation Act,1984, Act 69 of 1984	CIPRO CK1 or CK2 (Certified copies of the founding statement) and list of members
2	Private Company incorporated with share capital, under the companies Act, 1973, Act 61of 1973 (Including Companies incorporated under Art 53 (b))	Certified copies of: a) CIPRO CM 1 - Certificate of Incorporation b) CIPRO CM 29 – Contents of Register of Directors, Auditors and Officers c) Shareholders Certificates of all Members of the Company, plus a signed statement of the Company's Auditor, certifying each Member's ownership/shareholding percentage relative to the total.
3	Private Company incorporated with share capital, under the companies Act, 1973, Act 61of 1973 in which any, or all, shares are held by another Closed Corporation or company with, or without, share capital.	Certified copies of documents referred to in 1 and/or 2 above in respect of all such Closed Corporations and/or Companies
4	Public Company incorporated with share capital, under the companies Act, 1973, Act 61of 1973 (Including Companies incorporated under Art 21)	A signed statement of the Company's Secretary confirming that the Company is a public Company.
5	Sole Proprietary or a Partnership	Certified copy of the Identity Document of: a) such Sole Proprietary, or b) Each of the Partners in the Partnership Certified copy of the Partnership agreement.

If the Tendering Entity is a:		Documentation to be submitted with the tender
6	Co-operative	CIPRO CR2 - Certified copies of Company registration document.
7	Joint Venture / Consortium	All the documents (as described above) as applicable to each partner in the joint venture / consortium as well as a certified copy of the joint venture / consortium agreement.

Note:

1. If the shares are held in trust provide a copy of the Deed of Trust (only the front page and pages listing the trustees and beneficiaries are required) as well as the Letter of Authority as issued by the Master of the Supreme Court wherein trustees have been duly appointed and authorised
2. Include a certified copy of the Certificate of Change of Name (CM9) if applicable.

3. Registered for VAT proposes in terms of the Value-Added Tax Act (89 of 1991)

Yes ☐

No ☐

(Make an X in the appropriate space)

REGISTRATION NO: _____

PROOF OF REGISTRATION WITH THE CIDB

3. Attach original or certified copy of CIDB registration certificate to this page.

4. In the case of a joint venture / consortium (excluding consulting engineering partners) parties must each attach original or certified copy of their CIDB registration certificate.

Firm	**CRS Number**	**CIDB Grading**	**Lead Partner** (Indicate with X)
Combined CIDB Grading for Joint Venture / Consortium:			

(Calculator is available at https://registers.cidb.org.za/common/jvcalc.asp)

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

RD.C.10 CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids[1] invited.
2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging) [2]. Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.
3. Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
    a. Take all reasonable steps to prevent such abuse;
    b. Reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
    c. Cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
5. In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid.

[1] Includes price quotations, advertised competitive bids, limited birds and proposals.
[2] Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices of lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

EEBU 13-2025.26: TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION: OVER A THREE YEAR PERIOD

(Bid Number and Description)

In response to the invitation for the bid made by:

City of Tshwane Metropolitan Municipality

(Name of Municipality/Municipal Entity)

Do hereby make the following statement that I certify to be true and complete in every respect:

I certify, on behalf of,

_____

(Name of Bidder)

that:

1. I have read and understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and compete in every respect;
3. I am authorised by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorised by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word “competitor”” shall include any individual or organization, other that the bidder, whether or not affiliated with the bidder who:
   a. Has been requested to submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
   b. Could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and provides the same goods and services as the bidder and/or is in the same line of business as the bidder.
6. The bidder has arrived at the accompanying bid independently form, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[3] will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement of arrangement with any competitor regarding:
   a. Prices;
   b. Geographical area where product of services will be rendered (market allocation);
   c. Methods, factors of formulas used to calculate prices;
   d. The intention or decision to submit or not to submit, a bid;
   e. The submission of a bid which does not meet the specifications and conditions of the bid; or
   f. Bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangement with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or to the awarding of the contract.

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

[3] Joint venture of Consortium means an associations of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.
Person authorized to sign the tender:
Full name (in BLOCK letters): _____
Signature: _____
Date: _____

RD.C.11 BANK RATING REPORT

Banking Details:

Bank:	
Branch:	
Name of Account:	
Account No.:	
Type of Account:	

The Tenderer shall affix a Bank Rating Report, stamped and verified by the bank, to this page.

FORM RD.D.1 EVALUATION SCHEDULE: TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT

Equipment	Submitted Type Test Certificate. State YES/NO	Test Laboratory / Institution	Date of Testing
132KV Outdoor Circuit Breakers			
400KV Outdoor Circuit Breakers			
132KV Disconnectors & Earthing Switches			
132kV Surge Diverters			
400kV Surge Diverters			
132kV Voltage Transformers			
400kV Voltage Transformers			
132kV Current Transformers			
400kV Current Transformers			
132KV Insulators			
400KV Insulators			

FORM RD.D.2 ESTIMATED MONTHLY EXPENDITURE ON CONTRACT WORKS BY TENDERER

The tenderer shall, in the table below, state the estimated cash flow on the contract based on his preliminary programme, his tendered unit rates and his submission of payment certificates to the Employer. Amounts for Contract Price Adjustment shall not be included.

Payment Certificate No.	Amount (VAT Included)					
	a	b	a-b			Cumulative cash flow
	Payments Received	Expenditure		Net cash flow		
1			d		j=d	
2			e		k=j+e	
3			f		l=k+f	
4			g		m=l+g	
5			h		n=m+h	
6			etc		etc	
7						
8						
9						
10						
11						
12						
13						
14						
etc						
Maximum negative cash flow: take the largest negative number in the last column and write it here						

From what sources will you fund the above amount (e.g. funds internally available, bank overdraft, loan, partner (his source), etc.)

……

……

……

……

FORM RD.D.3: KEY PERSONNEL EXPERIENCE - MANAGEMENT AND SUPERVISORY STAFF

The tenderer shall list in the table below the key personnel to be engaged for this project.

Note: Form RD.D.3 must be complete for each person listed below.

	PROPOSED POSITION	NAME	YEARS OF EXPERIENCE
1	Director/Senior Manager		
2	Project Manager		
3	Site Supervisor		
4	Occupational Health and Safety Officer		
5	Environmental Officer		
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

(Attach additional pages if more space is required)

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL (Director/Senior Manager)

Note: This form should be completed for each key person listed in Form RD.D.3

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service:	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL (Project Manager/Engineer)

Note: This form should be completed for each key person listed in Form RD.D.3. **(Attach certified copies of qualifications)**

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service (Construction of electrical substations):	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL (Site Supervisor)

Note: This form should be completed for each key person listed in Form RD.D.3. **(Attach certified copies of qualifications)**

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service (Construction of electrical substations):	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL (Occupational Health and Safety Officer)

Note: This form should be completed for each key person listed in Form RD.D.3. **(Attach certified copies of qualifications)**

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service (Construction of electrical substations):	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL (Environmental Officer)

Note: This form should be completed for each key person listed in Form RD.D.3

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service (Construction of electrical substations):	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

FORM RD.D.3: CURRICULUM VITAE OF KEY PERSONNEL

Note: This form should be completed for each key person listed in Form RD.D.3

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	
Professional membership:	
Name of employer (firm):	
Current position:	**Years with firm:**
Employment record: (list in chronological order starting with earliest work experience)	
Experience record pertinent to required service (Construction of electrical substations):	
Certification: **I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.** _____ _____ *(Signature of person named in schedule)* Date:	

EPWP STAFF FOR LABOUR INTENSIVE CONSTRUCTION WORKS

The tenderer shall, submit the names of all management, design and supervisory staff that will be employed to design and supervise the labour intensive portion of the works together with satisfactory documentary evidence that such staff members satisfy the eligibility requirements.

CATEGORY OF EMPLOYEE	NAME OF EMPLOYEE	NQF LEVEL	LABOUR INTENSIVE SKILLS PROGRAM UNIT STANDARD TITLES	DATE COMPLETED	YEARS EXPERIENCE
Designer					
NQF 7 Unit Standard Required: Develop and Promote Labour Intensive Construction Strategies					
Administrator/ Site supervisor					
NQF 5 Unit Standard Required: Manage Labour Intensive Construction Projects					

(Attach documentary proof to this page)

RD.D. 3 Evaluation Schedule: Key personnel experience - Management and supervisory staff

NO	PROPOSED POSITION	MINIMUM REQUIRED QUALIFICATIONS	YES/NO
y	Director/Senior Manager	BEng/BSc/BTech Degree in Electrical Engineering (NQF Level 7 Qualification)	
2	Project Manager	BEng/BSc/BTech Degree in Electrical Engineering. ECSA Registration (NQF Level 7 qualification)	
3	Site Supervisor	National Certificate, (NQF Level 6 Qualification)	
4	Occupational Health and Safety Officer	SACPCMP Registration Mandatory	

FORM RD.D.4 QUALITY MANAGEMENT SYSTEM

Briefly describe the construction quality system incorporated by the tenderer in his organisation and which will be applicable to this Contract.

	Internal	External	Name of responsible Company /or Person (In case of Person give years' experience and qualification)
Survey: Setting out of the works and control			
Testing Laboratory			
Additional quality systems			

RD.D. 4 Evaluation Schedule: Quality Management System

4	QUALITY MANAGEMENT SYSTEM The tenderer must describe the construction quality system incorporated by the tenderer in his organisation and which will be applicable to this Contract (RD.D 4) Evaluation schedule: Quality Management System form to be filled by the tender	Provide company's ISO 9001 quality compliance certificate	1	5	10
		Provide company's ISO 14001 compliance certificate	1		

FORM RD.E.1 RECORD OF ADDENDA TO TENDER DOCUMENTS

We confirm that the following communications received from the Employer before submission of this tender, amending or amplifying the tender documents, have been taken in account in this tender offer:

	DATE	REFERENCE	TITLE
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.E. 2 PROPOSED AMENDMENTS

The Tenderer should record any deviations or qualifications he may wish to make to the tender documents in this Returnable Schedule. Alternatively, a tenderer may state such deviations and qualifications in **a covering letter to his tender and reference such letter in this schedule.**

The Tenderer's attention is drawn to clause 3.8 of the Standard Conditions of Tender referenced in the Tender Data regarding the Employer's handling of material deviations and qualifications.

PAGE	CLAUSE OR ITEM	PROPOSAL

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.E.3 COST PRICE ADJUSTMENT (CPA) LOCAL CONTENT (SEIFSA)

Is/Are the tender price/s firm until the end of contract period? ***(YES/NO)***

If not:	

LOCAL CONTENT:

Submit the cost factors which will be taken into account in the event of price increase/decrease, as well as the compilation of the tender price/s, i.e. cost price, transport cost, margin of profit, etc.

		INDEX FIGURE AND BASE DATE (E.G., SEIFSA TABLE E1)
Fixed	a= 0.1	
Material	b=	
Labour	c=	
Transport	d=	
Profit	e=	
Other		
Total	1	

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.E. 4 COST PRICE ADJUSTMENT (CPA) IMPORTED CONTENT (FOREX)

Is/Are the tender price/s firm until the end of contract period? ***YES/NO):***

If not:	

IMPORTED CONTENT:

When the price/s is/are subject to the rate of exchange, submit the price basis on which the exchange rate will be based (e.g. F.O.B. value, fixed value in respect of foreign exchange, etc.)

(ii) exchange rate upon which the bid price is based

.....

.....

.....

.....

(ii) What portion of the bid price (percentage or amount) will be affected by variations in the exchange rate?

.....

.....

.....

.....

NB: ***Tenderers are also required to submit a bank statement or an auditor's report regarding the actual exchange rate in respect of the transaction value paid to the overseas supplier.***

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.E. 5 SCADA OPERATIONAL VERIFICATION

CITY OF TSHWANE

This Certifies that the Supplier (Tenderer):……

Product Description offered:……

……

……
Has performed the required compatibility verification tests on site of the customer, the customer being: The City of Tshwane, Electricity Department, Power Management, Operational Systems SCADA, Capital Park, Pretoria.

The criteria for SCADA compatibility being:

ITEM	REQUIREMENT	VERIFIED YES/NO
1.	Interfacing with the front-end processor utilizing DNP3.3 protocol.	
2.	Digital input status verification to mapped points, 1bit and 2bit.	
3.	Digital output control verification to mapped points.	
4.	Analogue input verification to mapped points.	
5.	Transformer tap position indication, verification.	
6.	Sequence of events (SOE) with time stamping verification.	

These tests were conducted on site on the:……/……/……

Approved and Witnessed by the following role players:

- ❑ The Engineer, Tshwane, SCADA: …….. Date ……
- ❑ The Supplier, Tenderer: …….. Date ……
- ❑ Consulting Engineers: …….. Date ……

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

FORM RD.E.6P VERIFICATION ON SCHEDULE OF PARTICULARS & GUARANTEES

All bidders must complete the form in full. Failure to provide the required detailed information called for in the schedules will result in the bidders to be disqualified.

CONTENTS

No	DESCRIPTION	Verify if the requirements that are specified in the following schedules of particulars and guarantees 1. Are the schedules completed in full? State YES or NO 2. Do all items comply fully to the specifications required? State YES or NO 3. Do you comply with IEC and SANS specifications? State YES or NO		
		1	2	3
1	General Requirements			
2	132KV Outdoor Circuit Breakers			
3	400KV Outdoor Circuit Breakers			
4	132KV Disconnectors & Earthing Switches			
5	132kV Surge Diverters			
6	400kV Surge Diverters			
7	132kV Voltage Transformers			
8	400kV Voltage Transformers			
9	132kV Current Transformers			
10	400kV Current Transformers			
11	132KV Insulators			
12	400KV Insulators			

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Person authorized to sign the tender:

Full name (in BLOCK letters): _____

Signature: _____

Date: _____

PORTION 2: CONTRACT

PART C1: AGREEMENTS AND CONTRACT DATA

CONTENTS

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C1.1 FORM OF OFFER AND ACCEPTANCE

STAMP

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

CONTRACT EEBU 13 - 2025.26

TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION: OVER A THREE YEAR PERIOD

The Tenderer, identified in the Offer signature block below, has examined the documents listed in the Tender Data and addenda thereto as listed in the returnable schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF PRICES <u>INCLUSIVE</u> OF VALUE ADDED TAX IS

R *(in figures)*

(in words)

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

NAME(s): (BLOCK LETTERS) ....

CAPACITY of authorized agents: ....

SIGNATURE(s) of authorized agents: ....

SIGNED at ..... on this ..... day of .....

WITNESSES: (Full name – BLOCK LETTERS – and signature)

1. ....

2. ....

ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the Tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the, Conditions of Contract identified in the Contract Data. Acceptance of the Tenderer's Offer shall form an agreement, between the Employer and the Tenderer upon the terms and conditions contained in this Agreement and in the, Contract that is the subject of this Agreement.

The terms of the contract, are contained in

Part T1 Tendering Procedures

Part T2 Returnable Documents

Part C1 Agreements and Contract Data, (which includes this Agreement)

Part C2 Pricing Data

Part C3 Scope of Work

Part C4 Site Information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C4 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this schedule.

The Tenderer shall within two weeks after receiving a letter of acceptance, contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.
Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now Contractor) within five days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties[1].

[1] *As an alternative, the following wording may be used:*
Notwithstanding anything contained herein, this agreement comes into effect two days after the submission by the Employer of one fully completed original copy of this document including the schedule of deviations (if any), to a courier-to-counter delivery / counter-to-counter delivery /door-to-counter delivery / door-to-door delivery / courier service (delete that which is not applicable), provided that the Employer notifies the Tenderer of the tracking number within 24 hours of such submission. Unless the Tenderer (now Contractor) within seven days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties.

NAME(s): (BLOCK LETTERS) ....

CAPACITY of authorized agents: ....

SIGNATURE(s) of authorized agents: ....

SIGNED at ..... on this ..... day of .....

WITNESSE(s): (Full name – BLOCK LETTERS – and signature)

1. ....

2. ....

SCHEDULE OF DEVIATIONS

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender;

2. A Tenderer's covering letter shall not be included in the final contract document. Should any matter in such, letter, which constitutes a deviation as aforesaid become the subject of agreements reached during the process of, offer and acceptance, the outcome of such agreement shall be recorded here;

3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here;

4. Any change or addition to the tender documents arising from the above agreements and recorded here shall also be incorporated into the final draft of the Contract.

4.1 **Subject** .....

Details .....

4.2 **Subject** .....

Details .....

4.3 **Subject** .....

Details .....

4.4 **Subject** .....

Details .....

4.5 **Subject** .....

Details .....

By the duly authorised representatives signing this agreement, the Employer and the Tenderer agree to and accept the foregoing Schedule of Deviations as the only deviations from the amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

FOR AND ON BEHALF OF THE **TENDERER:**

NAME(s): (in block letters) .....

CAPACITY of authorized agents: .....

SIGNATURE(s) of authorized agents: .....

SIGNED at ..... on this ..... day of .....

WITNESSES: (Full name – in block letters – and signature)

1. ....

2. ....

FOR AND ON BEHALF OF THE **EMPLOYER**:

NAME(s): (in block letters) .....

CAPACITY of authorized agents: .....

SIGNATURE(s) of authorized agents: .....

SIGNED at ..... on this ..... day of .....

WITNESSES: (Full name – in block letters – and signature)

1. ....

2. ....

C1.2 CONTRACT DATA

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C.1.2.1 GENERAL CONDITIONS OF CONTRACT

The conditions of contract applicable to this contract shall be the **"Condition of Contract for Plant and Design-Build" First Edition 1999, published by the Fédération Internationale des Ingénieurs- Conseils (FIDIC)** read together with the Variations and Additions to the Conditions of Contract as well as the Data provided by Employer.

Should there be any contradicting conditions/statements between these Conditions of Contract and any other part of the tender documents/specifications, the Employer's Agent will give clarity on which version applies to this contract. For pricing purposes, the Contractor must take the least favourable meaning into consideration when tendering, no claims will be considered attributable to the contradicting conditions/statements.

Tenderers, contractors and subcontractors shall obtain their own copies of the **"Condition of Contract for Plant and Design-Build" First Edition 1999, published by the Fédération Internationale des Ingénieurs- Conseils (FIDIC)** for tendering purposes and for use for the duration of the contract from the Secretary of the South African Institution of Civil Engineering, Private Bag X200, Halfway House, Midrand, 1685 and shall bear all expenses in this regard.

C1.2.2 VARIATIONS AND ADDITIONS TO THE CONDITIONS OF CONTRACT

The following variations and additions to the **"Condition of Contract for Plant and Design-Build" First Edition 1999, published by the Fédération Internationale des Ingénieurs -.Conseils (FIDIC)**, shall apply to this contract:

CLAUSE or SUB-CLAUSE	PARTICULAR CONDITION
1.1.1.9	**Replace** the contents of this clause with the following: "Appendix to Tender" means the completed pages entitled **C1.2.3 - Data provided by the Employer** and **C1.2.4 - Data provided by the Contractor** which form part of the Contract Data.
6.2 *Add the following:*	**Rates of Wages and Conditions of Labour** "The contractor shall submit proof that he/she pays labourers at least the minimum wage as prescribed by the government. The Contractor shall verify such proof and submit it monthly to the Engineer."
14.9	**Payment of Retention Money** No retention money will be released at taking-over but only at the end of the guarantee period.
18 *Add the following:* "18.5	**Insurance**: 1. Contractor to Insure Without limiting the Contractor's/Sub-contractor's obligation in terms of the Contract, the Contractor will effect and maintain for the duration of the Contract until the issuing of the Defects Certificate or the end of the Maintenance Period, the following insurances in the name of the Contractor (including all Subcontractors whether nominated or otherwise): 1.1. The Employer's insurer will indemnify the Contractor/Sub-contractor against physical loss of or damage to any part of the Property Insured not exceeding the maximum contract value or the final contract value estimated at inception including free issue materials were applicable as stated in the Contract Data: a) Whilst in transit including loading and unloading whilst temporarily stored at any premises en route to or from the Contract Site within the Territorial Limits. b) From the time of unloading, dismantling or preparation at the Contract Site and thereafter until the Property Insured has been officially accepted by the Employer and becomes his responsibility by means of a notice of completion certificate or similar evidence of legal transfer of risk. c) During the contractual defects liability or Maintenance Period which shall not exceed the period reflected in the Schedule but only so far as the Contractors and/or Sub-Contractors may be liable for such loss or damage under the defects liability or maintenance condition/s of the Insured Contract. d) Removal of debris; e) Surrounding property; f) Work Away; g) Off Site Storage;

CLAUSE or SUB-CLAUSE	PARTICULAR CONDITION
	h) Temporary repairs; i) Contribution Clause – Marine; j) Escalation during Contract Period; k) Post Loss Escalation; l) Automatic Reinstatement; m) Principals Maintenance; n) Property taken over; o) Beneficial Occupation; p) Escalation due to Currency fluctuation; q) Manufacturers Guarantees 2. Additional insurance by Contractor/Sub-contractor The Contractor and Sub-contractor shall be free to effect and maintain at their own cost any additional insurance which the Contractor/Sub-contractor deem necessary to cover damage, loss or injury. The cost of the additional insurance will be for the account of the Contractor/Sub-contractor. 3. Contractor to observe conditions The Contractor shall give all notices and observe all conditions and requirements imposed by the relevant insurance policies, which shall be binding on the Contractor. 4. Contractor to Insure The Contractor/Sub-contractor must obtain for the duration of the contract until the issuing of the Defects Certificate or the end of the Maintenance Period, the following insurance policies at an insurance company within 14 (fourteen) days of the notification of acceptance of the tender and must pay all premiums and supply proof thereof to the relevant Project Manager, 30 (thirty) days before the inception of the contract, that the policies have been taken out and that all premiums have been paid: a) All Risk Insurance cover with regard to all Plant and Materials and Equipment, owned, leased or hired by the Contractor that are used in the execution of the contract for the full replacement value thereof. b) Motor Vehicle and Liability Insurance cover indicating the registration numbers of the vehicles owned, leased or hired by the Contractor that are used in the execution of the contract to the amount of at least R10-million per claim with the number of claims unlimited. c) SASRIA cover for motor vehicles and Plant and Materials and Equipment owned, leased or hired by the Contractor that are used in the execution of the contract for the full replacement value thereof.

CLAUSE or SUB-CLAUSE	PARTICULAR CONDITION
	d) In respect of Plant and Materials and Equipment and Motor Vehicles brought onto the Site by or on behalf of Subcontractors, the Contractor shall be deemed to have complied with the provisions of this Sub-Clause by ensuring that such Subcontractors have similarly insured such Plant and Materials and Equipment and Motor Vehicles. e) Proof must also be submitted that the Contractor complies with the conditions of the following legislation: • Compensation for Occupational Injuries and diseases, 1993. • Unemployment Insurance Act, 1996. • The Contractor shall in respect of the Site of the contract works appoint in writing a competent person to meet the requirements of the Health and Safety Act, No 85 of 1993 as amended. 5. The Project Manager involved must furnish the required insurance documentation 30 (thirty) days before the inception of the contract to the Section: Insurance and Risk Management.

C1.2.3 DATA PROVIDED BY THE EMPLOYER

C1.2.3.1 The Data which will apply to all work under the Framework Contract

Clause/Item		Entry
1.1.2.2 & 3	Employer's name and address	CITY OF TSHWANE PO Box 440 PRETORIA 0001
1.1.2.4 & 1.3	Engineer's Name and Address	PRIMARY AND SECONDARY ENGINEERING SERVICES City of Tshwane 312 Giovanetti Street Nieuw Muckleneuk Brooklyn, Pretoria
1.1.3.7	Defects Notification Period	365 days after Taking / Hand-Over
1.3	Electronic Transmissions systems	Any of the communications means as per Clause 1.3 shall be applicable.
1.4	Governing Law	Law of the Republic of South Africa
1.4	Ruling Language	English
1.4	Language for communications	English
2.1	Time for access to the Site	28 Days after Commencement Date (Working Days)
4.2	Amount of Performance Security	10% of the Accepted Contract Amount, in the currencies and proportions in which the Contract Price is payable. The cost to obtain the surety is carried by the Contractor. (Excluding VAT and Contingencies)
5.1	Period for notifying unforeseeable errors, faults and defects in the Employer's Requirements	10 days
6.5	Normal working hours	7h00 to 17h00
8.7 & 14.15(b)	Delay damages for the Works	A penalty of a sum per week of one-half per cent of the outstanding contract works. No penalty will apply in respect of any part of the Works which has been completed and certified by the City.
8.7	Maximum amount of Delay damages	Penalty shall not in any case exceed 15% of the contract price.
If there are Provisional Sums:		
13.5(b)	Percentage for adjustment of provisional sums	*Refer to Part T2.2 Cost Price Adjustment: Form RD.E3 / RD.E4*
If sub-clause 13.8 applies:		
13.8	Adjustment for Change in Cost; Table(s) of adjustment data	*As per Part T2.2 Cost Price Adjustment: Form RD.E3 / RD.E4*

14.2 14.2 14.2	Total Advance Payment Number and timing of instalment Currencies and proportions	0% of the Accepted Contract Amount (Not applicable) Not applicable Not applicable
14.2 14.2(b)	Start repayment of advance payment Repayment amortisation of advance payment	Not applicable Not applicable
14.3 14.3	Percentage of retention Limit of Retention Money	5% *No limit*
14.5(b) 14.5(c)	Plant and Materials for payment when shipped en route to the Site Plant and Materials for payment when delivered to the Site	*Not applicable* *As per Part C2.2 Activity Schedule / Bill of Quantities*
14.6	Minimum amount of Interim Payment Certificates	Not applicable
If payment are only to be made in a currency / currencies and named on the first page of the Letter of Tender:		
14.15	Currency / currencies of payment	*Refer to Part T2.2 Tender Forms Form Bid*
18.1	Periods for submission of insurance: a. Evidence of insurance b. Relevant policies	Refer to Particular Conditions
18.2(d)	Maximum amount of deductibles for insurance of the Employer's risks	Refer to Particular Conditions
18.3	Minimum amount of third party insurance	Refer to Particular Conditions
20.2	DAB	Dispute(s) shall be referred and determined by Arbitration and/or a Court of competent jurisdiction
20.3	Appointment (if not agreed) to be made by	Not applicable

C1.2.3.2 The Data which will apply to all Package Orders

The Conditions of Contract for all Package Orders will **form part of the "Condition of Contract for Plant and Design-Build" First Edition 1999, published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC)**.

The following variations and additions to the Conditions of Contract for construction works, shall apply to all Package Orders:

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
1.3	Communications	**Add** the following to the clause: *Sent by facsimile, electronic or any like communication irrespective of it being during office hours or otherwise.*
1.1.2	Parties and Persons	**Add** the following to the clause: *1.1.2.11 The Employer has authorised the* **Group Head: Energy and Electricity Business Unit** *to act on his behalf in respect of this Contract, save for such duties or functions:* *1.1.2.11.1 which other holders of office ex officio execute on behalf of the Employer; or* *1.1.2.11.2 for which the* **Group Head: Energy and Electricity Business Unit** *has no authority and the Employer's approval is required before execution thereof.*
	Engineer	**Add** the following new sub-clause: *1.1.2.4.1 The Employer may, in his sole discretion, provide technical support services to the Contractor. The technical team providing such support services will be appointed and remunerated by the Employer.* *In the case of EPWP Contractor Learnership Programmes, support services may be provided by the Department of Public Works.* *The technical team will consist of the Employer's Agent and a person or persons acting as Training, Construction and Materials Managers or Construction Mentor, depending on the services to be provided and the scope of the functions to be executed* *1.1.2.4.2 In addition to his/her duties and functions, the Employer's Agent will coordinate the work of the technical team providing the support services.* *1.1.2.4.3 The Construction Manager acts as mentor to the Contractor in respect of the following functions, which are described fully in the CESA document, Guideline Contract Specific Data C4- Construction Management Services of the Form of Agreement for Consulting Services for Labour Intensive Construction Projects:*

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
		i. Programming the execution of the works *ii. Interpretation of drawings, specifications and related contractual matters.* *iii. Workforce structuring, employment and management.* *iv. Guidance to expedite work progress/ improve productivity.* *v. Setting out of works.* *vi. Safety measures and legislation requirements.* *vii. Materials handling.* *viii. Tools and equipment needs.* *ix. Financial matters.* *x. Training requirements.* *xi. Security aspects.* *xii. Quality control systems* *1.1.2.4.4 The Materials Manager is responsible for the following functions which are described fully in the CESA document, Guideline Contract Specific Data C5 -Materials Procurement Services of the Form of Agreement for Consulting Services for Labour-Intensive Construction Projects on the Contract:* *i. Establishment of stores.* *ii. Determination of store administration procedures.* *iii. Determination of requirements of store staff.* *iv. Employment of store staff.* *v. Staff guidance, supervision and training.* *vi. Acquisition of materials.* *vii. Issue of materials.* *viii. Upholding of an assets register.* *ix. Insurance of assets.* *1.1.2.4.5 The main role of the Mentor is to support the Learner Contractor and to impart knowledge that will enable the Contractor to compete independently as soon as possible. The Mentor provides a wide range of support and advice functions, including but not limited to advice with regard to:* *i. Finance and dealing with banks.* *ii. Business management.* *iii. Contract management.* *iv. Procurement of materials and other required services.* *v. Technical and engineering.* *vi. Construction planning and management.* *vii. Fulfilling of statutory and tax obligations.* *viii. Labour and human resource guidance.*
6.2	Rates of Wages and Conditions of Labour	**Add** the following new sub-clause: *6.12 Wages and conditions of work:* *i. For conventional construction works the Basic Conditions of Employment Act of 1997 (Act No 75 of 1997) shall apply*

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
		and the minimum employment conditions which will apply shall be guided by the latest Sectoral Determination: Civil Engineering Sector published from time to time. *ii. Basic Conditions of Employment Act of 1997 (Act No 75 of 1997) as per Government Notice R63 of 25 January 2002, shall apply to works described in the Scope of Work as being labour intensive and which are undertaken by unskilled or semi-skilled workers.*
		Add the following new sub-clause: *6.12.1 Notwithstanding any actions which the Employer may take, the Contractor accepts sole liability for due compliance with the relevant duties, obligations, prohibitions, arrangements and procedures imposed by the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and all its regulations, including the Construction Regulations, 2014, for which he is liable as mandatory. By entering into this Contract it shall be deemed that the parties have agreed in writing to the above provisions in terms of Section 37(2) of the Act. The Contractor shall sign the Occupational Health and Safety Agreement for Contract Work in the City of Tshwane Metropolitan Municipality included in section C1.5.*
		Add the following new sub-clause: *6.12.2 The Employer retains an interest in all inquiries conducted under this Contract in terms of Section 31 and/or 32 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and its Regulations following any incident involving the Contractor and/or Sub-Contractor and/or their employees. The Contractor shall notify the Employer in writing of all investigations, complaints or criminal charges which may arise pursuant to work performed under this Contract in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Regulations.*
		Add the following new sub-clause: *6.12.3 Contractor's Designer* *The Contractor and his designer shall accept full responsibility and liability to comply with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Construction Regulations, 2014 for the design of the Temporary Works and those part of the Permanent Works which the Contractor is responsible to design in terms of the Contract*
8.4		**Add** the following new sub-clause

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
	Extension of Time for Completion	*8.4.1 Critical path provision* *A delay in so far as extension of time is concerned, will be regarded as a delay only if, on a claim by the Contractor in accordance with the General Conditions of Contract, the Employer's Agent rules that all progress on an item or items of work on the critical path of the approved programme for the execution of the Works by the Contractor, has been brought to a halt. Delays on normal working days only, based on a working week, of five normal working days, will be taken in account for the extension of time.*
		Add the following new sub-clause *8.4.2 Extension of time due to abnormal rainfall* *Extension of time due to abnormal rainfall shall be determined by means of Method 1, if rainfall records and/or values derived from rainfall records are supplied in the Scope of Work, otherwise Method 2 shall apply.* *Method 1: Rainfall formula method* *The rainfall records and/or values derived from rainfall records from a suitable rainfall station near the Site, which are supplied in the Project Specifications, shall be considered suitable for the determination of extension of time due to abnormal rainfall in accordance with this method.* *Extension of time arising from abnormal rainfall, shall be calculated separately for each calendar month or part thereof for the full period of completion of the Contract, including any extension thereof, in accordance with the rainfall formula given below:* $$V = (N_w - N_n) + \frac{(R_w - R_n)}{X}$$ *If V is negative and its absolute value exceeds N_n, then V shall be equal to minus N_n.* *If V is positive and greater than the number of calendar days in the calendar month under consideration, V shall be taken as equal to the number of calendar days in the relevant calendar month.* *The symbols shall have the following meaning:* V = *Extension of time in calendar days in respect of the calendar month under consideration* N_w = *Actual number of days during the calendar month on which a rainfall of Y mm or more has been recorded.*

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
		R_w = *Actual rainfall in mm for the calendar month under consideration.* N_n = *Average number of days as derived from existing rainfall records, on which a rainfall or Y mm or more has been recorded for the calendar month. Rainfall records and/or the derived values of N_n will be provided in the Specifications.* R_n = *Average rainfall in mm for the calendar month, as derived from existing rainfall records. Rainfall records and/or the derived values of R_n will be provided in the Project Specifications.* X = *20 unless otherwise provided in the Project Specifications* Y = *10 unless otherwise provided in the Project Specifications* *The total extension of time shall be the algebraic sum of the monthly totals for the period under consideration. However, if the grand total is negative the time for completion shall not be reduced on account of abnormal rainfall. Extension of time for parts of a month shall be calculated by pro rata values of N_n and R_n being used.* *The factor $(N_w - N_n)$ shall be considered to represent a fair allowance for variations from the average number of days during which rainfall exceeds Y mm and wet conditions prevented or disrupted work.* *The factor $\frac{(R_w - R_n)}{X}$ shall be considered to represent a fair allowance for variations from the allowance for variations from the average number of days when wet conditions further to that allowed for the factor $(N_w - N_n)$, prevented or disrupted work during the calendar month.* *Accurate rain gauging shall be taken at a suitable point on Site and the Contractor shall, at his own expense, take all necessary precautions to ensure that the rain gauges cannot be interfered with.* *This formula does not take into account further on concurrent delays which could be caused by other abnormal climatic conditions such as floods, which have to be determined separately in accordance with Sub-Clause (42.5 Critical Plath Provision) hereof.* <u>*Method 2: Expected delay method*</u> *The Contractor shall make provision in his programme for the execution of the Works, for an expected delay of "n" normal working days (based on a working week of five normal working*

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
		days) due to normal rainfall, for which he will not receive any extension of time. *Unless otherwise provided in the Project Specifications, the value of "n" shall be taken as equal to the tendered time for completion of the Works in months, rounded off to an integer.* *Extension of time during normal working days will be granted to the degree to which actual delays as determined in accordance with Sub-Clause (42.5 Critical Path Provision) hereof, exceed the number of "n" normal working days.* *The value of "n" does not take into account further or concurrent delays which are caused by other abnormal climatic conditions such as floods, which have to be determined separately in accordance with Sub-Clause (42.5 Critical Path Provision) hereof.*
14.7	Payment	**Add** the following new sub-clause: *14.7.1 Payment for works identified in the Scope of Work as being labour-intensive shall only be made in accordance with the provisions of the Contract if the works are constructed strictly in accordance with the provisions of the Scope of Work. Any non-payment for such works shall not relive the Contractor in any way of his obligations either in contract or in delict.*
		Add the following new sub-clause *14.7.2 The Contractor shall be paid at Pretoria in the currency of the Republic of South Africa only at the Office of the Chief Financial Officer of the CITY OF TSHWANE, unless otherwise stated in the Data provided by Employer.*
4.2	Performance Security	**Add** the following new sub-clause: *4.2.1 As an alternative to a performance guarantee, the Contractor may deposit with the Employer a cash amount in a sum equal to the amount stated in the Data provided by Employer. All the provisions in respect of the guarantee apply mutatis mutandis to the cash deposit accept that the amount deposited will be repaid to the Contractor within 30 (thirty) days after the issue of the Certificate or Certificates of Completion in respect of the whole of the permanent works.*
18.1	General Requirements for Insurances	**Add** clause 18.1.1 with the following: *18.1.1 Contractor to insure* *The Contractor/Sub-contractor must obtain for the duration of the contract until the issuing of the Defects Certificate or the end of the Maintenance Period, the following insurance policies at an insurance company within 14 (fourteen) days of the notification of acceptance of the tender and must pay all premiums and supply*

CLAUSE / SUB-CLAUSE	DESCRIPTION	VARIATION / ADDITION
		proof thereof to the relevant Project Manager, 30 (thirty) days before the inception of the contract, that the policies have been taken out and that all premiums have been paid: *a. All Risk Insurance cover with regard to all Plant and Materials and Equipment, owned, leased or hired by the Contractor that are used in the execution of the contract for the full replacement value thereof.* *b. Motor Vehicle and Liability Insurance cover indicating the registration numbers of the vehicles owned, leased or hired by the Contractor that are used in the execution of the contract to the amount of at least R10-million per claim with the number of claims unlimited.* *c. SASRIA cover for motor vehicles and Plant and Materials and Equipment owned, leased or hired by the Contractor that are used in the execution of the contract for the full replacement value thereof.* *d. In respect of Plant and Materials and Equipment and Motor Vehicles brought onto the Site by or on behalf of Subcontractors, the Contractor shall be deemed to have compiled with the provisions of this Sub-Clause by ensuring that such Subcontractors have similarly insured such Plant and Materials and Equipment and Motor Vehicles.* *e. Proof must also be submitted that the Contractor complies with the conditions of the following legislation:* - *Compensation for Occupational Injuries and disease, 1993* - *Unemployment Insurance Act, 1996* - *The Contractor shall in respect of the Site of the contract works appoint in writing a Section 16 appointee to meet the requirements of the Health and Safety Act, No 85 of 1993 as amended.* *18.1.2 Reporting of crime related incidents* *All crime related incidents, losses or shortages irrespective of the value, must be reported within 24 (twenty-four) hours by the person who was involved or who has discovered the incident to the nearest South African Police Services (SAPS) station. The name of the Police Station, Investigation Officer and the Case number must be obtained and stated on the Contractor Claim Form. Should the incident not be reported to the SAPS, the claim will be repudiated.* *.*

C1.2.4 DATA PROVIDED BY THE CONTRACTOR

CLAUSE / ITEM		ENTRY
1.1.2.3 &1.3	Contractor's Legal name and address	....
1.1.3.3	Time for completion of the works	..... weeks

C1.3 FORM OF GUARANTEE

WHEREAS

The City of Tshwane Metropolitan Municipality
(hereinafter referred to as the "Council"),

enters into a Contract (No _____) with

_____
(hereinafter referred to as the "Contractor")

for _____

_____

AND WHEREAS in terms of the General Conditions of the Contract the Contractor is required to furnish an acceptable independent guarantee for the due and proper fulfilment by him of all his duties and obligations in terms of the said contract.

NOW THEREFORE we the undersigned _____

_____ (full names of authorized agent(s))

and acting in my/our capacity as_____

and _____

and as such duly authorized thereto, do hereby bind the said _____

(hereinafter referred to as the "Guarantor") as surety and co-principal Debtor *in solidum* for the sum of

R _____ (_____)

for the due and proper fulfilment by the Contractor of all or any of his duties and obligations in terms of the said Contract. The guarantee shall not be interpreted as accessory to the contract between Council and the Contractor.

The Guarantor further undertakes, in the event of the Contractor failing duly and properly to fulfil any of his duties and obligations in terms of the said Contract, or if the Contractor is placed under provisional liquidation or in the event of termination of the Contract by the Council in terms of the General Conditions of Contract, to pay to the Council the said sum of

R _____ (_____)

or such portion thereof as may be required by the Council, immediately upon receiving written demand from the Council which written demand shall be addressed to the Guarantor at (*domicilium* address)

The Guarantor further hereby renounces the benefits of the legal exceptions:

Exceptio non numerate pecuniae

Exception non causa debiti

Beneficium de duobus vel pluribus reis debendi

Beneficium ordinis deu excussionis

Beneficium divisionis

and all other defence which could be pleaded against the validity of this guarantee, with the meaning and effect of which it declares itself to be fully acquainted.

This undertaking shall remain in full force and effect up to and including the date of issue of the Certificate of Completion, as provided for in the General Conditions of Contract, unless the Guarantor is advised in writing by the Council of his intention to institute claims, and the particulars thereof, in which event this guarantee shall remain in full force and effect until all such claims have been paid or liquidated. Notwithstanding the aforesaid, the Council may at its' sole discretion elect to have the amount provided for under this guarantee, paid out directly to it in the case of breach of contract by the Contractor by giving the Guarantor written notice to that effect, notwithstanding the fact that the Council may decide not to institute any further legal action against the Contractor.

This document is not negotiable or transferable.

FOR AND ON BEHALF OF THE BANKER/INSURER:

BANKER/INSURER: _____

NAME:
(in BLOCK letters) _____

CAPACITY:
(of authorized agent) _____

SIGNATURE:
(of authorized agent) _____

SIGNED at _____ on this _____ day of _____

WITNESSES:
(Full name in BLOCK letters and signature)

1. _____ _____

2. _____ _____

ANNEXURE

List of some institutions from which contract /deposit guarantees can be accepted. The contractor can utilize other institutions as long as they are registered with the NCR.

ABSA Bank
Credit Agricole Indosuez (South Africa Branch)
Development Bank of South Africa
FirstRand Bank
ING Bank N.V. (South Africa Branch)
Investec Bank
Landbank
National Housing Finance Co.
Nedcor Bank
South African Reserve Bank
Standard Bank
AIG South Africa
Credit Guarantee Insurance Co
Emerald Insurance Company
Federated Employers Mutual Assurance Co
Global Insurance Company
Guardrisk Insurance Company
Hannover Re:
Home Loan Guarantee Company
Lion of Africa Insurance Company
Metropolitan Life
Metropolitan Odyssey Ltd
MUA Insurance
Mutual & Federal Insurance Company
Rand Mutual Assurance Company
Regent Insurance Company
SA Eagle Insurance Company
Lombard Insurance.

C1.4 HEALTH AND SAFETY AGREEMENT

Article of Agreement in terms of Section 37(2) of the Occupational Safety Act, 1993 between

CITY OF TSHWANE
(Hereinafter referred to as the "EMPLOYER")

AND

_____

_____

_____

_____

Herein represented by _____ in his/her capacity as _____ duly authorised by virtue of a resolution dated _____, attached hereto Annexure A, of the said _____ (herein after referred to as the "CONTRACTOR")

WHEREAS the CONTRACTOR is the mandatory of the EMPLOYER as contemplated in an agreement in respect of

CONTRACT EEBU 13 - 2025.26

TENDER FOR THE SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF EQUIPMENT FOR THE CONSTRUCTION OF WILDEBEES 400/132KV INFEED STATION: OVER A THREE YEAR PERIOD

AND WHEREAS section 37 of the Occupational Health and Safety act, 1993 (Act 85 of 1993, hereinafter referred to as the "ACT"), imposes certain powers and duties upon the EMPLOYER.

AND WHEREAS the parties have agreed to enter into an agreement in terms of section 37(2) of the ACT.

NOW THEREFORE the parties agree as follows:

(a) The CONTRACTOR undertakes to acquaint the appropriate officials and employees of the CONTRACTOR with all relevant provisions of the ACT and the regulations promulgated in terms thereof.

(b) The CONTRACTOR undertakes that all relevant duties, obligations and prohibitions imposed in terms of the ACT and Regulations will be fully complied with. Provided that should the EMPLOYER prescribe certain arrangements and procedures, that same shall be observed and adhered to by the CONTRACTOR, his officials and employees. The CONTRACTOR shall bear the onus of acquainting himself/herself/itself with such arrangements and procedures.

(c) The CONTRACTOR hereby accepts sole liability for such due compliance with the relevant duties, obligations, prohibitions, arrangements and procedure, if any, imposed by the ACT and Regulations and the EMPLOYER expressly absolves the EMPLOYER from itself being obliged to comply with any of the aforesaid duties, obligations, prohibitions, arrangements and procedure as the case may be.

(d) The CONTRACTOR agrees that any duly authorised officials of the EMPLOYER shall be entitled, although not obliged, to take such steps as may be necessary to ensure that the CONTRACTOR has complied with the undertakings as more fully set out in paragraphs 1 and 2 above, which steps may include, but shall not be limited to, the right to inspect any appropriate site or premises occupied by the CONTRACTOR, or to

inspect any appropriate records held by the CONTRACTOR or to take such steps it may deem necessary to remedy the default of the CONTRACTOR at the cost of the CONTRACTOR.

(e) The CONTRACTOR shall be obliged to report forthwith to the EMPLOYER any investigations, complaint or criminal charge which may arise as a consequence of the provisions of the ACT and Regulations, pursuant to work performed in terms of this agreement, and shall, on written demand, provide full details in writing of such an investigation, complaint or criminal charge as the case may be

FOR AND ON BEHALF OF THE CONTRACTOR:

NAME:
(in BLOCK letters) _____

CAPACITY:
(of authorized agent) _____

SIGNATURE:
(of authorized agent) _____

SIGNED at _____ on this _____ day of _____

WITNESSES:
(Full name in BLOCK letters and signature)

1. _____ _____

2. _____ _____

FOR AND ON BEHALF OF THE EMPLOYER:

NAME:
(in BLOCK letters) _____

CAPACITY:
(of authorized agent) _____

SIGNATURE:
(of authorized agent) _____

SIGNED at _____ on this _____ day of _____

WITNESSES:
(Full name in BLOCK letters and signature)

1. _____ _____

2. _____ _____

PART C3

SCOPE OF WORK

CONTENTS

ITEM	DESCRIPTION
1	Scope of Contract
2	Extent of Work
3	Socio Economic Plan
4	Technical Training
5	Small Medium Enterprise
6	Tender Briefing Meeting and Site Visit
7	Drawings
8	Work Breakdown, Quantities & Price Schedule
9	Evaluation Criteria
10	Alternative Offers
11	CIDB Grading
12	Surety
13	Forward Cover
14	Reference

PART C3: SCOPE OF WORK

1. SCOPE OF TENDER & CONTRACT

The scope of this tender includes the design, supply, delivery, installation, testing and commissioning of all necessary equipment for the construction of Wildebees 400/132kV Infeed Station, as follows:

1.1 The scope of this tender/contract must be provided in full by one contractor. The contractor and sub-contractors must be fully trained, experienced and competent to carry out the work according to the contract and articles of agreement of the OHS Act (Act 85 of 93). No training and/or supervision will be provided by the municipality.

1.2 The work requires an electrical contractor with extensive experience in the design and construction of high voltage electrical substations.

1.3 The work will include the clearing of the substation site, bulk earthworks, design and construction of the substation platform, civil works (substation building, guard house, access and internal roads, perimeter fence, stormwater drainage system and equipment foundations) and electrical works consisting of the installation, testing and commissioning of 400kV and 132kV high voltage equipment.

1.4 The successful contractor will be responsible for the full scope of work, which will include among others the design, procurement, delivery, installation, testing and commissioning of all electrical equipment as per the substation layout drawing and integration thereof to render a fully functional substation.

1.5 The contractor must complete the scope of work and hand over of the fully completed 400/132kV Substation to the City of Tshwane on a turnkey contract basis.

1.6 The 2 x 315MVA, 400/132kV power transformers will be free issue items, however the transportation of the transformers from the current storage site and the installation, testing and commissioning of the power transformers form part of the scope of this tender.

1.7 The Substation will be equipped with the following high voltage bays:

a) 2 x 400/132kV, 315MVA Power Transformer Bays
b) 10 x 132kV Line Feeders Bays
c) 2 x 132kV Bus Coupler Bays
d) 2 x 132kV Bus Section Bays
e) 2 x 132kV Capacitor Banks

1.8 The quantities indicated against each item on the bill of quantities are only approximate figures and the City of Tshwane does not guarantee to purchase this or any other quantity. The contractor must confirm the quantities with the employer's engineer prior to placing orders with the manufactures.

2. EXTENT OF WORK

The total project work includes the following, but not necessarily in the order as listed:

2.1 Design of Works

2.1.1 The design work will include all the following work that is specified in more detail in the specifications, particulars and activity schedule.

2.1.2 The contractor's civil, mechanical and electrical designs must be approved by the City's engineer before manufacturing and construction start:

a) Electrical single line diagram: All equipment in circuit format with descriptions.

b) Electrical equipment diagrams: Mostly obtained from the suppliers of the equipment.

c) Site layout drawing: The terrain, buildings, access road, cable trenches, storm water drainage system, equipment, structures, etc.

d) Protection System: The protection equipment system operation and control.

e) Communication System: The control system including the SCADA system.

`

2.2 Site Works, Civil Engineering and Building Work

2.2.1 The site work will include all the following work that is specified in more detail in the specification, particulars and activity schedule:

a) Terrain civil work: Substation platform, cable trenches, access roads, storm water drainage system, fencing, paving and yard stoning.

b) Buildings: The construction of the substation building, guard house, oil pit and oil drainage system.

c) Equipment Foundations: For power transformers & NEC's, gantries, bus bar support structures and all HV yard electrical equipment steel support structures.

d) All the structures and building compaction must be tested by a qualified person and the results made available. The building compaction must be tested on each corner of the new building and every three-meter intervals.

e) Construction/Installation: All equipment supplied under this scope and free issue items.

f) Commissioning: The testing of all the equipment, system operation and control

g) Site cleaning: Remove all the excess material from site.

h) Soil condition: All excavations for tender purposes must be based on using a TLB for excavations. Pickable and Intermediate soil will fall in this category.

2.2.2 A professional civil engineer (structural) must certify the design for the above work.

2.3 Electrical Works and Mechanical Structures

2.3.1 The supply, delivery, installation, testing and commissioning of the following:

a) All HV yard electrical equipment including the 400kV and 132kV Disconnectors, CT's, VT's, Circuit breakers, bus bars and clamps.

b) Dismantle and transport of 2 x 315MVA, 400/132kV power transformers and NECs from the Njala Infeed Station to Wildebees Infeed Station.

c) The installation, testing and commissioning of the power transformers and NEC's.

d) 132kV Control and Protection Panels and SCADA functionalities.

e) Multicore control cables between all the 400kV & 132kV equipment and Control and Protection Panels.

f) The design and installation of the earth grid/mat and connection to equipment.

g) Steel support structures and gantries for the 400KV and 132KV bus bars and equipment

h) 110V DC Supply system, batteries and Chargers.

i) 220V & 380V AC Supply System.

j) Communication and SCADA system interfaces.

k) The SCADA Protocol at the Control Centre of the City of Tshwane is DNP 3 level 3. The tenderer shall submit the following documents:

- A document stating that the tenderer/contractor complies with IEC 60870-5-103
- A document explaining the protocol that the tenderer/contractor will be using in the substation.
- A document stating that the protocol being used by the tenderer/contractor can be converted to DNP3 level 3.

2.3.2 The conversion of the substation protocol to DNP3 level 3 can be done by the tenderer/contractor, by doing the conversion in the substation micro SCADA (MMI) or by doing the conversion in a Harris D20++ Processor board. The tenderer/contractor must be able to prove both conditions. The implementation of the protocol conversion at the substation will be the responsibility of the tenderer/contractor.

The tenderer/contractor must supply the City of Tshwane with an IO list indicating Digital Inputs, Digital Outputs, Analogs and DNP mapping.

2.2.3 The tenderer/contractor must provide training to personnel of the City of Tshwane on fault finding, populating of the database in the MMI and the substation protocol.

2.4 Commissioning of works

a) Test all electrical equipment and the system.

b) Check and test all mechanical structures.

c) Check and certify all civil works.

d) A test plan and procedures must be provided before any testing starts.

e) Supply Operating and Maintenance Manuals (O&MM) of all the equipment and the system.

2.5 CoT Safety Agent

2.5.1 The safety agent for CoT will perform all his/her duties during the execution of the project in accordance with Construction Regulation of the OHS Act 85 of 1993.

2.6 Project Implementation Plan

2.6.1 A Project Implementation Plan must be provided before any construction work starts.

2.6.2 A shutdown of construction work must be provided for over the Christmas period to the New Year.

2.7 Other

2.7.1 The contractor must provide all sanitary facilities and they shall be kept neat and hygienic throughout the contract period.

2.7.2 The Contractor must allow in his tender price for his staff accommodation and for the provision of a site office, which shall be large enough to hold site meetings to accommodate a minimum of 12 people. Sufficient tables and chairs must be provided to meet the above requirement.

3. SOCIO-ECONOMIC PLAN

3.1 The contractor must submit a detailed proposal on the number of job opportunities to be created during the construction phase of the project.

3.2 The contractor must state how many women and youth will benefit from the project.

3.3 The contractor must employ local labourers from the ward where the project is being implemented.

3.4 The Contractor must provide Personal Protective Equipment (PPE) with the EPWP branding for the local labourers.

3.5 The Contractor must ensure that all the EPWP local labourers have undergone the medical tests where necessary.

3.6 The contractor must submit a monthly report on the job opportunities created in line with EPWP requirements.

3.7 The successful tenderer will be required to appoint a Community Liaison Officer (CLO) in accordance with the City's policy on the appointment of CLO.

4. TECHNICAL TRAINING

4.1 The contractor must provide technical training for the City of Tshwane personnel on the maintenance and operation of the equipment installed as part of the project, with specific emphasis on the following:

a) Operators (Substation Switching Operations)

b) Maintenance

c) SCADA

d) Protection

e) Communication

5. SMALL MEDIUM ENTERPRISE

5.1 The contractor must appoint Small Medium Enterprise's (SME's), preferably, from within the ward where the project is executed.

5.2 The contractor will be required to identify activities within the project scope which will be allocated to the local sub-contractors and SME's. The activities shall among others, include but not limited to:

a) Procurement of material from Small Medium Enterprise's (SME) within the City of Tshwane area.

b) Steel reinforcing material

c) Bricks, cement and concrete

d) Paving bricks

e) Fencing

f) Windows, doors and frames

g) Roof trusses

h) Transportation of equipment, etc.

i) Security Services

j) Provision of yellow plant

6. TENDER BREIFING MEETING AND SITE VISIT

6.1 The tender clarification meeting and site visit are compulsory and the tenderer shall complete the tender meeting and site visit attendance registers at the meetings.

6.2 Prospective tenderers must already be in possession of the tender document at the tender clarification meeting and have prior studied the contents thereof to familiarize themselves with the scope of works.

6.3 Tender meeting and site visits shall be at the cost of the tenderer and the tenderer shall provide their own transport from the tender meeting place to the site.

6.4 Tenderers must be on time and attend the full tender meeting and site visit (a minimum of three hours must be allowed for).

7. DRAWINGS

7.1 A4 Drawings are included in the tender, but full-scale drawings will be available on request.

7.2 Tenderers must provide detail drawings with their tender for the layout, plinths, etc.

8. ACTIVITY, PARTICULARS AND GUARANTEES (PARTC 2.1), QUANTITIES & BILL SCHEDULE (PART C2.2)

8.1 The tenderer must complete the Schedule of Particulars and Guarantees for all electrical equipment in full. Failure to do so, will result in the tender being disqualified from further evaluation.

8.2 The prices must be completed in pen (black) in the Schedules and included in the tender document as was issued.

8.3 All item/activities as listed in the bill of quantities must be priced individually and no item prices are allowed to be included somewhere else combined with other item prices.

8.4 If an item/activity is not priced it would be regarded as offered free of charge.

8.5 The bill of quantities (in Excel) will be provided to tenderers with the minutes of the site meeting.

8.6 The description of items may not be changed or deleted as well as the quantities. Only changes that are minuted / instructed by the engineer will be allowed.

8.7 All tenderers must tender to the above as their main offer.

9. EVALUATION CRITERIA

Refer part T1

10 ALTERNATIVE OFFERS

10.1 Alternative offers will only be considered if tenderer(s) have submitted a fully completed main offer. For alternative offers a complete separate detailed activity, quantities and bill/price schedule must be submitted as a separate document.

10.2 Tenderers must for each offer provide a typed copy on USB (not PDF format) of the above schedule with their offers.

11 CONSTRUCTION INDUSTRY DEVELOPMENT BOARD GRADING

11.1 Only those tenderers who are registered with the Construction Industry Development Board CIDB, or are capable of being so prior to the evaluation of submissions, in a contract grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a **9EP** class of construction work, are eligible to submit tenders.

11.2 Joint ventures are eligible to submit tenders provided that:

a) Every member of a joint venture is registered with the CIDB within 10 days of the closing date of tenders.

b) Three contractors registered in contractor grading designation **8EP** and,

c) The combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor designation in accordance with the sum tendered for an **9EP** class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations.

12 SURETY

12.1 The Tenderer must supply a letter of intent, from a financial institution, with the tender for providing a surety of 10% of the tender price.

12.2 The Contractor must provide a surety of 10% of the contract price within 14 days after appointment/award.

12.3 The Contractor must carry the cost to provide the surety.

13 FORWARD COVER

13.1 Forward cover to be taken by the successful bidder for all the imported equipment.

13.2 The contractor must carry the cost of the forward cover to be provided for construction of the Wildebees Infeed Station.

14 REFERENCE

14.1 The following words will have the same meaning:

- BID(S) and TENDER(S).
- BIDDER(S) and TENDERER(S)
- BIDDING and TENDERING

If anywhere in this document it still refers to Bid(s), Bidder(s) and Bidding it shall be replaced with Tender(s), Tenderer(s) or Tendering.

SECTION 4

SPECIFICATIONS

CONTENTS

PART	DESCRIPTION	APPLICABLE
1	**General:**	
1.1	General Requirements	Yes
1.2	Security, Storage and Supervision Requirements	Yes
1.3	Quality Assurance Requirements	Yes
1.4	Technical Requirements	Yes
1.5	Yard Labelling	Yes
1.6	Substation Testing & Re-commissioning	Yes
1.7	Implementation Plan	Yes
1.8	Day works	Yes
1.9	Health & Safety	Yes
1.10	Environmental Management plan	Yes
2	**132kV Circuit Breakers:**	
2.1	132kV Outdoor Circuit Breakers	Yes
2.2	400KV Outdoor Circuit Breakers	Yes
3	**Disconnectors (Isolators) and Earthing Switches:**	
3.1	132kV Disconnectors (Isolators) and Earthing Switches	Yes
3.2	400kV Disconnectors (Isolators) and Earthing Switches	Yes
4	**Surge Diverters:**	
4.1	132kV Surge Diverters and Insulating Bases	Yes
4.2	400kV Surge Diverters and Insulating Bases	Yes
5	**Instrument Transformers:**	
5.1	132kV Outdoor Voltage Transformers	Yes
5.2	400kV Outdoor Voltage Transformers	Yes
5.3	132kV Outdoor Current Transformers	Yes
5.4	400kV Outdoor Current Transformers	Yes
6	**Busbars, Connections and Connection Clamps:**	
6.1	132kV & 400kV Busbars, Connections and Connection Clamps	Yes
7	**Insulators:**	
7.1	132kV Insulators	Yes
7.2	400kV Insulators	Yes

PART	DESCRIPTION	APPLICABLE
8	**Cables & Connections:**	
8.1	Between 315 MVA Transformer and NEC	Yes
8.2	Underground PVC-Insulated Multi-Core Control Cables	Yes
8.3	Termination and Connecting up of Cables and Cable Accessories	Yes
8.4	Trenching, Layout and the Installation of Multicore Cables	Yes
9	**Earthing:**	
9.1	Earthing Grid	Yes
10	**Transformer and NER/NEC:**	
10.1	315MVA, 400/132kV Power Transformers	Yes
10.2	Neutral Earthing Compensators (NEC's) Combined with Neutral Earthing Resistors (NER's) and Auxiliary Transformers	Yes
11	**11kV Switchgear**	
11.1	11 kV Metal Enclosed Outdoor Switchgear	No
12	**Protection and Control:**	
12.1	Control and Protection Equipment	Yes
12.1.1	Addendum to Control and Protection	Yes
13	**Auxiliary Equipment:**	
13.1	Low Voltage AC Wall Mounted Change-over & Distribution Panel	Yes
13.2	110V Battery Charger	Yes
13.3	110V Batteries and Battery Stands	Yes
14	**Building and Civil Works:**	
14.1	Building and Civil Works	Yes
14.2	Yard Stone	Yes
15	**Electrical Installation of Substation Building, Yard Lighting and Lightning Protection:**	
15.1	Electrical Installation of Substation Building, Yard Lighting and Lightning Protection	Yes
16	**Steel Lattice Construction Portal Type Gantries for 132 kV Overhead Busbars:**	
16.1	Steel Lattice Construction Portal Type Gantries for 132 & 400kV Overhead Busbars	Yes
17	**Communication System/Network:**	
17.1	Optical Fibre Based Tele protection- & Communications Equipment	Yes
17.2	Marshalling kiosk & Termination boxes	Yes
18	**SCADA:**	
18.1	SCADA Interface	Yes

SECTION 4: TECHNICAL SPECIFICATION

PART 1.1: GENERAL REQUIREMENTS

SPECIFICATION No: GR.01/0-97 – Rev 4

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1. SCOPE

Part 1 is the general specifications and must be read with the specific specifications of the various equipment.

2. STANDARDS AND COMPLIANCE WITH SPECIFICATION

All work shall be in accordance with this Specification and Standard Specifications herein, and the General Conditions of Contract Governing Tenders and Special Conditions of Contract Governing tenders: Energy and Electricity Business Unit.

Where no particular specification clause is referred to with respect to any item of equipment to be supplied, the latest issue/amendment of the relevant SANS specification or NRS, or IEC Specification shall be adhered to (in the same order).

In order to help control costs, the Tenderer shall where possible offer his available standard commercial equipment.

Tenderers shall highlight any deviations from the specification on a clause by clause basis explaining the reasons for any deviations in detail. Reference to attached pamphlets, brochures etc., which may contain details of such deviations, are not acceptable. Tenderers main offer must comply fully with this specification. Any alternative offer shall supply the same functionality as called for in this specification. Tenders not complying with these functional requirements will be summarily rejected.

All civil work shall be in accordance with the Standard Specifications for Municipal Civil Engineering Works.

3. ENVIRONMENT

Altitude above sea-level	1 530 m
Maximum ambient temperature	40 °C
Average daily maximum ambient temperature	30 °C
Minimum ambient temperature	-5 °C
Average daily minimum ambient temperature	2 °C
Maximum ground temperature	25 °C
Minimum ground temperature	10 °C
Relative humidity	94%
Lightning conditions	Severe
Degree of pollution	Medium
Earth resistivity	Varying between 50 and 1000 ohm per metre at a depth of 1,5m
Maximum wind speeds :	
a) Steady conditions;	25 m/s
b) Gusty conditions.	45 m/s

4. SYSTEM PARTICULARS

4.1 132 kV System

Nominal system voltage (r.m.s. line to line)	132 kV
Highest system voltage (r.m.s. line to line)	145 kV
System frequency	50 Hz
Maximum symmetrical fault current capacity (3 second rating)	31.5 kA
System BIL at sea-level	650 kV
System insulation level at Pretoria altitude	550 kV
Number of phases	3
Phase rotation	R-W-B anti-clockwise
System earthing	Neutral points on 132kV transformer windings solidly earthed

4.2 33 kV System

Nominal system voltage (r.m.s. line to line)	33 kV
Highest system voltage (r.m.s. line to line)	36 kV
System frequency	50 Hz
Maximum symmetrical fault current capacity (3 second rating)	13.10 kA
System BIL at sea-level	170 kV
Number of phases	3
Earthing	Through NEC and NER

4.3 11 kV System

Nominal system voltage (r.m.s. line to line)	11 kV
Highest system voltage (r.m.s. line to line)	12 kV
System frequency	50 Hz
Maximum symmetrical fault current capacity (3 second rating)	20 kA
System BIL at sea-level	95 kV
Number of phases	3
Earthing	NER on star/star transformer NEC on star/delta transformer

5. SOCIO ECONOMIC DEVELOPMENT

The contractor shall approach this contract and execute the Works with due consideration of the need to empower and subcontract a portion of the works to the local communities in which the project is executed. It is expected that a Project Steering Committee consisting of members of the local communities or forums still to be established, will monitor the extent to which government policy in this regard is supported.

It may be expected that these forums or committees or a committee established specifically for this contract, will also be involved in the requirements of labour, assessment of training needs and development requirements of entrepreneurs as contractors/sub-contractors as well as utilisation of sub-contractors from the relevant local communities.

The contractor shall give his full co-operation to these forums and committees.

All labour and sub-contractors utilised on this contract shall be drawn from the communities of the CITY OF TSHWANE METROPOLITAN MUNICIPALITY where large unemployment prevails and the need for a better quality of life exists, all in accordance with the EPWP guidelines.

If the contractor intends to utilise certain categories of employees (generally considered as being key-personnel of the contractor), or certain sub-contractors (generally specialist sub-contractors) in the Works, full details in this regard must be provided with the Tender. This clause shall apply mutatis mutandis to such a sub-contractor if accepted in terms of the General Conditions of Contract.

Should the contractor fail to comply with the conditions of this clause, the Engineer may suspend the progress of the Works in terms of clause 48 of the Special Conditions of Contract and the contractor shall not be entitled to make a claim for a delay or additional Cost.

Compliance with this clause does not relieve the contractor of any of his contractual obligations or liabilities

6. SITE SECURITY

The Contractor will be responsible for all security until hand over to the Council. This shall include all temporary security site lighting.

7. SITE OFFICE

The Engineer will allocate to the Contractor an area for the purpose of stacking or storing materials and the erection of site offices. On completion of the Contract Work, the Contractor will remove all buildings, equipment, rubble and materials at the construction site and leave it in a tidy condition.

8. FOOD, ACCOMMODATION AND TRANSPORT

Suitable provision shall be made for the supply of drinking water and food under sanitary conditions acceptable to the health inspectors of the Council.

The safe transport of plant, tools, materials and labour to and from the working sites is the responsibility Contractor.

9. CONTRACT MANAGEMENT

9.1 Project Team

The Tenderer shall submit a list of his proposed project team, with a brief CV of each candidate. The Engineer shall have the right to instruct the Contractor to change the team after negotiation with the Contractor.

9.2 Subcontractors

The Contractor shall submit a list of proposed subcontractors for approval to the Engineer. Any changes to the list of subcontractors shall be approved by the Engineer. Subcontractors may not subcontract work further without permission of the Engineer. The Engineer may at any time ask for a subcontractor to be changed.

9.3 Work Scheduling

Within 3 weeks of order date the Contractor shall submit a detailed plan covering all important activities. The Engineer, together with the Contractor, shall agree the final schedule. This schedule will be saved as the base case and may not be changed. The milestones so generated will become the contractual dates for payments.

9.4 Site Office

The Contractor shall establish a permanent on-site organisation for the proper control, management and execution of the works.

9.5 Progress Meetings

Weekly meetings shall be held at which reports shall be submitted to the Engineer indicating progress and adherence to the work program.

Minutes of meetings shall be kept by the contractor and shall be made available to all participants, and others to be decided by the Engineer, within 3 working days.

Agenda to be circulated to all participants by email 1 week before each meeting.

9.6 Progress Reports

Monthly progress reports reflecting the status at the end of each calendar month shall be made available to the Engineer before the 5th working day of the following month and shall include, but not be limited to, updated versions of the following:

a) Cover sheet for monthly report;

b) Minutes of the previous meeting;

c) Cash flow statements showing actual expended amounts and forecast amounts to the end of the project on a monthly basis;

d) Gantt charts generated on the approved project management software showing sequence and duration of work, as well as actual progress achieved and expected completion time. The base information as quoted for shall be shown and shall remain unchanged for the duration of the project;

e) Attendance list;

f) List of site instructions to date;

g) List of variation orders to date;

List of drawings on the project;

h) List of rainfall days;

i) Schedule of plant and personnel on site; and

j) List of subcontractors on site.

Furthermore, all variations to the contract, extras, omissions, etc., shall be processed and presented in the form to be directed by the Engineer.

10. SITE INSTRUCTION BOOK

The Contractor shall supply and keep in safe custody on site, a site instruction book of standard A4 size, with numbered pages and provision for two carbon copies per page.

The first page of every instruction will be removed and retained by the Engineer for record purposes.

11. DELIVERY AND STORAGE

The Contractor shall make his own arrangements regarding transport and off-loading of labour and materials and shall provide his own plant. The Contractor will be responsible for the safe storage of all equipment, materials and plant after delivery and will be held responsible for loss by theft or damage in any way, whether installed on the contract or not, until take-over of the works by the Council.

The Contractor will assume full responsibility for all materials which are supplied to him on site. He must provide adequate security measures to minimise the risk of theft. Materials on site shall be insured by the Contractor against all risks to their full value. Proof of such insurance and pre-payment of premiums to cover the duration of the Contract must be provided before the issue of any payment certificates will be considered.

12. SAFETY OF PERSONNEL

The Contract may involve work within close proximity of and work upon possible live high voltage equipment. Correct safety procedures must be adhered to at all times and work must be carried out under control and supervision of an experienced responsible person as detailed in the Occupational Health and Safety Act of 1993 as amended.

13. COMMENCEMENT AND COMPLETION DATES, PROJECT SCHEDULING

Within 1 week of written notification of acceptance of his tender, the Contractor shall arrange a kick-off meeting with the Engineer at which open points will be discussed and design freeze dates established.

The Contractor shall put the work in hand and shall submit a detailed programme to the Engineer for approval within two weeks after award of the contract, detailing the commencement date; duration and completion date and detail cash flow of each activity concerning the works. A suitable number of milestones shall be defined in order to ensure that the project is kept on schedule and that sufficient resources are employed.

The Contractor shall use a project planning programme approved by the Engineer.

Manufacture of equipment off-site is to run concurrently with the execution of the civil and building works. The various phases shall be properly co-ordinated to ensure that accommodation for equipment is ready when the equipment is ready for delivery.

A detailed manufacturing schedule for all equipment shall be supplied to the Engineer for his approval within 1 month of award of the contract. The Engineer will then insert hold points and inspection points at his discretion. The Engineer reserves the right to visit any works of the Contractor or any Sub-contractor at any reasonable time without prior announcement.

14. INFORMATION TO BE SUBMITTED WITH TENDER

Tenders shall be submitted complete with comprehensive literature, drawings, etc., describing the equipment offered. This information shall include the following as a minimum requirement:

a) Dimensioned drawings, to metric scale of each item of equipment;

b) Typical circuit diagrams of control and protection system;

c) Description of units and its operation, including vital design parameters (max. system voltage, fault capacity, current rating, impulse withstand level etc.).

All tenders must be fully priced. Items not specifically called for, but required for the successful completion of the works, shall be added by the tenderer.

Tenderers are further required to indicate in their tender their past experience in the execution of works of similar nature and scope.

Detail cash flow for each activity concerning the works.

15. INFORMATION TO BE SUBMITTED BY SUCCESFUL TENDERER

15.1 As-Built Drawings

The successful Tenderer shall during the course of this service update all drawings to reflect the as-built status of the works. Full sets of "AS-BUILT" drawings shall be supplied by the Contractor before final take over. These drawings must be to the satisfaction of the Engineer. One set of drawings shall be left on site, and the other used by the Contractor to correct the originals.

16. STATEMENT OF COMPLIANCE

Tenders are to be accompanied by the Statement of Compliance, stating whether the tender complies with the Conditions of Contract and the Specification.

17. STANDARD REGULATIONS

Wherever applicable the equipment, work and installation shall conform with the:

a) The Standard Regulations for the Wiring of Premises issued by the South African Bureau of Standards.

b) Any special requirements of the Supply Authorities of the area or district concerned.

Please note the requirements of Electrical Machinery Regulation R4 and R5. These state that no person employed by the Contractor or any Sub-contractor may enter any existing substation or switch-house without the uninterrupted presence of a "competent person" as defined in the Occupational Health and Safety Act acting on behalf of the client, unless a "permit to work" as referred to hereinafter has been obtained. When the electrical apparatus in any new substation or switch-house is made alive for the first time and at all times thereafter, such substation shall be treated as an existing substation and the requirements of the above paragraph shall apply for high voltage work.

18. PERMIT-TO-WORK

As the work may be done in stages, sections of the area can be energised. We draw your attention to the Electrical Machinery Regulation R4 & R5. The Contractor shall not work on any part(s) of the high voltage distribution system until such part(s) of the system have been isolated and earthed and the appropriate measures have been taken to prevent accidental re-energising of the part(s) and a "permit to work" authorisation in writing has been obtained from the Engineer or his duly authorised representative.

Before the responsible person of the Contractor signs for and accepts the permit he must satisfy himself that the part of the system on which he requires to work has been effectively isolated and earthed, that all circuits have been clearly identified, and that the Engineer has made it safe to work at the point of working.

The "permit-to-work" shall be made in duplicate and shall contain the following:

a) Written description of location of points of isolation and of earthing.

b) Name and signature of person to whom the permit is issued.

c) Time and date of issue of permit.

d) Statement handing-over section(s) of system clearly defining the part(s) handed-over as being safe to work upon.

e) Signature of the Supply Authority or his duly authorised representative.

The responsible person of the Contractor shall retain the original "permit-to-work" shall be handed to the Contractor and shall retain it while his work is being completed on that part of the system covered by the permit.

After ensuring that no person employed by the Contractor or any Sub-contractor is still working on the system, that work is completed and that the installation has been made safe, the Contractor shall sign the "permit-to-work" and return it to the Engineer. Then the electrical installation may be re-energised. The same person that took out and signed the permit must return it.

Notwithstanding the foregoing, the Contractor shall at all times take all necessary precautions and make all necessary tests to ensure the safety of all persons employed by him or by any Sub-contractor.

No extras to the contract or extension of time will be allowed due to any of the above factors.

19. PROTECTION OF EQUIPMENT AGAINST DAMAGE

Equipment shall be adequately protected against possible damage during transportation, off-loading and handling on site. Relays, instruments and other delicate equipment shall be adequately protected against transport and other damage to the satisfaction of the Engineer.

20. LV DISTRIBUTION VOLTAGE

The low voltage distribution will be at a nominal voltage of 400/230 volt 50 Hz 3 phase AC.

The voltage on miniature substations or transformers shall be set at a No Load voltage of 400/230 volts.

Distribution will be by 4 wire, 3 phases and a neutral. The neutral shall be solidly earthed at the substation.

21. TEST BY SUPPLY AUTHORITY

On completion of the work, the whole of the installation will be inspected and tested by the Engineer.

The Contractor will be required to attend on the Supply Authority's inspector(s) requests and give all assistance required and provide such tools, materials, implements and instruments as are necessary for the tests.

22. ARTICLES OF VALUE

Any article of value, archaeological finding, etc., found on the site during the execution of the Contract shall be handed to the Engineer who shall be the sole referee as to what constitutes articles of value and to report to who ever may be concerned.

23. WITNESSING OF TESTS

The Council reserves the right to have the Engineer inspect and witness factory and onsite commissioning tests of all equipment to the satisfaction of the Engineer.

The Contractor shall make due allowance for these inspection points in his manufacturing programme and to avoid delays occurring, shall notify the date for inspection or witnessed tests at least 14 days in advance of the actual date.

The Council does not accept responsibility for the late delivery on the basis of inspection delays.

All tests shall be documented to the satisfaction of the Engineer.

24. EXISTING SERVICES

The Contractor shall be responsible for obtaining drawings from other Municipal Departments and authorities showing the positions of underground services.

25. HANDOVER

The last payment on takeover (i.e prior to retention payments) will only be done on completion of a Handover Certificate and receipt of all manuals and test certificates

SECTION 4: TECHNICAL SPECIFICATION

PART 1.2: SITE SAFETY, SECURITY, STORAGE AND SUPERVISION REQUIREMENTS

SPECIFICATION No: SR.01/0-2003 (Previous No: SR.01/0-97)

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2. SECURITY MEASURES 2
3. STORAGE OF MATERIALS 3
4. WORKING HOURS 3
5. CLEARING SITE 3

1. WORKING IN LIVE YARDS

In order that the Council may make the necessary arrangements, each application for a Work Permit shall be submitted to the Engineer, together with all the required particulars, **at least three full working days** before access to the site yard is required.

With regard to the switching out of equipment to facilitate the carrying out of Contract Work, it shall be distinctly understood that switch-out dates, times and periods are subject to load and operational requirements. Operational and/or load requirements may dictate that Contract Work on the existing network be carried out over weekends or outside normal working hours.

The Contractor shall obtain, complete and return the following documentation one week before access to the site is required:

a) Issuing of substation keys to Contractors (where applicable)

b) Temporary Permit to enter a security area

c) Appointment of a competent person to supervise workers near electrical equipment

d) Duties and responsibilities for the competent person supervising construction work near live electrical work.

2. SECURITY MEASURES

Work inside electrical yards is subject to the Council's security measures and the contractor shall contact the responsible Project Engineer prior to the commencement of any work under the Contract, in order to make the required security arrangements. The costs of security measures shall be included in the rates for site work.

If so required by the Council, all Employees of the Contractor and his Subcontractors employed with regard to the execution of the Contract shall be security cleared on such conditions as laid down by the Council.

Should any Employee of the Contractor or his Subcontractor be declared unfit for whatever security reasons, the Contractor or the Subcontractor shall have the right to appoint any person in lieu of the disqualified Employee, subject to the Council's security clearance.

The Contractor undertakes -

a) to treat all information regarding the Contract and the execution thereof as strictly confidential;

b) that he himself, his Subcontractors and all Employees concerned will sign the Council's Declaration of Secrecy;

c) in the execution of the Contract, to report to the Council's responsible Project Engineer, without delay and confidentially, any information regarding:

d) Any suspected espionage in respect of the lay-out of the site where the work is being executed, or in respect of sites where protective measures are applied.

e) Actions which may be interpreted as sabotage, or any planning in this regard.

f) Any suspected subversive activities among his Employees.

g) The loss of any classified documents which came into his possession as a result of the Contract.

h) The contravening of any security measure by an Employee.

i) Housebreaking, theft, arson, vandalism, loss of identity documents, security keys or lock combinations.

j) Corruption, blackmail, intimidation, striking or inciting or unauthorized access to an office or premises.

k) Any Employee who is involved with the Contract and who is suspected of bringing drugs, intoxicating liquor, a weapon, ammunition or explosives on the site of the Council.

The Council shall have the right to inspect, at all reasonable times, and through its Security Department, the Contractor's and Subcontractor's premises and offices where work in connection with the Contract is executed or where documents in that connection are kept, in order to prescribe suitably security measures, and to determine whether the prescribed security measures are being implemented satisfactorily.

3. STORAGE OF MATERIALS

The Contractor shall be solely responsible for all security arrangements for the safe storage of materials on site. The Council will not be liable for any loss or damage of any materials or equipment whatsoever.

Prices for supply and delivery of materials shall allow for all transport, handling, loading and off-loading on site.

The receiving and handling thereafter on site of all materials is the responsibility of the Contractor.

4. WORKING HOURS

Site work carried out for the execution of this Contract shall be confined, as far as possible, to normal working hours on normal working days (i.e. 07h00 - 17h00 on Mondays to Fridays) excluding Public Holidays.

Work to be done outside normal working hours shall be approved by the Engineer who shall be notified of the reasons in writing at least three working days in advance of any work to be done outside normal working hours.

5. CLEARING SITE

On completion of the Contract the contractor shall clear the Site of all temporary offices, sheds, temporary structures and waste material and rubbish. Nothing shall be buried on site.

SECTION 4: TECHNICAL SPECIFICATION

PART 1.3: QUALITY ASSURANCE REQUIREMENTS

SPECIFICATION No: QR.01/0-2003 – Rev 4 (Previous No: QR.01/0-97)

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1. QUALITY SYSTEM

The Contractor shall provide and operate throughout the Contract, to the satisfaction of the Engineer, a Quality System in accordance with the requirements specified hereinafter.

The Contractor's quality assurance activities shall include, but not be limited to, those functions defined in the Schedule and such additional activities as the Engineer may direct to prove conformity to the Specification. They shall provide for the detection and removal of all non-conforming material either prior to or at the latest state of process or manufacture where the required characteristics can be measured or observed.

A valid ISO 9000 listing will be acceptable to the Engineer.

2. INFORMATION REQUIRED IN THE TENDER

The Contractor shall complete and submit in his Tender the Quality System Questionnaire.

In support of this information and when called upon to do so, the Contractor shall submit a description of his Quality System or a Quality Manual.

3. QUALITY SYSTEM DOCUMENTATION

3.1 Contractor's Quality Control Plan (QCP)

Within one month of instructions to proceed, the Contractor shall submit for approval of the Engineer two copies of a draft Quality Plan for the contract Works, defining the inspections, tests and other quality activities, which he proposes to carry out at each stage of his work under the Contract. The Engineer shall add his witness and hold points to the quality plan. Quality activities, which are to be performed at sub-contractor’s premises, shall be clearly defined.

The Quality Plan shall be in two parts, covering:

a) Quality activities during design (if applicable), and manufacture.

b) Quality activities at Site.

Following approval of the Quality Plan and within 1 month of approval by the Engineer, the Contractor shall submit to the Engineer four copies of the approved documents.

3.2 Witnessing by Engineer

Following his approval of the Contractor's Quality Plan the Engineer will notify the Contractor the inspections, tests and other quality activities, which he intends to witness. He may at any time call for the witness of such additional inspection and tests as he may require proving conformity with the Specification. When the Engineer has confirmed his intentions to witness any inspections or tests the Contractor shall be given due notice of his readiness. Work or dispatch may not proceed if the Engineer has not witnessed or attended tests required by the Quality Control plan.

The Engineer shall indicate on the QCP whether he wishes to attend factory witness tests, and site commissioning tests. The documentation of these tests shall be incorporated into the Contract Documentation system.

4. INSPECTION AND TESTING

4.1 Scope

Inspection and testing shall include all items in Schedule A and all relevant tests listed in the appropriate Standards. The quality plan shall be to the approval of the Engineer.

4.2 Statutory Testing

The Contractor shall be responsible for ensuring that all tests and approvals required by Statutory Authorities are duly performed and the relevant approval documents issued, free of charge, to the Employer.

Where classification of equipment is required, an approved Classification Society shall carry it out at the Contractor's expense. On completion, the Contractor shall issue the relevant documents to the Engineer.

4.3 Testing

Cognisance should be taken of the specific requirements detailed in other parts of Section 3 regarding testing. Tenderers are to ensure that all uncertainties regarding separate requirements are clarified with the Engineer in advance.

All test reports shall be incorporated into the Instruction, Operating and Maintenance Manuals.

4.3.1 Type tests

The electrical equipment, relays and control equipment shall be certified by means of test certificates to have been tested successfully and in accordance with the specified requirements and Standards. It shall also be certified that they have passed the following tests successfully:

a) Temperature rise test;
b) ability to withstand overload test;
c) durability test;
d) contact test;
e) insulation test;
f) high-frequency disturbance test; and
g) any other type tests normally carried out by the manufacturer and those laid down by the appropriate Standard Specifications.

If type testing is to be done specifically for the purpose of this contract, testing shall be carried out in accordance with the specified requirements by an independent recognised testing institute approved by the City of Tshwane.

Existing type test certificates will be considered on their merits and Tenderers are requested to submit copies of existing type test certificates with their tenders. Should reasonable doubt arise as to the validity of the test certificates submitted and accepted by the City of Tshwane, in respect of the relays to be supplied, the City of Tshwane may direct that further certificate(s) be obtained on a sample unit/sample units, provided by the successful Tenderer at his expense. An independent recognised testing institute shall carry out such further testing.

4.3.2 Routine tests

These are part of the manufacturing process and the test results shall be included in the operation and maintenance manuals.

A high-voltage test of insulation shall be carried out.

Any other factory routine tests normally carried out by the manufacturer and those laid down by the appropriate Standard Specification.

The general philosophy shall be to deliver a system to site only once it has been thoroughly tested and its specified performance has been verified, in so far as site conditions can be simulated in a test laboratory.

4.3.3 Instruments

All measurements shall be calibrated in accordance with SANS-ISO 9001:2015.

4.3.4 Detailed testing requirements

The Contractor shall give the City of Tshwane or its appointed representative not less than fourteen (14) days notice of such equipment being ready for inspection or witnessing of tests, as necessary (90 days in respect of overseas tests).

In order to assist the City of Tshwane in making provision for inspection and witnessing of tests, the name of the manufacturer, the place of manufacture, the place where equipment can be inspected and where equipment will be tested, shall be provided. Should the Contractor wish to change to another manufacturer, he shall in due time advise the City of Tshwane in writing of the details called for above.

The Contractor shall at the time of placing orders or sub-orders advise all Sub-contractors that all equipment may be subject to inspection and witnessing of tests by the City of Tshwane or its appointed representatives.

Factory tests shall be regarded as an integral part of the manufacturing of the various items and shall therefore be allowed for in the unit prices quoted for supplying.

Site and commissioning tests shall be regarded as an integral part of the installation of the various items and shall be allowed for in the unit prices quoted for installation.

The Engineer shall be furnished with two copies of the Contractor's records of all factory tests immediately after such tests and before any material is shipped. No material shall be installed before the Engineer has officially approved these tests.

The Engineer shall be furnished with two copies of the Contractor's records of all site and commissioning tests immediately after completion of such tests.

4.3.5 Site tests

Site tests shall be carried out in detail to confirm the integrated operation of the control and protection scheme.

Testing shall at the least include the following:

a) Secondary injection tests, to prove panel circuits and the operation, speed and operating curves of relays;
b) functional testing of all elements, to prove the operation of the different circuits. This includes the interfacing with yard equipment and the various other substation functions, like busbar protection, breaker fail/busbar strip protection, inter-tripping, aided tripping, interlocking, indications, alarms, control functions, communication networks, operator stations and master station control operations;
c) tests to prove the key features of instrument transformers;
d) primary injection, carried out from the yard equipment, to prove instrument transformer circuits; and

On-load testing, as a final proof of instrument transformer circuits and the phase relation of current and voltage inputs to the protection relays.

4.4 Procedures Subject to Approval

The Contractor shall submit his proposal to the Engineer when it is a condition of this Specification that a manufacturing, inspection or testing process be subject to the approval of the Engineer or when any matters require to be agreed between the contracting parties, as when specified Standards leave acceptance criteria to be so agreed.

Wherever practicable the Contractor's proposals shall be submitted early enough to allow ample time for agreement to be reached.

The approval of equipment, etc (issue for Manufacture/Construction) shall not relieve the Contractor of his responsibility regarding the correctness thereof or any subsequent failures as a result of faults or omissions by the Contractor.

5. WELDER QUALIFICATION

Welders who hold valid certificates of competence in accordance with the relevant National or International Standard shall carry out all welding.

6. CONTRACTOR'S RECORDS AND REPORTS

The Contractor shall maintain adequate records for inspection by the Engineer and shall submit for the Engineer's approval all test data, results and certificates as required. Following final tests on completion, test sheets recording the results of the tests shall be submitted in triplicate.

The Contractor shall obtain and submit to the Engineer copies of the relevant data and certificates when others carry out inspections and tests.

7. AUDITS BY THE ENGINEER

The Contractor's procedures and implementation thereof shall be subject to audit by the Engineer after Contract award. The frequency of audits shall be dependent upon the complexity and duration of the work. The Engineer shall give Two weeks notice to the Contractor of an intended audit.

8. QUALITY ASSURANCE REQUIREMENTS

Tenders shall present a Quality Plan to the satisfaction of the Engineer in the format suggested by SANS-ISO 9001:2015..

9. PROVISION OF STANDARD SPECIFICATIONS

The Tenderer shall supply the latest issues and amendments of the list of specifications to be issued on the tender designation to the successful tenderer. The standard specifications are:

a) SANS Catalogue;

b) IEC Catalogue;

c) IEC 129 - Alternating current disconnectors and earthing switches;

d) IEC 51 - Switchgear;

e) IEC 255 - Protection relays;

f) IEC 694 - Common clauses for high voltage switchgear and controlgear standards;

g) IEC 298 - Metal encapsulated, type tested, works manufactured switchgear assemblies for voltages up to 72.5kV;

h) IEC 298 - Testing the response of Type tested, works manufactured,

			metal encapsulated switchgear, for voltages up to 72.5kV, to an internal arc fault;
i)	NRS 001	-	Technical specifications guidelines for drafting;
j)	SANS 10199:2016-		The design and installation of earth electrodes;
k)	IEC 185	-	Current transformers;
l)	IEC 186	-	Voltage transformers;
m)	IEC 529	-	Degrees of protection afforded by enclosures (IP code);
n)	SABS-1195	-	Busbars and busbar connections; and
o)	SABS-1222	-	Enclosures for electrical equipment.

SECTION 4 : TECHNICAL SPECIFICATION

PART 1.5 : YARD LABELLING

SPECIFICATION No:

1. EXTENT OF WORK

Comprehensive yard labelling has to be implemented for the indication of circuits, bays and primary equipment items, in addition to the normal requirements for labelling for new equipment. The labels must be ready for installation during individual bay outages where a bay outage is required to install a label.

Tenderers are referred to:

a) Section III Part 1.4: Item 7 “Labels” for normal requirements for labelling of new equipment.

b) Section V Part 2: Schedule of Prices for individual price items.

c) Section VI Part 16: “Label Schedules” for the names and quantities of labels required.

d) Section VII: Drawing number PS09-150Z for the different label details.

SECTION 4 : TECHNICAL SPECIFICATION

PART 1.6 : SUBSTATION TESTING & COMMISSIONING

SPECIFICATION No: Rev Z/9

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1. SCOPE

This specification covers the complete testing and commissioning of all new control and protection (ICAP) equipment and all new non-ICAP equipment as well as the testing and re-commissioning of all existing primary and secondary equipment in order to re-commission the total substation.

2. STATION TESTING AND RE-COMMISSIONING OF ALL EQUIPMENT

The new control and protection (ICAP) equipment shall be tested and commissioned by the contractor, but he will also be responsible to test and re-commission “other” or non-ICAP equipment in order to re-commission the total substation. All existing and new secondary (non-ICAP) equipment such as battery chargers and auxiliary supply equipment, as well as primary equipment such as circuit breakers, isolators, current transformers, voltage transformers, current carrying connectors, surge divertors and power transformers shall be tested and re-commissioned as specified. Earthing and bonding of equipment must also be confirmed. The work shall encompass the following aspects with respect to the substation as an entity as well as to each individual bay.

2.1 First stage:

Available drawings, substation and equipment are available at the clients drawing office.

All marshalling kiosks and other panels and cubicles that are to remain after the refurbishment shall be dusted out and cleaned (apart from any cubicle refurbishment work described elsewhere).

The schematic diagrams shall be correlated with the physical bay wiring and cabling by means of visual inspection, ringing out and tracing of the circuits. Any alterations that may be found shall then be marked up on the schematic diagrams to represent 'as found' drawings. Again, this can primarily be restricted to the equipment and circuits, or parts of circuits, which will be retained after the station refurbishment.

Proposals as to the improvement of equipment characteristics or sub-standard parameters, correction of errors and replacement of defective parts or functions must be submitted as part of the first stage of the testing.

Generation of a new set of drawings, as if for a new substation, combining the new control and protection schemes with the existing drawings and the existing equipment, for each bay of the substation, the substation itself and scheme common drawings (i.e. bus zone scheme). It has to be ensured that all details of non-ICAP equipment are included in the drawings listed in Part 1.3: Drawings and Documentation. Schematic diagrams of motor drives, mechanisms and interface equipment of transformers, circuit breakers, isolators, earth switches and transformer cooling equipment must be included.

These proposals and drawings shall be handed to the Engineer and where applicable, approval will be given by the Engineer to incorporate the proposed changes. All the information gathered shall be incorporated in the ICAP-designs and be included in the DDS in a suitable format.

2.2 Second stage:

All approved modifications shall be carried out and commissioned as part of the control and protection installation and commissioning process.

Apart from the tests prescribed for the ICAP system the following tests shall be conducted on each bay for a given substation:

a) All the circuit breakers associated with the panels shall have their opening and closing motion measured depicting the position of the breaker related to time as the breaker opens or closes. The total opening and closing times shall also be indicated. These results shall be graphically represented and the breakers shall then be certified if it complies with the manufacturers specifications.

b) In conjunction with the Control Centre, functional test of inter-trip circuits:

   i. For pilot wire inter-trip receive relay: - determine the operating range and operating time over the relay's range of operating voltage at 10 V intervals.

   ii. For pilot wire inter-trip system: - From the furthermost point on the line, send an inter-trip signal and measure the receiving voltage at the substation being tested with the relay in service.

   iii. For all inter-trip systems: - In conjunction with the Engineer or his representative, determine the time elapsed for a substation on a particular line to send an inter-trip and for the system voltage at the substation to fall below 30% of the nominal system voltage.

c) Measure and record the earthing bonding resistance as well visually inspect the earthing from a centrally defined point within the substation that has been proved to have a low earthing resistance:

   i. Control panels

   ii. Protection panels

   iii. Tap change control panel (TCCP)

   iv. Transformer/line marshalling kiosk (TMK), (LMK)

   v. Transformer

   vi. Cooling fins (where applicable)

   vii. Closing rectifier

   viii. Battery chargers

   ix. HV apparatus (neutral CT's etc)

   x. Neutral isolators

   xi. Switchgear

   xii. Fences

   Where there are two bonding straps to a piece of equipment, the resistance of each bond shall be determined separately.

d) Do core and sheath insulation tests on all multi-core cables for the complete bay/scheme

e) Current transformers, determine:

i. Polarity from the furthermost possible point.

ii. Magnetising curves. One ratio per core. Specify the ratio. The magnetising curves shall be represented graphically in the format as described in the requirements for documents.

iii. Star point connections

f) Functional tests, as part of the commissioning of the ICAP system, of:

i. Main tripping circuits

ii. Back-up circuits

iii. Control circuits

iv. Tap change control circuits (where applicable)

v. Alarms circuits

vi. No volt relay (secondary injection)

vii. Back-up Auxiliary supply failure circuits

viii. Battery charger chop over relay

ix. Stability of the bus zone tripping circuits

x. Coupler interlocking

g) Functional testing of all VT circuits and testing of VT's (phasing).

h) Check all fuse ratings and MCB ratings (mainly restricted to remaining battery charger, transformer marshalling kiosks and 275 kV yard marshalling kiosks).

i) Check lugs for correct application and type (crimping).

j) Do primary injections on all CT's and VT's and record readings on the secondary side at the furthermost accessible points.

k) All redundant wiring inside the remaining panels shall be removed and all redundant cores shall be strapped into the harness inside the panel (mainly restricted to remaining battery charger, transformer marshalling kiosks and 132kV yard marshalling kiosks).

l) Commission with primary voltage and current. Prove phasing with phasing gear where possible. Do synchronising checks. Voltage and current measurement on all accessible points and record results. Prove stability of the bus-zone.

Any changes made during the testing and commissioning shall be included in the "as commissioned" documentation.

SECTION 4 : TECHNICAL SPECIFICATION

PART 1.7 : IMPLEMENTATION PLAN

SPECIFICATION No: - Rev Z/8

1. IMPLEMENTATION PLAN

The purpose of this section is to highlight the aspects involved and points for consideration in preparation of the detail implementation planning that is required of the Contractor in order that due allowance is made in terms of budget and manpower to perform this element of the project work at a sufficient level of refinement. Preparing the Detail Implementation Program will be the second major project activity running concurrently with and following the Functional Design Specification activity as an important step towards preparation for site work.

Here a distinction is drawn between the Detail Project Schedule in the sense of the overall scheduling of all the project elements and activities including detailed equipment specification and procurement scheduling, schemes design, laying down the sequence and duration of activities in the factory and on site including testing and commissioning to ensure optimal (cost/time/quality) project scheduling on the one hand and;

A Detail Implementation Plan in terms of which the project work on site is interfaced with physical and operational system constraints to ensure that the intervention at the Kwagga Infeed Station in order to refurbish the control and protection equipment is done at the absolute minimum risk to the safety of workmen, system stability and disruptions of supply on the other hand.

In the 132 kV yard of the Station the majority of existing current transformers will be replaced departmentally as part of the larger refurbishment initiative. Isolators and earth switch mechanisms in this yard will also be refurbished and upgraded. This departmental work will be co-ordinated with the Refurbishment of Control and Protection Equipment contract work to be performed during the same period when the bay or equipment is out of operational service. The Contractor shall make allowance in costing and scheduling the site work for allowing the Employers departmental teams or own contractors reasonable access to the primary plant of this refurbishment work.

The Detail Implementation Plan shall be drawn up taking into account the following considerations plus any further factors that come to the fore in the process. The Contractor shall submit the Plan to the Engineer for approval and endorsement by all parties that could be affected by it.

1. Seasonal loading of the Infeed Station;

2. Operational constraints in terms of Kwagga/Rooiwal/Pta West/Njala interconnect;

3. Minimum / maximum loading on given Kwagga elements or sections;

4. Energy unit (opportunity) cost for different system switching configurations and the duration of these conditions;

5. System stability and outage risk associated with specific temporary switching configurations;

6. Minimising loss of protection functionality in terms of bus zone or back-up protection schemes including the justification of specific interim protection schemes;

7. Considerations such as sequence of work dictated by the re-use requirement on certain of the existing protection equipment in the same or similar equipment bays and;

8. Basic constraints such as the accessibility of existing multi-core cables in cable ducts for purposes of re-routing.

SECTION 4 : TECHNICAL SPECIFICATION

PART 1.8 : DAYWORKS

SPECIFICATIO No: Rev Z/8

SCOPE

Extra work which is not covered in any Contract Item and which is ordered by the Engineer in writing as such shall be undertaken by the Contractor on a day work basis.

Day labour as may be required for such day works shall be provided by the Contractor at the rates of wages of the particular category as inserted in the schedules provided for this purpose.

When the Contractor is required to supply materials in connection with such day works as may be ordered, the percentage over actual cost price at the Works on which the Contractor agrees to supply such material as may be required shall be as inserted in the schedules provided for this purpose.

The Contractor shall, when required by the Engineer, produce all time sheets, correspondence, invoices and receipts and any other particulars necessary to enable the Engineer to certify the correctness of claims for payment in terms of this provision.

HEALTH AND SAFETY SPECIFICATIONS

CONTENTS

1. Document purpose and intent

2. Application and Interpretation
    2.1. Definitions

3. Notification of Construction Work

4. Legal Documentation/Appointments

5. General duties of Principal Contractor

6. Supervision of Construction Work

7. Risk Assessment

8. Safe Work Procedures

10. Safety of Public/Pedestrians

11. Fall Protection

12. Registers

13. Training

14. Agent Health and Safety Instruction Register

15. General Requirements

16.Hazardous Chemical Substances (including Asbestos and Lead)

17. Asbestos (additional requirements)

18. Lead (additional requirements)

19. Noise Induced Hearing Loss

20. Lighting

21. Hazardous Biological Agents (HBA)

REFERENCES TO THE SCOPE OF WORKS IN TERMS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT, REGULATIONS AND THE BASELINE RISK ASSESSMENT: HEALTH AND SAFETY SPECIFICATION

1. DOCUMENT PURPOSE AND INTENT

The specifications contained in this document relate to the health and safety requirements pertaining to the supply, delivery, installation and commissioning of equipment for the construction of Wildebees 400/132kV Infeed Substation and associated works for the City of Tshwane, so as to ensure the health and safety of the persons carrying out the associated works for the period of 3 years.

Compliance to the Occupational Health and Safety Act (Act 85 of 1993) and the Regulations shall not be limited to the specifications and definitions contained in this document.

A comprehensive, documented Health and Safety Plan is to be drawn up by the Main Contractor, based on the results of Health and Safety Risk Assessments conducted by him, and the specifications provided, and presented to the engineer for approval prior to commencement of work.

Monitoring of compliance on site shall be to the requirements of the OHS Act and Regulations as well as the contents of the H&S Plan(s) of the Main-Contractor and Sub-Contractors.

2. APPLICATIONS AND INTERPRETATION

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

- Occupational Health and Safety Act (Act 85 of 1993).
- All regulations published in terms of the Occupational Health and Safety Act.
- Construction Regulations, 2014.
- SABS codes referred to by the Occupational Health and Safety Act.
- Contract Documents
- Basic Conditions of Employment Act (Act 75 of 1997)
- South African Rail Commuter Corporation Ltd: General conditions and specifications for work on, over, under or adjacent to Railway lines and near High Voltage Equipment. (SPK7/2)

ABBREVIATIONS

- OHS: Occupational Health and Safety
- CEO: Chief Executive Officer
- CR: Construction Regulations
- HCS: Hazardous Chemical Substances
- MSDS: Material Safety Data Sheet
- AIA: Approved Inspection Authority
- HBA: Hazardous Biological Agents
- OEL: Occupational Exposure Limit

3.1 DEFENITIONS

The following definitions from the Occupational Health and Safety Act are listed as follows:

Chief Executive Officer

In relation to a body corporate or an enterprise conducted by the State, means the person who is responsible for the overall management and control of the business of such body corporate or enterprise.

Danger
Means anything that may cause injury or damage to persons or property.

Employee **(**Contractor)
Means, subject to the provisions of Subsection (2), any person who is employed by or works for any employer and who receives or is entitled to receive any remuneration or who works under the direction or supervision of an employer or any other person.

Employer **(**Client / Engineer**)**
Means, subject to the provisions of Subsection (2), any person who employs or provides work for any person or remunerates that person or expressly or tacitly undertakes to remunerate him, but excludes a labour broker as defined in Section 1(1) of the Labour Relations Act, 1953 (Act No. 28 of 1956).

Healthy
Means free from illness or injury attributable to occupational causes.

Machinery
Means any article or combination of articles assembled, arranged or connected and which is used or intended to be used for converting any form of energy to performing work, or which is used or intended to be used, whether incidental thereto or not, for developing, receiving, storing, containing, confining, transforming, transmitting, transferring or controlling any form of energy.

Medical Surveillance
Means a planned program of periodic examination (which may include clinical examinations, biological monitoring or medical tests) of employees by an occupational health practitioner or, in prescribed cases, by an occupational medicine practitioner.

Plant
Includes fixtures, fittings, implements, equipment, tools and appliances, and anything which is used for any purpose in connection with such plant.

Properly Used
Means used with reasonable care, and with due regard to any information, instruction or advice supplied by the designer, manufacturer, importer, seller or supplier.

User
In relation to plant or machinery, means the person who uses plant or machinery for his own benefit or who has the right of control over the use of plant or machinery, but does not include a lessor of, or any person employed in connection with, the plant or machinery.

Reasonably Practicable
Means practicable having regards to:

(a) the severity and scope of the hazard or risk concerned,
(b) the state of knowledge reasonably available concerning that hazard or risk and of any means to remove or mitigate that hazard or risk.
(c) the availability and suitability of means to remove of mitigate that hazard or risk; and
(d) the cost of removing or mitigating that hazard or risk in relation to the benefits deriving there from.

Risk
Means the probability that injury or damage will occur.

Safe
Means free from any hazard.

Standard
Means any provision occurring:
(a) in a specification, compulsory specification, code of practice or standard method as defined in Section 1 of the Standards Act, 1993 (Act No. 29 of 1993); OR
(b) in any specification, code or any other directive having standardization as its aim and issued by an institution or organization inside or outside the Republic which, whether generally or with respect to any particular article or matter and whether internationally or in any particular country or territory, seeks to promote standardization.

The following definitions from the Construction Regulations are listed as follows:

Agent
Means any person who acts as a representative for a client.

Competent Person
Means any person having the knowledge, training, experience and qualifications specific to the work or task being performed:
Provided that where appropriate qualifications and training are registered in terms of the provisions of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995), these qualifications and training shall be deemed to be the required qualifications and training.

Construction
Means any work in connection with:

(a) the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;
(b) the installation, erection, dismantling, or maintenance of a fixed plant where such work includes the risk of a person falling;
(c) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; OR
(d) the moving of earth, clearing of land, the making of an excavation, piling or any similar type of work.

Contractor
Means an employer, as defined in Section 1 of the Act, who performs construction work and includes principal contractors.

Hazard Identification
Means the identification and documenting of existing or expected hazards to the health and safety of persons, which are normally associated with the type of construction work being executed or to be executed.

Health and Safety File
Means a file, or other record in permanent form, containing the information required as contemplated in these regulations.

Health and Safety Plan

Means a documented plan, which addresses hazards, identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

Health and Safety Specification
Means a documented specification of all health and safety requirements
pertaining to the associated works on a construction site, so as to ensure the health and safety of persons.

Method Statement
Means a document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment.

Principal Contractor (Main Contractor)
Means an employer, as defined in Section 1 of the Act who performs construction work and is appointed by the client to be in overall control and management of a part of or the whole of a construction site.

Risk Assessment
Means a program to determine any risk associated with any hazard at a construction site, in order to identify the steps to be taken to remove, reduce or control such hazard.

4. NOTIFICATION OF CONSTRUCTION WORK

- The Principal/Main Contractor shall notify by registered mail, the local relevant Provincial Director of the Department of Labour, before commencing with construction work, of the intended work in the form of Annexure A of the Construction Regulations.
- A copy of the completed Annexure A of the Construction Regulations, as well as proof of notification shall be included in the Health and Safety Plan. (Proof of fax or proof of hand delivery)
- A copy of the completed Annexure A is to be kept on site by the principal Contractor.

5. LEGAL DOCUMENTATION/APPOINTMENTS

The following documents must be provided in the Health and Safety Plan:

- Health and Safety Policy signed by CEO.
- Letter of good standing with the Compensation Commissioner, Federated Employers or similar insurer.
- Health and Safety Organogram (or table), outlining the Health and Safety Team, as well as the appointment(s) they have under the Act and Regulations (reference to specific section/regulation applicable to appointment)

Example:

Tom Smith
Section 16(2)
Construction supervisor CR 6(1)

Dick Smith
Construction vehicle competent person CR 21(1)(j)
Excavation competent person CR 11(1)

Harry Smith
H&S Rep - Section 17(1)

- The competency of each member of the Health and Safety Team must be provided and should` include knowledge, training, experience & qualifications specific to the work or task being performed.

Signed copies of the following legal appointments must be provided in the Health and Safety Plan:

APPOINTMENT	**OHS-ACT / REGULATION REFERENCE**
Section 16.2 appointment	Section 16.2
Health and Safety Representative (if necessary)	Section 17
Health and Safety Committee Members (if necessary)	Section 19
Incident Investigator	GAR 8(2)
First Aiders (Include training certificates)	GSR 3
Fire Fighters	ER 9 & CR 27(h)
Risk Assessor	HC (Incl. Asbestos & Lead); CR 7

The following information must be provided in the Health and Safety Plan:

- Indicate the estimated number of employees to be working on site.
- Indicate the expected number of contractors to be appointed by the Principal/Main Contractor.

The following Competent Persons, **where applicable**, shall be appointed in writing by the Principal/Main Contractor, prior to any work being carried out, and shall adhere to the requirements of the specific sub-regulations.

The competency of each of these appointed competent persons must be provided and should include knowledge, training, experience & qualifications specific to the appointment.

The table below indicates the applicability of the appointments but contractors should by no means be limited to these indications.

APPOINTMENT	**OHS-ACT / REGULATION REFERENCE**
Construction Supervisor	CR 6 (1)
Assistant Construction Supervisor	CR 6 (2)
Fall Protection Competent Person	CR 8 (1)
Formwork/ Support Work Competent Person	CR 10 (a)
Excavation Work Competent Person	CR 11 (1)
Demolition Work Competent Person	CR 12 (1)
Scaffolding Competent Person	CR 14 (2)
Batch Plant Competent Person	CR 18 (1)
Explosive Powered Tools Competent Person	CR (b) 19
Construction Vehicle and Mobile Plant Competent Person	CR 21 (1)(j)
Electrical Installation Competent Person	CR 22 (d)
Stacking Competent Person	CR 26 (a)
Fire equipment Competent Person	CR 27 (h)
Confined Spaces Competent Person	GSR (5)
Blasting Competent Person	
Safety Officer Full time or part time	CR 6(6)
Traffic Safety Officer	CR 6(6)
General Machinery Competent Person	GMR (2)
Lifting Machines Operators	DMR 18(11)
Pipe Jacking Competent Person	
Competent Person referred to in South African Rail Commuter Corporation Ltd: General conditions and specifications for work on, over, under or adjacent to Railway lines and near High Voltage Equipment. (SPK7/2)	(SPK7/2)

- **Indicate in the H&S Plan, which of these listed appointments are applicable to the construction work in question.**
- no work involving any of the listed appointments may be performed without the knowledge and approval of an appointed competent person.
- The competent person shall be responsible to determine the level of supervision required for each activity.
- The agent/engineer must be informed of any changes made to the above appointments.
- The agent/engineer reserves the right to require from any contractor at any stage to appoint a full or part time construction health and safety officer.

6. GENERAL DUTIES OF PRINCIPAL CONTRACTOR

- The principal contractor will be responsible for co-operation between all contractors to ensure compliance to the OHS–Act and Regulations on site.

- To ensure the above, the Principal/Main Contractor must carry out the following and provide proof of such in his H&S plan:

    - Provide health and safety specifications to Contractors.
    - Appoint Contractors in writing.
    - Proof than Contractors H&S Plan has been approved, implemented and maintained.
    - Proof that Contractors are registered with the Compensation Commissioner or similar insurer.
    - Proof that Contractors made provision for the cost of Health and Safety measures during the construction process.
    - A comprehensive & updated list of all contractors on site, also indicating the type of work being done.
    - Copies of Section 37(2) agreements with the relevant contractors.
    - Comply with the covid 19 health and safety regulations

7. SUPERVISION OF CONSTRUCTION WORK

- The agent/engineer must be informed if the Construction Work Supervisor is also appointed as a Construction Supervisor for another site.

8. RISK ASSESSMENT

- Risk assessments of all required activities/hazards shall form an integral part of the Health and Safety plan.

- All risk assessments shall be conducted in terms of an acceptable methodology, prior to commencement of work, according to the provisions of CR 7 and should cover at least the following:

    - Excavations
    - Backfilling in trenches
    - Pipe laying
    - Blasting
        - open trench blasting
        - pipe jack blasting

    - Identification of existing Services
    - Clearing of vegetation

- Work in the vicinity of houses/buildings
- Movement of Construction Vehicles
- Working in confined spaces
- Demolition
- Temporary stockpiling
- Connecting to existing sewer
- Accommodation of traffic
- Accommodation of pedestrians
- Temporary vehicle bridges
- Control of access of public/pedestrians to excavations
- Work surrounding live sewage connection

- All health hazards that can be present during any of the above activities and should include individual dusts, gases, fumes, vapours, noise, extreme temperatures, illumination, vibration and ergonomic hazards due to any of the above activities.

- The above list is by no means exhaustive and should not be limited to these activities but must cover all activities that forms part of the said construction work. Each activity must be split down to individual tasks and all associated hazards identified and listed in the risk assessment. This ensures that critical tasks and subsequent critical hazards are not missed.

- The risk assessment to be included in the H&S Plan must clearly indicate:

    - The methodology used to do the risk assessments.
    - Breakdown of processes and activities covered.
    - High risks anticipated.

- All risk assessments are to be conducted by competent persons as appointed under paragraph 5 of this document. The plan must include a declaration in this regard or the risk assessment must contain the signature(s) of this appointed persons.

- Risk assessments are to be handed to the agent prior to commencement of work.

- The agent reserves the right to stop any work if such work is not conducted in terms of the recommendations of the risk assessment.

- Risk assessments are to **cover safety as well as health and ergonomically hazards.**

9. SAFE WORK PROCEDURES

Safe Work Procedures are to form part of the H&S Plan and **must be compiled for all the above-identified activities.**

The safe work procedures must address the following elements:

- The work method to be followed to conduct work safely
- Mitigation of identified risks
- Reducing and controlling risks and hazards that have been identified
- Responsibilities of competent persons
- Required personal protective equipment
- Correct equipment/tools/machinery to be used
- Reference to relevant registers to be completed
- Reference to applicable risk assessment

- **The following two tables provides information on all factors to be taken into account when the Risk Assessments and Safe Work Procedures are compiled:**

Physical	**Chemical**	**Biological**	**Mechanical**	**Psycho-social**
Noise	Liquids	Insects	Guards	Stress
Vibration	Dusts	Fungi	Hand tools	Work pressure
Ionizing radiation	Fumes	Bacteria	Machinery	Monotony
Non-ionizing radiation	Fibers	Viruses		Unsociable hours
Health and cold	Mists			Ergonomically:
Electricity	Gases			• Posture
Pressure	Vapors			• Movement
				• Repetitive tasks

System	**Stress/Agency**	**Illness/Disease**
Musculoskeletal	Lifting/loads Repetitive strain Abnormal postures Whole body vibration	Muscular pain syndromes Tenosynovitis Bursitis Osteoarthrosis
Sensory	Noise	Hearing loss
Skin	Cement (chromates), rubber Thinners, epoxies Tar, pitch Solar radiation	Allergic contact dermatitis Irritant contact dermatitis Acne, Skin cancer Keratoses, Cancer
Respiratory	Silica Asbestos Spray paints, woods, epoxies Irritant dusts, welding fumes Organic Solvents	Silicosis, TB Asbestosis, Cancer Asthma Bronchitis Headaches, Dizziness, Cancer
Psychosomatic	Physical stress Psychosocial stress	Head aches Depression Fatigue Substance abuse
Nervous System	Lead Organic solvents	Peripheral and central neuropathy Headaches, Dizziness, Mood disorder, Dementia, Cancer

10. SAFETY OF PUBLIC/PEDESTRIANS

Access to the construction site must be cordoned off as much as possible in all work areas. All excavations are to be fenced/barricaded to prevent access by public / pedestrians. Barriers must be of an impenetrable nature – barrier tape will not be seen as a sufficient barrier mechanism.

Work must be planned in such a manner as to ensure that the minimum amount of trenches is left open after hours or during weekends.
No trenches/excavations are to be left open during any December shutdown period.
Temporary pedestrian crosses over excavations are to be of adequate width and provided with sturdy handrails.

11. FALL PROTECTION

In addition to the requirements of this regulation (CR 8) the following shall apply:

- The fall protection plan is to be prepared by a competent person. This competent person must sign the fall protection plan.

- Contents of the fall protection plan must cover all the requirements as stated in sub-regulation CR 8.
- The fall protection plan is to be handed to the agent before work commences.
- The level of supervision is to be stated in the fall protection plan.
- Medical certificates, work near edges, presence of dew, dangerous walking areas etc. should be addressed in the fall protection plan.

12. REGISTERS

- Examples of the registers listed below must be provided in the Health and Safety Plan.
- All registers must be available at the site offices at all times for inspection by the agent.
- The list of registers to be kept is by no means exhaustive and the H&S Plan should list all the registers that are applicable and at what frequency they are going to be maintained.

ACTIVITY	FREQUENCY	FORMAT
Form work / Support work	Daily, prior to any shift	
Excavation Work	Daily, prior to any shift, after rain or blasting or after unexpected fall of ground	
Scaffolding	Daily, prior to any shift, after rain or blasting.	
Material Hoist	Daily	
Batch Plants	Daily	
Explosive Powered Tools	Daily Before Use	
Crane(s) Logbook	As per DMR 18	
Construction Vehicles and Mobile Plant	Daily	
Temporary Electrical Installation	Weekly	
Stacking	Weekly	
Fire Extinguishers	Bi – Monthly	
Ablution Facilities	Weekly	
Ladders	Weekly	
Incident Register in terms of GAR 9	As Required	Annex 1 of GAR
Fall Protection Equipment	Daily	
Portable electrical tools	Weekly	
Suspended Platforms	Daily	
Accommodation of traffic	Daily	
Fire fighting equipment	Monthly	

13. TRAINING

Each Health and Safety Plan shall indicate the following regarding training:

- Name and contents of the following training courses which have to be conducted:
    - Induction Training
    - Training regarding hazards identified and any corrective measures in place
    - Training regarding all applicable regulations
    - Specific training regarding applicable competencies
- Attendance registers must be kept as proof of training provided
- Method of informing visitors and other persons entering the site of hazards prevalent on site.
- Method of providing personal protective equipment to visitors and non-employees.
- An example of ID training card for each employee (if used).
- Methodology to be used in the issuing and communication of written instructions/safe work procedures.

14. AGENT HEALTH AND SAFETY INSTRUCTION REGISTER

- All Health and Safety instructions will be given via the resident engineer in writing
- The Principal Contractor shall be required to sign the register at the end of each day to acknowledge any instructions issued.

15. GENERAL REQUIREMENTS

- ***Personal Protective Equipment***
  The procedures for issuing and control over PPE shall be indicated in the Health and Safety Plan, as well as the enforcement for the wearing thereof.

- ***Hired Plant***
  The responsibility for the safe condition and use of all hired plant shall be that of the contractor.

- ***Transport of Employees***
  Transport of employees shall be carried out in terms of the National Road Ordinances and the OHS Act - Construction Regulations.
  The Health and Safety Plan shall detail the arrangements and methods of the transportation of workers.

- ***Signs***
  The Principal Contractor shall indicate in his Health and Safety Plan the arrangements regarding the posting of danger signs.

- ***Certificates of fitness***
  The Principal Contractor shall include in his H&S Plan copies of medical fitness certificates for the following:
    - Crane Operators
    - Construction vehicles and Mobile plant operators
    - Pipe Jacking employees

- Any other medical certificates that might be applicable in terms of the other regulations governing health & safety of construction personnel such as HCS regulations and Noise induced hearing loss etc.

- ***Site Visitors Register***
  - A site visitor's register is to be kept on site and steps are to be taken to ensure that all visitors sign the visitors' register before entering the site.
  - A sign should also be provided directing all visitors to report to
  - the site officer.

- ***Safety of excavations***
  - Provision should be made for the utilisation of geo technical services on a monthly basis to independently evaluate the safety off all excavations
  - All excavations are to be fenced/barricaded to prevent access by inter alia children and other members of the public
  - All barricading is to be maintained and protected against theft and vandalism

- ***Blasting***
  - A separate Health and Safety Plan will be required from the blasting contractor
  - The Health and Safety Plan must also be approved by the relevant Petronet servitude supervisor
  - All the requirements of the Petronet Standard Crossing Conditions and Requirements for underground Services document (Ref P2-18 (CE8)) must be complied with. This document is attached to the back this Health and Safety Specification.

16. HAZARDOUS CHEMICAL SUBSTANCES (including Asbestos and Lead)

In addition to the requirements in the HCS Regulations, the principal contractor must provide proof in the H&S Plan that:

- Material Safety Data Sheets (MSDS's) of the relevant materials/hazardous chemical substances are available prior to use by the contractor. Mention should be made how the principal contractor is going to act according to special/unique requirements made in the relevant MSDS's. All MSDS's shall be available for inspection by the agent at all times.
- Risk assessments are done at least once every two years.
- Exposure monitoring is done according to OESSM and by an AIA and that the medical surveillance programme is based on the outcomes of the exposure monitoring.
- How records are going to be kept safe for the stipulated period of 30 years.
- How the relevant HCS's are being/going to be controlled by referring to:
  - Limiting the amount of HCS
  - Limiting the number of employees
  - Limiting the period of exposure
  - Substituting the HCS
  - Using engineering controls
  - Using appropriate written work procedures
- The correct PPE is being used.
- HCS are stored and transported according to SABS 072 and 0228.
- Training with regards to these regulations was given.
- The H&S plan should make reference to the disposal of hazardous waste on classified sites and the location thereof (where applicable).

17. ASBESTOS

Should asbestos be identified as a hazard **whilst work is carried out**, the following must be included in the health and safety plan:

- Notification to the Provincial Director in writing, prior to commencement of asbestos work.
- Proof of a structured medical surveillance programme, drawn up by an occupational medicine practitioner.
- Proof that an occupational health practitioner carried out an initial health evaluation within 14 days after commencement of work.
- Copies of the results of all assessments, exposure monitoring and the written inventory of the location of the asbestos at the workplace.
- Only proof that medical surveillance has been conducted and not the actual records itself since these areas of a confidential nature.
- How records are going to be kept safe for the stipulated period of 40 years.
- Proof that asbestos demolition (if applicable) is going to be done by a registered asbestos contractor and provide proof that a plan of work for such demolition is submitted to an Approved Asbestos Inspection Authority 30 days prior to commencement of the demolition.
- Provide proof that the plan of work was approved by the asbestos AIA and submitted to the provincial director 14 days prior to commencement of demolition work together with the approved standardised procedures for demolition work

18. LEAD

Besides the requirements listed under par. 15 should lead be identified as a hazard at the workplace, the following must be included in the health and safety plan or as soon as its available:

- Proof that an occupational health practitioner carried out an initial health evaluation within 14 days after commencement of work.
- Copies of the results of all assessments, exposure monitoring and the written inventory of the location of the lead at the workplace.
- Only proof that medical surveillance has been conducted and not the actual records since these are of a confidential nature.
- How records are going to be kept safe for the stipulated period of 40 years.

19. NOISE INDUCED HEARING LOSS

Where noise is identified as a hazard the requirements of the NIHL regulations must be complied with and the following must be included/ referred to in the Health and Safety Plan:

- Proof of training with regards to these regulations.
- Risk assessment done within 1 month of commencement of work.
- That monitoring carried out by an AIA and done according to SABS 083.
- Medical surveillance programme established and maintained for the necessary employees.
- Control of noise by referring to:
  - Engineering methods considered
  - Admin control (number of employees exposed) considered
  - Personal protective equipment considered/decided on
- Describe how records are going to be kept for 40 years.

20. LIGHTING

Where poor or lack of illumination is identified as a hazard the lighting regulations must be complied with and the following must be included in the H&S Plan:

- How lighting will be ensured/ provided where daylight is not sufficient and /or after hours are worked.
- Planned maintenance programme for replacing luminaries.
- Proof of illumination levels of artificial illumination equipment.

21. HAZARDOUS BIOLOGICAL AGENTS (HBA)

Because of the possible exposure of workers to raw sewage the H&S Plan shall include details of the following:

- The conducting of Risk Assessment specifically aimed at exposure to HBA which shall include the following:
  - Nature and dose of HBA
  - Where HBA may be present and in what physical form
  - The nature of work or process
  - Steps in the event of failure of control measures
  - The effect of the HBA
  - The period of exposure
  - Control measures to be implemented

- Monitoring of exposure of workers shall be conducted to establish whether any worker is infected with an HBA associated with working or being exposed to raw sewage, in terms of the following:
  - By an occupational medical practitioner
  - Before entering the site to establish the workers baseline
  - During the period of the contract the risk assessment indicate possible exposure
  - After completion of the contract

- Medical surveillance should such be required after the above-mentioned by an occupational health practitioner.

- Indication on how all records of assessment, monitoring, etc will be kept, taking into account that records have to be kept for a period of 40 years.

- How exposure to HBA is to be controlled

- The provision of personal protective equipment

- What information and training is to be provided to employees regarding the following:
  - The contents of these regulations
  - Potential risks to health
  - Control measures to be implemented
  - The correct use and maintenance of personal protective equipment
  - The results of the risk assessment.

SECTION 4 : TECHNICAL SPECIFICATION

PART 9.1 : Earthing Grid

SPECIFICATION NUMBER : EG.01/0-04

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11. ANNEXURES 4

1. SCOPE

This specification shall include the design, supply, installation, connection and testing of the substation earthing system and ancillary works described below.

This specification includes the supply of copper conductor, lightning masts, earth spikes, earth mats etc. and the necessary excavation and civil works to install the earthing system and the replacement of stolen earth trails in substations.

The required general layout of the substation yard is shown on the drawings attached to this specification.

This specification describes all major components, but the Contractor shall supply and install all minor items and labour as may be necessary to complete the installation.

2. QUALITY OF WORK AND STANDARDS

All work shall be carried out strictly in accordance with the Code of Practice for earthing. (CP 1013)

The following SANS standards must be adhered to:

1. Earth rods, couplers and clamps shall be supplied and installed in accordance with SANS 1063-1985 and SANS 0199.
2. The two pack zinc-rich epoxy primer must be in accordance with SANS 926: 1968
3. The zinc and aluminium coatings for the protection of iron and steel against atmospheric corrosion must be in accordance with SANS 1391: 1983.
4. The replacement or new earth tail shall be two copper-plated steel earth rods according to SANS 1063: 1985.
5. Each earth rod shall have a diameter not less than 14.5mm, equivalent M16, according SANS 1063: 1985. The thickness of the copper plating on the earth rod shall not be less than 250μm.

3. DESIGN AND APPROVAL

The Contractor shall allow for soil resistivity tests to be performed on site. A detailed report on the resistivity tests shall be submitted to the Engineer together with a preliminary earthing scheme showing how the Contractor envisages installing the earth mat before commencing installation of the earth mat. The Contractor shall employ a specialist to investigate, plan and install the earthing installation.

The earth mat installation shall incorporate earthing electrodes at the extreme corners of the station, in the vicinity of earthing switches and transformer neutrals. The fences shall also be earthed at regular intervals. The installed maximum earth resistance shall be 1 Ω, or as agreed by the Engineer. Copper rod, 10mm² shall be used for the earth grid. The earth conductors shall generally be laid at a depth of more than 500 mm below the finished surface.

The complete earth mat design shall be submitted for written approval. The Engineer may then add or delete equipment and change the design of the earth system if he so requires. The installation of the earth mat shall be so arranged as not to cause delays in civil works.

4. EARTH RESISTANCE SURVEY

The Contractor will be responsible to have an earth resistance survey carried out on site by a specialist in this field, to be approved by the Engineer. The test shall be done on the undisturbed site, i.e. before earth works, trenching, building etc. commence.

The Engineer shall attend the survey. The Contractor shall inform the Engineer in good time when the test is scheduled to take place. If it is done without his or his representative being present, the test shall be repeated in the Engineer's presence at no additional cost to the Council.

The results of this survey will be used to adjust the earthing system as specified herein, if necessary, on the basis of the quoted rates.

Payment for the services of the specialist shall be by the Contractor who may recover such costs out of the provisional amount allowed for this purpose. The recoverable amount will be the nett invoice amount charged by the specialist, plus a 5% mark-up to cover the Contractor's administrative overhead and profit.

5. STOLEN AND NEW EARTHING FOR OUTDOOR EQUIPMENT

To discourage theft of copper bar or conductor, no bare earthing copper shall be visible above ground. For all visible outdoor connections to equipment or structures, copper plated solid steel rods having an equivalent resistance as the copper it replaces, shall be used. Sizes and cross sections shall be according table 1 (see appendix A) and be approved by the Engineer

Connections shall either be bolted directly to the earthing conductor, or bolted to a copper flag silver soldered or exothermically welded to the earth conductor to the approval of the Engineer. Alternatively, each joint shall be made with adequate bolts to the approval of the Engineer

The copper plated earth rod must be exothermic welded onto the structure as well as the copper earth mat. The reason is to enable a temperature rise up to 800°C for the copper plated earth rod. This provides for higher current capability for 3 seconds. The galvanising of the structure must be removed with a grinder and the surface cleaned where the exothermic weld is to be preformed. Failing to remove the galvanising will cause holes in the exothermic weld, which will result in poor contact and poor current carrying capability. After completion of the exothermic weld, the area on the structure, where the galvanizing was removed, must be covered with cold galvanizing. All exothermic weld joints are to be hammered tested to ensure that the mechanical strength of the joints are adequate. It is very important to use the correct weld metal power for the correct joint.

After connection the Engineer shall inspect all joints before the joints are sealed or trenches closed.

The following equipment needs to be earthed and the standard practices for earthing this equipment are as follows:

a) Transformer earthing:

   Transformers need to be earthed on the top cover on two different places and by using double earth rods.

b) Surge arresters:

   Insulated surge arrestors will be earthed on the surge arrestors base where non-insulated surge arrestors will be earthed on the structure exothermically.

c) Voltage and current transformers:

   Voltage and current transformers will be earthed on the structure exothermically.

d) Earth switches and isolator earthing:

   Earth switches and isolator earthing will be earthed on the structure exothermically on two different ends. The handle of the earth switches shall be earthed through a flexible earth.

e) Fences:

   All steel fencing must be earthed with in every 20M

f) Mechanism boxes and kiosks:

   Mechanism boxes and kiosks shall be earthed independently of the associated device or steel structure on which they are supported.

6. INDOOR EQUIPMENT EARTHING AND CABLE TRENCHES

Control panels, battery chargers, cable racking and other indoor auxiliary equipment shall be bonded by earth rod.

An earth rod shall be laid in the cable trench together with the multicore cables. This earth strap shall be run into the building and serve as the building earth to which all equipment in the building is connected.

The building earth shall be connected to ground rods or bonding bar at diametrically opposite ends of the building.

7. EARTHING ELECTRODES

The number and lengths of earthing electrodes shall be determined from the resistivity tests above. Earthing electrodes shall be of the extendible rod type. The rods shall be of copper clad steel and the copper to steel weld shall be a true molecular bond according SANS 1063.

8. LIGHTNING CONDUCTORS

Lightning conductor aerial masts shall be designed according to SANS 0160 with a safety factor of 2.5. They shall be hot-dip galvanised to SANS 763.

Masts shall be joined and hinged at ground level and shall be supplied complete with foundations.

9. TESTING OF EARTH RODS

SANS 1885: 2004

10. DRAWINGS REQUIRED

After completion of the Works, the Contractor shall supply the necessary drawings as agreed upon with the Engineer

11. ANNEXURES

Annexure A:

Copper earthing conductor sizes.

Fault current	**Copper area required mm²**		**Main earth grid (Rod)**		**Connections to equipment support (50 × 3 strap)**		**Connections to equipment support (2 × 10mm rod)**	
I (kA)	**Grid**	**Earth lead**	**No. of directions**	**Actual area mm²**	**No. of connections**	**Actual area mm²**	**No. of connections**	**Actual area mm²**
12.5	125	150	2	160	1	150	1	160
16	160	190	4	320	2	300	2	320
20	200	240	4	320	2	300	2	320
25	250	300	4	320	2	300	2	320
31.5	315	375	4	320	3	450	3	480
40	400	480	6	480	4	600	3	480
50	500	600	8	640	4	600	4	640

Table 1: The table above illustrates the conductor arrangements required to meet standard fault levels.

SECTION 4 : TECHNICAL SPECIFICATION: ANNEXURE 2

PART 1.10 : ENVIROMENTAL MANAGEMENT PLAN

SPEC NUMBER: EPPS0020

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1. GENERAL

1.1. This plan is to be adhered to by the Contractors for the life of construction operations; this includes rehabilitation of areas as and when required. The Contractors shall ensure that all construction staff, sub-contractors, suppliers, etc. are familiar with, understand and adhere to the Construction Management Plan. In addition, during construction the Contractors must ensure that all personnel are fully aware of any environmental issues relating to the construction activities that are being undertaken on site and the related environmental precautions that need to be taken. Construction supervisors and crews will be trained to recognize 'chance finds' during construction, and such finds (i) will not be disturbed, damaged or removed and (ii) will be brought to the immediate attention of the relevant authority.

1.2. The Client (Council) shall order the Contractors to suspend part or all of the works if the Contractors and/or any sub-contractors, suppliers, etc. fail to comply with the Environmental Management Plan.

1.3. Prior to construction the Contractors shall provide layout designs of the site indicating the position of all of the following: offices, ablution facilities, storage areas, workshops, batching plant, stockpile areas (i.e. soil/granular chemicals/cement fines, etc.), waste disposal facilities, hazardous substance storage area, access route, etc. This layout plan is to be submitted to the Client (Council) for acceptance prior to site establishment.

1.4. An "Environmental Site Book' should be supplied and kept on site. This book will reflect all issues, and proposed actions as noted during site visits. This site book should be in the form of a file wherein all Environmental Status Reports are kept. In addition, a separate file containing the EMP should also be kept on site. A copy of the Scoping Report, the EMP report and construction layout plan are to be available on site.

1.5. To reduce the effect of habitat loss, construction activities must be planned and implemented in a way that facilitates the restoration of plant communities. Specifications for soil preparation, endemic plant/seed mixes, fertilizer, and mulching should be provided for all areas disturbed by construction activities.

1.6. Restoration activities should be accomplished (established) within a year after construction is completed. The minimum vegetation disturbance must be permitted and the removal of vegetation must be managed and monitored to ensure a minimum exposed period. Monitoring must occur to ensure that revegetation was successful, plantings were maintained, and unsuccessful plant materials replaced.

2. ENVIRONMENTAL MANAGEMENT PLAN (CONSTRUCTION)

2.1. **Site establishment and preparation**

Management Action:

2.1.1. Limit site to existing road and/or already disturbed areas as far as possible.

2.1.2. Demarcate the boundaries of the total works site clearly for site management purposes. The preferred method of demarcation consists of steel droppers placed at regular intervals with nylon rope between the markers.

2.1.3. Fence off entire works area with 2.4m high temporary fence.

2.1.4. The Contractors shall maintain the demarcation line and ensure that materials used for construction on site do not blow or move outside the site and environs, or pose a threat to animals.

2.1.5. The Contractors shall restrict construction activities to within these boundaries. This extends to ensuring that all construction personnel and equipment remain within the demarcated construction site at all times.

2.1.6. Routes for temporary access and haul roads are to be located within the approved demarcated areas and vehicle movement is to be confined to these roads.

2.1.7. Movement of vehicles outside the designated working areas is not permitted.

2.1.8. Clearly indicated which activities are to take place in which areas within the site e.g. the mixing of cement, stockpiling of materials, etc. Limit these activities to single sites only, preferably on the existing road or otherwise on an already disturbed area.

2.1.9. Remove all markers when the construction phase comes to an end.

2.1.10. Fully rehabilitate (e.g. clear and clean area, rake, pack branches, etc.) the disturbed areas and protect them from erosion.

2.1.11. The Contractor shall only prune or remove vegetation where absolutely necessary. No large trees shall be removed. Topsoil should be stockpiled for later use in revegetation efforts.

2.2. **Construction staff**

Management Action:

2.2.1. Demarcate the boundaries of the construction staffs' eating and storage areas by means of a 1.5m diamond mesh fence.

2.2.2. Adequate ablutions must be erected on site for construction staff. It is critical that the services (water and sewerage) be properly monitored to ensure that these services are not overused or overloaded. Adequate provision for water shall be made for construction, drinking and washing.

2.2.3. Construction staff (emergency only) may only be accommodated on site once all the necessary services (water, sewerage and waste) are in place.

2.2.4. Dry chemical toilets must be made available on site.

2.2.5. Chemical toilets shall be cleaned and serviced regularly.

2.2.6. A designated place for food preparation and eating must be established.

2.2.7. An adequate number of refuse bins shall be provided.

2.2.8. No pets allowed on site.

2.2.9. All staff to be identifiable through identity badges.

2.2.10. No explosives (with the exception of blasting requirements) or fire-arms to be permitted on site.

2.2.11. No open fires will be allowed.

2.3. **Vegetation clearing**

Management Action:

2.3.1. While bush will have to be undertaken in some areas, the areas needing to be cleared and the degree of clearing required will be determined and demarcated prior to construction. Ancillary activities, such as stockpiles, and storage yards, will be demarcated to areas already disturbed or where they will cause minimal disturbance.

2.3.2. Identify areas to be affected by construction and secure plant species/habitat in these areas. Prevent unnecessary harvesting, destruction and removal of plant material.

2.3.3. No large trees (with trunk diameter exceeding 200mm) are to be removed.

2.3.4. Consider the selective trimming of branches to allow for free vehicle movement before opting to remove any trees.

2.3.5. Remove alien/exotic vegetation, and monitor regularly.

2.3.6. Ensure no exotic vegetation is introduced into the surrounding natural habitat.

2.3.7. All sites disturbed by construction activities shall be monitored for colonization by invasive alien plant species.

2.3.8. The collection of firewood for cooking and other uses is strictly prohibited.

2.3.9. The Contractors may not deface, paint or otherwise mark and/or damage natural feature/vegetation on the site. Any features/vegetation defaced by the Contractors shall be restored.

2.4. **Conservation of topsoil**

Management Action:

2.4.1. The Contractors are required to strip topsoil (as defined in this specification) together with grass/groundcover from all areas where permanent or temporary structures are located, construction related activities occur, and access roads are to be constructed, etc.

2.4.2. Topsoil is to be handled twice only – once to strip and stockpile, and secondly to replace, level, shape and scarify.

2.4.3. Topsoil is to be replaced along the contour.

2.4.4. Topsoil is to be replaced by direct return where feasible (i.e. replaced immediately on the area where construction is complete), rather than stockpiling it for extended periods.

2.4.5. Topsoil stockpiles are not to exceed 1,5m in height and should be protected by a mulch cover. This mulch cover must not contain alien vegetation/seeds.

2.4.6. Topsoil stockpiles are to be maintained in a weed free condition.

2.4.7. Topsoil should not be compacted in any way, nor should any object be placed or stockpiled upon it.

2.4.8. Topsoil, which is to be stockpiled for periods exceeding 4 months, is to be vegetated. A groundcover or grass seeding may be specified.

2.5. **Access roads**

Management Action:

2.5.1. All disturbed areas along the fringes of the road must be rehabilitated once the road is complete.

2.5.2. Contractors will be required to submit a delivery timetable. Strict control is to be exercised over entering and exiting traffic and delivery procedures.

2.5.3. Special attention will be paid to limit the number of deliveries as far as possible.

2.5.4. Any damage caused by the construction activities to the access roads must be rehabilitated completely upon completion of the works.

2.5.5. Proactively protect steep access roads and cuttings against erosion. Mitre drains, Reno mattresses, extended concrete drifts, drainage pipes, etc. should be considered for this.

2.5.6. Any cement and gravel spillage on the roads is to be cleared up completely.

2.5.7. Construction staff should only use authorised paths and roads.

2.5.8. Construction access roads should not be wider than necessary with a maximum of 3m.

2.5.9. If two-way traffic is to take place, passing bays are to be used to prevent access/detours into the surrounding areas, unless otherwise stated. The drivers delivering construction materials to site are to be made aware of this and are to be forced to utilise the passing bays. They may not drive off the road in order to allow another vehicle to pass.

2.5.10. During the contract period, the Contractors shall ensure that all existing water attenuation and drainage structures are maintained in a state in which they can optimally perform their function.

2.5.11. Vehicles used during construction or to transport material or staff on site, should have the minimum impact on the environment (trees, roads or other) or other road users. The size, height and weight of vehicles must be kept in mind; the access route will determine the type of vehicle that can be used.

2.5.12. Construction vehicles are to be maintained in an acceptable state of repair and cleanliness when leaving the site. Sand, dust and spillages from these vehicles that inevitably fall on the main roads should be cleared on a regular basis.

2.5.13. Drivers of all vehicles on site are to be licensed.

2.5.14. Upon completion of the construction period, the Contractors shall ensure that the access roads are returned to a state no worse the prior to construction commencing.

2.5.15. Continual use of dirt access roads by heavy machinery and increased transport loads means they will have to be carefully monitored and regularly graded as soon as potholes or rutting occurs.

2.5.16. Traffic speeds on the site need to be reduced to a maximum of 25km/hour and regular application of water on gravel road surfaces may be required to prevent high dust disturbance.

2.6. **Excavation, backfilling and trenching**

Management Action:

2.6.1. Excavation of sand to solid ground to be done carefully and appropriate drainage incorporated i.e. sand and debris need to be removed and solid rock preferably exposed to ensure proper binding with concrete material.

2.6.2. Construction must preferably be extended over rocky substrate to give maximum anchoring opportunity.

2.6.3. Blasting operations, if required, to be planned by competent specialists, with due regard to adjacent land users. Blasting t be programmed in cooperation with adjacent land owners to result in the most impact limiting operation.

2.6.4. Record to be kept of infrastructure and facility conditions prior to and after the blasting operations.

2.6.5. Consider using any excess rocks or boulders that were excavated from the construction site for any erosion protection work which is required on site. Consider removing the rocks for the packing of gabions at other soil erosion sites.

2.6.6. If need be, spread the rocks in as natural a manner as possible in the veld along the access roads. This should be considered as the last option only and only if a few excess rocks remain.

2.6.7. Similarly, excess sand as a result of excavation activities is not to be dumped along the roadsides.

2.6.8. Removed soil is to be used to backfill areas where required and excess is to be landscaped into natural looking banks that fit the surrounding topography.

2.6.9. During excavation, topsoil is to be conserved.

2.6.10. Excavated material is to be stockpiled along a pipeline trench within the working servitude, unless otherwise authorised.

2.6.11. Deficiency of backfill material shall not be made up by excavation in the protected area. Where backfill material is deficient, it should ideally be made up by importation from an approved borrow pit.

2.6.12. The Contractors shall backfill in accordance with the requirements of progressive reinstatement. 'Progressive reinstatement' is defined as: reinstatement of disturbed areas to topsoil profile on an ongoing basis, immediately after selected construction activities (e.g. backfilling of trench) are completed. This allows for passive rehabilitation (i.e. natural re-colonisation by vegetation) to commence.

2.6.13. The following trenching specification shall apply:

2.6.13.1. The trench will be excavated to a depth of 1m where possible. Where shallow bedrock makes this impractical the trench should only then be excavated to the maximum depth possible.

2.6.13.2. Care will be taken to remove the topsoil and then the subsoil and to stockpile these separately.

2.6.13.3. The pipeline/cable should be placed on a 200mm bed of river sand to protect it.

2.6.13.4. The subsoil will then be backfilled.

2.6.13.5. The topsoil will then be replaced and the entire length of the trench compacted.

2.6.13.6. The trench should be compacted to 90-93% AASHTO.

2.6.13.7. Sections of the trench that are excavated in a roadway should be compacted to 98% AASHTO.

2.6.14. Contract personnel at all levels to be made aware of potential archaeological and/or paleontological artefacts/occurrences.

2.6.15. Any discovery of artefacts to be reported immediately to SAHRA.

2.6.16. Works in areas where artefacts are discovered are to cease immediately until the area has been investigated and a go-ahead has been obtained from SAHRA.

2.7. **Levelling**

Management Action:

2.7.1. Excess sand and soil resulting from levelling activities of the work area should be stored in low heaps either on the access road or already disturbed area.

2.7.2. Excess topsoil is to be spread evenly over the area in a manner that blends in with the natural topography.

2.7.3. Excess stockpiled building material is to be removed completely and the areas levelled.

2.7.4. Once heavy machinery has cleared the bulk of these material stockpiles, the disturbed areas should be levelled and cleared of any foreign material manually. It is unacceptable to leave foreign material behind with the knowledge that it will become hidden amongst the rejuvenating vegetation with time.

2.7.5. Regular inspections must be undertaken to monitor and audit the effects and impacts of such removals.

2.8. **Stockpiling of building materials**

Management Action:

2.8.1. Limit to demarcated sites only.

2.8.2. Single sites should be a priority. This may not always be possible for example heaps of topsoil, but should definitely be the case for activities such as the mixing of cement.

2.8.3. Stockpiles of expensive materials such as bags of cement should be such that they can easily be removed from the site over weekends or during rainy weather.

2.8.4. Specific sites should be allocated for waste e.g. empty cement bags, discarded planks, etc. A low temporary fence should possibly be erected around such a site in order to contain the waste and assist the effective removal thereof from the site.

2.8.5. A specific site should be allocated for the storage and handling of diesel, grease, oils, solvents and soap, which create cleaning and disposal issues. This area should be bunded, and thus should take place in the area allocated for permanent storage of such materials.

2.8.6. Fuels required during construction shall be stored in a central depot at the construction camp. This storage area must be bunded.

2.8.7. Rehabilitate the sites as required.

2.9. **Materials handling and storage**

Management Action:

2.9.1. Tanks containing fuel shall have lids, which are to remain firmly shut.

2.9.2. Fuel stores shall be placed on a concrete, or similar, base surrounded by a brick bund.

2.9.3. The bund shall have a volume of 30% of the volume of the largest tank in the storage area plus 10% of the volume of all other tanks.

2.9.4. The slab shall be sloped towards a sump to enable any spilled fuel and water to be removed.

2.9.5. Any wastewater collected at the sump shall be disposed of as hazardous waste.

2.9.6. Gas and liquid fuel shall not be stored in the same storage area.

2.9.7. No smoking shall be allowed inside the stores or within 3m of a bund.

2.9.8. The Contractors shall ensure that there is adequate fire-fighting equipment at the fuel stores.

2.9.9. Do not store fuels and chemicals under trees.

2.9.10. Exercise extreme care with the handling of diesel and other toxic solvents so that spillage is minimised.

2.9.11. Excess concrete from mixing shall be deposited in a designated area awaiting removal to an appropriate landfill site. Liquid wastes to be treated at an approved facility.

2.9.12. The Contractors shall ensure that all operations that involve the use of cement and concrete are carefully controlled.

2.9.13. Concrete mixing shall only take place in the construction camp or in agreed specific areas on site.

2.9.14. Concrete shall not be mixed directly on the ground. No mixed concrete shall be deposited directly onto the ground prior to placing. A board or other suitable platform/surface is to be provided onto which the mixed concrete can be deposited whilst it waits placing.

2.9.15. All visible remains of excess concrete shall be physically removed immediately and disposed of as waste.

2.9.16. Timber products should be treated off-site prior to use in construction.

2.9.17. Periodic on-site application of timber treatment products (for maintenance purposes) should take place with due care for the nature of the product (toxicity) and for potential spillages that may occur. Areas where timber is to be treated should have secondary containment measures instituted, such as the placement of plastic layer (some form of covering) over soils, beneath the timber structures to prevent contamination of the soil surface.

2.10. **Servicing and refueling of construction equipment**

Management Action:

2.10.1. The Contractors shall ensure that servicing and/or refuelling of vehicles and equipment takes place within the construction camp.

2.10.2. Should construction vehicles have to serviced on site, it must be done in a designated area with a concrete floor and drain system that will prevent oils and fuels from contaminating the environment.

2.10.3. The ground under the servicing and refuelling areas shall be protected against pollution caused by spills and/or tank overfills (bunded/lined).

2.10.4. All water run-off from these areas shall be collected, contained on site and stored in water-tight containers prior to disposal off-site as hazardous waste

2.10.5. All equipment that leaks shall be repaired immediately or shall be removed from site.

2.10.6. The Contractors shall only change oil or lubricant at agreed and designated locations, except if there is a breakdown or emergency repair, and then any accidental spillages must be cleaned up/removed immediately.

2.10.7. In such instances the Contractors shall ensure that he has Drizit pads or similar, and/or drip trays available to collect any oil or fluid.

2.10.8. The only permitted method of refuelling and refilling lubricants is by means of a pump.

2.11. **Solid waste management**

Management Action:

2.11.1. If construction workers are to eat on site other than at the construction camp, the Contractors shall designate specific areas for eating and shall provide adequate steel refuse bins at al places. The refuse bins shall be cleaned on a daily basis.

2.11.2. The bins shall be provided with lids and an external closing mechanism to prevent their contents blowing out and shall be scavenger-proof.

2.11.3. The Contractors shall supply steel waste bins/skips throughout the site at locations where construction personnel are working

2.11.4. The Contractors shall not dispose of any waste and/or construction debris by burning, or by burying.

2.11.5. The Contractors shall ensure that all personnel immediately deposit of waste in waste bins for removal by the Contractors.

2.11.6. All waste shall be disposed of off-site at an approved landfill site.

2.11.7. Remove loose building materials and waste from the site and dispose of them at an appropriate waste disposal site.

2.11.8. Old cement mixing bags shall be placed in wind and spill proof containers as soon as they are empty. The Contractors shall not allow closed, open or empty bags to lie around the site.

2.11.9. All waste, which includes cigarette butts, cable ties, paper, plastic, tin, glass, organic waste like fruit pips and peels, planks, wire, tins of grease, etc. must be transported in an appropriate manner (e.g. plastic rubbish bags) to an appropriate waste site.

2.12. **Liquid waste management**
Management Action:

2.12.1. Construction water refers to all water affected by construction activities.

2.12.2. The Contractors may discharge 'clean' silt laden water overland and allow this water to filter into the ground. However, they shall ensure that they do not cause erosion as a result of any overland discharge.

2.12.3. All washing of plant/equipment/concreting equipment etc. shall take place within the construction camp.

2.12.4. Water from washing operations shall be collected in a conservancy tank removed from site and disposed of in the agreed manner.

2.12.5. The Contractors are encouraged to recycle dirty wash water to minimise the amount to be removed off-site.

2.12.6. Trucks delivering concrete shall not be washed on site.

2.12.7. All washing operations shall take place off-site at a location where wastewater can be disposed of in an acceptable manner.

2.12.8. Adequate ablution facilities to be provided on site, conveniently located near to work areas to avoid localised water pollution from camp sewerage.

2.12.9. Neither the river nor any other natural watercourse is to be used for cleaning of tools or any other apparatus. This includes for purposes of bathing, or washing of clothes etc.

2.12.10. A drainage diversion system is to be installed to divert runoff from areas of potential pollution, e.g. batching area, vehicle maintenance area, workshops, chemical and fuel stores, etc.

2.12.11. No spills may be hosed down into a storm water drain or sewer, or into the surrounding natural environment.

2.12.12. Discard construction waste at a registered waste management facility/landfill site, particularly those wastes or products that could impact on surface or groundwater quality by leaching into or coming into contact with water.

2.12.13. Construction vehicles are to be maintained in an acceptable state of repair and cleanliness when leaving site. Sand, dust and spillages from these vehicles that inevitably fall on the main roads should be cleared on a regular basis.

2.12.14. All soil contaminated, for example by leaking machines, refuelling spills, etc., is to be excavated to the depth of contaminant penetration, placed in 200 litre drums and removed to an appropriate landfill site.

2.12.15. The Contractors shall contain wash water from cement mixing operations, by directing the water into a sump for collection. The material contained in the sump shall be removed to an appropriate landfill site.

2.12.16. Water and slurry from concrete mixing operations shall be contained to prevent pollution of the ground surrounding the mixing points.

2.12.17. All visible remains of excess concrete shall be physically removed immediately and disposed as waste. Washing the visible signs into the ground is not acceptable. All excess aggregate shall also be removed.

2.12.18. Where, due to construction requirements, pollution of a water body may potentially occur, the Contractors are to ensure adequate measures (e.g. attenuation/settlement dams/oil absorbent products) are in place to prevent pollution. A method statement is to be provided to this effect.

2.12.19. Exercise extreme care with the handling of diesel and other toxic solvents so that spillage is minimised.

2.12.20. The Contractors shall take reasonable precautions to prevent the pollution of the ground and /or water resources on and adjacent to the site as a result of his activities.

2.12.21. Such pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage and waste products, etc.

2.12.22. The Contractor shall obtain Drizit pads or similarly designed products or materials to soak up oil, petrol and diesel.

2.12.23. These materials shall be readily available for use wherever construction equipment is working, fuel and lubricants are being offloaded and stored and equipment is filled and serviced.

2.12.24. The Contractors shall ensure that he is familiar with the correct use and disposal of any materials designed to soak op petroleum products.

2.12.25. The Contractors shall ensure that no oil, petrol, diesel, etc. is discharged onto the ground.

2.13. **Hazardous materials**

Management Action:

2.13.1. The Contractors shall comply with all national, regional and local legislation with regard to storage, transport, use and disposal of petroleum, chemical, harmful and hazardous substances and materials.

2.13.2. The Contractors shall obtain the advice of the manufacturer with regard to the safe handling of such substances and materials.

2.13.3. The Contractors shall provide a list of all petroleum, chemical, harmful and hazardous substances and materials on site, together with storage, handling and disposal procedures for these materials.

2.13.4. The Contractors shall furthermore be responsible for the training and education of all personnel on site who will be handling the material about its proper use, handling and disposal.

2.13.5. Storage of all hazardous material is to be safe, tamper proof and under strict control.

2.13.6. Petroleum, chemical, harmful and hazardous waste throughout the site shall be stored in enclosed bunded areas. The bunded areas shall be clearly marked. Such waste shall be disposed of off site at a hazardous waste disposal site.

2.13.7. The bunded area is to be sufficiently large to contain a spillage equivalent to the volume of one container of the substances stored.

2.13.8. Temporary fuel storage tanks and transfer areas also need to be located on an impervious surface adequately bunded to contain accidental spills. Appropriate run-off containment measures must be in place.

2.13.9. All products to be dispensed from 200 litre drums shall be done with appropriate equipment, and not dispensed by tipping of the drum.

2.13.10. Any accidental chemical/fuel spills to be corrected immediately.

2.13.11. Fuels, solvents and other wastes will be stored in vessels equipped with secondary containment structures and will be removed from the concession area and the park being disposed of in compliance with national and local requirements

2.13.12. The containers in which the products are kept should, in compliance with hazardous material management procedures, be removed from the site once empty. Hazardous products should otherwise be stored on adequately bunded surfaces in the designated hazardous material storage areas.

2.14. **Erosion protection work**

Management Action:

2.14.1. Correct any cause of erosion at the onset thereof trough the most appropriate mechanism.

2.14.2. Soils should not be stripped when they are wet. This can lead to compaction and loss of soil structure.

2.14.3. During construction the Contractors shall protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible and by taking such other measures as may be necessary to prevent surface water being concentrated in water sources and from scouring the slopes, banks or other areas.

2.14.4. In essence soil erosion protection is about reducing the velocity of water run-off in the disturbed areas. There are many appropriate methods, depending largely upon the size and topography of the area to be protected against erosion.

2.14.5. The stabilisation of disturbed areas, access roads and/or steep cuttings is very site specific and could include:

2.14.5.1. Mitre drains;

2.14.5.2. Drainage pipes;

2.14.5.3. Reno mattresses (biodegradable material, upon which soil and rocks are packed which then keeps it in place to bind the soil);

2.14.5.4. Benches (consisting of sand bags);

2.14.5.5. Gabions;

2.14.5.6. Gabion mattresses;

2.14.5.7. Scarifying (ripping) areas along the natural contours; or

2.14.5.8. Packing branches and rocks in small gullies and disturbed areas.

2.14.6. Drainage of access routes and mitre drains to be maintained and kept open and functional.

2.14.7. Block off access to gravel pits and temporary routes so as to prevent them being used as ‘roads’ at a later stage.

2.14.8. Surface erosion protection measures shall be required to prevent erosion where slopes are steeper than 1:8 on all soil types.

2.14.9. Erosion protection measures required should include all or some of the below, as specified by the Engineer:

2.14.9.1. Use of groundcover or grass, retention of as much of the indigenous vegetation as possible;

2.14.9.2. Construction of cut off berms (earth and/or rock pack) – these are to be angled across the contour and normally would approximate an angle of 30° from the bisector of the contour;

2.14.9.3. Placing of brush wood on bare surface;

2.14.9.4 Hard landscaping, e.g. gabions etc.

2.14.10. Scour chambers are to be fitted with energy dissipaters, or the jet of water directed onto a protected (i.e. grouted stone pitching/rock pack/Reno mattress) area to dissipate water velocity and to control and prevent erosion.

2.14.11. Storm water drainage measures shall be required on site to control runoff and prevent erosion.

2.15. **Use and rehabilitation of gravel pits**

Management Action:

2.15.1. The extent of the borrow area (envelope area) is to be clearly explained to the contractors prior to the commencement of gravel extraction activities. This gravel area is not to be increased.

2.15.2. Topsoil is to be stockpiled separately and used to recover and rehabilitate the pits after use.

2.15.3. Plan to reuse the soil, as soon as possible; the biological components will deteriorate over long periods of storage.

2.15.4. Do not stockpile in large piles. Store in low heaps no more than one or two metres high to best retain the organic components in good condition.

2.15.5. The stockpiles should be located where they will not be disturbed by activities within the gravel pit. Disturbing the topsoil can further damage the soil structure prior to final reuse.

2.15.6. Soils should not be stripped when wet. This can lead to compaction and loss of structure of the soil.

2.15.7. The stripping of the gravel pit to solid bedrock with no chance for rehabilitation should be avoided. Such areas within the gravel pit should be rehabilitated immediately.

2.15.8. The natural slopes in the area, which have evolved as a result of natural erosion processes, should be studied and used as a guideline to determine the inclination of the reconstructed slopes. Obviously, the size of the area to be rehabilitated is a major consideration.

2.15.9. Slopes should be designed to reduce the velocity of the run-off as the catchment area of the increases. Where the area of the site limits formation of the stable slope profile, contoured benches or similar erosion control methods may be required. Slopes with an overall convex profile should always be avoided.

2.15.10. Where the size of the slope area to be rehabilitated is small, benches consisting of sandbags can be considered. These temporary structures should under no circumstances be left in a place beyond their projected life, as they will deteriorate in a very short period of time.

2.15.11. Benches are best located in the middle of the slope. Where long spaces cannot be avoided several benches may be required. In such cases the slope and run-off characteristics must be considered.

2.15.12. The site must be surveyed to maintain the contours. Where banks are graded to direct run-off to specific draw points ensure that run-off is dissipated or properly controlled.

2.15.13. Topsoil will commonly not adhere to slopes that are steeper than 27 degrees. The maximum slope for mechanically spreading topsoil is approximately 19 degrees.

2.15.14. Depending on the characteristics of the site, such as geology, the nature of the soils and other site specific topographical features, more gentle slopes may be necessary.

2.15.15. When contouring, always rip and scarify precisely along the contour. This prevents inadvertently creating down slopes channels.

2.15.16. The contour line should be surveyed and marked by posts, if necessary.

2.15.17. The ripping should normally be as deep as is possible depending on the material, the equipment that is available and the sub-surface conditions. However, some subsoil conditions (e.g. where boulders are present) may not permit ripping to these depths.

2.15.18. The spacing of the lines when ripping or scarifying should be such that they overlap each other.

2.15.19. When soil conditions are wet, soil will not break up so avoid ripping and scarifying under wet conditions.

2.15.20. Water discharge from small retention structures (e.g. earth embankments and artificially created pits that hold water) should be implemented. Where practical, it can be controlled via corrugated metal or plastic pipe/s that drain the water through the retention structures into a safe discharge area (i.e. one, which does not promote erosion or the creation of another artificial water pit).

2.15.21. These temporary structures should under no circumstances be left in place beyond their projected life, as they will deteriorate in a very short period of time.

2.15.22. The siting of any disposal sites for waste rock, within a specific borrow pit should be considered in the earliest plans. In many cases the filling and rehabilitation of any artificial water pits within the gravel pit could be considered. The site is covered by at least 0,5m of local gravel and then the available topsoil.

2.15.23. Access point to the borrow pit site is closed when not in use.

2.16. **Run-off from construction camps**

Management Action:

2.16.1. Pumps and other machinery requiring oil, diesel, etc., which are to remain in one position for longer than two days shall be placed on drip trays. The drip trays shall be watertight and shall be emptied regularly and the contaminated water disposed off-site at a facility capable of handling such waste liquid. Drip trays shall be cleaned before any possible rain events that may result in the drip trays overflowing.

2.16.2. A drainage diversion system is to be installed to divert runoff from areas of potential pollution, e.g. batching area, vehicle maintenance area, workshops, chemical and fuel stores, etc.

2.16.3. Contaminated runoff and wastewater is to be directed into a collection system (e.g. sump, attenuation dam, PVC porta-ponds, etc.) for treatment or collection and disposal. The final collection point (e.g. sump) is to be PVC lined.

2.16.4. Collected contaminated runoff/wastewater is to be pumped out of the final collection point and disposed of at an appropriate waste disposal site. Sump liners are to be treated in the same manner.

2.17.**Fire**

Management Action:

2.17.1. The Contractors shall take all the necessary precautions to ensure that fires are not started as a result of activities on site.

2.17.2. No open fires for heating or cooking shall be permitted on site.

2.17.3. Closed fires or stoves shall only be permitted at agreed designated safe sites in the construction camp.

2.17.4. Adequate suitable fire fighting equipment shall be provided at each fireplace or stove.

2.17.5. The Contractors shall be responsible for providing the necessary basic fire-fighting equipment.

2.17.6. All equipment shall be maintained in good operating order.

2.17.7. The Contractors shall supply all site offices, kitchen areas, workshop areas, material stores and other areas identified with suitable, tested and approved fire fighting equipment.

2.17.8. Workers are to be provided with gas for cooking and shall be prevented from burning fires.

2.17.9. No open fires shall be allowed anywhere on site.

2.17.10. The Contractors shall ensure he has the necessary fire fighting equipment on site in terms of SANS 1200. This shall include at least rubber beaters when working in 'veld' areas. A minimum requirement for construction in a high fire risk area shall be a water bowser/cart (minimum 5 000 litres) equipped with pump and hose (min 30m) which shall be permanently on site.

2.17.11. The construction site must also be protected against fire, and a sufficient fire break must be constructed, around the construction site.

2.17.12. A road to be constructed along the entire boundary of the site.

2.17.13. A firebreak to be made along the site boundary road.

2.18.**Accidents**

Management Action:

2.18.1. The Contractors shall comply with the Occupational Health and Safety Act.

2.18.2. The Contractors shall be responsible for establishing an emergency procedure for dealing with spills or releases of petroleum.

2.19.**Storm and wind conditions**

Management Action:

2.19.1. Special care will be taken during rainy periods to prevent the contents of sumps from overflowing.

2.19.2. The Contractors shall set up a procedure for rapidly emptying any collection points to prevent their filling with rainwater.

2.19.3. The Contractors shall ensure that rainwater does not run off areas containing pollutants and thus result in a pollution threat.

2.19.4. Stockpiles of the fine material such as sand, topsoil material, cement, etc. must also be protected from runoff and wind.

2.20. **Dust**

Management Action:

2.20.1. At all times the Contractors shall control dust on site.

2.20.2. Dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments. These impacts include visual pollution on gravel and earth roads.

2.20.3. A dust abatement programme shall be used. Standard dust abatement measures include watering or otherwise stabilising soils, covering haul trucks, employing speed limits on unpaved roads, minimising vegetation clearing, and promptly revegetating after construction is completed.

2.20.4. Revegetation plans should be developed for areas impacted by construction activities. Salvaged vegetation, rather than new planting or seeding, should be used to the extent possible.

2.20.5. Efforts to reduce dust and soil loss are to be undertaken, as appropriate, for all excavation, grading, construction, and other dust-generating and soil-disturbing activities.

2.21. **Noise**

Management Action:

2.21.1. Machinery and vehicle silencer units are to be maintained in good working order. Offending machinery and/or vehicles shall be banned from use on site until they have been repaired.

2.21.2. Noise levels shall e kept within acceptable limits for a protected area, and shall not be of such nature as to detract from the natural experience of other visitors to the protected area.

2.21.3. Music and other social noise to be controlled on site so as to not impose on others.

2.21.4. The Contractors shall at all times use equipment that is appropriate to the task in order to minimise the extent of damage to the environment and minimise noise levels.

2.21.5. Construction work will take place during the day as far as possible.

2.21.6. Work will only be undertaken at night in the case of emergencies.

2.21.7. Work hours will be from approximately 07:00 to 17:00

2.22. **Visual**

Management Action:

2.22.1. The type and colour of roofing and cladding materials are to be selected to reduce reflection.

2.22.2. Security lighting (both temporary and permanent) and lighting required for specific work activities must be placed such that it is not a nuisance to residents, visitors and the general public. Shields may be required to prevent lights from being visible from other parts of the area.

2.22.3. Construction will only take place at night during emergency situations and not as common practice.

2.22.4. Care will be taken when positioning the lights to ensure the least visual impact, while still providing a safe work environment for construction staff.

2.23. **Loitering**

2.23.1. The contractors shall ensure that loitering around the construction sites is not permitted. This includes job seekers, socialisers, food vendors, squatters, etc.

2.24. **Site clean up**

Management Action:

2.24.1. The Contractors shall ensure that all temporary structures, materials, waste and facilities used for construction activities are removed upon completion of the project.

SECTION 4: SPECIFICATION

PART 2.1: 132KV OUTDOOR CIRCUIT BREAKERS

SPECIFICATION No: CB.60/1-97 – Rev 2/B

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1. SCOPE

This specification covers the supply, erection and commissioning of circuit breakers of the gas insulated type for use in outdoor switch-yards on a three-phase 132 kV 50 Hz supply network.

2. STANDARDS

The Switchgear and associated equipment shall comply with the requirements of this specification, the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees. See also section III -1.4 above.

3. SF_6 PRESSURE VESSEL ENCLOSURES

In terms of Instruction No OS/BV 0009/1 from the Chief Inspector of Factories, exemption may be granted from the provisions of Regulations C73 to C86, inclusive, in respect of enclosures containing SF_6 normally pressurised up to 500 kPa. Contractors shall obtain the test documentation from the manufacturers.

Unless otherwise specified elsewhere, the SF6 gas chambers shall have a gas density monitoring gauge with a low gas alarm, trip and lockout voltage free contacts wired out to terminals for remote monitoring, protection and control purposes

Facilities shall be provided on the gas gauge to allow complete end to end functional tests once the control system is in place and being commissioned. Provision shall also be made to prevent unauthorised operation of this facility.

The low pressure alarm must be initiated well before the switching lockout becomes necessary

The above monitoring gauge shall be suitably covered to be protected against all weather elements to the approval of the engineer. The gauge shall be clearly visible to a person standing on the ground.

The provisions for vessels under pressure which require that the enclosures are to be designed, tested and manufactured to an approved code and have to be inspected by an independent approved inspection authority, are to be complied with. The tenderers shall specify the relevant code.

This contract includes the supply and filling with sulphur hexafluoride (SF6) gas to the correct density and the subsequent supply and filling of any gas lost due to failure or during commissioning tests or maintenance during the maintenance period.

4. CIRCUIT-BREAKER REQUIREMENTS

4.1 General

The circuit-breakers shall comprise of three single break vertically mounted interrupters, mounted on suitable steel support structures supplied with the circuit-breakers.

Phase spacing and conductor terminations and their positions shall be as specified in the particulars and guarantees.

Circuit-breaker mechanisms are to be of unitary design, requiring only an external electrical power source as specified in the schedules. A common mechanism operating all three poles of the circuit-breaker at the same time will be preferred over three single mechanisms.

Each circuit breaker unit shall be provided with a control kiosk which shall be positioned on the circuit breaker structure at a convenient height above the ground.

Control coils/valves shall operate at the voltages specified in the schedules. Tripping circuits shall be duplicated electrically and, as far as possible, mechanically.

The circuit-breaker shall be of the SF_6 auto puffer type and shall be rated as specified in the schedules.

The minimum requirements for contacts from each of the gas pressure level monitors are as follows:

a) 1 x low gas pressure alarm (normally closed);

b) 4 x gas pressure trip and lockout (1 - control; normally closed), (1 - close circuit inhibit; normally open), (2 - trip circuit inhibit; normally open).

5. OPERATING MECHANISMS

Pneumatically operated drives, i.e. working with compressed air, will not be acceptable.

5.1 Electrically Operated Motor Wound Spring Operation

Control and operation mechanisms for motor-wound spring operation shall be arranged that the spring recharging takes place after a "close" operation. Local facilities shall however be provided to lock out or initiate spring recharging with the circuit-breaker in any position.

Sufficient energy storage shall be provided by the spring to carry out the duty cycle specified in the schedules.

Mechanical means shall prevent damage should the spring charge motor fail to stop. Spare contacts as detailed in the schedules shall be provided for indication and blocking of operation.

Contact operation and change-over during normal circuit breaker operation and spring charging must be clearly described. It has to operate in such a manner as to allow the substation control system to distinguish between a normal recharge operation and a mechanism failure.

Visible indication of the state of the spring as well as the circuit-breaker shall be provided in a position on the mechanism clearly visible to a person standing on the ground.

The operating mechanism shall be designed that it is possible to immediately trip the circuit-breaker after a closing operation, both mechanically and electrically. The mechanism shall ensure that once an operation has commenced it will always be completed.

Direct acting manual tripping and closing devices, not relying on any electrical circuit, shall be provided on the operating mechanism. Padlocking facilities shall be provided on these controls.

A means of manually recharging the operating springs shall be provided. A single person standing on the ground shall be able to do this without requiring undue strength. Unique winding handles which can only be utilised for winding of the circuit breaker spring etc. shall be mounted in the mechanism cubicle.

Means shall also be provided to inhibit any electrical or mechanical operation of the circuit breaker mechanism whilst the manual spring charging is in progress. Insertion of the winding handle shall “make” an auxiliary switch contact wired out to terminals for external control and indication purposes.

An auxiliary switch contact that “makes” when any latch or door or enclosure is open, shall be wired out to terminals for external control and indication.

Mechanism(s) shall be enclosed in a suitable weatherproof enclosure of rustproof construction. Stainless steel type enclosures are preferred. Enclosure class IP 54

Alarm indication and auxiliary contacts shall be provided to indicate mechanism failure.

5.2 Pneumo-Hydraulic Type Mechanisms

Pneumo-hydraulic mechanisms shall be of unitary type construction requiring only external power supply and control circuits as specified in the schedules.

Sufficient energy storage shall be provided by the operating system to carry out the duty cycle specified. The design of the energy storage shall be such that any cooling effects due to gas expansion during the required cycle shall not cause the mechanism to lock out.

Visible indication of the energy stored in the mechanism as well as the state of the circuit-breaker shall be provided in a position on the circuit-breaker and operating mechanism visible to

a person standing on the ground. Means shall be provided by a two stage alarm/lockout relay monitoring the energy stored to electrically interlock the closing/tripping signals to the mechanism.

Alarm devices to detect loss of hydraulic oil and the energy storage gas, monitoring of the charging motor running time shall be provided.

The operation mechanism shall be so designed that it is possible to trip the circuit-breaker immediately after a closing operation, both mechanically and electrically. The mechanism shall also ensure that once an operation has commenced it will always be completed.

Direct acting manual tripping and closing devices, not relying on any electrical circuit shall be provided on the operating mechanism. Padlocking facilities shall be provided on these controls.

A means of mechanically recharging the operating mechanism by hand shall be provided. Such a manually operated hydraulic pump shall enable a single person to recharge the mechanism at ground level without requiring undue strength, or taking an excessively long time. The number of these pumps to be supplied shall be as stated in the schedules.

Mechanism(s) shall be enclosed in a suitable weatherproof enclosure of rustproof construction. The hydraulic pump, if subject to vibration, shall be mounted in a separate enclosure, with rubber type mountings to isolate any vibration. The enclosure shall be class IP54.

Alarm indication and auxiliary contacts shall be provided to indicate mechanism fail.

5.3 Mechanism Motors

The supply voltages for mechanism motors shall be as stated in the schedules..

Motors using brushes shall be supplied with two sets of spare brushes for each motor.

Unless otherwise approved, motors shall have ball or roller type bearings, lubricated for the expected life of the motor. The type of lubricant used shall not harden with long periods of non-use. All motors shall be easily accessible and removable from the mechanism for maintenance or repairs.

Motors shall be designed and rated to IEC standards. All motors shall be provided with suitable protective control gear, incorporating suitable overload devices including protection against loss of a phase in the case of three phase motors. A suitable alarm contact shall be provided for external alarm and indication purposes to indicate the motor "tripped" condition.

5.4 Closing Devices

All electrical mechanisms used in the closing circuit shall be suitable for safe operation at the voltage ranges specified in the schedules. The range will be between 80% and 120 % of normal rated control voltage.

A limit switch shall de-energise the close coil when the breaker closes to avoid burning out the closing coil under mall-operation conditions due to a sustained closing signal.

An approved means of mechanically closing the circuit-breaker, without recourse to any electrical circuit shall be provided. Padlocking facilities shall be provided on this control.

Provision shall be made by means of a Local-Off-Remote selector switch to select electrical closing control of the circuit-breaker. Spare contacts shall be provided on this switch and wired out to terminals for remote indication of the position of the switch.

5.5 Tripping Devices

Circuit-breakers shall be equipped with duplicate tripping mechanisms, electrically and mechanically separate as far into the mechanical mechanism as possible.

An approved means of mechanically tripping the circuit-breaker, without recourse to any electrical circuit, shall be provided.

A limit switch shall de-energise the open coil when the breaker opens to avoid burning out the opening coil under mall-operation conditions due to a sustained open signal.

All electrical mechanisms used in the tripping circuit shall be suitable for safe operation at the voltage ranges specified in the schedules.

Provision shall be made by means of a Local-Off-Remote selector switch to select electrical tripping control of the circuit-breaker. Spare contacts shall be provided on this switch and wired out to terminals for remote indication of the position of the switch.

Provision shall be made for remote trip circuit supervision of both the main and back-up trip circuits in the open **and** closed positions of the circuit breaker. These circuits shall be wired out to terminals for remote indication.

5.6 Interlocks

5.6.1 General

In the case of circuit-breakers with individual mechanisms for each phase interlocking shall be provided to prevent their closing unless all mechanisms are in a "ready to close" state.

Interlocks shall be designed to ensure the safety of operating personnel at all times i.e. no remote opening or closing of the breaker shall be possible with the local/off/remote selector switch in the local position

Door switches shall be provided on mechanism doors wired to terminals for remote supervision (non urgent alarm)

In the case of gas insulated circuit-breakers, mechanisms shall be blocked against operation should the internal gas pressure fall below the required minimum level (“lockout”) as determined by the gas density monitor.

5.6.2 Motor wound spring mechanisms

The following interlocks shall be provided as a minimum requirement: :

a) Closing may not take place without the springs being in a fully charged state;

b) releasing of the springs shall only be possible with the circuit-breaker in the open position; and

c) it shall be impossible to overcharge the springs.

5.6.3 Anti-pumping devices

Approved means shall be provided to prevent "pumping" of the circuit-breaker whereby the "close" command shall fall away before a further "closing" operation may be initiated.

This protection shall form an integral part of the circuit-breaker mechanism, and shall be mounted in the circuit-breaker control cubicle.

5.7 Operation Counters

Each circuit-breaker mechanism shall be provided with a minimum of one digital operation counter, which shall increment by one unit every time the mechanism is tripped. It shall not be possible to reset this counter.

5.8 Auxiliary Switches and Contacts

Contacts shall be of a type that can be independently changed from a "normally open" to a "normally closed" type and vice versa, on site and without undue difficulty.

The number, type and rating of the contacts to be supplied shall be as specified in the schedules. Unless otherwise specified a minimum of 20% of spare contacts shall be supplied. The use of auxiliary relays to achieve the required number of contacts will not be accepted.

All contacts shall be independently wired out to the secondary terminal block, using a conductor with a cross section of at least 1.5 mm².

All multi-core terminals and all auxiliary switch contacts shall be permanently marked.

Auxiliary switches shall be readily accessible for maintenance and shall be properly adjusted where necessary.

6. INTERRUPTER UNIT

Interrupter ratings shall be as described on the schedule of particulars.

The SF6 gas-insulated interrupter unit shall be of the puffer type, utilising gas compressed during the tripping cycle to cool and extinguish the electrical arc.

The contacts shall be so designed to carry the current as specified in the schedules continuously without any adverse effects Multiple contacts shall be used for the main current carrying female contact, with each contact preferably having its own spring. Separate contacts shall be used for contacts subject to arcing.

The design of the interrupter shall be such as to enable easy inspection and replacement of the main and arcing contacts. Tenderers shall explain how this is achieved.

Insulated components used within the unit shall be capable of withstanding the effects of arcing.

Gas leakage shall be such that no recharging is necessary for a period of at least ten years. Suitable couplings shall be supplied for refilling and sampling of the SF_6 gas.

Tenders shall state the guaranteed leakage rates of the equipment offered.

Each gas compartment unless stated otherwise elsewhere, shall be provided with an individual density monitor. This monitor(s) shall have individually adjustable alarm levels, as depicted in Part 4.1 Each level shall be provided with individual contacts as specified in the schedules. The lowest pressure shall be utilised for mechanism lockout while the others will be utilised for trip and alarm purposes.

The monitor shall have an indicator with a clearly graduated scale indicating the normal, high, low and lockout gas pressures.

Interrupter units shall be provided with the initial filling of new SF_6 gas in accordance with IEC.

The porcelain insulator of the interrupter unit shall be designed in accordance with the regulations concerning pressure vessels. Porcelain sections shall be brown in colour and shall comply with the creepage and flash over distances specified. Where SF_6 gas seals are involved metal to metal flanges with gaskets are preferred to porcelain to metal seals.

A suitable means of pressure relief shall be provided to prevent excessive internal pressure that could lead to explosion of the interrupter. The tenderer shall give details of the pressure relief device offered.

Electrical connections to the interrupter shall be as specified in the schedules.

7. WIRING

The wiring shall be strictly in accordance with the general requirements in Part 1 of the Technical Specification.

7.1 MCB’s and Isolators

Mcb’s and isolators shall be provided as required for the protection and isolating of circuits. The arrangement, type and kA rating of Mcb’s shall be to approval.

The Mcb’s and isolators shall be mounted in such a way as to allow easy access and replacement from the front.

All Mcb’s and isolators shall be suitably and permanently labelled, displaying the designation and identification number using the prefix "MCB" for circuit breakers and the prefix "ISOL" for isolators.

Current ratings shall also be displayed.

The labels shall not be fixed to removable parts of Mcb's or isolators.

7.2 Multi-Core Terminals

Multi-core terminal blocks shall be provided inside the control cubicles in an easily accessible position(s) for terminating multi-core cable tails and for connecting up with the internal wiring in the cubicles. Unless other-wise approved, terminal strips shall be mounted vertically in order that ferrule numbers may be read without difficulty.

All terminals and connections for secondary wiring shall be sufficiently large to accommodate at least two 2,5 mm² PVC insulated wires.

Terminal blocks shall either be of the double ended insertion type or the linked double terminal stud type with suitable provision made for mounting the terminal blocks on terminal boards or rails in rows or in strips. The insertion type is preferred.

Terminal blocks of the insertion type shall incorporate serrated clamping yokes of plated steel which clamp the wire ends onto a silver or nickel plated serrated current bar by means of plated steel clamping screws. The complete assembly shall be encased in a non-hygroscopic moulding of insulating material with high electrical and mechanical strength. Klippon type SAK 6/10 or type RSF 1 spring loaded terminals are preferred. The precise type of terminal used shall be approved by the Engineer.

Terminal boards or strips shall be mounted such as to allow sufficient space for cable tails and working on cable glands without impeding access to any other equipment.

Terminal boards or strips shall be wired such that all internal or incoming wiring enters from one side and all outgoing or external connections (multi-core cable tails) enter from the other side.

No more than two wires shall be connected to any one terminal.

At least 20% spare terminals shall be provided on all terminal boards or strips, with a minimum of ten (10) terminals.

Covers of transparent insulating material shall be fitted where necessary on terminal rows to prevent accidental contact with live equipment.

Each terminal shall be marked clearly, permanently and conspicuously and all terminal strips and boards shall be suitably identified with durable labels fixed in an approved manner.

7.3 Small Wiring

All cables and wiring shall be of approved types and sizes. Unless otherwise authorised, the minimum size of wire to be used internally in the control cubicles shall be multi-strand, 1,5 mm² copper wire.

Small wiring shall be insulated with at least 660 V grade insulation of approved material.

All wiring, external as well as internal, shall be ferrule marked to approval with suitable ferrules at both ends.

The type of ferrule marker to be used shall be to approval. Ferrule markers shall be of a durable insulating material having a reasonable glossy finish to prevent adhesion of dirt. Ferrule markers shall be marked clearly and permanently and shall not be affected by moisture or oil. Unless otherwise approved, ferrules shall be white with black marking.

If stud type terminals are employed, stranded conductors shall be terminated with tinned (not soldered) approved claw washer or lock-nuts, or with approved crimping lug. Separate washer or lugs shall be used for each conductor.

All wiring shall be taken to terminals and wires shall not be jointed or teed between terminal points.

7.4 Labels

Cubicles shall be provided complete with all labelling. Labels shall be made of durable materials and shall be engraved or etched. Dymotape labels or similar types of labels shall not be used.

All labels shall be mechanically fixed. Double sided tape or contact adhesive will not be accepted

All labelling and lettering shall be in English and shall be to the approval of the Engineer.

Fixing of labels on removable doors or lids will not be accepted.

See also Part 1.4.

7.5 Earthing

All potential free metal parts which do not form part of any electrical circuit, shall be earthed to an earth bar to be provided in the mechanism box.

8. CORONA

There shall be no audible or visible corona on the circuit-breakers as installed on site and energised to the maximum system voltage under the service conditions specified. In this connection it shall be observed that the circuit-breakers may be installed adjacent to earthed structures such as gantries with a minimum clearance of 2 400 mm in air between live metal on the circuit-breaker and earthed structures.

The circuit-breaker and conductor clamps shall be designed such that the voltage stress anywhere on the metal surface shall not exceed a value of 1,65 MV/m at sea-level with the circuit-breaker and clamps energised to maximum system voltage.

9. RADIO INTERFERENCE LEVEL

When energised to the maximum system voltage under the service conditions specified, the radio interference caused by the circuit-breakers or clamps at 1 MHz, when measured in accordance with IEC-270, shall not exceed 2 500 micro volt.

There shall be no sudden increase in the values of radio interference measured between the specified test voltage and 1,1 times the specified test voltage.

Recent test certificates shall substantiate the radio interference level claimed by the tenderer.

SECTION 4 : TECHNICAL SPECIFICATION

PART 4.3 : 54kV to 468kV kV Surge Diverters and Insulating Bases

SPECIFICATION No: SD.40/0-97 – Rev 2

CONTENTS

1. STANDARDS 1
2. GENERAL 1
3. HOUSING 1
4. INSULATED BASE 1
5. SURGE DIVERTER TERMINALS AND CLAMPS 2
6. BOTTOM OR EARTH TERMINAL 2
7. DISCHARGE COUNTERS 2

1. STANDARDS

The surge diverters shall comply with the requirements of this specification, (see Section III Part1.3) the particulars of guarantees stated in the attached Schedules and the relevant requirements of the latest revision of IEC 60099-4

2. GENERAL

The metal oxide gapless surge diverters are required for protecting step-down transformers, switchgear and associated equipment in an outdoor switchyard fed by overhead busbars and on transmission lines.

The surge diverters will be located in an area prone to severe lightning and light pollution levels.

This tender is based on surge diverters of gapless ZnO (zinc oxide) type.

The surge diverters shall be of the heavy duty station type.

The surge diverters shall be supplied complete and suitable for outdoor mounting on steel structures, including structures and foundations.

The surge diverters shall be supplied complete with all bolts, nuts and washers required for mounting. The thickness of steel sections on which the equipment is to be mounted shall be taken as 12 mm.

The rated impulse crest discharge current shall be as specified.

3. HOUSING

The surge diverter housing shall be constructed of a composite silicon rubber

All necessary bolts, nuts and washers required for bolting the surge diverter units together shall be supplied with the units.

4. INSULATED BASE

Insulating bases are not needed.

5. SURGE DIVERTER TERMINALS AND CLAMPS

The top terminal of surge diverters having a rated voltage up to 468 kV, shall be provided with an approved clamp of the bolted type suitable for accommodating a stranded circular aluminium conductor with a nominal overall diameter of 25 mm. If necessary this clamp shall be of the bi-metallic type to prevent electro-galvanic action between dissimilar metals.

All top clamps shall be arranged for vertical approach.

6. BOTTOM OR EARTH TERMINAL

The bottom or earth clamp of all surge diverters shall be suitable to accommodate galvanised steel earthing strap equivalent to a 50 mm by 3 mm flat copper strap. Unless otherwise agreed the clamp shall be of the four bolt fixing type and shall be tinned or cadmium-plated.

The earth terminal shall preferably be arranged for horizontal approach.

All terminals and clamps shall have a minimum short time current rating of 65 kA for one second.

7. DISCHARGE COUNTERS

Discharge counters are not needed.

SECTION 4: SPECIFICATION

PART 5.1A: VOLTAGE TRANSFORMERS 132KV

SPECIFICATION No: Cot/02/2022

CONTENTS

1. SCOPE 1
2. DEFINITIONS 1
3. STANDARDS 1
4. DELIVERY AND OFFLOADING 1

1. SCOPE

This Specification and the NRS specification indicated in clause 3 cover the manufacture, supply, test and delivery of type tested and works manufactured 132 kV electromagnetic Voltage Transformers.

2. DEFINITIONS

For the purpose of this specification the definitions referred to in clause 3 of NRS 030 apply.

3. STANDARDS

The voltage transformers shall comply with the requirements of this the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees, and the relevant requirements of the latest edition NRS: Electromagnetic Voltage Transformers, and the relevant requirements of the Standards referred to in this NRS specification. Tenderers must ensure that they obtain the correct revisions of these NRS specifications and prepare their submissions accordingly. Where applicable, the requirements of this NRS specification and referred standards shall be amended, augmented or qualified by the requirements of this Specification, which reflect requirements particular to Tshwane's standards, and which shall take precedence over the NRS specification and referred standards.

4. DELIVERY AND OFFLOADING

The price for the voltage transformers shall include the cost of delivery and offloading on site.

SECTION 4: SPECIFICATION

PART 5.1A: CAPACITOR VOLTAGE TRANSFORMERS 400KV

SPECIFICATION No: COT/02.1/2022

CONTENTS

1. SCOPE 1
2. DEFINITIONS 1
3. STANDARDS 1
4. DELIVERY AND OFFLOADING 1

1. SCOPE

This Specification and the IEC specification indicated in clause 3 cover the manufacture, supply, test and delivery of type tested and works manufactured 400 kV Capacitor Voltage Transformers.

2. DEFINITIONS

For the purpose of this specification the definitions referred to in claws 3 apply.

3. STANDARDS

The voltage transformers shall comply with the requirements of this Specification, the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees, the relevant requirements of IEC-0029-2015 : Capacitor Voltage Transformers IEC16869-1 and IEC60044-5, and the relevant requirements of the Standards referred to in ESKOM specification 240-56030645. Tenderers must ensure that they obtain the correct revisions of these specifications and prepare their submissions accordingly.

The Supplier is therefore requested to review the latest versions and amendments and to incorporate these where possible and agreeable to both parties.

4. DELIVERY AND OFFLOADING

The price for the voltage transformers shall include the cost of delivery and offloading on site.

SECTION 4: SPECIFICATION

PART 5.2: CURRENT TRANSFORMERS 132KV

SPECIFICATION No: Cot/01/2022

CONTENTS

1. SCOPE 1
2. DEFINITIONS 1
3. STANDARDS 1
4. DELIVERY AND OFFLOADING 1

1. SCOPE

This Specification cover the supply, test and delivery of type tested and works manufactured of 132 kV Current Transformers for outdoor use.

2. DEFINITIONS

For the purpose of this specification the definitions referred to in latest versions clause 3 of NRS 029 apply.

3. STANDARDS

The current transformers shall comply with the requirements of this Specification, the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees, the relevant requirements of IEC 60815 latest edition : Outdoor Type Current Transformers, and the relevant requirements of the Standards referred to in this IEC specification. Tenderers must ensure that they obtain the correct revisions of these IEC specifications and prepare their submissions accordingly. Where applicable, the requirements of this NRS specification and referred standards shall be amended, augmented or qualified by the requirements of this Supplementary Specification, which reflect requirements particular to Tshwane's standards, and which shall take precedence over the NRS specification and referred standards

4. DELIVERY AND OFFLOADING

The price for the current transformers shall include the cost of delivery and offloading on site.

SECTION 4: SPECIFICATION

PART 5.2: CURRENT TRANSFORMERS 400KV

SPECIFICATION No: Cot/01.1/2022

CONTENTS

1. SCOPE 1
2. DEFINITIONS 1
3. STANDARDS 1
4. DELIVERY AND OFFLOADING 1

1. SCOPE

This Specification cover the supply, test and delivery of type tested and works manufactured of 400 kV Current Transformers for outdoor use.

2. DEFINITIONS

For the purpose of this specification the definitions referred to in latest versions clause 3 of NRS 029 apply.

3. STANDARDS

The current transformers shall comply with the requirements of this Specification, the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees, the relevant requirements of IEC 60815 latest edition : Outdoor Type Current Transformers, and the relevant requirements of the Standards referred to in this IEC specification. Tenderers must ensure that they obtain the correct revisions of these IEC specifications and prepare their submissions accordingly. Where applicable, the requirements of this NRS specification and referred standards shall be amended, augmented or qualified by the requirements of this Supplementary Specification, which reflect requirements particular to ESKOM standards, and which shall take precedence over the NRS specification and referred standards

4. DELIVERY AND OFFLOADING

The price for the current transformers shall include the cost of delivery and offloading on site.

SECTION 4: SPECIFICATION

PART 6.2: 132kV to 400kV Busbars CONNECTIONS & CONNECTION CLAMPS

SPECIFICATION No: BR.60/0-97 – Rev 1/A

CONTENTS

1. BUSBARS, CONNECTIONS AND CONNECTION CLAMPS 2
2. Labelling 2

1. BUSBARS, CONNECTIONS AND CONNECTION CLAMPS

The busbar arrangement shall be of the low-profile type.

Busbars and connections shall be aluminium tubular as required.

The current ratings shall be suitable for the application.

The busbar is to be a tubular aluminium with the diameter and thickness as specified in the schedules A particulars and guarantees

All clamps and connectors shall have a current carrying capacity not less than conductors joined.

All clamps shall be specifically designed for the particular application such as to avoid deformation of the conductors.

The loading details and factors of safety for all conductors and connections shall comply to the relevant specification. The successful Tenderer shall prove to the Engineer how the static and dynamic strengths of the equipment to a safety factor of 2.5.

The strength of the conductors shall be such that they and the various insulators will withstand the maximum dynamic forces exerted by short circuit currents, wind and other loading with a safety factor of at least 2,5. The contractor shall prove to the Engineer how the figures were derived.

Solid busbars shall be of sufficient dimension and suitably supported so that the sag will not exceed normally acceptable values. The Tenderer shall indicate what these values are.

Strain clamps for use with disc insulator strings shall be made of certified iron and steel and the minimum ultimate strength shall suit the loading details and factors and shall comply to the relevant specification.

All ferrous parts shall be hot dip galvanised.

Rigid busbar shall be clamped at one end only and have flexible connections at the other end to allow for expansion and contraction.

All sliding clamps must be provided with potential clips.

The successful Tenderer will have to prove his electrical and mechanical design to the approval of the Engineer.

2. LABELLING

For open busbar, phase identification discs shall be fitted where practical, i.e. for strung busbar on the gantry beam below every string insulator set and for solid busbar on post insulator support pedestals. These shall be 150 mm diameter discs and shall be coloured red, yellow or blue according to phase and shall be fitted to be visible from ground level.

All such labelling shall be securely fixed to the satisfaction of the Engineer.

For solid busbar, the phase colours shall be painted directly on the busbar to the satisfaction of the Engineer.

SECTION 4 : TECHNICAL SPECIFICATION

PART 7.2 : 132KV to 400KV INSULATORS

SPECIFICATION No: IN.60/0-97 – Rev 8/Z

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1. Insulators 1
1.1 String Insulators 1
1.2 Post Type Insulators 1

1. INSULATORS

1.1 String Insulators

String insulators shall be of composite material and shall be designed, manufactured and tested in accordance with the latest revisions and amendments of IEC (Secretariat) 65-Draft: Tests on composite insulators for AC overhead lines with nominal voltages greater than 1000 V.

The design shall be such as to ensure that the core is totally encapsulated and fully sealed from end by an insulating material. This requirement is to ensure that the ingress of moisture does not occur through environmental conditions.

The end fittings shall be of the ball and socket type to IEC 120 and the security clips shall be stainless type "W" to I.E.C. 372.

All ferrous parts shall be hot dip galvanised.

All accessories, including strain clamps, suspension clamps, arcing horns, turnbuckles, yoke plates, etc. shall be manufactured to SANS 178 - 1970.

1.2 Post Type Insulators

All post type insulators of the same voltage rating shall be identical, whether used for the support of busbars or as a part of other equipment.

The post insulators shall be capable of withstanding any shock loading which may be encountered in service and the deflection under the conditions of assumed maximum working loads shall not result in the misalignment of the contacts of isolators.

Test and tolerance must comply to IEC 60168 and 60273

SECTION 4 : TECHNICAL SPECIFICATION

PART 9.1 : Earthing Grid

SPECIFICATION NUMBER : EG.01/0-04

0 CONTENTS

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9. TESTING OF EARTH RODS 4
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1. SCOPE

This specification shall include the design, supply, installation, connection and testing of the substation earthing system and ancillary works described below.

This specification includes the supply of copper conductor, lightning masts, earth spikes, earth mats etc. and the necessary excavation and civil works to install the earthing system and the replacement of stolen earth trails in substations.

The required general layout of the substation yard is shown on the drawings attached to this specification.

This specification describes all major components, but the Contractor shall supply and install all minor items and labour as may be necessary to complete the installation.

2. QUALITY OF WORK AND STANDARDS

All work shall be carried out strictly in accordance with the Code of Practice for earthing. (CP 1013)

The following SABS standards must be adhered to:

1. Earth rods, couplers and clamps shall be supplied and installed in accordance with SABS 1063-1985 and SABS 0199.
2. The two pack zinc-rich epoxy primer must be in accordance with SABS 926: 1968
3. The zinc and aluminium coatings for the protection of iron and steel against atmospheric corrosion must be in accordance with SABS 1391: 1983.
4. The replacement or new earth tail shall be two copper-plated steel earth rods according to SABS 1063: 1985.
5. Each earth rod shall have a diameter not less than 14.5mm, equivalent M16, according SABS 1063: 1985. The thickness of the copper plating on the earth rod shall not be less than 250μm.

3. DESIGN AND APPROVAL

The Contractor shall allow for soil resistivity tests to be performed on site. A detailed report on the resistivity tests shall be submitted to the Engineer together with a preliminary earthing scheme showing how the Contractor envisages installing the earth mat before commencing installation of the earth mat. The Contractor shall employ a specialist to investigate, plan and install the earthing installation.

The earth mat installation shall incorporate earthing electrodes at the extreme corners of the station, in the vicinity of earthing switches and transformer neutrals. The fences shall also be earthed at regular intervals. The installed maximum earth resistance shall be 1 Ω, or as agreed by the Engineer. Copper rod, 10mm² shall be used for the earth grid. The earth conductors shall generally be laid at a depth of more than 500 mm below the finished surface.

The complete earth mat design shall be submitted for written approval. The Engineer may then add or delete equipment and change the design of the earth system if he so requires. The installation of the earth mat shall be so arranged as not to cause delays in civil works.

4. EARTH RESISTANCE SURVEY

The Contractor will be responsible to have an earth resistance survey carried out on site by a specialist in this field, to be approved by the Engineer. The test shall be done on the undisturbed site, i.e. before earth works, trenching, building etc. commence.

The Engineer shall attend the survey. The Contractor shall inform the Engineer in good time when the test is scheduled to take place. If it is done without his or his representative being present, the test shall be repeated in the Engineer's presence at no additional cost to the Council.

The results of this survey will be used to adjust the earthing system as specified herein, if necessary, on the basis of the quoted rates.

Payment for the services of the specialist shall be by the Contractor who may recover such costs out of the provisional amount allowed for this purpose. The recoverable amount will be the nett invoice amount charged by the specialist, plus a 5% mark-up to cover the Contractor's administrative overhead and profit.

5. STOLEN AND NEW EARTHING FOR OUTDOOR EQUIPMENT

To discourage theft of copper bar or conductor, no bare earthing copper shall be visible above ground. For all visible outdoor connections to equipment or structures, copper plated solid steel rods having an equivalent resistance as the copper it replaces, shall be used. Sizes and cross sections shall be according table 1 (see appendix A) and be approved by the Engineer

Connections shall either be bolted directly to the earthing conductor, or bolted to a copper flag silver soldered or exothermically welded to the earth conductor to the approval of the Engineer. Alternatively, each joint shall be made with adequate bolts to the approval of the Engineer

The copper plated earth rod must be exothermic welded onto the structure as well as the copper earth mat. The reason is to enable a temperature rise up to 800°C for the copper plated earth rod. This provides for higher current capability for 3 seconds. The galvanising of the structure must be removed with a grinder and the surface cleaned where the exothermic weld is to be preformed. Failing to remove the galvanising will cause holes in the exothermic weld, which will result in poor contact and poor current carrying capability. After completion of the exothermic weld, the area on the structure, where the galvanizing was removed, must be covered with cold galvanizing. All exothermic weld joints are to be hammered tested to ensure that the mechanical strength of the joints are adequate. It is very important to use the correct weld metal power for the correct joint.

After connection the Engineer shall inspect all joints before the joints are sealed or trenches closed.

The following equipment needs to be earthed and the standard practices for earthing this equipment are as follows:

a) Transformer earthing:

   Transformers need to be earthed on the top cover on two different places and by using double earth rods.

b) Surge arresters:

   Insulated surge arrestors will be earthed on the surge arrestors base where non-insulated surge arrestors will be earthed on the structure exothermically.

c) Voltage and current transformers:

   Voltage and current transformers will be earthed on the structure exothermically.

d) Earth switches and isolator earthing:

   Earth switches and isolator earthing will be earthed on the structure exothermically on two different ends. The handle of the earth switches shall be earthed through a flexible earth.

e) Fences:

   All steel fencing must be earthed with in every 20M

f) Mechanism boxes and kiosks:

   Mechanism boxes and kiosks shall be earthed independently of the associated device or steel structure on which they are supported.

6. INDOOR EQUIPMENT EARTHING AND CABLE TRENCHES

Control panels, battery chargers, cable racking and other indoor auxiliary equipment shall be bonded by earth rod.

An earth rod shall be laid in the cable trench together with the multicore cables. This earth strap shall be run into the building and serve as the building earth to which all equipment in the building is connected. The building earth shall be connected to ground rods or bonding bar at diametrically opposite ends of the building.

7. EARTHING ELECTRODES

The number and lengths of earthing electrodes shall be determined from the resistivity tests above. Earthing electrodes shall be of the extendible rod type. The rods shall be of copper clad steel and the copper to steel weld shall be a true molecular bond according SABS 1063.

8. LIGHTNING CONDUCTORS

Lightning conductor aerial masts shall be designed according to SABS 0160 with a safety factor of 2.5. They shall be hot-dip galvanised to SABS 763.

Masts shall be joined and hinged at ground level and shall be supplied complete with foundations.

9. TESTING OF EARTH RODS

SANS 1885: 2004

10. DRAWINGS REQUIRED

After completion of the Works, the Contractor shall supply the necessary drawings as agreed upon with the Engineer

11. ANNEXURES

Annexure A:

Copper earthing conductor sizes.

Fault current	Copper area required mm²		Main earth grid (Rod)		Connections to equipment support (50 × 3 strap)		Connections to equipment support (2 × 10mm rod)	
I (kA)	Grid	Earth lead	No. of directions	Actual area mm²	No. of connections	Actual area mm²	No. of connections	Actual area mm²
12.5	125	150	2	160	1	150	1	160
16	160	190	4	320	2	300	2	320
20	200	240	4	320	2	300	2	320
25	250	300	4	320	2	300	2	320
31.5	315	375	4	320	3	450	3	480
40	400	480	6	480	4	600	3	480
50	500	600	8	640	4	600	4	640

Table 1: The table above illustrates the conductor arrangements required to meet standard fault levels.

SECTION 4 : SPECIFICATION

PART 12.1 : PROTECTION AND CONTROL EQUIPMENT

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1. SCOPE

1.1 Overview

This specification part calls for the detailed design, supply, installation, testing and commissioning of an integrated system of hardware and software for control, protection, interlocking, measuring, data recording, event recording, disturbance recording, communication, and engineering and operator interfacing for the 132, 33 and 11 kV equipment, transformers and substation secondary equipment, and includes interfacing to enable the remote master control centre at Capital Park Control Centre to control and interrogate the substation by means of bi-directional communication.

1.2 Integrated Control and Protection (Substation Automation)

The protection equipment shall consist, except where expressly stated to the converse, of numerical devices capable of communicating with and being interrogated by the substation control system on a local area network. The control equipment shall be suitable for continuous, reliable operation in a substation, and shall be required to carry out such tasks as interlocking, monitoring and control at bay-wide and station-wide levels. The systems offered shall be of the state of the art, follow the latest engineering practice, and shall ensure long term compatibility, continuity of equipment supply and the safety of the operating staff. Tenderers are requested to present only their latest **proven** products. The Tenderer may be required to demonstrate the operation of these proven products in actual, similar applications in South Africa or abroad.

1.3 Cubicles

The control and protection equipment shall be housed in sheet steel panel suites in the different control rooms, normally with one cubicle for each of the 132 kV bays and separate cubicles for busbar protection, local control computers and other common functions. For construction of these cubicles, refer to the relevant part of this enquiry document. Actual quantities of panels and content thereof are indicated in the relevant price schedules.

1.4 Overall Design and Commissioning

The Contractor will be responsible for the overall detailed electrical design to integrate all the equipment and switchgear supplied under this contract to form a complete working system which meets the requirements of this specification as a whole. The Contractor will also be responsible for site testing, functional integration and overall commissioning of the complete substation.

1.5 Complete Installation and Service

The Contract will include the provision, installation and commissioning of all equipment required, including all matters and details to provide a complete installation, negotiations with other Municipal Departments or other Authorities where necessary, and the carrying out of all aspects of the Work necessary to complete the Contract commitments. The specified requirements shall be considered basic in that the necessary refinements and additions to provide equipment which will function reliably shall be included in the Tender. Minor items not specifically mentioned in the Addendums and Schedules will be taken as having been included in the Contract Price.

1.6 Compliance

Compliance or otherwise with each item of this specification shall be expressly stated. Any items which may require clarification shall be taken up with the Engineer during the Tender stage, and the presentation of a Tender document by a Tenderer shall imply that the requirements of the specification presented herein have been thoroughly understood and shall be complied with unless the Tenderer clearly indicates the contrary. The Tenderer shall state compliance or otherwise for each paragraph of the written specification.

The Municipality reserves the right to accept or reject Tenders based on the overall compliance to the specification and each part thereof.

1.7 Assistance

Assistance will be given by the Electricity Department of the Municipality as specifically provided for in the Contract and at the discretion of the Engineer.

2. DEFINITIONS, ABBREVIATIONS AND SYMBOLS

For the purposes of this specification part and the related Particulars and Guarantees, Input lists, Outputs lists, Logic definitions, Event lists, block diagrams and scheme philosophy diagrams, refer to drawings and the definitions listed below. The substation control system philosophy diagram may also be of assistance in understanding the concepts described in the following definitions.

2.1 11 kV Switchgear Controller (SGC)

This refers to one of two devices. In the case of switchgear panels which have a multi-function combined over-current and earth fault relay, this relay shall, in addition to the protection functions, serve as the 11 kV switchgear bay controller. In the case of the 11 kV bus coupler and bus section panels, which do not require protection functions, a dedicated I/O module shall be used as the SGC. The functions of this device are to obtain status inputs from the switchgear, provide control outputs to the switchgear and associated equipment and perform the necessary interlocking as is shown in the relevant diagrams and input/output lists.

2.2 33 kV Switchgear Controller (SGC)

The multi-function over-current relay shall, in addition to its protection functions, serve as the 33 kV switchgear bay controller. The functions of this device are to obtain status inputs from the switchgear, provide control outputs to the switchgear and associated equipment and perform the necessary interlocking as is shown in the relevant diagrams and input/output lists.

2.3 11 & 33 kV SGC Supervisor

Should the 11 or 33 kV SGC not be capable of performing the required communication, interlocking and control logic, an SGC Supervisor shall be provided to carry out these functions.

2.4 132 kV Bay Controller (BYC)

An Intelligent Electronic Device (IED) used on every 132 kV bay panel, which assimilates general primary plant status information, contains the interlocking logic and provides the control mimic by taking cognizance not only of the bay-specific equipment status but also the status of other relevant equipment in the substation.

2.5 Engineering Local Area Network (E-LAN)

The separate LAN terminal via which a laptop may access the SMMI, all BYCs and SGCs, all protection relays and any other IEDs which may be present on the S-LAN, in order to carry out programming, setting and data retrieval. This LAN terminal makes use of the S-LAN, and does not require a separate engineering-oriented S-LAN.

2.6 Integrated Control And Protection (ICAP)

A concept whereby protection and control device functionality is merged into single modules. Protection devices therefore offer data gathering functions and control of the protected plant, while control devices may offer supplementary or backup protection functions. The primary purpose of ICAP is to maximise the utilisation of equipment in terms of functionality and information resolution while minimising the duplication of functions and wiring by making use of data processing and communication facilities inherent in modern numerical devices.

2.7 Isolator

A generic term used to describe all primary disconnectors and switch disconnectors.

2.8 Numerical device

A device termed as numerical in this document shall be microprocessor-based, programmable in terms of settings and configuration and, where required communications facilities to allow remote setting and re-configuration of the device.

2.9 Remote Engineering Workstation (REW)

The computer which may reside at a remote location relative to the substation and, via a communications channel installed for this purpose (the extended E-LAN), provide functions such as retrieval of engineering information from the SMMI and the setting and configuration of protection relays. The REW shall access the SMMI and IEDs via an extension to the E-LAN.

2.10 SCADA Access Port (SAP)

The physical point of connection between the protocol translator and the SMMI.

2.11 Substation IED (SIED)

The device which facilitates the gathering of substation common information and provides control facilities for substation common devices.

2.12 Substation Local Area Network (S-LAN)

The network which allows the BYCs, SIED, other IEDs and the SMMI to communicate and exchange information regarding the substation primary plant status, analogue values and secondary device generated information. The S-LAN shall also serve as the substation local communication medium to the IEDs for the E-LAN.

2.13 Substation Man-Machine Interface (SMMI)

The computer, monitor, keyboard, mouse and basic interfaces as well as all necessary configured software which comprise the local control computer for the substation.

3. STANDARDS

Refer to Section III, Part 1 of this specification for requirements regarding standards of workmanship and materials.

4. INTEGRATED CONTROL AND PROTECTION EQUIPMENT SPECIFICATION COMPONENTS

The specification part concerning the control and protection equipment is composed of a number of documents, which are interrelated and require careful studying as a whole in order to understand the full implication of the Municipality's requirements for the ICAP system. In addition, all other parts of the overall specification should be read in conjunction with Section III, Part 12 in order to understand the interface requirements. Section III, Part 1 in particular contains general information and requirements which are directly applicable to Section III, Part 12, such as drawing and documentation, ferruling, steelwork, painting, permits, etc.

4.1 Written specification: Part 12

This document contains the general requirements for the ICAP equipment.

4.2 Particulars and Guarantees: Part 12

Specific requirements regarding the equipment described in the written specification are listed in this document.

4.3 Price Schedule: Part 12

The price schedule lists the major items required for the ICAP system as well as the grouping of functions in cubicles or relay chambers. Any items not specifically listed are taken as having been included in the overall price. Detailed price breakdowns have been allowed for in order to allow the Municipality to make informed decisions regarding the inclusion or otherwise of specific functions. Tenderers shall complete the price schedule in the detail allowed for. The

price schedule also allows for a number of options described in the written portion of the specification be priced in order to allow for the implementation of the most viable system. Tenderers are required to comment on alternative offers with regard to the compliance of alternative offers to the specification.

4.4 Input, output and event lists

The Hardwired Inputs sheet contains a list of status contacts from primary and secondary devices, which are to be made available to the control system via hard wiring to the communicating protection and control devices. The inputs listed are also indicated on the included logic diagrams. For the purposes of these lists, primary devices shall mean primary switchgear and disconnectors, and secondary devices shall mean protection, control and auxiliary devices.

The Secondary Inputs sheet lists the status information which is to be made available to the SMMI from the communicating protection and control devices via the S-LAN, and should preferably not be hardwired. Should the system not be capable of communicating a specific item of status information to the SMMI, this item should then be communicated to the SMMI via hardwiring to the relevant BYC, and a specific note made thereof in the Tender.

The Derived Inputs sheet lists variables that are to be used for SMMI indication and interlocking, and are the result of the interlocking and general logic equations listed which reside in the relevant bay modules. Abbreviations used in this sheet are sourced from the Hardwired Inputs and Secondary Inputs sheets.

The Analogue Inputs sheet lists the requirements for analogue values and at the levels which these values should be displayed on the SMMI.

The Digital Outputs sheet lists the digital outputs that are to be wired to various equipment from the BYC, SIED or SGC.

The Event lists indicate the Municipality’s requirements regarding the Input Zone code, the Event Description which is made up of a Source field and a Status field, the Logic required to trigger the event, and the destination of the Event, be it the SMMI Mimic (denoted “Mimic” in the event lists, the event page, the alarm page or the SCADA system. Note that, in order to facilitate ease of fault post-mortems, only the events which are ticked are to be provided. Any events not ticked or listed but which are to be provided or cannot be disabled must clearly be indicated by the Tenderer.

4.5 Substation single line diagram

A single line diagram of the primary substation configuration is provided for tender purposes. The Contractor shall be responsible for the provision of a single line diagram, similar in resolution to the one provided, which reflects the actual installation.

4.6 Protection and Control logic diagrams

The substation control system’s required architecture, as well as specific requirements regarding the implementation of the protection schemes is indicated on these diagrams. For interpretation of the symbols and abbreviations, refer to the above-mentioned Input and Output lists as well as the legend sheet. Note that the contacts shown in these diagrams are only representative of the type of contacts required for the control system. Actual quantities and types of contacts should NOT be based solely on the quantities shown in these diagrams.

5. GENERAL SERVICE CONDITIONS

5.1 Climatic Conditions

Refer to Section III, Part 1 for details regarding the climatic conditions applicable.

5.2 Distribution Network

The relay equipment will be utilised on an electricity distribution network comprising high-voltage overhead transmission lines, underground cables, switchgear and transformers, all of which are energised from interconnected power stations and infeed stations.

5.3 Operation and Maintenance

The equipment is intended for installation in remote, unattended switching stations and substations. The protection equipment shall be designed for minimum attention and maintenance and Tenderers shall state the extent of maintenance required for each major item in the scheme offered.

6. POWER SYSTEM PARTICULARS

6.1 General Parameters

Refer to Section III, Part 1 for details regarding the applicable system parameters.

6.2 System Configuration

A Single line schematic diagram of the substation is issued with the Enquiry for tender purposes.

Control room panel arrangement: a proposed layout is shown on the general building layout drawing. This will be finalised after award of Tender.

Sufficient space shall be left for relay panels for future feeders and equipment indicated on the drawings. Where these future feeder bays are spatially interspersed with present feeders, correctly sized spaces shall be left in the suite of panels for future panels to image the orientation of the switchgear bays.

7. GENERAL DESCRIPTION OF INTEGRATED CONTROL AND PROTECTION SYSTEM

7.1 Overview of System Elements

An overview of the basic architecture of the integrated control and protection system required is given below and is also shown on drawing. It does not represent a complete list of functions required. Detailed descriptions of the functions are given in the rest of the specification and in the schedules and drawings, or are to be added by the Tenderer.

The basic requirements for the ICAP system are as follows:

a) Local substation operator station (SMMI), with control computer, software and printer, for supervision, local control and engineering functions.
b) SIED module for common interlocking, alarms and event recording.
c) An interface between the SMMI and the SCADA RTU (specified in Section III, Part 12) to allow complete substation interrogation and control from the Master Control Centre at Capital Park.
d) SGC Supervisors for communicating with, controlling and providing automatic sequences via the 33 & 11 kV multifunction over-current relays, should these relays not be capable of providing the required automatic sequences and communication facilities. These relays shall also provide the necessary measurands to the control system.
e) Bay controller (BYC) modules for network, relay and equipment interfacing, provision of local bay control mimics on 132 kV bays, local bay interlocking, supervision and local engineering.
f) SGCs for monitoring & controlling 33 and 11 kV switchgear.
g) Displays on relays may be used provided it is not too small and cumbersome to read. The relay shall also be setable to have current values as the default display.
h) No local alarm annunciator for local bay control is required, provided that the bay module status indications are labelled to provide annunciation should the SMMI fail.
i) Should the relays not be able to display clear English descriptions of events and alarms, a legend label shall be provided and installed on the panel to assist in the interpretation of the relay indications.
j) Data exchange between the different units via an optical fibre serial station bus.
k) Parallel, hard wired inputs from and outputs to 132 kV switchgear and yard equipment.
l) Local engineering network with a single point connection for a laptop computer and extended communication to a remote engineering workstation (E-LAN).
m) Global Positioning System (GPS) satellite receiver for accurate time synchronisation of all control devices and relays.
n) Remote engineering workstation software for a standard Intel 486/Pentium-based PC with Windows 95 or NT as the operating system.

7.2 Numerical Technology

The equipment offered shall be based on the latest generation of numerical technology, to allow a wide range of integrated protection and control functions, with comprehensive communication facilities. All internal relay events shall be logged separately in the SMMI. The system shall have forward compatibility with future equipment for a period of at least ten years.

Tenderers shall provide detailed descriptions as to how their equipment would improve the "Power System Management" aspects such as protection, control, monitoring, automation and analysis.

The degree of standardisation and compatibility with the equipment and communication with products from other leading suppliers must be stated clearly, giving a clear description of possible restrictions.

If non-numerical, solid state measuring relays are offered by the Tenderer, or requested as options in the Tender, Tenderers shall clearly state the limitations of these relays compared to the numerical equivalent. Tenderers shall give clear descriptions, aided by diagrams, if necessary, to illustrate how these relays will be incorporated in the integrated control and protection scheme.

7.3 Security

Every part of the system shall have continuous self-supervision and user-friendly diagnostic functions with clear alarm outputs to indicate malfunctions in the protection and control system.

Protection and control systems shall be based on distributed, intelligent multi-processor technology and fibre optic communications for increased reliability and security. This requires that event data be buffered and stored at distributed network points including the protection relays, the bay controllers and the SMMI.

Event data stored at any level in the network must immediately be retrieved on restoration of a failed network connection to any device.

The devices must be designed to operate in an electrically hostile environment, with stringent requirements on electromagnetic interference immunity. Restrictions on radiated emissivity shall be adhered to.

Although the protective relays are integrated into the control system, all protection functions shall work independently of the control system communications network.

Control system redundancy should be limited and reliance should instead be made on equipment with high reliability and proper monitoring of each system component.

7.4 General Control System Design

The system shall be designed so that personnel without any background in microcomputer based technology can operate the system easily after some basic training.

The substation automation system offered shall support control, monitoring and interrogating functions from SCADA centres (Master Control Centre) via the communications gateway to the SMMI.

Local control of bays shall be via the following mechanisms:

a) 132 kV bay : bay local mimic diagram incorporated in the BYC.

b) 33 kV bay : switchgear bay control pushbuttons or cord control pendant.

c) 11 kV bay : cord control pendant or plug control box. (see Section III, Part 11.1).

Maintenance, modification or extension of components or programs may not cause a shutdown of the whole substation automation system. Self-monitoring of single components, modules and communication equipment shall be incorporated to increase the availability and the reliability of the equipment and minimise maintenance.

Preference will be given to multi-user systems whereby maintenance, modification and extension of programs and databases can be performed via the E-LAN, either locally or remotely.

All the protection functions shall be enabled by downloaded settings from the SMMI or REW within their defined ranges, but inadmissible settings shall be prevented by the system.

The entire substation is controlled and supervised from the station level while individual bays are protected, supervised and controlled from the bay level equipment. It shall not be possible to control the substation from more than one operating level (SCADA, station or bay level) simultaneously. Clear indication of the "active" control level shall be given at every control level.

At each control level, the selection of a local control mode shall over-ride any higher level operating level's control. For example, the selection of a 132 kV ICAP bay panel to local shall over-ride any authority which the SMMI may have had, and disallow any commands to come from the SMMI, although full transparency must be maintained to higher control levels at all times.

The bay controllers (BYC) and other IEDs shall be independent of each other and of the network administrator and their operation shall not be affected by any fault occurring in the other BYC or other IED of this substation. The only exception to this shall be where a BYC receives interlocking information from another BYC, in which case the healthy BYC shall fail to safe. One BYC shall control and monitor only one bay at 132 kV level and, where applicable, not more than 6 bays at 11 kV level.

The main process information of the substation shall be stored in distributed databases. The system shall be based on a concept of bay oriented distributed intelligence for safety and availability reasons. Functions shall be decentralised and bay oriented as close as possible to the process whenever possible. In the event of a network administrator fault, the bay module should still be able to power up correctly and function independently.

It shall be possible to explicitly prescribe, by means of software configuration, which events will be recorded and reported, and duplicity and redundant information should be minimised. Many events (as indicated in the Events listings provided) are only required to be logged on the rising edge transition, and must be maskable for the falling edge transition.

In the event of the SMMI or the communications channel between the BYC and the SMMI being inoperative, the BYC shall store at least 50 discrete bay events in a FIFO buffer for later retrieval by the SMMI.

7.5 Substation Control and Monitoring Functions

All substation functions have to be designed for a safe and reliable operation. The following are the minimum functions required:

a) Acquisition of binary and analogue signals.
b) Control, interlocking and supervision of the bays and the substation.
c) Alarm handling in the BYC and in the SMMI.
d) Display of the bay and substation status.
e) Display of measured and processed analogue values.
f) Display of system status (BYCs, network connections, printer, etc.).
g) Station control via a mouse controlled SMMI.
h) Support of automatic control sequences for standard switching routines, e.g. busbar transfer, simultaneous closing of two or more circuit-breakers, 11 kV chop-over scheme.
i) Provisions for remote master control centre access via a gateway.
j) Provision for a Substation Remote Engineering Workstation.
k) Facilities to independently and remotely reset each bay's protection relays after a fault.
l) Transformer tap change and protection control and supervision.
m) Synchronising-check functions (where required).
n) Display of trend values.
o) Fault recording.
p) Event recording.
q) Evaluation of historical data.
r) Archiving facilities for trending data to enable complete storage and retrieval of trending data for later analysis. The data must also be made available in a format which can be transferred to standard spreadsheet software packages.

7.6 SMMI Displays

The SMMI shall provide at least the following unique screens:

a) A logon screen which provides access to:
    i. the substation primary equipment main view for each of the 132, 33 and 11 kV equipment;
    ii. a main control system view;

iii. the alarm list;
iv. the event list;
v. the protection and control system programming tools; and
vi. the trending view.

b) A substation primary equipment main view for the 132, 33 and 11 kV primary equipment which shows a single line diagram of all primary equipment at that level as well as key analogue values. 33 & 11 kV equipment may be controlled from this view, while at the 132 kV level the bay views must be accessed for control of the 132 kV primary equipment.
c) Bay views for each of the 132 kV bays, from which the 132 kV equipment may be controlled. Detailed analogue values are to be displayed in these views.
d) A main control system view which displays the basic connectivity of the SLAN, together with the status of each device connected to the network, and allows access to detailed views of specific groups of devices connected to the network, such as a 132 kV bay's control and protection devices.
e) An alarm list with the filtering and management functions required.
f) An event list with the filtering and management functions required.
g) A menu from which the protection and control system programming tools may be accessed.
h) A trending view which provides a graphical view of user-definable trends.

A block with the text "INT" shall be displayed next to each item of primary plant in the operating display, and shall indicate whether or not the item may be operated due to interlocking by colouring the block green when operation is allowed, and red when operation is not allowed.

7.7 Automatic sequences

The following automatic sequences should be selectable from the SMMI:
a) automatic live load transfer at 132 kV level;
b) automatic transformer chop-over at 11 kV level in event of a main transformer failure; and
c) simultaneous closure of 11 kV circuit-breakers.

The processing and control of these sequences may not, however, take place within the SMMI and should instead be performed by the SIED.

7.8 Bay standardisation

It can be seen from the block schematic diagrams PS5-011 to PS5-014 that phase and earth fault over-current protection is used on all 132 kV panels, whether it be as back-up protection or as the only bay protection. It is proposed that the same "intelligent" base relay or terminal, that would include the basic common functions such as breaker fail, measurements display, basic disturbance recordings and load level alarm and trip, be used on all panels for these functions, to promote uniformity and operator confidence.

The disturbance recording abilities of the "base" relay must be indicated in the Schedule of Particulars and Guarantees. The requirements for a "Medium resolution" disturbance recorder are also given in the Schedule of Particulars and Guarantees. If the base relay does not meet these, separate "Medium resolution" disturbance recorders shall be incorporated in the relevant feeders, as indicated in the Price Schedules.

Both the main and the back-up relay on a bay could have measurement, event recording and disturbance recording. Tenderers may rationalise the allocation of the features between the relays, but always ensuring that the requirements for detailed, high-resolution event recording and disturbance recording are retained. Precise details as to the allocation of these functions shall be given in the tender.

7.9 Control Supplies

Duplicated 110 V station batteries/charger units are to be supplied, for reliability and redundancy in control, protection and tripping circuits. An automatic change-over switch of adequate rating shall be provided and the selected output bus-wired through the control cubicles, to provide redundancy in the supply to all bay controllers and station control units. Capacitive dip-proofing equipment shall be provided on the output to allow the control units and other equipment to "ride" through the changeover operation. Alternatively, suitably rated diodes may be used to obtain a "selected" supply.

The battery charger has a facility to transfer the supplies to its separate DC distribution boards from the one battery bank to the other, by means of a hand-operated selector switch. The automatic changeover switch described above shall not operate for manual selector switch operation on the battery charger. The hand-operated selector switch may be operated during maintenance. It is therefore of utmost importance that the control system not be affected by the normal operation of this switch.

If BYCs with provision for dual supply inputs are available and offered, the requirement for the automatic change-over switch will fall away.

Tenderers shall describe their proposed auxiliary supply arrangement for control units and in particular the operator station. It is of the utmost importance to have all control units and the operator station operative for at least 8 hours without AC main supply. Tenderers shall state the minimum standby time offered. Measurements shall be made on total.

8. SPECIFIC CONTROL SYSTEM DEVICES

8.1 132 kV Bay Controller (BYC)

The BYC shall be based on microprocessor technology and a real time operating system. The BYC performs all bay related functions, such as local control, command sequences, bay and station interlocking, data acquisition, data storage, event and alarm storage, outputs of commands and signal processing required for the different switchgear units of the bay.

The BYC shall preferably have an integral mimic capable of controlling and displaying the status of up to seven primary plant devices per bay, and have a user-definable layout to suit the substation physical layout. The mimic shall only allow operation if the bay has been selected to local control.

The following functions shall be provided:

a) Event handling with event buffering.
b) Acquisition of measured and counted values.
c) Execution and monitoring of commands.
d) Data pre-processing.
e) Data communication to the SMMI and connected subsystems.
f) Calculation of derived operational measured values.
g) Generation of group signals.
h) Interlocking.
i) Self-monitoring.
j) Mimic panel with local control facilities for each bay.

Auxiliary power shall be supplied from a separately monitored, automatic changeover circuit taken from a selected output of the duplicated station batteries.

The BYCs, with all related input and output equipment, are to be installed in the bay ICAP panels in the control room.

The electronic system has to be provided with functions for self-supervision and testing.

Each circuit board shall contain circuits for automatic testing of its own function.

Faults in a unit have to be indicated on the front panel of the unit. The time for fault tracing and replacement of a faulty unit shall be reduced to a minimum. The supervision shall also cover the power supply system, the internal system bus and the ability of the central processing unit (CPU) to communicate with the different printed circuit boards.

The function and design of the switchgear interlocking systems shall be reliable and safe. Perfect determination and processing of all switchgear positions of the whole substation must be ensured at all times. Unclear information, such as intermediate switchgear positions, switchgear faults, faulty data transfer, etc. must prevent non-permissible switching operations and state clearly, intelligently and exactly the reason for the prevention. Control, regulation and synchronising functions shall require perfect collection and processing of all information of the substation. The information must be up to date and valid. Mal-operation of control and regulation facilities such as on-load switching of an isolator, out of step operation of on-load tap change control, switching on in an asynchronous state, etc. shall be avoided. When the station level control (SMMI and gateway) and regulation facilities have failed, back-up control shall be possible via the bay local mimic, with retention of bay related interlocking.

The BYC must have spare capacity for future equipment. The input and output modules must have 10% spare capacity with a minimum of 2 inputs and 2 outputs spare. The BYC must have at least 2 spare positions for extra I/O modules. The RAM or on-board memory must have at least 20% spare capacity for programs once the application's requirements are met.

The interlocking software RAM or on-board memory must be backed-up via a battery back-up or non-volatile memory and in the case of a supply failure, on return of supply automatically resume their function. The software must be reprogrammable via the SMMI in a straightforward manner.

8.2 Substation Intelligent Electronic Device (SIED)

Numerous substation-common items are to be monitored and controlled. For this purpose a communicating IED shall be provided. Tasks for this device shall include:

a) Substation-common interlocking;
b) automatic sequence control;
c) substation common alarm monitoring; and
d) substation access control system monitoring.

Refer to the relevant I/O lists for details regarding items to be monitored and controlled by this device.

The device shall be capable of communicating directly with all necessary devices on the S-LAN in order to perform the required automation functions.

8.3 SGC and SGC Supervisor

The SGC shall be based on microprocessor technology and a real time operating system. The SGC performs all 11 and 33 kV bay related functions, such as command sequences, bay interlocking, data acquisition, data storage, event and alarm storage, outputs of commands and signal processing required for the different elements of the switchgear bay.

The following functions shall be provided:

a) Event handling with event buffering.
b) Acquisition of measured and counted values.
c) Execution and monitoring of commands.
d) Data pre-processing.
e) Data communication to the SMMI and connected subsystems.
f) Calculation of derived operational measured values.
g) Generation of group signals.
h) Interlocking.
i) Self-monitoring.

The SGC is to be installed in the 11 or 33 kV switchgear panels.

The electronic system has to be provided with functions for self-supervision and testing.

Faults in a unit have to be indicated on the front panel of the unit. The time for fault tracing and replacement of a faulty unit shall be reduced to a minimum. The supervision shall also monitor the power supply system, the internal system bus and the ability of the central processing unit (CPU) to communicate with the different printed circuit boards.

The function and design of the switchgear interlocking systems shall be reliable and safe. Perfect determination and processing of all switchgear positions of the whole substation must be ensured at all times. Unclear information, such as intermediate switchgear positions, switchgear faults, faulty data transfer, etc. must prevent non-permissible switching operations and state clearly, intelligently and exactly the reason for the prevention. Control, regulation and synchronising functions shall require perfect collection and processing of all information of the substation. The information must be up to date and valid. Mal-operation of control and regulation facilities such as on-load switching of an isolator, out of step operation of on-load tap change control, switching on in an asynchronous state, etc. shall be avoided.

The interlocking software RAM or on-board memory must be backed-up via a battery back-up or non-volatile memory and in the case of a supply failure, on return of supply automatically

resume their function. The software must be reprogrammable via the SMMI in a straightforward manner.

Should the SGC be unable to provide these functions, an SGC Supervisor shall be provided to supplement the SGC in performing these functions.

8.4 Disturbance recording : particular requirements

Each 132 kV line shall have a medium resolution disturbance recorder, as defined in the schedule of particulars and guarantees, installed and set up to operate for any 132 kV or transformer protection operation in the substation, including the transformer bays.

Each 33 & 11 kV transformer incomer shall, as an option, have a medium resolution disturbance recorder, as defined in the schedule of particulars and guarantees, installed and set up to operate for any transformer bay protection operation and any protection operation in the suite of 33 & 11 kV panels.

Each 33 & 11 kV feeder shall have a low resolution disturbance recorder, as defined in the schedule of particulars and guarantees, installed and set up to operate for any feeder-specific protection operation.

Analysis software for the disturbance recorder data shall be integrated into the SMMI software, and shall operate without having to suspend execution of the SMMI software.

8.5 11 kV I/O module

A communicating I/O device shall be provided to allow control and status determination for the 11 kV bus couplers and bus sections (refer to drawing).

The device shall be a modern numerical, self-monitoring instrument. It shall offer full interrogation by the substation control system, time tagged event recording and plant control capability.

The nominal ratings of the I/O module shall be as follows :

a) Auxiliary voltage 110 V DC ± 20 %

b) Output relay make and carry for 0,2 s 30 A

c) Output relay carry continuously 5 A

d) Output relay break (DC) 50 W resistive or 25 W inductive ($^{L}/_{R}$ = 0,045)

e) Output relay break (AC) 1 250 VA

The I/O module shall perform continuous self-monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

Time tagged event recording with a 1 ms resolution incremented every millisecond shall be provided, with access via the communication port.

8.6 Router

The modular router shall be robust, compact, portable, user friendly, micro-processor controlled and offer the following:

a) An Ethernet card slot;
b) A WAN interface card slot; and
c) A serial card slot.

The serial WAN port on the router shall support asynchronous serial connections up to 115.2 Kbytes/s and synchronous connections such as Frame Relay, leased lines, Switched 56, Switched Multi-megabit Data Service (SMDS) and X25 up to 2.048 Mbytes/s.

The WAN interface on the router shall allow easy change of - or add of WAN interface cards.

The router shall be designed to be ‘plug and play”.

The modular router shall accommodate the following software capabilities:

a) PCMCIA cards from where pre-configured software can be loaded at a central site and be sent to remote sites.
b) At the remote sites the software should be accessible via PCMCIA cards by means of plugging it into the WAN, LAN or power cables.
c) A Web-browser and monitoring utility shall be available to the user.

9. CONTROL SYSTEM CAPABILITIES

9.1 General Software

The software shall consist of basic type tested software modules and standardised supplementary function modules, which are configured depending on the layout and operation concept of the substation.

Security of control selections is of paramount importance and every precaution shall be taken in the software and hardware design to ensure that false selection or execution of a control is rejected. Failure of a communication, partial or total, intermittent or permanent, shall not lead to a false control action.

The system software shall be standard software as offered to other customers, and the structure shall be specially designed for the important requirements of switchgear operation. The system shall be able to restart faultlessly and as quickly as possible after loss of supply voltage. All necessary information must be kept in memory in case of supply voltage outage.

It shall be possible to test the system with help of simulations and without any hazard or unwanted influence to the substation.

The following software functions relate to the substation control system and shall be included in the tender as a minimum:
a) Design of the data base including all substation data
b) Design of an overall display for each voltage level
c) Design of single line diagrams
d) Design of system status displays

9.2 Programming Language

The application programming shall be made in a programming language dedicated for substation automation applications. Programming and documentation shall be based on pre-programmed functional blocks available in a library. These blocks perform typical functions that should be familiar to a substation engineer who is used to design hard-wired logic. Programming of the SMMI and reconfiguration thereof shall be possible by the highest authority level user, and the programming language in all cases shall be an English-language-based programming language.

The programming language has to be graphical as far as possible. Functions shall be programmed in a modular way, where each module shall handle a well-defined task. It shall be possible to test, change, add or remove an application function.

Full information and software manuals shall be supplied by the Contractor to enable the Municipality to reprogram the control system if so desired.

9.3 Station Interlocking and Control Sequence

The control program shall include the possibility for future modification and extension of the station control. It shall be possible to do on-line engineering and reprogramming of the actual application, while the main task is still running in the background, i.e. events are still logged, measurement still stored, etc.

9.4 Bay Interlocking

The control units referred to in the following paragraphs imply the following devices:
a) 132 kV bay ICAP panels : BYC
b) 33 kV panels : SGC
c) 11 kV incomer and feeder relay panels : SGC
d) 11 kV bus coupler and bus section relay panels : SGC

The bay as well as the station-wide interlocking shall be performed in the individual control units. The station-wide interlocking evaluation shall require switch position indications from other bays (e.g. busbar disconnector, bus-coupler busbar earth), which are transferred to the corresponding control unit via the inter-bay bus.

No protection function may be interlocked through the control unit.

A normally open and a normally closed "change of state" contact from each item of primary equipment must be wired into the control unit.

The "change of state" contacts of each item of primary equipment must be used as a failsafe check of equipment operation or equipment malfunction. In the case of equipment malfunction an alarm identifying the specific item of equipment must be initiated and all further control of that bay disabled until this malfunction has been corrected. This must not only include “change of state” discrepancies but also other alarms like circuit-breaker lockout or spring not charged.

The interlocking at bay and substation level shall prohibit the incorrect operation and or sequence of operation of all items of primary equipment (e.g. isolator opening or closing on load).

Due regard must be given to the operating of the primary equipment during a "dead" or maintenance condition.

The BYC must control the supply to the motorised isolators and mag bolt interlocks where applicable. The contacts within the control unit must be sufficiently rated to perform these operations.

9.5 Interlocking Concepts and Specific Interlocking

Due to the different types of software interlocking methods offered by the manufacturers, specific interlocking requirements will be decided with the successful Tenderer. However, details regarding the general interlocking requirements are listed in the Addendum.

10. SUBSTATION CONTROL SYSTEM : MAN-MACHINE INTERFACE

10.1 General

The SMMI-system shall be a high performance operator station with one operator workplace. It shall be designed for advanced operator's communication. The following functions are required :

a) Presentation of user defined displays (single line diagrams, switching status and analogue values e.g. V, I, P, f, power factor), standard displays, trend curve displays and reports.
b) Effective and safe dialogues for manual control of the substation and for release of control sequences. "Select before operation" procedures are required.
c) Presentation of alarms and events on the operator's video display units and printouts on the printer.
d) Presentation of system status displays (status of BYCs, etc.).

The system software shall be loaded from a transportable medium (e.g. diskettes) and shall be stored in a memory with error correction and battery back-up power or non-volatile memory.

The SMMI shall include a bi-directional logic-seeking 9 or 24-pin dot-matrix printer with a standard parallel interface, and it shall be used for continuous listing of all events occurring in the substation. An ink-jet type printer will not be accepted. It shall be possible to select between at least the following functions for the printer on the SMMI in a easy and straightforward manner:

a) Continuously print all events required as or shortly after they occur, in chronological order;
b) disable continuous printing, in which case the printer buffer is not written to by the SMMI;
c) printing of any sorted or unsorted events from the SMMI event list; and
d) printing of any sorted or unsorted alarms from the SMMI alarm list.

On completion of the substation commissioning, a new ribbon shall be supplied and fitted to the printer.

The operator shall have access to the distributed databases via the SMMI. For control of the substation the operator will use a mouse and soft keys on the screen. The operation

procedures shall be user friendly and easy to understand. Data entry is performed with the keyboard.

It shall be possible to design new pictures in an interactive dialogue without taking the total substation control system off-line. Access to the engineering tools shall be provided.

The system shall distinguish between alarm lists and event lists selected on the monitor by the operator. Besides screen displays of these lists, there shall be a print out of any alarm or event in an event log which shall be arranged in chronological order.

An audible alarm shall indicate abnormalities and all unacknowledged alarms shall be accessible from any screen selected by the operator.

The following items shall be presented by the SMMI :
a) Single line diagram showing the switching status;
b) substation overall alarm list;
c) section alarm list;
d) system status list;
e) substation overall event list;
f) section event list;
g) event and alarm log;
h) measured values; and
i) parameter setting (on request).

Tenderers shall allow sufficient time for detailed set-up of the operational procedures and displays in close co-operation with the City Municipality. This will ensure that the SMMI system "appearance" will be compatible with that of the master control system.

Examples of symbols preferred by the Municipality have been included in the Addendum for this part.

10.2 Process Displays

The operational status of the substation, measured values of currents, voltages, frequency, active and reactive powers shall be presented in the single line diagrams. These displays shall also present the status of process objects such as circuit-breakers, disconnectors and transformers.

To ensure a high degree of security against unwanted operation, a special operation procedure "select - confirm - execute" shall be provided. After "selection" the operator shall be able to recognise the selected device on the screen and all other switching devices shall be blocked.

The interlocking conditions shall be checked by the BYCs. The operator can only execute the command successfully if the device is not blocked and if no interlocking condition is violated. After command execution the operator shall receive a message, either about the new switching position or about the unsuccessful switching.

Primary equipment control level selection (local, remote or off) shall be indicated on the SMMI in all displays which show the affected device by means of a single letter or symbol, to be defined during detailed design of the system, and which shall appear next to the relevant device.

Items relating to primary equipment shall be monitored, and functions assigned (e.g. event logging, control command refusal, etc.) as indicated in the input, output and event sheets in the Addendum.

Transformer tap changing shall be operated from a dedicated dialogue in a single line diagram. Manual control shall be selected, and after selection the operator may issue a command for increase or decrease of tap changer position. The status of the tap changer control mode shall be displayed clearly in this dedicated dialogue as well as in the transformer bay view.

The synchro-check function shall allow circuit-breaker closing only if the voltages on both sides of the breaker fulfil the pre-set conditions as to magnitude, phase and frequency difference.

The operator shall be able to remotely control the status of the auto-reclose function, where implemented, at the SMMI or master control centre. The status of the auto-reclose function shall be displayed on all dialogues which display the relevant circuit-breaker, and shall be clearly displayed on the auto-reclose control dialog and the relevant bay view.

Clear indication of each portion of the single line diagram’s voltage shall be displayed by means of line colouring on all of the single line diagram views as follows:

a)	Earthed	Green
b)	132 kV	Orange
c)	33 kV	Dark Blue
d)	11 kV	Light Blue
e)	Uncertain	Flashing yellow

The indication of the voltage for each item of primary plant as described above shall be checked for correctness by considering all available information in order to minimise the chance of an incorrect display.

10.3 Alarm List

Faults and errors in the substation shall be listed in the alarm list and shall be simultaneously transmitted to all control centres. It shall contain unacknowledged alarms and persisting faults, e.g. "Circuit-breaker low SF6 pressure". Date and time of occurrence shall be indicated, with an overall resolution of 10 ms or better.

The operator shall be able to acknowledge alarms on display. Acknowledged alarms shall be marked on the list.

Faults that appear and disappear without being acknowledged (fleeting alarms) shall be marked as such in the alarm list.

A chronological alarm list shall be presented on the display screen, and shall be able to be transferred to the event printer.

The user-definable alarm description shall have at least 28 characters, and grouping of alarms based on their source shall be possible.

10.4 Control System Status Display

The system status display shall show the substation control system configuration and the status of all devices of the system.

10.5 Event List

The event list shall contain events that are important for the control and monitoring of the substation. The type of event and its time of occurrence have to be displayed for each event, with a resolution of 10 ms or less.

The operator shall be able to call up the chronological event list on the monitor at any time for the whole substation or sections of it, as required.

The event list shall be capable of storing at least 500 events in a first-in-first-out (FIFO) buffer.

The chronological event list shall contain :

a) Position changes of circuit-breakers, disconnectors and earthing devices;
b) indication of all protective relay operations, with clear distinction of the different functions of multi-function relays;
c) fault signals from the switchgear;
d) exceeding setable upper and lower limits of analogue measured value;
e) loss of communication; and
f) user-defined inputs.

The user-definable event description shall have at least 30 characters, and grouping of alarms based on their source shall be possible.

It shall be possible to select separately for each event whether or not it will be logged and whether it will be logged on a rising edge, a falling edge or for both transitions.

10.6 Event and Alarm Log

The event and alarm log shall be the continuous listing of events and alarms on the event printer.

Events that occur when the printer is off-line due to lack of paper or other similar occurrence shall be queued in the SMMI until the printer is again available. Queuing shall not, however, occur if the event printing function has been disabled.

It shall be possible to conduct searches in the alarm and event lists based on any of the following:

a) Characters with “wildcards” (so that a search for “??IBM*” will display all events or alarms which have the third, fourth and fifth letters of their description matching “IBM”);
b) time-period searches to obtain all events or alarms which occurred within a certain period of time on a specified date; and
c) functional group specific searches to obtain events or alarms which relate to a specific bay or the substation common items.

Typical event and alarm lists have been provided in the Addendum.

10.7 Power Supply

The supply shall be taken off the station batteries, via the automatic supply changeover unit described. Tenderers shall calculate the total standing and intermittent auxiliary supply load. The capacity of the battery banks shall be increased from the presently specified value, if needed, to allow a standby time, with control system operation and printing taking place, of at least 8 hours without AC mains supply for all protection and control functions.

10.8 Operator Station Hardware

The computer system shall be a high quality, high-speed industrial type with high reliability and immunity to electromagnetic interference. The Tenderer shall supply specific details regarding the computer’s extraordinary ruggedness and suitability to extended terms of unattended operation in the substation environment. The main requirements are given in the Schedule.

The computer hardware shall, at a hardware level, be Energy Star compliant, and shall enter the following modes during periods of inactivity in the following sequence:

a) Computer monitor shutdown after an inactivity period of 10 minutes
b) Computer hard drive shutdown after an inactivity period of 10 to 30 minutes

Inactivity for the monitor shall be defined as no input activity from the local keyboard or mouse.

The operator station equipment shall be mounted in a lockable cubicle(s), with provision for a chair and a comfortable operating position for the operator. Space shall be provided for manuals, a writing area or desk and for locking away the operator's chair.

Manufacturers’ MTBF figures shall be quoted for all hardware components of the operator station.

The printer described shall be positioned in a separately lockable compartment, in such a way that they are easy to reach and operate. It shall also be possible to utilise the printer from the engineering network connection.

Only a single station computer is required, but the hard drive system shall consist of two mirrored hard disk drives, which must be mirrored at a hardware level to minimise software dependency.

10.9 User Authority Levels

Access rights to the operator station shall be controlled by means of passwords. The allocation of user rights to each of the six levels required is shown in Table 1.

Individual users signing on to each level shall also be identified and logged.

11. REMOTE ENGINEERING WORKSTATION

11.1 General

Software for the existing REWs shall be provided and installed to allow protection engineers and service technicians to set up, do application programming, change and test the control system and analyse the behaviour of the control system and the primary network. Disturbance recorders and protection units shall be incorporated in the hardware configuration to allow access to event and disturbance recordings.

The system shall provide on-request information from protection terminals and disturbance recorders, comprising :

a) Reading of all indications;

b) resetting of all indications;
c) settings and configuration of all parameters;
d) measuring values at fault;
e) service values from analogue and digital inputs;
f) self supervision results; and
g) disturbance record analysis.

The E-LAN shall also have a communication port (LAN-extension) for data exchange with a remote centralised engineering workstation, via a multiplexed serial link.

The software of the REW shall consist of a flexible software package, handing both disturbance recorders and protection units. All programs shall be PC based.

Reading and setting of all parameters in the protection relays and changing between complete groups of parameters shall be possible. The editing of the parameters shall be done off-line. Fault recording for protection relays, each giving disturbance reports for 3 disturbances, shall also be included. It shall be possible to reset all values remotely.

Password access control shall be implemented.

Item No.	Function	Authorisation					
		Level 1 (MV operator)	Level 2 (HV operator)	Level 3 (Maint.)	Level 4 (Engineer)	Level 5 (Operator Supervisor)	Level 6 (System Administrator)
1.	Operator authorisation					√	√
2.	System Exit						√
3.	132 kV control		√			√	√
4.	11 kV control	√	√			√	√
5.	Alarm Acknowledge: 132 kV		√			√	√
6.	Alarm Acknowledge: 11 and 33 kV	√	√			√	√
7.	Print events and alarms	√	√	√	√	√	√
8.	Save log file to removable media				√	√	√
9.	Erase log file			√	√		√
10.	Program Trending curves				√		√
11.	View primary plant (132 kV)	√	√	√	√	√	√
12.	View secondary plant (11 and 33 kV)	√	√	√	√	√	√
13.	View control network	√	√	√	√	√	√
14.	Set protection Relays			√	√		√
15.	Substation local/ remote control	√	√			√	√
16.	System configuration						√

TABLE 1: USER OPERATING LEVELS

11.2 Disturbance Analysis

When disturbances occur on the network, various kinds of information are needed to analyse the fault and find the original cause, in as short a time as possible.

A communication program for manual or automatic collection of disturbance files to a PC shall be available. The automatic function shall poll the station at user-definable intervals. When new pre-selected disturbance recordings are available they shall automatically be transferred to the PC. The data collection program shall be integrated in the monitoring program.

The disturbance evaluation software shall include functions such as time, amplitude and angle measurement. Zooming in the time scale and independent magnitude scaling of each signal shall be possible and the software shall be able to handle 8 analogue and 8 digital signals in one window. The evaluation software shall accept the standard disturbance file format COMTRADE (IEE standard) and perform conversion between different formats which may be found in the substation.

A further option would be an expert system for automatic evaluation of disturbances. It shall include functions for handling of statistics and shall do accurate fault locator calculation using an algorithm that includes load compensation.

Tenderers shall give a detailed description of the evaluation software to be provided and the analysing and presentation features it offers.

12. SERVICE AIDS

12.1 General

All necessary software shall be provided for a laptop computer which is to be used as a service unit for on-site engineering, analysis and modifications. The software shall also enable the laptop to double as an REW.

Access to the SMMI shall be possible by means of a 10 Base-2 network BNC T-connection to the E-LAN from a laptop in order to access engineering data, program protection relays and make use of the local event printer.

12.2 Functions

The laptop-based service unit shall be used for the following purposes:

a) System entry
b) Application programming
c) Program testing
d) Fault tracing
e) Graphical program documentation
f) Loading and dumping of programs
g) Commissioning
h) Reading of values in the data base
i) Changing peripheral parameters and relay settings
j) Disturbance record analysis

12.3 Monitoring

The laptop-based service unit shall permit the user to investigate changes of status and analogues in the substation. The service aid shall be able to monitor data in the running substation control system and to present changing variables on the display screen, selected in tabular form or in graphic representation.

12.4 Display and Printouts

The program entry procedure shall be based on display screen techniques that provide the operator with visual control of the work performed.

The service aid shall be able to obtain data assimilated by the SMMI in order to allow for archiving and analysis.

12.5 Event Printer Compatibility

The event printer of the operator station shall be compatible with the service system computer’s standard parallel printer port to allow it to be used for service printouts at the substation.

12.6 System Information

Tenderers must provide detailed information of the system hardware and software offered, and where the hardware has previously successfully been installed in a similar environment.

13. COMMUNICATION

13.1 Communication between BYCs and Protection Relays

If the protection relays do not communicate directly with the SMMI, a secondary communications bus may be installed to transfer the information required to the BYC. It shall allow transfer of information like events, alarms, operations, settings, status, measured values, time synchronisation etc. Tenderers shall give full particulars of this secondary or object bus and communication protocols.

Should this secondary bus be used for communication to the protection and other bay IEDs, data such as disturbance records shall take lower priority than digital and analogue information in order to avoid loss of general information during disturbance record uploading to the SMMI.

13.2 Substation Local Area Network (S-LAN) Communication

Data exchange shall be provided between bay and station control modules on a optical station data bus. Tenderers shall clearly state the physical properties and arrangement of the bus, the data protocols utilised and the speed of data update for analogue and digital values on the SMMI.

Analogue and digital values shall be updated at least every 2 seconds in the SMMI database and display, and shall take a higher priority than such information as disturbance records.

13.3 Communication to the Master Control Centre

Communication to a Master Control Centre (MCC) shall be provided via a gateway port. Details regarding the gateway are discussed elsewhere in this specification.

13.4 Protocol

Different protocols among manufacturers pose a major problem for a utility in terms of forward compatibility and compatibility among different elements of their system.

Tenderers shall report on the latest developments in this regard.

Tenderers shall clearly indicate the protocols proposed for the different communication levels and the disadvantages or advantages of the particular choices.

13.4.1 IEDs which have the ability to interface to relays with the IEC 870.5 VDEW, in addition to the Proprietary protocol, will be preferred.

14. TIME SYNCHRONISATION

14.1 Master Clock

A substation master clock shall be provided. The master clock shall synchronise the substation automation system internal clocks of the SMMI, the BYCs as well as the fault recorders.

14.2 Global Positioning System

The master clock shall be synchronised by a GPS (Global Positioning System) satellite receiver. A regular time telegram shall be sent to all control and protection units to allow a final time resolution of 10 ms or better for all event and alarm records.

15. PROTECTION DEVICES, FUNCTIONS AND ASSOCIATED ITEMS

15.1 General Information and Requirements

The protection equipment provided shall be suitable to protect the electrical system in the event of the occurrence of faults such as phase faults, earth faults, busbar faults, feeder faults,

breaker failure, etc. The Contractor shall ensure that the equipment offered is suitable for the application and that the relay characteristics satisfy the tripping time and load current requirements. Should relays with different characteristics or operating principles to those specified hereafter be offered, the Tenderer shall state the reason for offering such a relay as well as the advantages of the said scheme over the one specified. The price for non-numerical relays shall be entered in the price schedule total if no offer is made on the numerical relay.

The protection measuring relays shall be based on the latest generation proven numerical technology, to allow a wide range of protection, control and measurement functions, with comprehensive communication facilities for integration with the overall substation control system. The system shall have forward compatibility with future equipment for a period of at least ten years.

Each relay element shall be provided with a sufficient number of correctly rated, electrically separate normally open contacts to cater for tripping of the two trip coils in each circuit-breaker directly, making use of two separate isolated DC supplies. Relay elements shall also be fitted with sufficient, suitable contacts for interconnecting to the bay processor and for blocking functions where necessary.

The circuit-breaker tripping supplies shall be provided from duplicated 110 V battery/charger units and shall be dedicated to tripping and related relay auxiliary supplies. The tripping supply circuits shall under no circumstances be used for closing, indication, monitoring, etc.

Redundancy shall be built into the tripping circuits by means of the following features:

a) Dual tripping supplies provided from duplicated 110 V battery/charger units.
b) Dual circuit-breaker tripping coils.
c) Main and back-up protection working in different modes and powered off different instrument transformers and power supplies.
d) Trip circuit supervision with circuit-breaker opened and closed on both tripping circuits.
e) Cross-tripping from relays to both tripping circuits.

Where trip contacts on relays are not adequately rated, high-speed shunt reinforcing contacts shall be provided. However, preference shall be given to direct operating relays. The Contractor shall present calculated values of the relevant parameters of tripping and closing circuits for approval of contact ratings.

All relays where possible shall be withdrawable, with suitable protection against open circuiting of current transformer circuits, where applicable. The tripping contacts of all relays shall also be so arranged that tripping does not occur while or when a relay is being withdrawn.

Operating of a relay element shall be clearly and positively indicated on the relay by an indicating light or alphanumeric display. The indication shall always positively identify the type of fault and where applicable the affected phase, busbar or bus-zone.

The adjustable settings on all relays shall be easily accessible, from the relay front panel, from the service aid (laptop), from the local SMMI and from the engineering network. At no time shall the downloading of new settings to the relay compromise the relay protection functions. Protection settings shall be completely alterable from the relay front panel, service aid (via the E-LAN), the REW and the SMMI.

Users shall be able to completely re-configure relays and protection functions via a service aid, the E-LAN and the SMMI.

Each protection relay and function shall have at least two complete setting groups, which may be selected from the relay front panel, a laptop computer, the E-LAN and the SMMI. The alternative setting group shall be selected by either energising an opto-isolated input assigned to this function, or by a suitable command via the serial communication port of the relay. These inputs shall be energised from an internally generated DC source and must not be affected by induced power frequency AC signals in the wiring.

Test blocks for each separate current transformer circuit shall be provided. The test block shall have 14 sockets and 28 terminals to allow, through the insertion of a test plug, short circuiting of the CT circuits and secondary injection testing by external testing equipment, or current measurement to be made while the circuit is in service. Insertion of the multi-finger test plug shall isolate the trip contacts of the relays whilst allowing external monitoring of the trip contacts. Three multi-finger and three single-finger test plugs, complete with shorting and bridging links, shall be provided with the test blocks.

Relays and auxiliary coils specified for operation from a nominal 110 V DC substation battery supply shall operate reliably and satisfactorily at any voltage between minimum limits 80 % to 120 % of 110 V DC, and shall be capable of withstanding the voltage level associated with boost charging of the station battery. Where relays require auxiliary power at a voltage other than 110 V DC, provision shall be made for the necessary DC to DC convertor equipment. Preference shall, however, be given to equipment operating directly from 110 V DC.

The relays shall all be of robust construction and shall have a positive action without chatter.

All relays shall be flush mounted.

The manufacturer's name, type and designation number and ordering code of each type of relay offered, together with the corresponding pamphlet or brochure reference shall be entered by the Tenderer in the Schedule of Particulars and Guarantees. The necessary brochures with sufficient information on each device, including the explanation of the order code shall be provided.

Where applicable, the ordering code of the relay shall also be specified as an indication of the choice of options which are intended to be supplied.

Full details, including any technical literature, descriptive and illustrative publications and catalogue pamphlets of the protection scheme and equipment offered shall be included in the Tender Document.

15.2 Particular Requirements

Various protection relays are covered in the remainder of this clause and in the Particulars and Guarantees. Information about the specific protection schemes covered by this enquiry is included in the following clause and in the form of block schematic diagrams of the schemes required.

The final arrangement of the protection circuits shall be agreed with and shall be to the approval of the Engineer.

The stated requirements are the City Municipality's minimum requirements for the protection of the various circuits and Tenderers are at liberty to expand on the requirements detailed hereunder.

15.3 Two terminal digital current differential protection

Digital current differential protection relays shall be supplied as the main unit protection on the 132 kV overhead transmission line or cable feeders where indicated.

The relay shall consist of a modern numerical, self monitoring IED utilising programmable scheme logic to provide multiple and independent tripping. It shall offer a user friendly interface, a display of measured steady state and fault quantities, isolated serial communication, remote setting and interrogation by the substation control system and time tagged event/disturbance recording to a 1 ms resolution.

The differential protection relay shall obtain it’s power supply from a dedicated DC Main Trip Supply circuit, and shall function independently of any control IEDs in the bay.

The relays shall communicate via dedicated optical fibre channels for current comparison and inter-tripping.

The current differential relay shall evaluate each phase current separately at both ends utilising the current amplitude and phase angle.

CT saturation detection or dual slope bias restraint characteristics must be utilised to stabilise the relay during through faults.

The relay shall allow direct inter-tripping via opto inputs. A prerequisite of this feature would be clear alarm indication descriptions and the origin of the inter-trip clearly defined at all ends of the protected zone.

The relay must perform continuous self monitoring and shall not trip when a relay or communication error occurs. A separate output relay that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

Comprehensive computer based test facilities and the software for it shall be provided, to allow the relay to be thoroughly tested during commissioning, routine maintenance and fault finding operations.

The optical fibres for the relay communication will be available in the station communications cubicle, and are normally terminated with ST type optical connectors. The Contractor will be responsible for the installation and connection of the optical fibres from the relay panel to the communications cubicle. The particulars of the optical fibres are as follows :

a) Type of fibre Single mode glass fibre
b) Max attenuation level at 1 300 nm 0,5 dB/km
c) Cut-off wavelength 1 100 nm to 1 310 nm

The contractor shall install only single mode glass fibre for connection to the communications cubicle, and shall select the correct communications interface unit for the relay to suit the wavelength and attenuation of the installed system.

The feeders that are to be protected are short. The exact lengths of the optical fibre-links and an optical loss budget will be provided to the Contractor on request.

Current transformer details are given in the relevant part of this specification.

15.4 Combined transformer differential, HV and LV restricted earth fault protection relay

The relay shall consist of a modern numerical, self-monitoring IED utilising programmable scheme logic to provide independent transformer biased differential protection, overfluxing protection and restricted earth fault protection separately on the HV and LV sides of the transformer. It shall offer a user friendly interface, a display of measured steady state and fault quantities, alternative setting groups, isolated serial communication, remote setting and full interrogation by the substation control system, time tagged event/disturbance recording, plant control capability and start contacts.

The combined differential/REF relay shall obtain it’s power supply from a dedicated DC Main Trip Supply circuit, and shall function independently of any control IEDs in the bay.

The relay shall be stable for all through-faults without compromising the sensitivity to in-zone faults.

The biased differential protection shall utilising six biased current inputs (two per phase) and be able to compensate internally for CT ratio and vector group mismatch.

The differential protection operation shall be blocked for normal magnetising in-rush currents (inrush restraint), by means of either a high-speed waveform recognition technique or a second harmonic restraint technique.

The restricted earth fault (REF) protection for the HV and LV side of the transformer shall utilise two additional inputs, one from each of the transformer neutral circuits. Separate trip elements shall be provided for each of the REF functions.

The differential protection shall detect over-fluxing (over-excitation) of the transformer and allow for a definite time delayed alarm output as well as an inverse time delayed trip output. A 3-phase VT will be installed (under part 11 of this Contract) on the LV side of the transformer for this purpose.

The relay shall have programmable output relays which can be allocated to the different relay functions.

The relay shall perform continuing self monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

An alternative group of settings shall be provided for both the phase fault and earth fault protection functions. The alternative setting group shall be selected by either energising an opto-isolated input assigned to this function, or by a suitable command via the serial communication port of the relay. These inputs shall be energised from an internally generated DC source and must not be affected by induced power frequency AC signals in the wiring.

The relays shall provide and display the following control and measurement features :

a) Measured or derived quantities such as phase currents and zero sequence currents. When CT ratios are entered into the relay, measured quantities and settings shall be displayed in primary quantities.

b) Circuit breaker maintenance data ie. sum of the square of the fault current interrupted by the circuit breaker for each individual phase and also the number of times the relay has issued a trip command.
c) Fault records such as setting the trip LED and displaying the responsible protection function(s) and fault currents.

Time tagged event recording with a 1 ms resolution incremented every millisecond shall be provided. This data must be automatically uploaded to the SMMI as soon as the recording has been completed, and the storage facilities within the relay shall allow for first-in-first-out buffering of the event records.

15.5 132 kV Busbar Protection

A busbar protection scheme comprising one zone per connected busbar of the station and an overall check-zone (utilising separate CTs) shall be supplied to detect busbar faults quickly and selectively and thereby isolate the faulty zone only, with the minimum damage occurring.

Busbar protection schemes offered may be either of the static or numerical type.

Should a numerical scheme be offered, the scheme should be integrated into the substation ICAP system.

The design of the protection scheme shall be based on the biased low or medium impedance current differential principle offering protection against phase-to-phase and phase-to-earth faults. The protection scheme shall be based on the latest generation of numerical technology, to allow a wide range of protection, control and measurement functions, with comprehensive communication facilities for integration with the overall substation control system. The system shall have forward compatibility with future equipment for a period of at least ten years.

The lay-out of the busbars and the number of circuits to be incorporated are depicted on the accompanying single line drawing. The busbar scheme and central unit shall be configured for all the future feeders, bus-sections and bus-couplers. Measuring units shall only be provided for present bays, as far as possible, without compromising the future upgrading to a complete scheme.

The busbar protection scheme shall preferably operate from dual redundant power supplies for the purpose of continuity of operation. Alternatively, the busbar protection scheme shall obtain it’s power supply from a dedicated DC Supply circuit connected to the main battery bank, and shall function independently of any control IEDs in the bay.

Each zone measuring unit shall have integral CT circuit supervision which must detect CT circuit faults, flag these faults and prevent mal-operation of the protection scheme during normal system operation. It must not be necessary for the CT circuit supervision to await an over-current situation to detect a problem.

Each zone measuring unit shall have two separate measuring elements, one of which operates for the differential current exceeding the current setting threshold (differential detection) while the other element must operate for the differential current exceeding the through current bias (over-current start detection). Both elements must operate in order to allow a busbar fault output to occur.

In order for a busbar fault to be acknowledged and acted on, the main and check measuring unit outputs must both operate.

The busbar protection scheme shall perform self-supervision and provide local indication and alarm outputs should any element of the scheme become faulty.

Current transformer circuits are to be wired directly to the busbar protection scheme and must not be routed through the isolator auxiliary contacts. The busbar protection scheme must perform its function via "busbar imaging" and obtain plant status via isolator and circuit-breaker auxiliary contacts.

Comprehensive test facilities shall be provided.

The protection shall retain full stability in the event of a through fault.

The busbar protection shall accept inputs from external breaker fail protection relays which shall activate bus-zone trip auxiliary relays to disconnect all the circuits connected to the affected busbar zones(s).

The busbar protection scheme shall automatically detect the closing of two busbar selector isolators in the same bay and immediately combine the two bus zones and disable the main and backup trip circuits of the bus coupler circuit-breaker (Bus coupler “solid”). Any busbar fault detected after combination of the two busbar zones must strip both busbars.

The detection of the movement of the busbar selector isolators shall be based on the changing of state of the outermost limit contacts N or G.

Local indication on the busbar protection panel and alarm outputs to the SMMI shall be provided to indicate the combination of bus zones.

In order to ensure the stability of the busbar protection, the resistance of the secondary CT circuit wiring shall be taken into account, and the resistance of this wiring reduced to a minimum.

The busbar protection schemes shall be housed in free-standing protection panels in the control room. In the case of a distributed busbar protection scheme the main unit must be housed in a free standing protection panel. Data transfer between bay units and central units shall be via optical fibre links to ensure immunity to electromagnetic interference.

15.6 Combined over-current and earth fault protection relay/function

The multi-function relay must perform the bay standardisation function described. Where bay VT's are not available, an accurately derived or imaged busbar voltage shall be supplied to the relay for voltage and power measurement information.

The relay shall be a modern numerical, self-monitoring instrument utilising programmable scheme logic to provide multiple, independent three-phase and earth fault protection curves. It shall offer a user friendly interface, a display of measured steady state and fault quantities, alternative setting groups, isolated serial communication, remote setting and full interrogation by the substation control system, time tagged event and disturbance recording, plant control capability and start contacts.

The functions required of the combined over-current/earth fault protection may, alternatively, be incorporated into the BYC, should the BYC be suited to this purpose.

The relay shall obtain it’s power supply from a dedicated DC Backup Trip Supply circuit, and shall function independently of any control IEDs in the bay. Alternatively, should the relay functionality be implemented within the BYC, it shall make use of the selected supply provided to the BYC.

Over-current elements shall conform to the following :

a) The relays shall contain three independent over-current stages for both phase elements ($I_{>}$, $I_{>>}$, $I_{>>>}$) and for earth fault elements $I_{o>}$, $I_{o>>}$, $I_{o>>>}$). Measurement shall be based on the Fourier derived value of the power frequency component, with harmonics up to and including the sixth suppressed.
b) The $I_{>}/I_{o>}$ elements shall operate when the power frequency component of the current exceeds the set threshold. The time/current characteristic associated with these elements must provide a selection of inverse definite minimum time (IDMT) curves, or be setable to a fixed (definite) time delay.
c) The $I_{>>}/I_{o>>}$ and $I_{>>>}/I_{o>>>}$ elements shall provide instantaneous functions that are not affected by offset waveforms, such as those occurring with power transformer inrush currents. This shall allow the instantaneous elements to be set down to 35% of the anticipated peak transformer inrush current. To a first approximation, the peak inrush is given by the reciprocal of the per unit series reactance of the transformer. These over-current stages shall also have selectable definite time settings.

The relay shall be provided with a start function (and programmable relay output) that responds to the current exceeding either the $I_{>}$ or $I_{o>}$ thresholds.

The relay shall have programmable output relays (quantified in the Particulars and Guarantees) that can be individually and collectively allocated to the different relay over-current functions.

The relay shall perform continuing self monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

An alternative group of settings shall be provided for both the phase fault and earth fault protection functions. The alternative setting group shall be selected by either energising an opto-isolated input assigned to this function, or by a suitable command via the serial

communication port of the relay. These inputs shall be energised from an internally generated DC source and must not be affected by induced power frequency AC signals in the wiring.

The relays shall provide and display the following control and measurement features :

a) Measured or derived quantities such as phase currents and zero sequence currents. When CT ratios are entered into the relay, measured quantities and settings shall be displayed in primary quantities.
b) Circuit breaker maintenance data ie. sum of the square of the fault current interrupted by the circuit breaker for each individual phase and also the number of times the relay has issued a trip command.
c) Fault records such as setting the trip LED and displaying the responsible protection function(s) and fault currents.

Breaker failure protection with internal and external initiation and a programmable relay output shall be available as an integral relay feature.

Time tagged event recording with a 1 ms resolution incremented every millisecond shall be provided, with access via the communication port.

15.7 Transformer standby earth fault protection relay

The relay shall be a modern numerical, self-monitoring instrument utilising programmable scheme logic to provide multiple, independent three-phase and earth fault protection curves. It shall offer a user friendly interface, a display of measured steady state and fault quantities, alternative setting groups, isolated serial communication, remote setting and full interrogation by the substation control system, time tagged event/disturbance recording, plant control capability and start contacts.

The relay shall obtain it's power supply from a dedicated DC Main Trip Supply circuit, and shall function independently of any control IEDs in the bay.

The earth fault elements shall conform to the following :

a) The relays shall contain three independent, single-phase earth fault over-current stages ($I_{o>}$, $I_{o>>}$, $I_{o>>>}$). Measurement shall be based on the Fourier derived value of the power frequency component, with harmonics up to and including the sixth suppressed.
b) The $I_{o>}$ element shall operate when the power frequency component of the current exceeds the set threshold. The time/current characteristic associated with this element must provide a selection of inverse definite minimum time (IDMT) curves or be setable to a fixed (definite) time delay.
c) The $I_{o>>}$ and $I_{o>>>}$ elements shall operate when the power frequency component of the current exceeds the set threshold. The time/current characteristic associated with this element must be setable to a fixed (definite) time delay.

The relay shall be provided with a start function (and programmable relay output) that responds to the current exceeding the $I_{o>}$ thresholds.

The relay shall have programmable output relays that could be allocated to the different relay functions.

The relay shall perform continuous self-monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

An alternative group of settings shall be provided for the earth fault protection functions. The alternative setting group shall be selected by either energising an opto-isolated input assigned to this function, or by a suitable command via the serial communication port of the relay. These inputs shall be energised from an internally generated DC source and must not be affected by induced power frequency AC signals in the wiring.

The relays shall provide and display the following control and measurement features :

a) Measured or derived quantities. When CT ratios are entered into the relay, measured quantities and settings shall be displayed in primary quantities.
b) Circuit breaker maintenance data ie. sum of the square of the fault current interrupted by the circuit breaker for each individual phase and also the number of times the relay has issued a trip command.
c) Fault records such as setting the trip LED and displaying the responsible protection function(s) and fault currents.

Time tagged event recording with a 1 ms resolution incremented every millisecond shall be provided, with access via the communication port.

15.8 Transformer voltage regulating relay

The relay shall be a modern numerical, self-monitoring instrument utilising programmable scheme logic to provide multiple, independently programmable settings for each measuring element and timer. It shall offer a user friendly interface, a display of measured quantities, isolated serial communication, remote setting and full interrogation by the substation control system, time tagged event/disturbance recording, plant control capability and start contacts.

The relay shall obtain it's power supply from a DC Control Supply circuit, and shall function independently of any other control IEDs in the bay.

The relay shall provide the following voltage regulating features:

a) The tap change controller's regulating voltage, deadband, initial activation time delay and inter-tap time delay shall be user setable.
b) Line drop compensation shall be provided which simulates resistive and reactive components of the voltage drop across a feeder.
c) An over-current situation on any or all of the three phases shall be provided to inhibit tap changing (i.e. the device shall provide three phase over-current blocking).
d) Voltage blocking (setable in the range of 70% to 100% of the nominal voltage) shall be provided to inhibit tap change operations.
e) Should a VT failure be detected, the voltage blocking function shall not inhibit tap changing.

The relay shall provide the following supervisory functions:

a) Tap changer position display and control from the front of the unit.
b) User-selectable automatic and manual control of the tap changer, with manual tap changing being possible from the front of the relay and remotely via the communications port.
c) Tap changing in progress shall be clearly indicated on the relay.
d) Tap changer runaway detection to detect incorrect tap changer operation, inhibit further operation and present an alarm.

The relay shall be able to provide the tap position and the transformer voltage as default displays, with preference given to the display of actual primary system voltage values. The type of tap position indication transducer or method must be determined in co-operation with the ICAP equipment and transformer suppliers

The relay shall perform continuous self-monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

Control of the voltage regulating relay shall take place as follows:

a) If the relay is on remote and the transformer bay is switched to remote control mode, the tap position must be selectable from the SMMI or the SCADA, whichever is in control of the substation;
b) If the relay is on remote and the transformer bay is switched to local control mode, the relay must be manually controllable from the bay local position; and
c) If the relay is on auto, the tap position shall be automatically selected by the voltage regulating relay regardless of the substation and bay control mode selected.

15.9 132 kV Inter-trip Send and receive facilities

Inter-tripping shall be facilitated via the digital protection channels, which form a part of the communication equipment specified elsewhere in this Enquiry document.

Provision shall be made on the terminal blocks of each panel for terminating the inter-trip circuit loops to the yard marshalling kiosk and isolator and back to the fibre optic communication equipment panel via the relay panel.

Inter-trip circuits shall be taken through isolating MCBs with auxiliary contacts for control system monitoring.

Where possible the digital current differential relay will be used for the inter-trip send medium via an optic isolated input on the relay. This will serve as a back-up inter-trip, as indicated on the block diagrams.

Two spare normally open contacts shall be provided on the inter-trip send relay, over and above the full relay contact requirement.

A self-resetting auxiliary inter-trip receive relay is used to cross-trip to the two trip circuits. It also provides a contact to the BYC for inter-trip receive indication.

15.10 132 kV synchronising-check relay and busbar voltage imaging

Busbar VT's are not normally provided.

A reflected busbar 3-phase voltage, sourced from incomer line VTs and derived from each bay primary equipment configuration, must be bus-wired through each panel to provide the "running" busbar voltage reference for synchronising.

The reflected busbar voltages must also be used for the measurement and indication on the bus- coupler, bus-section and transformer panels, or other bays where there are no VT's available.

Where required, a synchronising-check relay is to be incorporated, so that connecting-up of two systems through the circuit-breaker may only take place whilst the voltages of the two systems are synchronised or close to synchronism. Provision shall also be made for dead-line and dead busbar charging. The relay shall measure phase angle difference and slip frequency, and shall block for differential voltage above setting.

The synchronising-check scheme shall be designed so as to prevent the circuit-breaker from closing if the operator holds the control switch in the closed position and waits for the synchronising-check relay to operate.

Overriding the relay synchronisation check function shall be performed via a clearly marked push-button mounted on the protection and control panel.

15.11 132 kV Line automatic reclosure

The relay shall be a modern numerical, self-monitoring instrument utilising programmable scheme logic to provide multiple, independent reclose actions. It shall offer a user friendly interface, a display of measured quantities, alternative setting groups, isolated serial communication, remote setting and full interrogation by the substation control system, time tagged event/disturbance recording, plant control capability and start contacts.

The relay shall obtain it’s power supply from a dedicated DC Main Trip Supply circuit, and shall function independently of any control IEDs in the bay. Alternatively, should the relay function be implemented within the BYC, it shall make use of the selected supply provided to the BYC.

The relay shall perform continuing self monitoring. A separate output relay, that has one make and one break contact, shall be provided to indicate both healthy and relay defective conditions.

The relay shall provide the following functions:

a) Four-shot, three phase auto-reclosing with independent control of the time characteristics for each of the different stages of the reclosing cycle.
b) Manual closing of the circuit-breaker shall start the relay reclaim timer, whilst manual tripping shall lock out reclosure. When the line is energised onto a fault the instantaneous protection shall operate and no reclosing shall be initiated.
c) A clearly marked centre-return switch shall be provided on the panel to override the auto-reclosing function.
d) The relay shall take cognisance of the circuit-breaker spring status.
e) The relay shall clearly indicate and communicate the auto-reclose in progress state.

The relay shall have the following time settings:

a)	Close pulse	0,1 to 2 s
b)	Dead time 1	0,25 to 180 s
c)	Dead time 2	1 to 180 s
d)	Dead time 3 and 4	10 to 200 s
e)	Reclaim time	1 to 180 s

An alternative group of settings shall be provided. The alternative setting group shall be selected by either energising an opto-isolated input assigned to this function, or by a suitable command via the serial communication port of the relay. These inputs shall be energised from an internally generated DC source and must not be affected by induced power frequency AC signals in the wiring.

The relay shall clearly indicate whether or not auto-reclosing is enabled, and also indicate when an auto-reclosing cycle is in progress.

Time tagged event recording with a 1 ms resolution incremented every millisecond shall be provided, with access via the communication port.

Auto-reclosing must be inhibited if the bay main protection relay is faulty.

15.12 Pilot-wire biased differential relay

Due to the Municipality's standardisation on the GEC HO4 biased differential "Translay" relay, only these relays will be accepted.

15.13 132 kV Trip Circuit Supervision

Both trip coils and the main and back-up DC trip supplies must be monitored by a relay with the circuit-breaker in the open and the closed position.

Separate supervision relays shall be used for each of the trip circuits, and one of the relays may reside in the bay controller.

The relay must be suitably slugged to prevent false alarming due to voltage dips caused by faults on other circuits, or due to the "change-over" action from one element to the other when a circuit-breaker is tripped.

The relay must operate at ± 40% of rated voltage and reactivate at ± 80% of rated voltage.

Relay internal resistors must be suitably rated for the circuit-breaker trip coils.

15.14 Auxiliary latching and flagging trip relays

These relays shall be of the latching, hand reset type with flag indication.

15.15 Auxiliary relays for inter-tripping

These inter-trip receive relays shall be of the self-resetting type without any flag indication.

16. PROTECTION SCHEMES

This section summarises the composition of each bay's protection scheme. The protection devices referred to below are specified in the previous clause.

16.1 132 kV overhead line bay protection

Refer to the drawing for details regarding this bay's protection scheme.

The main overhead line protection shall be the digital current differential protection relay specified. Circuit-breaker closing shall be inhibited (by the BYC) should the main protection relay fail.

The backup protection shall consist of a combined backup over-current and earth-fault relay, as specified, which shall also fulfil the role of bay standardisation as described.

Supplementary functions to be included are as follows:

a) Trip circuit supervision for both the main and backup circuit-breaker trip circuits, with a software circuit-breaker close control lockout should both circuits be faulty.
b) Busbar voltage imaging.
c) Synchronism checking (only as an option in the price schedule).
d) Automatic reclosing of the circuit-breaker (only as a price option in the price schedule).
e) Breaker fail logic implemented in the backup relay.

16.2 132 kV Bus coupler bay protection

Refer to the drawing for details regarding this bay's protection scheme.

The main and only protection for this bay shall be the combined over-current and earth-fault relay specified, which shall also fulfil the role of bay standardisation as described.

Supplementary functions to be included are as follows:

a) Trip circuit supervision for both the main and backup circuit-breaker trip circuits, with a software circuit-breaker close control lockout should both circuits be faulty.
b) Busbar voltage imaging.
c) Synchronism checking (only as an option in the price schedule).
d) Breaker fail logic implemented in the main relay.

16.3 132/33 & 132/11 kV Transformer bay protection

Refer to the drawings for details regarding this bay's protection scheme.

The first main protection for this bay shall be the combined biased differential and HV and LV restricted earth fault relay specified.

The second main protection consists of the Buchholz trip repeat relay and the transformer tank over-pressure trip repeat relay. This circuit is to obtain its power supply via the DC Backup Supply, and shall also perform cross-tripping as prescribed for the protection relays.

The third main protection consists of the transformer standby earth fault protection relay.

Failure of any main protection relay shall inhibit closure of the transformer HV circuit-breaker.

The backup protection shall consist of a combined backup over-current and earth-fault relay on the transformer HV side, as specified, which shall also fulfil the role of bay standardisation as described.

Supplementary functions to be included are as follows:
a) Trip circuit supervision for both the main and backup circuit-breaker trip circuits, with a software circuit-breaker control lockout should both circuits be faulty.
b) Busbar voltage imaging.
c) Breaker fail logic implemented in the backup relay.

16.4 132 kV busbar protection

The 132 kV busbar protection scheme shall be implemented as described.

16.5 33 kV Transformer incomer protection

Refer to the drawing for details regarding this bay's protection scheme.

The only protection installed in the switchgear instrument cubicle shall be the combined over-current and earth-fault protection relay specified, as well as the auxiliary tripping relays. Circuit-breaker closing shall be inhibited should the protection relay fail. This relay shall also fulfil the role of bay monitoring and control as indicated in the block diagram.

Supplementary functions to be included are as follows:
a) Busbar voltage imaging.
b) Blocking and breaker fail logic (refer to drawing).

16.6 33 kV Overhead line feeder protection

Refer to the drawing for details regarding this bay's protection scheme.

The main feeder protection shall be the Translay HO4 relay specified. Circuit-breaker closing shall not be inhibited (by the BYC) should the main protection relay fail.

The backup protection shall consist of a combined backup over-current and earth-fault relay, as specified, which shall also fulfil the role of bay monitoring and control as indicated in the block diagram.

Supplementary functions to be included are as follows:
a) Busbar voltage imaging.
b) Blocking and breaker fail logic (refer to drawing).

16.7 33 kV Bus section protection

Refer to the drawing for details regarding this bay's protection scheme.

The bus section protection shall consist of a combined backup over-current and earth-fault relay, as specified, which shall also fulfil the role of bay monitoring and control as indicated in the block diagram.

The only supplementary function required is busbar voltage imaging.

16.8 33 kV busbar protection

Refer to the drawing for details regarding this protection scheme.

The functions required in this scheme are as follows:

a) Feeder blocking of transformer 1 and 2 (TX1 & TX2) incomer and the bus section definite time trip outputs via the feeder over-current starter element for feeder faults. Since the intention is to operate the transformers in parallel, the single relay blocking outputs from feeders 1 and 2 should be commoned.
b) The feeder relay shall not block the transformer incomer or bus section for a busbar zone fault, and the bus section definite time will be set lower than the transformer definite time, to allow them to trip in sequence and thus obtain discriminative tripping of the two busbar zones.
c) Immediately upon detection of a feeder breaker fail condition, the feeder relay must remove the blocking signal to enable the bus section and the relevant TX definite time element to trip the bus section circuit-breaker and the correct incoming circuit-breaker.
d) The transformer incomer relay shall, for a definite time over-current trip, trip the circuit-breaker and operate a latching, flagging, hand-reset relay which shall inhibit re-closing of the 11 kV transformer circuit-breaker.
e) The bus section relay shall, for a definite time trip, inhibit re-closing of the bus section circuit-breaker.
f) Should the transformer incomer or bus section relay detect its own breaker fail condition, the 132 kV transformer circuit-breaker should be tripped and operate a latching, flagging, hand-reset relay which shall inhibit closing of the 132 kV transformer circuit-breaker.

16.9 11 kV Transformer incomer protection

Refer to the drawing for details regarding this bay's protection scheme.

The only protection installed in the switchgear instrument cubicle shall be the combined over-current and earth-fault protection relay specified, as well as the auxiliary tripping relays. Circuit-breaker closing via the control system shall be inhibited should the protection relay fail. This relay shall also fulfil the role of bay monitoring and control as indicated in the block diagram.

Supplementary functions to be included are as follows:

a) Busbar voltage imaging.
b) Blocking and breaker fail logic (refer to drawing).

16.10 11 kV Main feeder protection

Refer to the drawing for details regarding this bay's protection scheme.

The main feeder protection shall be the Translay HO4 relay specified. Circuit-breaker closing via the control system shall not be inhibited should the main protection relay fail.

The backup protection shall consist of a combined backup over-current and earth-fault relay, as specified, which shall also fulfil the role of bay monitoring and control as indicated in the block diagram.

Supplementary functions to be included are as follows:

a) Busbar voltage imaging.
b) Blocking and breaker fail logic (refer to drawing).

16.11 11 kV bus coupler protection

No protection functionality is required for the bus coupler. Control of these panels should therefore be implemented with a communicating I/O module as described in the control paragraphs.

16.12 11 kV bus section protection

No protection functionality is required for the bus coupler. Control of these panels should therefore be implemented with a communicating I/O module as described in the control paragraphs.

16.13 11 kV busbar protection

Refer to the drawing for details regarding this protection scheme.

The functions required in this scheme are as follows:

a) Feeder blocking of both transformer A and R incomer (TXA & TXR) definite time trip outputs via the feeder over-current starter element for feeder faults. The outputs shall be separate relay outputs, and each transformer will have a single set of buswires to each relevant panel (i.e. transformer R is connected to all feeders, but transformer A is only connected to section A's feeders).
b) Immediately upon detection of a feeder breaker fail condition, the feeder backup relay must remove the blocking signal to enable the relevant TX definite time element to trip the incoming circuit-breaker.
c) The feeder backup relay shall not block the transformer incomer for a busbar zone fault.
d) The transformer incomer backup relay shall, for a definite time over-current trip, trip the 11 kV circuit-breaker and operate a latching, flagging, hand-reset relay which shall inhibit closing of the transformer 11 kV circuit-breaker.
e) Should the transformer incomer backup relay detect a breaker fail condition, it shall trip the 132 kV transformer circuit-breaker via a latching, flagging, hand-reset relay which shall inhibit closing of the 132 kV transformer circuit-breaker.

17. DEMONSTRATION OF SYSTEM

Tenders must be prepared to arrange a fully working display of the main components of the control and protection equipment to demonstrate the system's functions and capabilities to the client or his representative. This demonstration will take place at the request of the client. Visits to completed, functional substations and meetings with other clients could form a part of the client's inspection.

Time for in-depth, detailed inspection and familiarisation shall be set aside, to allow the client to assess the advantages and limitations of the new concept of highly integrated control and protection systems.

18. SPARES

A comprehensive list of each different part, which could be considered as a possible spare, shall be submitted with the offer, stating descriptions, quantities and prices.

19. INSPECTION AND TESTING

Refer to Part C2.1, Specifications 4, Part 1 for requirements regarding the inspection and testing of equipment and systems.

20. DRAWINGS AND DESCRIPTIVE LITERATURE

Refer to Part C2.1, Specifications (Section 4), Part 1 for requirements regarding the drawings and descriptive literature.

21. INPUTS, OUTPUTS, LOGIC AND EVENT LISTS

Refer to Appendixes for this information.

SECTION 4 : SPECIFICATION

PART 13.1 : AUXILIARY EQUIPMENT: LOW VOLTAGE AC WALL MOUNTED CHANGE-OVER & DISTRIBUTION PANEL

SPECIFICATION N0: LV.01/0-97 – Rev 1

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1. SCOPE

This Specification covers the supply and delivery of wall mounted sheet steel low voltage AC distribution board(s).

2. STANDARDS

The board shall be manufactured to comply with the appropriate requirements laid down in SABS-1180 and the moulded circuit breakers with SABS-156.

3. QUALITY OF MATERIAL AND WORKMANSHIP

All materials used on these boards shall be new, of approved quality and of the class most suitable for the intended use.

Workmanship shall be of the highest standard and shall in all respect be subject to approval by the Engineer.

4. TECHNICAL REQUIREMENTS

4.1 General

The sheet steel board(s) shall be manufactured and fitted in accordance with the following technical requirements.

4.2 Equipment

The board shall be suitable for a 240/415 volt three phase four wire supply system with a short circuit level of 5 kA for 3 seconds. The rating of the busbars and incomer shall be 200 amperes.

The board shall be equipped with the following type and number of miniature type moulded case circuit-breakers to SABS-156 for the outgoing circuits:

a) 4 off triple pole 100 ampere, plus neutral;

b) 4 off triple pole 30 ampere, plus neutral;

c) 1 off single pole 60 ampere, plus neutral;

d) 3 off single pole 30 ampere, plus neutral; and

e) 2 off single pole 5 ampere, plus neutral.

The board shall be equipped with manual supply change-over facilities and the main supply shall be supervised by a time delayed under voltage relay as per drawing C-86 in Section IV.

4.3 Steel Board(s)

The minimum thickness of the sheet steel that the board(s) are to be manufactured from is 2 mm.

Overall dimensions of the panels shall be as follows:

a) Height - 735 mm;

b) Width - 1530 mm; and

c) Depth - ± 365 mm.

Suitable provision shall be made for wall mounting of the board(s).

All surfaces to be painted shall be cleaned completely from rust, scale, grease or other spoil by sandblasting and/or acid pickling prior to painting.

Ferrous parts, shall have an acid phosphate treatment before applying priming coats.

The exterior surfaces of the panels required as detailed in drawing C-86 shall be finished in the colour Cloud Grey - SABS 1091-1975, colour No F48, Munsell Ref.2.5 PB7,5. The interior surfaces shall be finished in a white gloss paint.

4.4 Labelling

The board shall be fitted with main label, circuit labels and danger labels to approval.

Labels shall be made of durable materials to approval. Metal labels where used shall be engraved or etched. Labels made of Trafolite or other similar materials shall have engraved lettering. Dymotape or similar types of labels shall not be used. All labels shall be fixed mechanically.

Refer also to Section III Part 1.4.

4.5 Chop-Over

A change-over (chop-over) contactor arrangement shall be provided to switch between the two 3 phase auxiliary supplies.

The changeover shall be controlled by a setable time delayed under-voltage relay.

The voltage being monitored by the under-voltage relay shall be selectable from the two auxiliary supplies. The under-voltage relay shall be either a 3 phase unit or two single phase units coupled phase to phase on the 3 phase supply to be monitored.

4.6 Drawings

Full drawing inclusive of equipment single line diagrams shall be submitted prior to manufacture for approval.

The quantity and positions of these distribution boards are shown in the building/civil drawings.

SECTION 4: SPECIFICATION
PART 13.2: 110 V BATTERY CHARGER

SPECIFICATION No: Rev 8

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1. SCOPE

This Specification covers silicon-controlled rectifier type battery chargers suitable for charging battery's from a nominal 400/230 V 50 Hz alternating current supply, and includes a battery management system. The charger shall be voltage controlled and current limiting.

The size of the battery charger shall be calculated by the Tenderer, who shall state in detail how the figure was derived. He shall take into account the normal static load of the protection and any other devices as well as the UPS (if applicable).

If called for in the schedule of Particulars and Guarantees, this Specification also covers the associated DC distribution board(s), complete with the busbars, switchgear, relays, alarm and indication equipment to be housed with the charger unit.

2. STANDARDS

The battery charger(s) and associated equipment to be supplied against this Specification shall comply fully with the requirements thereof, the particulars and guarantees stated by the tenderer in the Schedule of Particulars and Guarantees and the relevant requirements in the latest edition of the following standard specification :

a) NRS 026:1993 Battery charger - industrial type.

3. GENERAL

The station battery is required for permanent indoor installation at an unmanned substation to provide DC power supplies for:

a) continuous and intermittent relay energising;

b) continuous and intermittent alarm and position indication signalling;

c) intermittent operation of tripping coils and contactors;

d) intermittent operation of closing coils and contactors;

e) intermittent energising of control circuits and interlocking circuits;

f) continuous supervision of control and protection circuits;

g) intermittent operation of motor - driven isolators and transformer tap changers;

h) operation of emergency lights; and

i) stand-by duties such as emergency operation of solenoid - operated switchgear.

Reliability of operation and full availability on demand at any time are of the utmost importance. The battery equipment shall operate unattended between scheduled maintenance intervals over a lifetime of at least 20 years.

4. BATTERY CHARGER

4.1 AC Supply

The battery charger may be fed off overhead lines which are exposed to severe lightning and switching surges.

A pilot light shall be provided on the charger to indicate when the AC supply to the charger is switched on. The pilot light shall preferably be of the LED type.

4.2 Battery Charger Requirements

The battery charger to be supplied with each complete battery. Solid state micro processor controlled will be acceptable. Tenderers shall give full details of the unit offered.

To facilitate equalising charging after a prolonged AC mains supply failure or charger failure the charger shall be fitted with boost charging facilities which must be both manually initiated and automatically controlled either by means of a timer or other suitable control circuitry. To prevent unauthorised operation of boost charging the initiating device shall be concealed or shall be lockable. After elapse of the set boost charging time, the charger shall revert back to trickle float charging automatically. Boost charging must also have the facility to be able to be initiated externally via the SCADA. system.

4.3 Battery Management System

A battery management system shall provide the following :

a) Independent battery charging management;

b) control operator intervention;

c) charger boost control via SCADA and local controls;

d) comprehensive alarm systems;

e) charge currents from 5 amps to 500 amps;

f) indication of DC and AC voltages and current;

g) plug-in system;

h) separate power supply has dual AC and DC input;

i) continual battery monitoring after power failure;

j) automatic calculation of AH capacity;

k) controls two parallel chargers and loads; and

l) charger protection.

Protection shall be achieved by a double pole moulded case circuit-breaker. In the case of 3-phase units, triple pole breakers shall be used. All circuit breakers shall be equipped with auxiliary contacts for alarm indication.

The charger shall be self-protecting against overload and external faults to the extent that accidental short circuiting of the charger output terminals will not cause any damage to the charger. Current limiting in addition to protection devices such as breakers is preferred.

A device shall be provided on the DC side of the charger to prevent the battery from discharging into the internal circuits of the charger in the event of failure of the DC output of the charger.

5. CHARGER CUBICLE

5.1 Construction

Approved vermin-proof ventilation shall be provided at or near the top and bottom of the enclosure.

Combustible or flammable materials shall not be used in the construction of the enclosure excluding painting.

All cubicles shall be arranged for front access. Front access shall be by means of stiff side-hinged, lift-off doors which shall be lockable. In the case of a door, the door handle shall not stand proud of the cubicle.

Cubicles shall be spacious enough to permit full and easy access to all terminals and equipment mounted in the cubicle. However the overall dimensions of any cubicle shall not exceed the following limiting dimensions :

a) Overall height 1 950 mm;

b) overall length (dual chargers) 1 200 mm; and

c) overall depth 600 mm.

All cubicles shall be provided with a brass earth terminal stud not less than 10 mm in diameter for earthing the cubicle.

5.2 Cable Gland Plate

The charger cubicle shall be arranged for bottom cable entry bearing in mind that a large number of cables are to be terminated. Suitable, removable gland plates of acceptable dimensions and located in approved positions shall be provided for glanding of incoming and outgoing cables. The gland plate shall consist of at least five removable sections mounted at 300 mm height from the ground, shall be freely accessible and no equipment shall be mounted within a distance of 300 mm above the gland plates in order to facilitate drilling of gland holes on site. Gland plates shall be left unpunched and the minimum thickness of the gland plates shall be 2,5 mm.

5.3 Earth Arrangements

All potential free metal parts in the charger shall be earthed to the cubicle which in turn shall be earthed to the substation earth for which purpose an earthing stud is to be provided in the cubicle.

The metal screen between the primary and secondary windings of the rectifier transformer shall be earthed directly to the earthing terminal.

6. DC DISTRIBUTION BOARD

DC distribution board(s) incorporating the change over switch equipped with the necessary busbars, busbar connections, DC circuit-breakers , cable terminal blocks, labels and warning notices shall be provided for the distribution of the output of the battery/charger unit. The distribution board shall be of the totally enclosed type with front access by means of side-hinged, lift-off doors. The busbars and all "live" terminals shall be covered by a removable front cover plate to prevent accidental contact when doing switching.

The DC distribution board(s) shall not be incorporated in the charger cubicle but be separate, to be installed on a wall at 1.6 metres above ground level.

Cubicles shall be spacious enough to permit full and easy access to all terminals and equipment mounted in the cubicle. However the overall dimensions of any cubicle shall not exceed the following limiting dimensions :

a)	Overall height	600 mm;
b)	overall length (dual chargers)	1 500 mm; and
c)	overall depth	300 mm.

All cubicles shall be provided with a brass earth terminal stud not less than 10 mm in diameter for earthing the cubicle.

Provision shall be made to isolate the DC distribution board(s) from the battery/charger unit(s) by means of a double pole moulded case DC circuit-breaker(s) of appropriate rating which will be installed between the selector switch and the outgoing DC circuit breakers.

The DC board(s) shall be provided with the number of outlet circuits specified in the Schedule of Particulars and Guarantees. Each outlet circuit shall be protected by a double pole, miniature type moulded case circuit-breaker of the specified rating, with auxiliary contacts for alarm indication, as called for in the Schedule of Particulars and Guarantees.

Moulded case circuit-breakers shall comply with SABS 156.

6.1 Manual Change-Over Selector Switch

Manual change-over selector switch for dual charger and dual distribution board shall be of the base mounted type.

A separate distribution board shall be equipped with a manually operated change-over selector switch which shall be arranged to facilitate the following switching:

a) Left hand position one; - DB one and DB two connected to charger one and battery

b) centre position two - DB one connected to charger one and battery one and DB connected to charger two and battery two; and

c) right hand position two. - DB one and DB two connected to charger two and battery

A three position switch, three ways without an "off" position shall be provided. Since both the positives and negatives of charger one and charger two distribution boards are to be switched simultaneously a 4-pole switch is required. This 4-pole switch must be “make before break “ with diodes to prevent any voltage surges or dips during the changeover as well as any possible backfeeds.

Manual change-over selector for dual charger and single distribution board.

A separate distribution board shall be equipped with a manually operated change-over selector switch which shall be arranged to facilitate the following switching:

a) Left hand position - DB connected to charger one and battery one; and

b) right hand position - DB connected to charger two and battery two.

A two position switch, two ways without an "off" position shall be provided. Since both the positives and negatives of charger one and charger two are to be switched simultaneously a 2-pole switch is required. This 2-pole switch must be “make before break “ with diodes to prevent any voltage surges or dips during the changeover as well as any possible backfeeds.

The change-over selector switch shall be an air-break, on-load switch complying with the requirements of SABS 152. The switch chamber shall have a continuous load current and thermal current rating not less than 100 A at 250 V. The switch shall be rated for uninterrupted duty and for utilisation category DC - 22 in terms of SABS 152.

The switch shall be rated for an operating voltage no less than 250 V.

The wiring of the selector switch shall be as shown on the single line diagram issued with the enquiry. The switch shall be mounted at the top, in the centre of the distribution board's front panel (viewed from the front).

The selector switch shall be of the spring assisted type, shall change over by snap action and shall be arranged for independent manual operation. The switch shall preferably be of the rotating type and shall have wiping (make before break) type contacts. Plain contacts will not be acceptable.

The selector switch shall be fitted with bolted type terminals suitable for accommodating 25 mm² cable lugs. Terminal bolts shall be M16 minimum.

The change-over selector switch shall be fitted with a suitable and robust operating lever or handle preferably of the lever type equipped with padlocking facilities in each position. The coupling of fixing of the handle to the operating shaft shall be to approval.

Labels shall be in accordance with Clause 6.3.

6.2 Wiring, Terminals, Ferrules

Wiring shall be colour coded and ferrule marked in accordance with NRS 003-1:1994 and such ferrule marking as may be shown on schematic diagrams that may be issued with the enquiry. For identification purposes identical ferrule markers of approved type shall be fitted to both ends of each wire. Ferrule markers shall be of a durable insulating material having a reasonable glossy finish to prevent the adhesion of dirt. Ferrule markers shall be marked clearly and permanently and shall not be affected by moisture, heat or battery acid. Unless otherwise approved, ferrule markers shall be white with black lettering.

All wiring shall be taken to terminals and wires shall not be jointed or teed between terminal points. Terminals shall be of the insertion double ended pinch bar type. Terminals shall be suitable to accommodate at least two 4 mm² wires but not more that two wires shall be connected to an end of an insertion type terminal. Unless terminals are of the fully insulated type, suitable insulating barriers shall be provided between terminals. Terminal strips shall be

suitably labelled and terminals shall be numbered to facilitate identification. All terminal strips shall have a minimum of 20% spare terminals.

6.3 Labels and Designation Plates

Labels shall preferably have black lettering on a white background but danger plates and warnings shall have red lettering on a white background.

Suitable notices warning against malpractices such as incorrect operation of equipment, or any practice which may endanger the safety of the operator or other personnel, shall be provided when and as required. Such notices shall be to the approval of the Engineer in all respects.

Letter types and sizes for all labels shall be to approval.

Sufficient blank labels of the same type and size as that fitted on the board shall be supplied with the board for those positions where spare space for future possible circuit-breakers have been called for.

In addition to a designation label for the change-over switch, the switch shall be equipped with labels corresponding to the switch positions tabulated below.

Manual change-over selector switch for dual charger and dual distribution boards :

POSITION OF SWITCH	LABEL INSCRIPTION
Left-hand	DB one and DB two connected to charger one and battery one.
Centre	DB one connected to charger one and battery one. DB two connected to charger two and battery two
Right-hand	DB one and DB two connected to charger two and battery two.

Manual change-over selector switch for dual charger and single distribution board :

POSITION OF SWITCH	LABEL INSCRIPTION
Left-hand	DB connected to charger one and battery one
Right-hand	DB connected to charger two and battery one

7. INSPECTION AND TESTING

The City Electrical Engineer or his representative shall have access to the manufacturer's premises at all reasonable times, and shall have the power to inspect and examine the materials and workmanship of the equipment during its manufacture there.

If the manufacturing of the equipment or part thereof takes place on other premises, the successful Tenderer shall obtain permission for inspection as per the foregoing paragraph.

The successful Tenderer shall give at least seven (7) days notice to the Engineer of any material being ready for testing in order that he may be present, or arrange with his representative to be present, if he so desires.

No inspection or passing by the Engineer or his representative shall relieve the Contractor from his contractual obligations or exonerate him from any of his guarantees.

8. TESTS AND TEST CERTIFICATES

8.1 Routine Tests

Tests shall be carried out to prove the operation of the alarms and to determine current drain of alarm relays.

Voltage insulation test on transformer and wiring.

Measuring of output ripple voltage.

9. MANUALS AND DRAWINGS

Refer to Section 4 Part 1.4.

SECTION 4: SPECIFICATION

PART 13.3: 110V BATTERIES & BATTERY STANDS

SPECIFICATION No: Rev 8

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1. SCOPE

This Specification covers a rechargeable station storage battery composed of series connected secondary cells (accumulators) of the lead-acid type having the voltage rating(s) called for in the Schedule of Particulars and Guarantees. The Specification includes inter-cell connections, hardware and battery stand.

The size of the battery shall be calculated by the Tenderer, who shall state in detail how the figure was derived. He shall take into account the normal static load of the protection and any other devices as well as the UPS (if applicable). The battery shall be dimensioned to give satisfactory service for 8 hours supply failure.

See also Part 5.1 for further details of the battery chargers.

2. STANDARDS

The battery, and associated equipment to be supplied against this Specification shall comply fully with the requirements thereof, the particulars and guarantees stated by the Tenderer in the Schedule of Particulars and Guarantees and the relevant requirements in the latest editions of the following standard specifications:

a) SABS 1632 Vented - type lead acid cells and batteries.

3. GENERAL

The station battery is required for permanent indoor installation at an unmanned substation to provide DC power supplies for:

a) continuous and intermittent relay energizing;

b) continuous and intermittent alarm and position indication signalling;

c) intermittent operation of tripping coils and contactors;

d) intermittent operation of closing coils and contactors;

e) intermittent energizing of control circuits and interlocking circuits;

f) continuous supervision of control and protection circuits;

g) intermittent operation of motor-driven isolators and transformer tap changers;

h) operation of emergency lights;

i) stand-by duties such as emergency operation of solenoid-operated switchgear; and

j) continuous running of UPS for the MMI.

Reliability of operation and full availability on demand at any time are of the utmost importance. The battery equipment shall operate unattended between scheduled maintenance intervals over a lifetime of at least 20 years.

Provision is usually made for the battery to be installed in a separate battery room on a special stand. Particulars of the actual arrangement to be supplied under this contract is given in the Schedule of Particulars and Guarantees.

4. BATTERY

4.1 Battery Cells

Batteries shall be of the lead-acid low-maintenance type designed for use in substations over long periods. The Tenderer shall state what type of battery cell he is proposing, and what the expected life of a properly-maintained battery would be. The Tenderer shall further give details of the type of battery cell proposed.

Battery cells shall be housed in tough, transparent plastic or glass containers. The Tenderer shall state what material the housings are made of.

All cells shall be supplied complete with electrolyte in a fully-charged condition. The exterior parts of every cell shall be clean, dry and free from contamination. The supplier shall take the necessary precautions to prevent spillage of electrolyte or cell discharge during transit.

Each cell shall bear the manufacturer's name or trade-mark and the type number. In addition, every cell shall be marked permanently with an identification number for record purposes. The cells in each individual battery shall be numbered consecutively starting with No 1 at the positive end. Identification marking of cells shall be to the approval of the Engineer.

The bank of battery cells shall be earthed in the centre. The poles of the battery shall not be earthed.

4.2 Battery Voltage

Throughout the lifetime of the battery the efficiency of a discharge - recharge cycle of the battery shall not fall below the following values:

a) Ampere-hour efficiency 90%; and

b) Watt-hour efficiency 75%.

4.3 Inter-cell Connections and Terminals

Inter-cell connections shall preferably be flexible to some degree to prevent stress on cell terminals. Tenderers shall state how this is achieved.

All batteries shall be supplied complete with all necessary inter-cell connections and with the necessary main terminal connections. Tenderers shall submit their recommendations for connecting up separately-mounted batteries with their respective chargers and shall quote for the supply of such connecting up equipment.

All inter-cell connections and main terminal connections shall be of the bolted type. Inter-cell connections shall be designed for low contact resistance throughout the lifetime of the battery. Unless otherwise agreed bolts and nuts used for inter-cell connections and terminal connections shall be made of lead, cadmium-plated phosphor bronze or stainless steel, and shall be free of anti-corrosive lubricants. Only flat washers shall be used.

4.4 Battery Accessories

Each individual battery shall be supplied complete with the following accessories or as detailed in the attached schedule of Particulars and Guarantees:

a) One syringe type hydrometer with a specific gravity scale range of approximately 1,100 to 1,300;

b) one electrolyte thermometer with a range of approximately 0 ºC to 40 ºC; and

c) one cell bridging connector.

The price of the above accessories shall be included in the price of each complete battery.

5. BATTERY STAND

Battery stands shall be freestanding and be of strong, rigid and robust construction and suitable in every way for the lifetime support of the battery.

The battery cells shall be accessible from all sides, and not be mounted against a wall. It shall be possible to walk around the battery to have access to all cells.

Unless otherwise approved, battery stands shall be constructed of plastic sections. All joints, voids and crevices shall be filled properly to prevent the ingress of electrolyte.

Maximum overall length of stand (regardless of single tier) single row or (double tier) double row shall not exceed 2 327 mm.

Maximum overall height of double tier stand (excluding height of top tier batteries) not to exceed 1 250 mm.

Maximum overall width of single row stand not to exceed 400 mm.

Maximum overall width of double row stand not to exceed 850 mm.

Minimum clearance between the top of cells in bottom tier and the underside of the lowest support in tier above, shall not be less than 400 mm.

Minimum height to the top of the bottom support from floor level shall not be less than 100 mm.

Double row stands shall either be level or terraced type as called for in the Schedule of Particulars and Guarantees. In the case of terraced type stands the difference in support levels between the front and rear row shall not be less than 100 mm and shall not exceed the height of a cell. The top of the battery shall not be higher than 1 500 mm. It shall in all cases be possible to see the whole end view of each battery cell so that any sediment will be clearly visible.

6. INSPECTION AND TESTING

The City Electrical Engineer or his representative shall have access to the manufacturer's premises at all reasonable times, and shall have the power to inspect and examine the materials and workmanship of the equipment during its manufacture there.

If the manufacturing of the equipment or part thereof takes place on other premises, the successful Tenderer shall obtain permission for inspection as per the foregoing paragraph.

The successful Tenderer shall give at least seven (7) days notice to the Engineer of any material being ready for testing in order that he may be present, or arrange with his representative to be present, if he so desires.

No inspection or passing by the Engineer or his representative shall relieve the Contractor from his contractual obligations or exonerate him from any of his guarantees.

7. TESTS AND TEST CERTIFICATES

a) Tests to be certified

The equipment to be supplied shall successfully pass the following tests and/or shall be certified to have been successfully type tested in accordance with the specified requirements in the relevant test certificates:

a) Battery load test after installation;

b) capacity test;

c) suitability for floating battery operation;

d) endurance discharge cycle test;

e) charge retention test; and

f) short-circuit current test.

SECTION 4: SPECIFICATION

PART 14.1: BUILDING & CIVIL WORKS

SPECIFICATION No: /1-98/Z – Rev 8

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1. SCOPE

A separate standard specification for Municipal Civil Engineering Works second eddition 1991 is part of this specification.

Tenderers must ensure that they are in possession of such a Specification.

2. GENERAL

All building works form an integral part of this contract, including the supply, cartage and off-loading of all materials, as well as subsequent clean up of the site.

Soil condition: All excavations for tender purposes must be based on using a TLB for excavations. Pickable and Intermediate soil will fall in this category.

Contractors will be permitted to use Sub-Contractors specialised in this field for the execution of this part of the works. A list of proposed sub-contractors shall be submitted with the Tender. The final list shall be approved by the Engineer.

The Builder employed for construction of the switch room, shall have demonstrated his ability in the field of substation buildings in addition to domestic buildings.

2.1 Extension of Time due to Abnormal Rainfall

Extension of time due to abnormal rainfall shall be determined by means of Method 1, if rainfall records and/or values derived from rainfall records are supplied in TABLE 1 : below.

2.1.1 Method 1 : Rainfall Formula Method

The rainfall records and/or values derived from rainfall records (TABLE 1:), from a suitable rainfall station near the Site, shall be considered suitable for the determination of extension of time due to abnormal rainfall in accordance with this method.

Extension of time arising from abnormal rainfall, shall be calculated separately for each calender month or part thereof, for the full period of completion of the Contract, including any extension thereof, in accordance with the rainfall formula given below.:

$V = (Nw - Nn) + (Rw - Rn) / x$

If V is negative and its absolute value exceeds Nn, then V shall be taken as equal to minus Nn.

If V is positive and greater than the number of calender days in the calender month under consideration, V shall be taken as equal to the number of calender days in the relevant calender month.

The symbols shall have the following meanings:

V	=	extension of time in calendar days in respect of the calendar month under consideration.
Nw	=	actual number of days during the calendar month on which a rainfall of Y mm or more has been recorded.
Rw	=	actual rainfall in mm for the calendar month under consideration.
Nn	=	average number of days as derived from existing rainfall records, on which a rainfall of Y mm or more has been recorded for the calendar month.
Rn	=	average rainfall in mm for the calendar month, as derived from existing rainfall records.
X	=	20, unless otherwise provided.
Y	=	10, unless otherwise provided.

The total extension of time shall be the algebraic sum or the monthly totals for the period under consideration. However, if the grand total is negative, the time for completion shall not be reduced on account of abnormal rainfall. Extension of time for parts of a month shall be calculated by pro rata values of Nn and Rn being used.

The factor (Nw - Nn) shall be considered to represent a fair allowance for variations from the average number of days during which rainfall exceeds Y mm and wet conditions prevented or disrupted work.

The factor (Rw - Rn) / x shall be considered to represent a fair allowance for variations from the average number of days when wet conditions further to that allowed for by the factor (Nw - Nn), prevented or disrupted work during the calendar moth.

Accurate rain gaugings shall be taken at a suitable point on Site and the Contractor shall, at his own expense, take all necessary precautions to ensure that the rain gauges cannot be interfered with.

This formula does not take into account further or concurrent delays which could be caused by other abnormal climatic conditions such as floods which have to be determined separately.

TABLE 1 : Rainfall data available :

Rainfall Station : De Wildt

MONTH	Rn (mm)	Nn (days)
January	88.7	3.3
February	102.1	3.3
March	107	3.5
April	40.5	1.1
May	19.3	0.4
June	5.3	0.1
July	1.5	0.1
August	1.9	0.1
September	19.1	0.6
October	60.3	2
November	88.1	3
December	90.9	3.7
Yearly Average	52.1	1.8

2.2 Water Supply

No provision of site domestic water and fire hydrant services will be made. At the site the Contractor will supply and erect 2500 litre water tank with a 6 meter stand.

2.3 Domestic Main Valve

A 20 mm main valve shall be located externally at 600 mm above ground level on the wall of the building at each site. It shall be a cast brass full way to SABS 776, Class 6 with non rising spindle and female ends.

3. STORM WATER

The design and installation of a storm water and erosion protection scheme form part of this.

4. MISCELLANEOUS ITEMS

4.1 Danger notices

Supply and fix in position to be pointed out on side, the following notices required in terms of the Regulations to the Occupational Health and Safety Act, 1993

a) Notice prohibiting unauthorised persons for entering the substation.

b) Notice prohibiting any unauthorised persons from handling or interfering with electrical apparatus;

c) Notice containing directions as to procedure in case of fire;

d) Notice containing directions as to resuscitation of persons suffering from the effects of electric shocks.

The above notice shall be combined and applied by painting to a single steel sheet.

4.2 Fire Extinguisher

Supply and secure in position, three 9 kg Dry Chemical Power type fire extinguishers, complete with polyurethane treated meranti base boards and all fittings at each of the three sites.

These units shall comply with SABS 810 : 197

5. SOIL POISONING

Allow for soil poisoning over the whole site before the 100 mm stone cover is applied having first removed all weeds, grasses and roots of whatever undergrowth exists on the site, all in accordance with SABS 0124. Soil insecticides shall comply with SABS 1164 and 1165.

6. CONCRETE

6.1 Trenches (In Switchyard)

All cable trenches shall be constructed as shown on the drawings.

6.2 Equipment Foundations

Transformer and NEC plinths shall be cast in situ to dimensions stated on the relevant drawing.

Foundations for equipment supporting structures, line termination and support structures shall be located by the Contractor to suit his equipment. The drawings only show typical arrangement for measuring purposes. All foundations (other than transformer and NEC plinths) shall be constructed with the top surface 75 mm clear of the stone layer with all edges bevelled to 40 mm. All equipment foundations throughout the site shall finish on the same level on any one platform.

The exposed surfaces of all cast concrete plinths shall be smooth and without any exposed aggregate.

The design of foundations for equipment and supporting structures shall be undertaken by a Professional Engineer whose services shall be retained by the Contractor at his own expense. The calculations shall be made available to the Engineer and approved by him before any work is done on site.

7. EXTERNAL WORKS

All external works of a civil nature are included in this contract, including the supply, cartage and off-loading of all materials.

Contractors will be permitted to use Sub-Contractors specialized in this field for the execution of this work.

Only experienced Sub-Contractors will be permitted to undertake this work. The quality of all civil works shall conform to accepted good practice and shall follow the Code of Practice applicable, and will be subject to inspection by the Engineer.

The Engineer will have the right to refuse the employment by the Contractor of any Sub-Contractor who, in his own opinion is incompetent or inexperienced for the kind of work he is called upon to perform.

8. SITE CLEARANCE

Remove all grass, weeds, undergrowth of whatever nature, level all humps and knolls, fill all hollows, remove all boulders, stones and other obstructive protrusions to form a flat area across the whole site, though not necessarily horizontal.

Throughout the contract period, the site shall be kept free of weeds and grass. On completion of the site works when the contract is at an end, the whole area shall be poisoned and thereafter the 100 mm stone cover applied.

9. FENCING

9.1 Perimeter Fence and Gates

Construction of the entire perimeter fence and gates, as per drawings (C-1007, C-1008), forms part of this contract, and shall be to the Engineers approval.

The fence and gates shall be erected as soon as the grading operations are complete, and shall be used to safeguard the site against entry of unauthorized persons.

Security of the site throughout the contract period is the Contractor's responsibility. To this end it would be in the Contractor's best interest to have an electricity supply made available as early as possible for security lighting. The cost will be for the Contractor's account.

The early erection of the fencing will not relieve the Contractor of the guarantee on the fencing which will only commence when first delivery is taken of the whole installation.

SECTION 4: SPECIFICATION

PART 14.2: STONE SURFACING OF YARD

SPECIFICATION NO: Rev 1

1. SCOPE

This specification covers the requirements for the stone surfacing of the yard.

2. INTERPRETATIONS

2.1 Supporting Specifications

The stone surfacing shall be constructed in accordance with:

a) SANS 1083-1976. Table 7 single sized crushed stone for Roads.
See table on page 2

b) This specification

3. MATERIALS

3.1 Stone

Stone shall be clean, hard, durable and sound crushed stone of 26,5mm nominal size, approved by the Project Manager and details of the stone being offered shall be submitted timeously. The stone shall be of norite, granite, quartzite, dolomite or any other approved igneous rock. Sandstone or furnace slag will not be acceptable

Samples of the stone shall be submitted in good time to the Engineer for approval and no stone, other than the samples, shall be delivered to the site before the Engineer's written approval has been obtained.

3.2 Weedkiller

Weedkiller shall be in accordance with the terms of clause 5.3.

4. CONTRACTOR'S EQUIPMENT

The Contractor shall ensure the provision of suitable construction equipment for the construction of the stone surfacing in compliance with the requirements of the specification.

5. CONSTRUCTION

5.1 Surface Preparation

After the completion of the earthworks and just before the application of the stone surfacing the Contractor shall clear the area of all vegetable growth and ensure that the underlying wearing course layer is compacted to 93% Mod AASHTO density.

5.2 Laying of Stone

The stone shall be spread over the compacted surface of the yard, levelled and lightly rolled to a finished thickness of 100 mm or as otherwise specified on the drawings.

5.3 Weed Killer

A granular or liquid weedkiller suitable for the soil to be treated, the climate and the general site conditions shall be applied before or after the spreading of the stone surface.

Choice and application of the weedkiller to be used shall be carried out only by a pest control operator with a current registration certificate covering the field of weed control, issued in terms of Government Notice R1 449 dated 1 July 1983.

The application of weedkiller shall be guaranteed by the Contractor to provide a 95% effective control of growth of all types of vegetation for a period of 2 years from the date of application.

Any growth, in excess of 5% of the area treated, which occurs within the guarantee period shall be removed and re-treated at the Contractor's expense.

The Contractor shall exercise due care while applying the weedkiller to ensure that vegetation, animals or persons on areas adjoining the site are not affected by movement of the weedkiller through wind, rain or transport by water. He shall be responsible for any claim which may be made by adjoining property owners for damages resulting from his activities.

6. TOLERANCES

The average finished thickness of the stone layer shall be at least 100 mm or as otherwise specified on the drawings, and nowhere shall the finished thickness be less than 15 mm less than the specified average finished thickness.

7. TESTING

Not applicable.

8. MEASUREMENT AND PAYMENT

The rates as scheduled in the Bill of Quantities shall cover the cost of all activities, labour, materials and testing required for the provision of the relative item in accordance with the drawings and specification.

SANS 1083-1976

TABLE 7- SINGLE-SIZED CRUSHED STONE FOR ROADS

1	2	3	**4**	5	6	7	8	9
Property	Requirements - Nominal size of stone, mm							
Grading, %(m/m) of material passing Sieves of nominal aperturesize, mm	53,0	37,5	**26,5**	19,0	13,2	9,5	6,7	4,75
75.0	100							
53.0	85-100	100						
37.5	0-30	85-100	**100**					
26.5	0-5	0-30	**85-100**	100				
19.0		0-5	**0-30**	85-100	100			
16.0				0-30	100			
13.2			**0-5**		85-100	100		
9.5				0-5	0-30	85-100	100	
6.7					0-5	0-30	85-100	100
4.75						0-5	0-30	85-100
3.35							0-5	0-30
2.36								0-5

SECTION 4: SPECIFICATION

PART 15.1: ELECTRICAL INSTALLATION OF SUBSTATION BUILDING, YARD LIGHTNING & LIGHTNING PROTECTION

SPECIFICATION No: EI.01/0-97 – Rev 4

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1. SCOPE

This specification covers the supply, delivery, installation, testing, commissioning, handing over and a limited period of maintenance of the hereunder mentioned, in accordance with the specification and schedules of particulars and guarantees.

The complete conduit, wiring and accessories for the lighting and small power installation as indicated on the drawings.

The semi-recessed distribution board.

The lighting luminaires complete with lamps as specified.

The extractor fan.

Yard lighting.

Lightning Protection.

2. APPLICABLE STANDARDS

The complete electrical installation in the Pretoria City Council's substation buildings shall be carried out in accordance with the SABS Code of Practice for the Wiring of Premises number 0142 as amended and the requirements of the specification and shall be to the complete satisfaction of the Supply Authority and the City Council's Electrical Inspector.

The arrangement of supply authorities tests and any financial implications thereto shall be the responsibility of the electrical Sub-Contractor.

Due allowance shall be deemed to have been made in the price Schedules for these costs.

3. BUILDERS WORK

The main building Contractor shall be responsible for the supply and installation of all sleeve pipes required. The "chasing in" of conduits, droppers, etc., shall be the responsibility of the electrical Contractor. The builder shall provide an opening for the battery room extractor fan of 400 mm wide by 400 mm high.

4. CONDUIT AND CONDUIT ACCESSORIES

Conduits used in the execution of this contract shall be of the steel screwed or PVC type, concealed in concrete and brickwork. Conduit and Conduit Accessories shall comply with the relevant SABS Standards.

5. CONDUCTORS AND CABLES

Conductors and cables shall be of the stranded-copper PVC insulated type in accordance with SABS 150 as amended.

The wiring shall be installed using the "Looping In" system. The use of connectors, etc, in conduit boxes will not be accepted.

6. LIGHTING OUTLET POINTS AND FITTINGS

Lighting outlet points shall be installed in the positions indicated on the drawings.

Lighting circuits shall be wired by means of 1,5 mm PVC insulated conductors in 20 mm dia conduit, unless otherwise indicated or approved.

Lighting switches shall be equal and similar to those manufactured by either "MK" or "Litemaster" masterlite range. They shall be suitable for fitting into standard conduit boxes, and shall be fitted with piano type toggles and ivory steel cover plates.

The electrical connection into the totally enclosed surface mounted flameproof fluorescent luminaire in the battery room shall be from the end of the luminaire only. This connection shall comprise three PVC conductors, live, neutral and earth, contained 20 mm corrosion resistant flexible conduit.

No switches shall be allowed in the battery room, but shall be mounted outside the door to the satisfaction of the Engineer.

Luminaires shall be similar or of equal and approved type and manufactured to those specified and shall include all lamps and fluorescent tubes. Incandescent luminaires shall have ES type lamp holders unless otherwise specified. Ballasts shall carry the SABS mark. Luminaires shall be fixed to ceilings and walls by approved methods. Fluorescent lamps shall be cool white in colour. The complete luminaires shall be suitable for operation at a voltage of 240 V.

7. DESCRIPTION OF LUMINAIRES

Type A : Two tube, 26.5 watt, LED 4ft out put 5800 lumen(lm)

The surface mounted double tube industrial type luminaire shall be complete with two 26.5 watt LED lamps, switch start control gear, internal wiring and positive type lamp holders.

Type B : 15 watt, Class 1, Division 1, LED

The luminaire shall be manufactured to comply with the SABS specification No 1031-1976 (Class 1, Division 1) for use in explosive gas atmospheres.

Type C : Bulkhead fitting.15watt Led

The fitting shall be of the bulkhead polycarbonate bowl, dust-proof and watertight type complete with a 15 Watt, LED. The fitting shall be suitable for ceiling or wall mounting in either the vertical or horizontal position. All internal wiring shall be insulated by heat resisting silicone insulation with fibreglass sleeving

Type D : 215W, LED floodlight with a light output of 32076(lm) and driving current of 700mA,

8. SWITCHED SOCKET OUTLET POINTS

Flush mounted, three pin, 16 ampere rated, switch socket outlet points shall be installed in the positions indicated on the drawings.

Switched socket outlet circuits shall be wired by means of 2,5 mm^2 PVC insulated conductors and a 2,5 mm^2 PVC copper earth conductor in 20 mm diameter conduit. Switch socket outlet points mounted directly in walls shall be suitable for mounting in 100 mm x 100 mm x 50 mm deep standard plug boxes. They shall be mounted above the work tops of desks, counters and work benches and at a height of 1 400mm above finished floor level.

Switch socket outlet points shall be rated for 16 amperes at 240 volts. They shall be fitted with piano type toggles and ivory steel cover plates and shall be equal and similar to those manufactured by either "MK" or "Litemaster" masterlite range.

9. EXTRACTOR FAN

The Contractor shall supply and install a 240 mm diameter built-in wall extractor fan in the battery room.

The fan shall be explosion proof and equal to the "Woods G.P." type. It shall be completed with diaphragm plate, wire guard and louver shutters to fit the 400 x 400 mm opening, and shall be

to approval.

The fan shall be of the continuous running type. The connection into the fan shall be by 3 - 1,5 mm^2 PVC conductors in a 20 mm dia. weather proof flexible conduit from dome lid fitted into a flush mounted circular conduit box directly above the fan.

10. EARTHING

The Contractor shall be responsible for the earthing of all outlet and switch points, steel ceilings, roof, roof gutters and down pipes where necessary to comply with the requirements of the Code of Practise.

11. INCOMING POWER SUPPLY

The incoming power supply, main switchboard, and the power cables between the main switchboard and the small power and lighting distribution boards shall be supplied and installed under a separate main installation contract.

12. EARTH LEAKAGE UNITS

Earth leakage units shall comply with SABS 767 of 1964 as amended. Unless shown otherwise on drawings, the moulded case units shall have a fixed sensitivity of 30 mA and be complete with integral test button.

13. MINIATURE CIRCUIT-BREAKERS

Where miniature circuit-breakers are specified, these shall be fully in accordance with SABS 156-1964 for lighting, heating and domestic purposes.

14. DISTRIBUTION BOARDS

All boards shall be commercially manufactured and assembled in metal enclosures arranged for semi-flush mounting on walls. Each wall mounted board shall be mounted at a height of 1,5 m measured from the floor to the bottom edge of the enclosure, unless otherwise directed elsewhere in the documents. All metal enclosures shall be fabricated from sheet steel having an adequate gauge to ensure a rigid, robust construction, free from distortion. Each enclosure shall be of adequate size to accommodate all components necessary or specified elsewhere in the documents plus the required spare ways and spare space. The interior of all enclosures shall be white baked and all external surfaces grey hammertone baked enamel.

Each enclosure shall be complete with a sheet steel front panel. The front panel shall :

a) Be firmly fixed by fine threaded or non-pointed self tapping cheese-head screws on all edges to the enclosure but it shall readily removable by the use of a screwdriver. Each fine threaded screw shall be screwed into a minimum thickness of 3 mm of a metal or where self tapping screws are used, these shall only be used in conjunction with self tapping clip-in spring nuts;

b) be neatly cut to permit switch and MCB operating toggles to protrude through, meters to be read and other gear where fitted to be accessible. The panel shall conceal all cable ends, conductors, connections, contacts, busbars and equipment shall be mounted on the front panel;

c) be cut for all spare spaces and these spare apertures shall be neatly and adequately blanked off;

d) be closely fitted to the enclosure and all apertures shall be closely fitted to the equipment mounted behind to minimise ingress of vermin and dust; and

e) be finished to match the outside of the enclosures.

Each enclosure shall be designed to have 25% spare MCB space available after all necessary or specified components are assembled within.

Each enclosure shall be installed with its sides vertical, top and bottom horizontal and square, on or within the wall. All conduits to and from the tray shall be securely and effectively bonded to the enclosure, each using a male bush inside the enclosure, screwed into a coupling fitted to the conduit outside the enclosure. The male bush shall be properly tightened using a proper tool.

In any event pliers, hammers and chisels shall not be used to tighten the male bushes. Where necessary, in the case of a metal conduit, to ensure a properly tightened joint with good earth continuity, the sub-contractor shall fit a steel lock-nut on the conduit before the coupling and shall screw the lock-nut into the coupling. Where a roof space exists above a flush mounted distribution board, spare conduits shall be installed for each spare space into an accessible position in the roof space blanked off.

Each distribution board shall :

a) Be designed for miniature circuit-breakers, all mounted within the enclosure. In any one board or number of boards on one site all miniature circuit-breakers shall be of the same manufacture; and

b) be internally wired with conductors from the main switch to the busbars having the same current rating as the conductors feeding the distribution board. Conductors from the busbars to outgoing protection shall be :

   i. Rated to the full value of the outgoing protection, and

   ii. rated not less than half the rating of the main switch unless otherwise permitted in writing by the Engineer;

   iii. be provided with phase, neutral and earth busbars installed behind the front panel. All phase and neutral bars rated over 60 ampere and all busbars in 3-phase distribution boards shall be of flat tinned copper rigidly mounted and adequately supported on insulators with adequate spacing and clearance. Earth bars shall be mounted directly on to the back of the enclosure. Each connection to or from the a phase or neutral bar shall have its own brass fixing screws, washer and nut, and where a round insulated solid conductor is used, the busbar end of the conductors shall be connected by two set screws or an approved sweating lug with brass screws, washers and nuts;

   iv. be provided with a substantial earth stud on the bottom of the enclosure. The earth stud shall pass through and be fixed by means of nuts and washers on both sides of the enclosure with nuts and lock-nuts provided inside and outside. An adequately rated bare earth conductor shall connect the earth stud to the earth bar inside the enclosure; and

   v. be complete with all miniature circuit-breakers arranged in rows, mounted on rigid metal bases. Each miniature circuit-breaker shall be separately and readily removable from the board without disturbing adjacent miniature circuit-breakers, busbars, or other equipment.

Non-automatic or isolating switches in a board shall be mounted within the enclosure on a rigid metal base, with operating handles protruding through the front panel, preferably matching the miniature circuit-breakers.

Each way in the distribution board shall be labelled using 8 mm letters engraved on trafolite or similar approved material, white on black background, by numbering each MCB. A permanent index card shall be fixed on the inside of the front door or adjacent to the board behind a clear perspex or similar approved sheet so that it can be easily read without having to be removed. The index card shall be of good quality white cardboard and of adequate size for recording full details of each way.

15. LABELS

Labels on the fascia panel shall be fixed below each MCB, these shall be secured by means of screws. Designation, source of supply and warning labels shall be fitted externally to distribution board by means of screws.

Labels fixed to distribution boards by means of glue are not acceptable.

Labels shall be to the Engineer's approval.

16. DRAWINGS AND TECHNICAL DETAIL

The drawings indicating the proposed lighting and small power installation shall form part of this specification.

Details of drawings and technical details to be provided by the Tenderers and successful Tenderer are as follows:

a) General arrangement of distribution boards; and

b) technical details of luminaires offered.

17. MANUFACTURER'S WORKS

The Engineer reserves the right to inspect, test of observe testing of all items of plant and equipment constituting the contract at the manufacturer's works.

18. TESTS

Insulation resistance tests shall be carried out as detailed in the wiring code, the testing pressure being 500 volts. The result of these testes shall be submitted to the Engineer in duplicate.

The continuity of each conduit run or earth wire shall be tested between the distribution switch board and the most distant point of the run.

A test shall be made to verify that all non-linked single pole switches have are fitted in the phase conductors.

A test to determine the sensitivity of earth leakage units shall be carried out.

Verifying tests will be carried out at the site by the Engineer after erection is completed.

19. MAINTENANCE PERIOD

The maintenance period shall be three months commencing from the date on which the whole of the works shall be deemed to be taken over from the Contractor (first delivery).

20. GENERAL

All outlet boxes up to 100 x 100 mm are measured as one item regardless of the number of entries.

Conduit boxes shall always include the fixing to the conduit with locknuts and bushes as specified.

Industrial switch and plug units shall include the fixing to conduit as specified.

Outlet boxes shall be without covers and draw boxes shall include covers, screws, etc.

Light switches, switch plugs, etc. shall include screws, cover plates and other equipment specified.

All fittings and accessories shall always include the connections thereto. All lighting luminaires shall be complete with lamps and tubes.

21. FLOODLIGHTING

Supply 215W, LED floodlights with a light output of 32076(lm) and driving current of 700mA, Mount three on each of the lightning protection poles, in the locations shown on the drawings.

The floodlighting luminaires shall be fed from the photocell controlled contactor in DB.LV by means of 4,0 mm² 4-core PVC.PVC.SWA.PVC cable, run via the control cable ducts and underground trenches. The floodlights shall be similar to Genlux.Kratos S13 LED floodlight

22. PHOTOCELL

A photocell switch unit shall be mounted on a suitable bracket on the face of the switch room building, and shall be wired to DB LV by means of 1,5 mm PVC-insulated conductors in 20 mm conduit, to control exterior lighting as per circuit shown.

The unit shall consist of a photocell, thermal driving mechanism and single pole switch, with a separate by-pass single pole switch.

The outer casing shall be of vandal-proof material and weather-proof, and not subject to deterioration due to ultra-violet radiation.

The unit shall incorporate a plug-in base.

Switch-on shall occur at approximately 54 lux, and switch-off at 108 lux. These levels shall be adjustable. The sensitivity shall be independent of voltage fluctuations.

A built-in time delay of at least 15 seconds shall render the unit insensitive to light impulses of short duration.

Photocell units shall be equal and similar to M&G or GRÄSSLIN type units.

23. WELDING OUTLET

Supply and install a 63A, 4 pole and earth outdoor switch socket constructed from moulded plastic material, as " Marechal " manufacture, complete with matching plug top, and connect to DB.LV by means of 16 mm 4-core PVC.PVC.SWA.PVC copper cable.

24. SUBSTATION EARTH BARS

Supply and fit six substation earth bars, of sufficient length to accommodate the number of earthing conductors to be connected allowing only one connection per bolt.

Bolts to be M10 cadmium-plated.

Earth bars to be of 50 mm x 3 mm minimum cross-section, securely fixed to the cable trench walls by means of spacers and concrete anchors, allowing a space of at least 40 mm behind the bar.

25. NEUTRAL POINT EARTHING: 400V SYSTEM

Interconnect the following points by means of 70 mm single bare copper conductor:

a) Aux. Transformer neutral terminal : Transformer tank;

b) Aux. Transformer tank : Substation earth bar; and

c) DB LV earth bar : Substation earth bar.

26. DC SUPPLY UNITS : EARTHING

Connect the two DC supply control units to the substation earth bar by means of 70 mm bare copper conductors.

27. LIGHTING PROTECTION MASTS

27.1 Foundations

The foundations shall be designed and constructed in accordance with the relevant specification, taking all requirements for stability as set out in this specification, into account.

27.2 Construction of Masts

Each mast shall be constructed to form tapering totally enclosed column, as slender as possible, taking structural design requirements into account.

Masts shall be installed at the positions as indicated on the drawings.

The masts shall have an appropriate height above the foundations.

The structural design shall comply in all respects with SABS Standard Building Regulations, and, in particular, with following SABS Codes of Practice:

SABS 0160- 1980: General procedures and loadings to be adopted for the design of buildings.

SABS 0162 - 1980: The structural use of steelwork

The appropriate maximum wind speed to be used for design purposes shall be selected by reference to SABS 0160.

Tenders shall contain full particulars of the structural design of the mast, which particulars shall bear the signature of a competent registered Professional Engineer taking responsibility for the design.

Free standing lightning structures shall be composed of tubular sections wherein each section is locked into its mating section by means of a drive fit, the whole to provide a rigid suitable structure.

Unless otherwise approved, the mast shall be designed with minimum safety factors of 2.5.

The mast shall be of high tensile steel to SAE/AISI 950X specification to a minimum tensile strength of 500 MPa.

Each completed section is to be hot-dipped galvanised after fabrication including all jointing pieces, flanges and nuts and bolts.

The last 3 m of the specified height may be a tube of minimum outside diameter of 50 mm.

The largest dimension at the base shall not exceed 1 metre.

The use of incompatible materials without satisfactory separation will not be acceptable.

Where the height of the mast exceeds 20 metres it shall be fitted with a ladder and cage which shall comply with the OHAS Act of 1994.

Approved means shall be provided for plumbing the mast after erection to compensate for any ground settlement.

Any condensate inside the pole shall be adequately drained at the base and no pockets shall exist where water could accumulate.

Adequate provision shall be made for earthing of this mast. At least two separate earth connections of 150 mm² copper section shall be made to the main earth mesh.

The cone of protection affordable by a mast shall be determined by assuming a protective angle of 30° (unless otherwise approved) and the area between two masts shall be treated according to the South African Bureau of Standards Code of Practice (SABS 03 - 1985: The protection of structures against lightning).

Code of Practice (SABS 03-1985: The protection of structures against lighting).

27.3 Quality Management System

The manufacturer will be required to apply an appropriate Quality Management System at the design, manufacture, and installation stages of the high masts.

The procedures as laid down in SABS ISO 9000 *Quality Systems*, will be used as a basis for

evaluation of the manufacturer's Quality Management System.

Should the manufacturer's system be found to fall short of the requirements as set out in the SABS Code, the masts may be rejected.

27.4 Site Assembly

If masts are not delivered to the site as complete pre-manufactured units, but in parts to be assembled on site, the tender must contain full and detailed information as to the method of site assembly and structural stability of such assembled masts. The acceptability of site-assembled masts will be at the sole discretion of the Engineer.

27.5 Design Parameters

Masts shall be adequately designed to withstand the static and dynamic stresses imposed by the mast itself together with all luminaires and ancillary equipment fitted, under the wind loading conditions as selected from SABS 0160. The maximum permissible deflection at the top of the mast when subject to the above speed shall not exceed 2,5 % of the height of the mast above the base plate. The mast design shall be such that wind induced oscillations are minimised.

In addition to the requirements of the above clause, the design of the masts shall be adequate to resist, during raising and lowering and in the horizontal position, the wind forces specified in the above clause from the worst direction, as well as self-weight including luminaires and any inertial effects due to sudden stoppage.

Particular attention shall be paid to slip joints of site assembled masts, to ensure that slip joints do not show the slightest sign of movement after simulation of the conditions set out as above. A sample mast, selected at random by the Engineer from the first batch to be delivered, may be subjected to such tests at the manufacturer's works before delivery of any mast is effected.

27.6 Mounting

The masts shall be designed to accommodate a hinge connecting the mast shaft to a 1,4 m long foundation stub, which stub shall be imbedded into the reinforced concrete foundation.

The mast shaft and foundation stub shall have a flange to which the hinge is welded. Flanges shall be free from laminations.

Supplementary gussets shall be provided.

Two locking bolts with washer, nuts and locknuts, with standard SABS metric threads, all hot dip galvanised, shall be provided.

27.7 Provision for Floodlight Mounting

A bracket suitable for bolting on of the floodlights with a weather shielded 30 mm diameter cable access hole, shall be provided at a suitable height above the foundation level.

Refer to the layout drawings for the location of the floodlight with respect to the mast lowering direction.

27.8 Seal

The top of the mast shall be effectively sealed against the ingress of moisture.

27.9 Corrosion Proofing

All masts and associated ferrous parts shall be hot dip galvanised to SABS 763 Type of article A.

The mass of galvanised coating shall be determined in accordance with the non-destructive method under Clause 6.3 of the above SABS specification.

No welding, drilling of holes, etc., that would expose the under-lying steel, shall be carried out after galvanising.

27.10 Cable Access

Provision shall be made for underground cable entry into the mast foundation stub, and through the mast shaft to the luminaire via a weather-protected 30 mm diameter hole below the luminaire mounting bracket.

27.11 Earthing

The mast shaft shall be earthed directly to an earthing peg by means of 70 mm flexible copper conductor connected directly to the moving part of the mast, routed via the cable access duct. This conductor shall be looped within the mast base to eliminate strain on it when the mast is lowered.

27.12 Cradle

A cradle shall be provided for each mast lowered down towards the substation building as protection for the fence running across the front of the transformers. The cradle shall be provided complete with foundation.

27.13 Raising & Lowering Mechanism

One raising and lowering device, whether electrical, hydraulic or mechanical, shall be provided for the masts on the site.

If the masts offered are not the hinge down type, but have a light fitting cradle which is lowered and raised for maintenance of the light fittings, this is quite acceptable. In this instance the raising and lowering device shall be self contained within the base of the mast.

27.14 Alternative Raising and Lowering Mechanism

Tenders may offer balanced scissors masts combined with detachable lightning arrestor head as an alternative to the mast and winch system specified above. Suitable cradles must also then be provided for the mast to rest on when in the lowered position. Other parameters remain unchanged.

28. PROTECTION OF BUILDING AGAINST LIGHTNING

Lightning protection bonding shall be provided in accordance with SABS.

SECTION 4: SPECIFICATION

PART 17.1: OPTICAL FIBRE BASED TELEPROTECTION & COMMUNICATION EQUIPMENT

SPECIFICATION No: /0-98 – Rev 1

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1. SCOPE

This chapter specifies the requirements for communications equipment with regard to the project, which includes dedicated communications equipment for protection signalling purposes and dedicated equipment for voice and data communications.

To render a sufficient communications service to the Metering-, Protection-, and Control Divisions of Pretoria Electricity, adequate communication links have to be established with equipment and infrastructure. The equipment will be the optical fibre terminal equipment and the infrastructure the optical fibre cables installed between Buffel and Soshanguve substation on the power lines. The services commonly rendered are the following :

1.1 Protection System Communications

Installed on request exclusively for the use of protection relays to communicate with each other for sending 1st, 2nd or 3rd stage tripping and ARC blocking signals. This is a specialised application supplied on request of the Protection Division.

1.2 Data Communications

Used to transport data from the Quality of Supply and Tariff Metering, Remote Control, SCADA and Fault Recorders to the Control Centre or centralised office sites. Channels are configured as point-to-point or point-to-multipoint, depending on the equipment capabilities and requirements.

1.3 Voice Frequency Communications

Telephone services are essential for verbal communications with the Control Centre during switching operations. Service personnel also need to phone the office for advice or information when locating faults. The use of voice frequency modems is very limited, but serves as a temporary means for data communications.

Clause 4 will cover the technical and general requirements for the establishing of a teleprotection service to the Protection Division of Pretoria Electricity. Clause 5 covers all general and technical specifications for a reliable voice and data communications service for several users within Pretoria Electricity.

2. DEFINITIONS

Protection System Communications : A dedicated set of communications infrastructure for protection relays to exchange their protection signals on.

Data Communications : Non-verbal digital data transmission for the purpose of monitoring conditions of indicators and remotely measure variables at the control centre and for transporting control signals from the control centre to the remote substations.

Voice Frequency Communications : Verbal or data communications using the voice frequency band. Verbal communications provided by means of extending the private automatic exchange's lines over the communications network.

Infrastructure : The presently installed and the to be installed base of optical fibre cable, patch panels, multiplexers and related communication equipment to realise the provision of communication services to operate the electricity network.

3. STANDARDS

The equipment offered against this specification shall comply fully with the requirements thereof. Any deviation from this specification shall be clearly stated.

Alternative offers will be considered, providing the equipment offered complies fully with the minimum requirements of this specification.

The tenderer shall submit a detailed statement of compliance or non-compliance and reasons (if any) for each and every requirement called for in this specification.

Any non-conformance not indicated will render the supplier liable for any expenses incurred by Pretoria Electricity to make good the non-conformance.

3.1 Works Content

The tenderer shall be responsible for the manufacturing or sourcing and delivery to site of the equipment, accessories and/or options and the carrying out of installation works in installing the said equipment, accessories and/or options, asked for in this specification.

The tenderer shall be required to source, transport to his workshops and deliver to site after fitment of equipment any cabinet, rack or tray needed in order to install the equipment called for in this specification.

3.2 General Requirements

The tenderer/supplier shall comply to ISO9002. A copy of such a compliance certificate shall be included with this enquiry.

Delivery and installation costs shall be included in the Schedule Of Prices, where requested.

Preference shall be given to equipment with extended warranties.

The tenderer shall submit a separate price in the Schedule of Prices on each item (Equipment, Accessories and Options) asked for in this specification. Each item shall be listed separately.

A separate Schedule Of Prices shall be completed for alternative offers with the same detail as requested in 2.5.4.

Equipment offered with a higher or better specification asked for in this tender shall be considered.

The successful tenderer shall submit a complete itemised invoice, describing all the equipment, accessories and technical documentation of the equipment delivered.

Each unit shall be packed in a container with all the accessories. The packaging shall be robust to prevent damage to the equipment when transported by public transportation.

Pretoria Electricity reserves the right to visit the factory to inspect the manufacturing process at any time during normal office hours.

The tenderer shall submit a list of references with this document.

3.3 Training

The successful tenderer shall present a course in the installation, maintenance and configuration of the equipment to at least four (4) staff members.

The City Electrical Engineer shall be satisfied as to the standard, duration and contents of the course.

The cost of the course shall be quoted and included in the Schedule of Prices.

3.4 Maintenance

The City Electrical Engineer shall be satisfied that the successful tenderer carries adequate stock or has access to a complete range of spare parts for the equipment offered and has adequate service facilities to maintain the equipment for a period of 10 years.

3.5 Demonstration

Tenderers shall be prepared to demonstrate their equipment offered, as specified in this document before the tender is awarded, at no extra cost. The tenderer shall also demonstrate that the equipment is working correctly in his workshop before delivering equipment to site.

3.6 Guarantee

The tenderer shall guarantee all the equipment offered in this tender against defects arising from faulty materials, design or workmanship for a minimum period of twelve (12) calendar months from the date of delivery.

The tenderer shall repair and make good at his own expense and to the satisfaction of the City Electrical Engineer any omissions from the statement of work and defects arising or becoming noticed during the guarantee period.

If any faults or defects are not rectified within a reasonable period, the City Electrical Engineer may arrange for the equipment to be repaired at the suppliers expense.

The tenderer shall collect and deliver any faulty equipment during the guarantee period, the costs of such transportation shall be for the suppliers account.

3.7 Execution of Orders

Tenderers are reminded that orders placed against accepted quotation are to be executed in strict accordance with the accepted specification and within the quoted delivery period.

The Pretoria City Council shall not be held responsible for any losses incurred by tenderers should the tender not be awarded.

The City Council reserves the right to accept the whole or any portion of this tender.

4. COMPACT FIBRE OPTIC BASED TELEPROTECTION EQUIPMENT

The equipment supplied shall comply fully to CCITT Rec. G.703.10, G.732 and G.958.

The equipment offered shall be tested against surge voltages, insulation and impedance in accordance to IEC 255-4, Class III.

Equipment offered shall be interchangeable and / or adaptable with existing equipment in use and shall interact seamlessly with the equipment base already installed, which is equivalent or similar to the FOX6+/20 range of compact multiplexers.

The serial number of the equipment supplied shall be engraved or imbedded on a label on the outside of the modules or housing.

The equipment shall be used between primary infeed substations with drop and insert facility at various teed-off substations.

The equipment offered shall have a universal bus, an omnibus and time slot through-connection as a standard feature.

In some cases installation work will not be required, but the successful tenderer is not relieved from the responsibility to make sure that the equipment supplied operates reliable and according to specification.

Detail specifications are as follows :

4.1 Power Supply

the supply shall be protected against RF interference; and

the supply shall be fitted with an Over and Under voltage protection to prevent damage to the equipment in use.

The power supply shall be galvanically isolated with short circuit protection and shall be fitted with an externally accessible fuse.

Please refer to the Schedule of Particulars and Guarantees for additional information.

4.2 Multiplexer

Please refer to the Schedule of Particulars and Guarantees for detail.

4.3 Alarm and Oscillator unit.

Please refer to the Schedule of Particulars and Guarantees for detail.

4.4 Digital Protection Interface

The Digital Protection Interfaces will interface electrically to the intertripping protection relay. An intertrip signal will be sent across the infrastructure to the distant relay to effect a line trip.

Please refer to the Schedule of Particulars and Guarantees for detail.

4.5 Asynchronous data interface

The asynchronous data interface has to be a standard feature in the backplane of the equipment. It should be capable of being configured as a point-to-point link or a multi-drop data bridge.

Please refer to the Schedule of Particulars and Guarantees for detail.

4.6 Binary interface

The binary interface shall be capable of transmitting 8 input/output signals via one 64 kbit/s time slot in full duplex.

All the input/output connectors shall be galvanically and optically isolated, except for the auxiliary voltage source.

In transmission interference or in transmission loss the unit shall store the last output states or reset all the jumpers.

4.7 Accessories and Options

Please refer to clause 4.75.11 for specifications on accessories and options for both Teleprotection and Communications items.

5. COMPACT FIBRE OPTIC BASED COMMUNICATIONS EQUIPMENT

Specifications in general must include and comply to the following :

The equipment supplied shall comply fully to CCITT Rec. G.703.10, G.732 and G.958.

The equipment offered shall be tested against surge voltages, insulation and impedance in accordance to IEC 255-4, Class III.

Equipment offered shall be interchangeable and / or adaptable with existing equipment in use and shall interact seamlessly with the equipment base already installed, which is equivalent or similar to the FOX-U range of compact multiplexers.

The serial number of the equipment supplied shall be engraved or imbedded on a label on the outside of the modules or housing.

The equipment shall be used between substations for protection, SCADA, telephones, etc., with drop and insert facility at various substations.

The equipment offered shall have a universal bus, an omnibus and capable of time slot through-connection.

In some cases installation work will not be required, but the successful tenderer is not relieved from the responsibility to make sure that the equipment supplied operates reliable and according to specification.

The following elements have to comply to the following specific specifications:

5.1 Power Supply.

The supply shall be protected against RF interference according to EN55022 of 4/87.

The supply shall be fitted with an Over and Under voltage protection to prevent damage to the equipment in use.

The power supply shall be galvanically isolated with short circuit protection and shall be fitted with an externally accessible fuse.

Chopper clock frequency shall be synchronised to the 64kHz system clock to minimise in-band interference

Test points on the front panel shall be available with a visual indication on the front panel when output voltage fails.

Please refer to the Schedule of Particulars and Guarantees for more technical detail.

5.2 Equipment Chassis

The construction of the equipment chassis shall be such that it is 19" rack mountable with the width of slots number 1 to 17 of 8M and the width of slots 18 and 19 of 14M. Chassis with units have to be designed to achieve EMC Directive 89/336/EEC, meet EN55022 (1993) Class B for emission and meet EN50082-1 (1992) for immunity to noise. All internal connections are to be made by the backplane.

Please refer to the Schedule of Particulars and Guarantees for more technical detail.

5.3 Control Card

The digital cross-connection of time slots on 64 kbit/s and on 2 Mbit/s levels resides within this module

Controls the functionality of a drop & insert multiplexer

Shall be equipped to permit conference circuits to be set up by means of time slot sharing.

The module shall act as the main clock supply to the whole multiplexer unit.

Monitoring of the entire system and alarm generation.

Availability of an Embedded Operations Channel for maintenance purposes is essential

5.4 64kbits/s Data interface

The 64 kb/s data interface shall enable the creation of Engineering Overhead Channels to enable the remote configuration and monitoring of the communications equipment, metering information or SCADA. Refer to the Schedule of Particulars and Guarantees for details.

5.5 Universal data interface

The Universal Data Interface shall enable the creation of Super-Rate (n x 64kb/s) primary rate connections to enable a Router Network to interlink several Local Area Computer Networks.

5.6 Telephone Subscriber Line interface

The Telephone Subscriber Line interface card shall emulate the telephone exchange line to the Subscriber Unit and shall comply to the specifications in the Schedule of Particulars and Guarantees.

5.7 Telephone Exchange Line interface

The Telephone Exchange Line interface card shall emulate the Subscriber Unit to the telephone exchange line and shall comply to specifications in the Schedule of Particulars and Guarantees.

5.8 Ringing generator

The Ringing Generator shall supply the Subscriber Unit with a ringing current via the Telephone Subscriber Line interface when the telephone exchange presents a ringing current to the Telephone Exchange Line interface. Shall comply to specifications in the Schedule of Particulars and Guarantees.

5.9 Optical Fibre transmission interface

The Optical Fibre transmission interface shall connect to the single mode optical fibre infrastructure of Pretoria Electricity. Specifications as per Schedule of Particulars and Guarantees.

5.10 G.703 2Mbits/s transmission interface

The 2Mbit/s transmission interface shall be an integral part of the Optical Fibre transmission interface and specifications shall be as per Schedule of Particulars and Guarantees.

5.11 Accessories and Options (Clause 4 and 5)

A complete installation kit with all the connecting cables and connectors including patch leads shall be supplied with each unit.

A complete set of configuration / setup / network monitor software and firmware shall be included and/or supplied with each unit, whichever is necessary. If only one item of the latter is needed for a complete network, it shall be supplied as such.

Blanking plates shall be supplied for the front cover to cover open slots.

The tenderer shall list all accessories and options not listed that are of importance to the user and that are essential to the successful installation, commissioning and operation thereof.

An extra power supply shall be available for redundancy, the power supply shall slot into a open slot in the main chassis.

SECTION 4: SPECIFICATION

PART 17.2: MARSHALLING KIOSKS & TERMINATION BOXES

SPECIFICATION : Rev 0

1. EXTENT OF WORK

The single, free-standing 132 kV bay yard marshalling kiosks shall be supplied to terminate the multi-core cables from tthe primary equipment or to small collection boxes mounted directly on the primary equipment support structures.

The collection boxes shall be weatherproof, manufactured of galvanised steel and suitably equipped, meeting the general requirements of Section III Part 1.4. Contractors shall submit detailed general arrangement drawings for approval by the Engineer.

SECTION 4: SPECIFICATION

PART 18.1: SCADA INTERFACE

SPECIFICATION No: SC.03/0-97 - Rev 3

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1. INTRODUCTION

This specification specifies the Supervisory Control and Data Acquisition (SCADA) interface for a substation.

The City of Tshwane Metropolitan Municipality control centre are situated at Capital Park, from where fifty substations are monitored and controlled via SCADA links

The Scada Protocol at the Control Centre of the City of Tshwane is DNP 3 level 3. The Tenderer shall submit the following documents

) A document stating that the tenderer complies to IEC 60870-5-103

ii) A document explaining the protocol that the tenderer will be using in the substation.

iii) A document stating that the protocol being used by the tenderer can be converted to

DNP3 level 3.

The conversion of the substation protocol to DNP 3 level 3 can de done by the tenderer, by doing the conversion in the substation MMI or by doing the conversion in a Harris D20++ Processor board. The tenderer must be able to prove both conditions. The implementation of the protocol conversion at the substation will be the responsibility of the tenderer. The tenderer will supply the City of Tshwane with an IO list indicating Digital Inputs, Digital Outputs, Analogs and DNP mapping.

The Tenderer will give training to personnel of the City of Tshwane on fault finding, populating of the database in the MMI and the substation protocol

2. STANDARDS

The following documents are referred to in this specification:

a) The DNP Basic 4 Document set which includes the complete description of all the facilities available in DNP together with their usage; and

b) the DNP V3.00 Subset Definitions which explains the minimum functionality that is expected in the three officially recognised subsets of DNP.

Both of these documents are available from the DNP users group and from Pretoria Electricity.

3. OVERVIEW

Harris Distributed Network Protocol (DNP) has been developed by Harris Canada Inc. for application in both SCADA and distributed automation systems. The DNP protocol are being used by CCP to interface the front end processor at Capital Park with different substations.

4. COMMUNICATION MEDIUM

The communication medium consists of optical fibre with multi-plexers, twisted copper pilot wire with modems and micro wave radio links. The baud rates vary between 300 baud and 19 200 kilo baud.

5. SUBSTATION SCADA INTERFACE

The preferred option will be for the Tenderer to make use of a standard D20 ++ processor card from Harris to convert the protocol inside the substation to interface to the Control Centre at Capital Park talking DNP protocol on the SCADA link.

Harris support protocols such as ABB SPA-BUS, GEC Courier K-bus, Modbus, etc.

The configuration for the substation will be programmed on NV Ram situated on the D20 ++ card.

The Council will provide a suitable cubicle to house the 19 inch rack.

An option for the Tenderer to make use of an intelligent device (Gateway) to convert the protocol inside the substation to interface to the Control Centre at Capital Park talking DNP protocol on the SCADA link would also be considered by the Council.

The Tenderer should quote on both the above options.

6. BUSBAR COLOURING

a) Powered : 275 kV Busbar : Blue
b) 132 kV Busbar : Orange
c) 33 kV Busbar : Magenta
d) 11 kV Busbar : Cyan
e) Without power : All busbars white
f) Earthed : All busbars green
g) Invalid : All busbars yellow
h) Background : Black

7. SYMBOLS LIST

For further details see Part 12.

7.1 Breaker

Use a square symbol with the following conditions:

a) Breaker closed : a square solid red;
b) breaker open : a square solid green; and
c) breaker disturbed : a square yellow with a line running from top left to bottom right.

7.2 Isolator

Use a circle with the following conditions:

a) Isolator closed : a circle solid red
b) isolator open : a circle solid green
c) isolator disturbed : a hollow circle in yellow with a 45 degree line running from top left to bottom right.

7.3 Earth

The conventional 3 horizontal lines arranged within the outline of a triangle.

When earthed the green symbol should show, when not earthed no symbol should show.

8. DATA POINT NUMBERING

For the purposes of maximum efficiency of the communications system and data entry into the SCADA system the following are recommended for any equipment to be connected to the control centre via DNP.

a) All point numbers for all types of data should start from zero (0);
b) all point numbers should be contiguous, with no gaps or spares within the point mapping. This is recommended because on start-up and at pre-set intervals the FEP will ask for all data (integrity poll) and gaps in data will make the response inefficient as the real data and the spare points are all transmitted together;

c) the two points associated with status of a device (e.g. open-closed status of a circuit breaker) shall be adjacent to each other in the point map and located at an even boundary. The Open and Close indications should be in the same order as for the RTU□s that have already been installed (Closed Indication first, Open indication second). If this procedure is followed the SCADA system data entry and FEP mapping will be easier; and

d) control output bits should follow the same procedure in that the associated output should be next to each other and at an even boundary. The sequence should be Trip first and then Close.

Digital Inputs (time tagged or not) should be allocated to Class 1, Analogue Inputs should be allocated to Class 2 and Counter values to Class 3

9. OFFICIAL DNP SUBSETS

Three official subsets of DNP have been defined by the DNP Users group. These are as follows:

a) Level 1 Implementation (DNP-L1)

b) level 2 Implementation (DNP-L2)

c) level 3 Implementation (DNP-L3)

Level 1 is the minimum subset that should be implemented and is typically used between a master station and an IED. The requests for the following data objects from the slave must be accepted

a) Reads of Class Data Objects;

b) Reads of Binary Outputs and Analogue Output Objects only if these objects exist in the slave;

c) Control Operations;

d) Writes to the RESTART Internal Indication;

e) Cold Restarts; and

f) Time Synchronisation.

The Level 2 implementation consists of all the Level 1 features plus additional data objects as defined in the subsets document.

The Level 3 implementation consists of all Level 2 plus additional data objects as defined in the subsets document. This is the level which is required and specified by the Council.

10. CLASS DATA

DNP has the facility to send □changed (event), data to the master station. The master station thus polls for changed data rather than for data of a specific type e.g. the poll is for all Class 1 data rather than all Analogue.

DNP has 4 different classes of data, each of which can contain different types of data, but which have different event queues and priorities :

a) Class 0 Data is the exception in the that data is static data rather than changed data. Class 0 consists of all data and is called an integrity poll because it returns the status of all the I/O points in the RTU; and

b) Class 1, 2 and 3 data there are different priorities of data and the master station can be set up to poll more frequently for Class 1 data than for Class 2 data and Class 3 data.

Class Data requests are the basis for the communications in the Pretoria Electricity SCADA network. This is due to the necessity to most efficiently use the bandwidth available for communications, as DNP is a relatively high overhead protocol.

11. MODES OF OPERATIONS

DNP provides several different means of operation:

a) **Quiescent Operation;**

where the master never polls the slave. All communications are unsolicited report by exception. This mechanism is generally used for systems using radio communications and pole top RTU□s to keep communications to a minimum. The integrity of the data is never verified and is thus not recommended for Pretoria Electricity;

b) **Unsolicited Report by Exception;**

in which most communications is unsolicited, but the master occasionally send integrity polls for Class 0 Data (all data) to verify its database. This option is not acceptable to the Council.

c) **Polled Report by Exception Operation;** and

in which the master polls frequently for event data and occasionally for Class 0 Data. Polling is generally quick because only significantly changed data objects are reported to the master station. This is the mechanism that is used by the Pretoria Electricity system at this moment, due to the combination of high efficiency, good integrity, and control by the master. The slave never sends data unless polled by the master and the master is thus controlling the system. This is the recommended implementation needed by the Council.

d) **Polled Static Operation.**

where the master always polls for all data. This is very inefficient and not acceptable to the Council.

12. GPS CLOCK

The Tenderer shall supply and install a GPS clock for the time tagging of events at the substation and also for time synchronisation with the front end processor at Capital Park with an accuracy of 1 ms or better.

13. FUNCTIONALITY OF THE SCADA

The SCADA shall be able to control the substation in the same way and with the same detail as the MMI or substation control system. All controls, status indication, analogue indications, event recording and alarms shall be provided.

When any of the elements of the substation is in local mode it shall not be possible to control that element by the SCADA.

It is not necessary for the SCADA to be able to communicate with the relays

In addition intruder detection and alarms shall be supplied, as well as battery status alarms and charger control (e.g. battery boost charge).

14. TESTING

The Contractor shall be responsible to test all the Substation SCADA alarms, analogues, tap positions and indications to the front end processor at Capital Park

15. DOCUMENTATION

The following drawings shall be supplied by the Tenderer :

a) Single line diagrams showing the basic layout of the busbars, breakers, isolators, bus couplers, bus sections etc.

b) a document showing the numbering of addresses for all the different 1 bits, 2 bits, analogues, tap positions, controls and alarms

c) a drawing of the element types (circuit breakers, transformers, isolators etc.

d) transducer outputs (0-5 mA or 4-20 mA etc.) and voltage- and current transformers ratios.

The following documentation will be supplied by CCP to the Contractor:

a) DNP documents mentioned above

b) protocols supported by Harris

c) a hardware manual on the Harris D20 ++ processor card

d) a name and telephone list of contact persons at CCP.

PART C2.1 – PRICING INSTRUCTION

SECTION 5

SCHEDULE OF PARTICULARS & GUARANTEES

All Tenderers must complete the following schedules in full. Failure to provide the required detailed information called for in the schedules will result in the tender to be disqualified.

CONTENTS

PART	DESCRIPTION	APPLICABLE
1	General Requirements:	
1.3	Quality Control / Assurance Questionnaire	Yes
2	132kV Circuit Breakers:	
2.1	132kV Outdoor Circuit Breakers	Yes
2.2	400kV Outdoor Circuit Breakers	Yes
3	Disconnectors (Isolators) and Earthing Switches:	
3.1	132kV Disconnectors (Isolators) and Earthing Switches	Yes
4	Surge Diverters and Insulating Bases:	
4.1	132kV Surge Diverters and Insulating Bases	Yes
4.2	400 kV Surge Diverters And Insulating Bases	Yes
5	Instrument Transformer:	
5.1	132kV Outdoor Voltage Transformer	Yes
5.2	400kV Outdoor Voltage Transformer	Yes
5.3	132kV Outdoor Current Transformer	Yes
5.4	400kV Outdoor Current Transformer	Yes
6	Busbars, Connections and Connection Clamps:	
6.1	400/132kV Busbars, Connections and Connection Clamps	Yes
7	Insulators:	
7.1	132 kV Insulators	Yes
7.2	400kV Insulators	Yes

8	11kV Cable, Connection, Termination and Accessories:	
8.1	11kV Cable Connections between Power Transformers & 11kV Switchgear	No
8.2	Underground PVC-Insulated Multi-Core Control Cable	Yes
8.3	Termination and Connecting up of Cables & Cable Accessories	Yes
8.4	Trenching, Layout and the Installation of Multicore Cables	Yes
8.5	Medium Voltage Cable Sealing Ends, Terminations and Cables	Yes
9	Earthing:	
9.1	Earthing Grid	Yes
10	Transformer, NER and NEC:	
10.1	315MVA Transformer	No
10.2	Neutral Earthing Compensators (NEC's) Combined with Neutral Earthing Resistors (NER's) and Auxiliary Power Transformers	No
10.3	Dismantle and Transport of Transformers and NEC	Yes
11	11 kV Switchgear:	
11.1	11kV Metal-Clad Switchgear	No
11.2	11kV Metal Enclosed Indoor Switchgear	No
12	Protection and Control:	
12.1	Protection and Control Equipment	Yes
12.2	Addendum to Control and Protection	Yes
13	Auxiliary Equipment:	
13.1	Low Voltage AC Change-over and Distribution Panel	Yes
13.2	110 V Battery Charger	Yes
13.3	110 V Batteries and Battery Stands	Yes

14	Building and Civil Works:	
14.1	Building and Civil Works	Yes
15	Electrical Installation of Substation Building, Yard Lighting and Lightning Protection:	
15.1	Electrical Installation of Substation Building, Yard Lighting and Lightning Protection	Yes
16	Steel Lattice Construction Portal Type Gantries for Overhead Busbars:	
16.1	Steel Lattice Construction Portal Type Gantries for 132 & 400kV Overhead Busbars	Yes
17	Communications:	
17.1	Optical Fibre Based Teleprotection- and Communications Equipment	Yes
18	SCADA:	
18.1	SCADA Interface	Yes
19	Power Lines/Cables:	
19.1	132kV Overhead Power Lines	No

SECTION 5: SCHEDULE OF PARTICULARS AND
PART 1.3: QUALITY CONTROL / ASSURANCE

SPECIFICATION No: PT.61/0-2003 - Rev 2 (Previous No: PT.61/0-98)

1 All Tenderers shall complete the following schedules in full. Failure to provide the required detailed information called for in the schedules will cause a tender to be disqualified.

2 All information provided by the Tenderer, or specified by the Council and not qualified by the Tenderer will be regarded as offered and guaranteed by the Tender.

ITEM NO	DESCRIPTION	YES	PARTLY	NO
1	**PROCEDURE:**			
1.1	Have you a formal procedure for approval and implementation of design changes?			
2	**PRODUCTION PLANNING:**			
2.1	Do you provide written work instructions?			
2.2	Do they list the inspections required?			
2.3	Do you provide written quality and inspection			
3	**PURCHASING:**			
3.1	Have you a procedure for approving and checking the performance of sub-contractors?			
3.2	Do you specify minimum requirements for quality control by your sub-contractor?			
3.3	Do you check the quality control activities of your sub-contractors?			
3.4	Does your purchase documentation include drawings, specifications, quality standards and other requirements?			
4	**MANUFACTURING CONTROL:**			
4.1	Do you have written procedures for checking the accuracy of special manufacturing equipment?			
5	**INSPECTION STATUS:**			
5.1	Do you have a system for identifying the inspection status of work in progress?			
6	**FINAL INSPECTION AND TEST:**			
6.1	Are all items subject to final inspection and test to ensure compliance with contract requirements?			
6.2	Are the final inspection and test witnessed and approved by the Quality control Department?			

7	**CORRECTIVE ACTION:**			
7.1	Do you have written procedure for correcting deficiencies in quality?			
8	**CONTROL OF NON-CONFORMANCE MATERIAL:**			
8.1	Do you have formal procedures for the identification of defective items and for re-work, repair or disposal?			
8.2	Do you have a system for segregating defective items?			
9	**DOCUMENT AND CHANGE CONTROL:**			
9.1	Do you maintain a complete list of all documents, drawings and forms in current use?			
9.2	Have you a formal system for the issue and revision of drawings, documents, manuals, instructions and the like?			
10	**INSPECTION EQUIPMENT:**			
10.1	Have you an organization and facilities for the control, storage and calibration of all inspection and testing of equipment?			
11	**HANDLING, STORAGE AND DELIVERY:**			
11.1	Do you have separate storage areas for incoming material, work in progress and finished products?			
11.2	Is access to all stores restricted to authorized personnel?			
11.3	Are all items in the store identified and issued in rotation?			
11.4	Are items in store periodically inspected?			
11.5	Can the stored goods be traced back to material certificates, test reports and purchasing orders when required?			
11.6	Are packing instructions detailed?			
12	**RECORDS:**			
12.1	Do you record the satisfactory completion of inspection and quality checks?			
13	**REVIEW AND ASSESSMENT:**			
13.1	Do you regularly monitor all production planning and quality control functions?			

SECTION 5: PARTICULARS & GUARRANTEES

PART 2.1A: 132kV CIRCUIT BREAKERS

SPECIFICATION NO:

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
1	**Class circuit breaker**		Outdoor	
2	**Number of poles**		3	
3	Manufacturer		State	
3.1	Type number		State	
3.2	Model		State	
4	Insulating and breaking medium		SF6 GAS	
5	**Voltage ratings**			
5.1	Impulse withstand voltage at sea level (BIL)	kV	650 peak	
5.2	Impulse withstand voltage at Pretoria altitude	kV	550 peak	
5.3	Impulse withstand voltage at sea level for SF6 breakers at :			
5.3.1	nominal working SF6 gas pressure	kV	State	
5.3.2	minimum working SF6 gas pressure	kV	State	
5.3.3	maximum working SF6 gas pressure	kV	State	
5.4	Switching surge withstand voltage at sea level for SF6 breakers at:			
5.4.1	nominal working SF6 gas pressure	kV	State	
5.4.2	minimum working SF6 gas pressure	kV	State	
5.4.3	maximum working SF6 gas pressure	kV	State	
5.5	One minute wet power frequency withstand voltage at :			
5.5.1	nominal working SF6 gas pressure	kV	State	
5.5.2	minimum working SF6 gas pressure	kV	State	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
5.5.3	maximum working SF6 gas pressure	kV	State	
5.6	Rated transient recovery voltage	kV peak	State	
5.7	First pole to clear factor		State	
5.8	Rated characteristic for short line faults :			
5.8.1	Rated peak factor		State	
5.8.2	Rate of rise of recovery voltage	kV/ mic. s	State	
6	**Electrical clearance**			
6,1	Minimum distance between live part and earth (Flashover distance)	mm	1200	
6,2	Total creepage distance across breaking chamber	mm	min 3 600	
6,3	Total creepage distance to earth	mm	min 1 450	
7	**Current ratings**			
7.1	3 second symmetrical breaking current	kA	31,5	
7.2	3 second asymmetrical breaking current	kA	36	
7.3	Maximum symmetrical short circuit-breaking current	kA	State	
7.4	Continuous current rating	A	2000	
7.5	Maximum three second current rating	kA	Sate	
7.6	Maximum rated making current at 145 kV	kA	79	
7.7	Rated breaking current under out of phase conditions	kA	State	
7.8	Rated line charging breaking current	A	50	
7.9	Rated cable charging breaking current	A	50	
8	**Contacts**			
8.1	Main contact type		State	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
8.2	Main contact material :			
8.2.1	Fixed		State	
8.2.2	Moving		State	
8.2.3	Insulated		State	
9	**Timing**			
9.1	Total circuit-breaker opening time from energisation of trip coil to final contact position	ms	State	
9.2	Circuit-breaker opening time from first contact break to final contact position	ms	State	
9.3	Total circuit-breaker closing time energisation of closing coil	ms	State	
9.4	Minimum dead time for autoreclosing duties	ms	300	
9.5	Operating sequence		0-0,3 sec-CO	
			3 min-CO	
10	**Auxiliary contacts**			
10.1	Spare auxiliary switch contacts to be provided additional to those normally needed for control and interlocking			
10.2	Can these contacts be adjusted :			
10.2.1	between NO and NC		Yes	
10.2.2	timing relative to breaker operation		Yes	
10,3	Rating of auxiliary contacts		240 AC, 5 A	
			110 DC 5 A	
11	**MECHANISM DETAILS**			
11,1	Mechanism(s) per 3 phase breaker		1	
11,2	Type of mechanism offered		Motor wound spring or Hydraulic	
11,3	Are the three poles mechanically linked?			
12	**ELECTRICAL CONTROL**			
12,1	DC control for closing and triping	V	110 (80% - 120%)	
12,2	No of closing coils		1	
12,3	No of tripping coils		2	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
12,4	Maximum power rating of each coil at nominal voltage :			
12.4.1	closing	W	State	
12.4.2	tripping	W	State	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
13	**Spring operated Mechanisms**			
13.1	Manual charging		Yes	
13.2	Motor recharging		Yes	
13.3	Rated power of individual charging motor	W		
13.4	Rated voltage of charging motor	V	110 DC	
13.5	Maximum motor starting current	A		
13.6	Duration of maximum starting current	ms	State	
13.7	Duration of normal charging cycle - after :			
13.7.1	Close operation	s	State	
13.7.2	To recharge fully discharged spring	s	State	
13.8	Mechanism heaters		Required	
13.9	Are heaters provided		Required	
13,1	Heater auxiliary supply		240 V, 50 Hz	
14	**GENERAL PHYSICAL DETAILS**			
14.1	Pole spacing		2 000 mm	
14.2	Height of upper electrical connection above ground		4 100 mm	
14.3	Height of lower electrical connection above ground		State	
14.4	Height of structure for above connection heights		State	
14.5	Dimensions of electrical connector		State	
14.6	Material of electrical connector		State	
14.7	Total mass of complete circuit-breaker (excluding structure)	kg	State	
14.8	Construction of mechanism cubicles		Weatherproof	
14.9	Dynamic forces when operating :			
14.9.1	- up	N	State	
14.9.2	- down	N	State	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
15	**MAINTENANCE**			
15,1	Number of interruptions before inspection of contacts at :			
15.1.1	Full fault interrupting capacity		min 10	
15.1.2	Rated current		State	
15.1.3	No load		State	
15.2	Number of interruptions before replacement of contacts at :			
15.2.1	Full fault interrupting capacity		min 10	
15.2.2	Rated current		State	
15.2.3	No load		State	
15.3	Accumulated breaking current before inspection of contacts :	(kA)ý		
15.4	Period of operation after which inspection of contacts is required	years	State	
15.5	Details of contact replacement procedure (please attach a separate description or manual)		State	
15.6	Volume of SF6 gas required for one complete CB	m3	State	
15.7	Number of technical manuals required		One per CB	

TECHNICAL SCHEDULES A & B FOR 400kV CIRCUIT BREAKERS
OUTDOOR CIRCUIT-BREAKERS

Schedule A: Purchasers specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Clause of 240	Description	Schedule A	Schedule B
1		**Ratings**		
1.1	1.1.1	• Rated voltage (Ur)	420	
1.2	1.1.2	• Number of phases on system	3	
1.3	1.1.3	• Rated short-duration power-frequency withstand voltage (Ud)-Phase -to earth and between phase	520	
1.4	1.1.4	• Rated short-duration power-frequency withstand voltage (u,)- Phase - to earth and between phases- under Wet conditions as per	State	
1.5	1.1.5	• Rated short-duration power- frequency withstand voltage (Ur) - across open switching device (under dry conditions	610	
1.6	1.1.6	• Rated short-duration power-frequency withstand voltage- Across open switching device (under wet conditions	State	
1.7	1.1.7	• Rated short-duration power-frequency withstand voltage (Ud- under Wet conditions as per SANS 62271-1 cl. 6.2 (Ur < 245 KV) KV	State	
1.8	1.1.8	• Rated peak lightning impulse withstand voltage Phase-to earth and between phases KV	1425	
1.9	1.1.9	. Rated peak lightning impulse withstand voltage (Ur) Across open switching device	1425 (+ 240)	
1.10	1.1.10	• Rated switching impulse withstand voltage (U,) - Phase-to- earth and across open switching device- (Dry conditions)	1050	
1.11	1.1.11	• Rated switching impulse withstand voltage (U,) - Between Phase - (Dry conditions)	1575	
1.12	1.1.12	• Rated switching impulse withstand voltage (U8) - Phase-to- earth and across open switching device- under wet conditions as per SANas 62271-1 cl.6.2	1050	
1.13	1.1.13	• Rated switching impulse withstand voltage (U,) - Between phases- under Wet conditions as per SANS 62271-1 cl. 6.2 KV	State	
1.14	1.1.14	• Rated frequency (fr) Hz	50	
1.15	1.1.15	• Rated normal current (/r) - main circuit A	3150	
1.16	1.1.16	• Calculated maximum continuous current - main circuit @ 40 C ambient A	3150	
1.17	1.1.17	• Calculated maximum continuous current - main circuit @ 45 C ambient A	3150	

1.18	1.1.18	• Maximum allowable temperature of main contacts (refer to Table 3 of SANS 62271-1)	105	
1.19	1.1.19	• Measured temperature rise (highest) of main contacts @ rated current(type test)	50,6	
1.20	1.1.20	• Maximum allowable temperature of bolted or equivalent connetctions(refer to table 3 of SANS 62271-1)	State	
1.21	1.1.21	Measured temperature rise (highest) of bolted or equivalent connections @ rated current (type test) K	State	
1.22	1.1.22	Maximum allowable temperature of terminals for the connections to external conductors (refer to Table of SANS 62271-1)	105	
1.23	1.1.23	Measured temperature rise (highest) of terminals for the connection to external conductors @ rated current (type test)	41	
1.24	1.1.24	Contact resistance of the main circuit measured during temparature rise pO	State	
1.25	1.1.25	Minimium contact resistance of the main circuit measured during temparature rise pO	State	
1.26	1.1.26	Maximium contact resistance of the main circuit not to be exceeded when testing CB during maintenace/ repairs pc	State	
1.27	1.1.27	Rated short-time withstand current (/k)	63	
1.28	1.1.28	Rated peak withstand current (In)	157,5	
1.29	1.1.29	Rated duration of short circuit (fk)	3	
1.30	1.1.30	Rated d.c. supply voltage of closing and opening devices and auxillary and control circuit (U,)	110	
1.31	1.1.31	Rated a.c. supply voltage of heaters and other a.c. auxiliary circuits (U) V	230	
1.32	1.1.32	Rated supply frequency of closing and opening devices and of auxillary and controls circuit Hz	d.c	
1.33	1.1.33	Rated supply frequency of heaters and other a.c. auxiliary and controls circuit Hz	50	
1.34	1.1.34	Rated short-circuit breaking current (!m) of circuit-breaker KA	63	
135	1.1.35	=- a.c. component of short-circuit breaking current	State	
136	1.1.36	- d.c. component of short-circuit breaking current	State	
1.37	1.1.37	Factor by which the 100% symmetrical and asymmetrical single-phase rated short circuit breaking current exceeds the three-phase ratings	1,15	
1.38	1.1.38	Circuit-breaker class S1 or class S2	S1/S2	
1.39	1.1.39	First-pole-to-clear factor (kpp) for circuit-breaker	1,3	

1.40	1.1.40	Standard values of TRV related to the rated short-circuit breaking current (SANS 62271-100)	SANS 62271-100 Table 5	
1.41	1.1.41	Peak value of TRV (us)	State	
1.42	1.1.42	Rate of rise of recovery voltage of TRV KV/us	State	
1.43	1.1.43	Time delay (td) of TRV	State	
1.44	1.1.44	Amplitude factor (ke) of TRV	State	
1.45	1.1.45	Peak value of the Initial TRV (ITRV)	State	
1.46	1.1.46	Rate of rise of recovery voltage of ITRV	State	
1.47	1.1.47	Rated short-circuit making current of circuit-breaker	157,5	
1.48	1.1.48	Rated operating sequence for circuit-breaker	O(1pole)-0,3sC(1pole)-O(all poles)-3m-CO(all poles)	
1.49	1.1.49	Minimum resting time following rated operating sequence min	State	
1.50	1.1.50	Characteristics for short-line faults tested in accordance	SANS 62271-100	
1.51	1.1.51	Rated out-of-phase making current for circuit-breakers KA	State	
1.52	1.1.52	Rated out-of-phase breaking current for circuit-breakers KA	State	
1.53	1.1.53	Classification of circuit-breaker according to its restrike perfomance (line- cable-charging breaking current)	Class C2	
1.54	1.1.54	Rated capacitive switching currents for circuit-breaker - line-charging breaking current A	400	
1.55	1.1.55	Rated capacitive switching currents for circuit-breaker cable-charging breaking current A	400	
1.56	1.1.56	Classification of circuit-breaker according to its restrike perfomance (capacitor bank switching)	Class C2	
1.57	1.1.57	Rated capacitive switching currents for circuit-breaker single capacitor bank breaking current	400 and 400	
1.58		Rated capacitive switching currents for circuit-breaker back to back capacitor bank breaking current	4250	
1.59	1.1.59	Rated capacitive switching currents for circuit-breaker back to back capacitor bank breaking current	20	
1.60	1.1.60	Inductive load switching tests performed in accordance to SANS 62271-110(for U>52KV) Y/N	Yes	

1.61	1.1.61	• Chopping number of the circuit-breaker for inductive load switching (used to determine suppression peak overvoltage factor) and re-ignition behaviour used to configure electronic controller A	State	
1.62	1.1.62	• Rated opening time for circuit-breaker ms	State	
1.63	1.1.63	• Rated break-time for circuit-breaker(max 60 ms for U, > 132 kv, max 50ms for U, > 132 KV	State	
1.64	1.1.64	• Rated closing time for circuit-breaker me	State	
1.65	1.1.65	• Rated open-close time for circuit-breaker ms	State	
1.66	1.1.66	• Rated reclosing time for circuit-breaker ms	State	
1.67	1.1.67	• Rated close-open time for circuit-breaker ms	State	
1.68	1.1.68	• Rated pre-insertion time for circuit-breaker with pre- insertion resistor ms	State	
1.69	1.1.69	• Circuit-breaker mechanical endurance class	Class M2	
1.70	1.1.70	Number of mechanical operations for circuit-breaker	1000	
1.71	1.1.71	• Classification of circuit-breakers as a function of electrical endurance (Class E1 or Class E2)	E0/E1/E2	
2		**Service Conditions**		
2.1	2.1.1	• Location (indoors/outdoors)	Outdoors	
2.2	2.2.2	• Ambient air temperature range 0.0	-10 to +40	
2.3	2.2.3	• Solar radiation W/m	1100	
2.4	2.2.4	• Altitude (ems)) m	1800	
2.5	2.2.5	• Class of pollution (SANS 60815-1:2009)	very heavy	
2.6	2.2.6	• Average humidity %	95	
2.7	2.2.7	• Wind speed (velocity) m/s	34	
2.8	2.2.8	• Condensation and precipitations	Yes	
2.9	2.2.9	• Seismic activity g	0,3	
3		**General**		
3.1	3.3.1	• Circuit-breaker compliant to SANS 62271-100	Yes	
3.2	3.3.2	• Circuit-breaker design (live-tank / dead-tank)	Live Tank	
3.3	3.3.3	• Circuit-breaker manufacturer	State	
3.4	3.3.4	• Circuit-breaker country of origin	State	
3.5	3.3.5	Circuit-breaker model/type designation	State	
3.6	3.3.6	Circuit-breaker total mass Kg	Horizontal	
3.7	3.3.7	CTs required	No	
3.8	3.3.8	- CT manufacturer	N/A	
3.9	3.3.9	- CT country of origin	N/A	
3.10	3.3.10	• Support structure design	State	

3.11	3.3.11	- Steel support structure to be supplied with circuit-breaker	No	
3.12	3.3.12	- Circuit-breaker pole operation	1 pole operated (1p)	
3.13	3.3.13	- Stored energy operation for circuit-breaker mechanism	Yes	
3.14	3.3.14	- Energy storage device	Spring	
3.15	3.3.15	- Operating drive mechanism country of origin	State	
3.16	3.3.16	NOTE: When a feeder circuit-breaker is in the closed position and the spring has been charged it shall be able to TRIP-CLOSE- TRIP before the spring needs to be rechamped	Yes	
3.17	3.3.17	- Manual and motorised spring charging	Yes	
3.18	3.3.18	- Manual and electric energy release	Yes	
3.19	3.3.19	- Mechanical energy stored in charged spring	State	
3.20	3.3.20	Mechanical device provided to prevent over-charging of the closing spring for manual and motor charging	Yes	
3.21	3.3.21	Safe conditions produced in the case of failure to latch	Yes	
3.22	3.3.22	Circuit-breaker insulation and/or extinguishing medium	SF/Enviro-friendly	
3.23	3.3.23	Mass of insulation and/or extinguishing medium Kg	State	
3.24	3.3.24	Type of interrupter design (puffer, self-blast, etc.)	State	
3.25	3.3.25	Configuration of moving contacts (single, double or triple motion)	State	
3.26	3.3.26	Minimim expected life-span of circuit-breaker Years	>40	
3.27	3.3.27	minimal maintenance accordance to electrical and mechanical endurance Y/N	Yes	
4		**Construction Requirements**		
4.1	4.4.1	• Design and layout of the circuit-breaker :	State	
4.2	4.4.2	standardised circuit-breaker elements to maximise interchangeability Y/N	Yes	
4.3	4.4.3	modular, pre-assembled elements shall be designed to facilitate landing and installation Y/N	State	
4.4	4.4.4	Filter material housing located to provide easy access during maintenance Y/N	Yes	
5		**Circuit-breaker operating mechanism enclosure requirements**		
5.1	5.5.1	Operating mechanisms, local control facilities and all parts requiring lubrication protected by weatherproof enclosure Y/N	Yes	

5.2	5.5.2	degree of protection for enclosures containing exposed bearings, auxillary switches, motors and other electrical devices IP	IP 55	
5.3	5.5.3	degree of protection for all open areas in the circuit-breaker common base frame as well as xtremely mounted indicating devices (where applicable) IP	IP 2X	
5.4	5.5.4	degree of protection for all other enclosures IP	IP 54	
5.5	5.5.5	Operating mechanism enclosure, handles and fixings materials	3CR12 stainless steel/ Painted aluminuim	
5.6	5.5.6	Operating mechanism enclosure corrosion protection in accordance with 3.2.6 of DSP 34-1658 Y/N	Yes	
5.7	5.5.7	Operating mechanism enclosure arranged to facilitate easy access from all sides Y/N	Yes	
5.8	5.5.8	all fastenings compliant with 240-56063756 and subject to Eskom approval Y/N	Yes	
5.9	5.5.9	Circuit-breaker designed for operation from the front of the operating mechanism enclosure Y/N	Yes	
5.10	5.5.10	• Access to the operating mechanism controls, terminals strips etc. provided through hinged front access door Y/N	Yes	
5.11	5.5.11	• Maximum height to top of mechanism allows servicing from ground (U,,< 132KV) or viewing indications and reading from ground (U,,> 132 KV)- it shall be shown clearly on the outline genaral Arrangement (GA) drawing Y/N	Yes	
5.12	5.5.12	• Front access door secured with a heavy-duty locking mechanism Y/N	Yes	
5.13	5.5.13	• Padlocking facility shackle diameter mm	6	
5.14	5.5.14	• Front access door equipped with travel stop Y/N	Yes	
5.15	5.5.15	• Rigid, corrosion resistant documentation pocket provided on inside of front access door, securely attached no protrusion throgh door Y/N	Yes	
5.16	5.5.16	• Facilites provided for securing operating tools on inside of front access door Y/N	Yes	
5.17	5.5.17	• Earthing of operating mechanism enclosure in accordance with 240-56063756 mm	Yes	
5.18	5.5.18	• Provision for bottom/ below entry of all control cabling into operating mechanism enclosure Y/N	Yes	
5.19	5.5.19	• Metallic cable racking provided for inter-pole cabling? Y/N	No	

5.20	5.5.20	• Upper surfaces of enclosure shaped/sloped to prevent the accumulative of water Y/N	Yes	
5.21	5.5.21	• Gasket material offered (0-rings)	Neoprene rubber/ Nitrile rubber/ Cork	
5.22	5.5.22	• Gauze-covered drain hole provided (> 25 mm) Y/N	Yes	
5.23	5.5.23	• Enclosure lifting eyes provided	Top	
5.24	5.5.24	• Enclosure colour in accordance with SANS 1019	Light Grey	
5.25	5.5.25	• Mechanical trip facility located inside mechanism enclosure (clearly marked with labels) Y/N	Yes	
5.26	5.5.26	Manuals switch for local remote operatio	State	
5.27	5.5.27	Alarm contact for door open	State	
6		**Circuit-breaker supporting structure**		
6.1	6.1.1	• Mechanical loads (in accordance to SANS 62271-100 clause 6.101.6) and parameters relating to the design of the circuit- breaker support structure and foundation	State	
6.2	6.2.2	Circuit-breaker steel support structure to be designed by manufacturer Y/N	No	
7		**Corrosion protection and lubrication**	IP55	
7.1	7.1.1	Corrosivity rating of enviroment Y/N	DSP34-1658/240-75655504	
	7.1.2	Corrosivity rating of enviroment- C4' and 'C5' (i.e. marine)	High C5 (marine)	
8		**Circuit-breaker operating mechanism enclosure heaters**		
8.1	8.1.1	• Heater size offered Watt	80	
8.2	8.2.2	• Heater maintains dew-point higher than ambient temparature, constantly circulates air to all parts of enclosure Y/N	Yes	
8.3	8.3.3	Electrical supply for heater shall be single phase 230V a.c. Y/N	Yes	
8.4	8.4.4	• Heater control circuit specification (240-56030489 and Eskom standard wiring drawing)	0.54/07529 and 240-56030489	
9		**Terminal requirements**		
9.1	9.1.1	• HV main terminal type	Flat pad	
9.2	9.2.2	• Flat pad details:	State	
	9.2.2.a	Number of holes and pitch mm	8x50/9x40	
	9.2.2.a	Thickness (min) mm	20	
	9.2.2.a	- Material	Aluminuim	
	9.2.2.a	• Main HV terminals shall be in accordance with SANS 62271•301 Y/N	Yes	

	9.2.2.a	• HV main terminals removable without interfering with operation of circuit-breaker Y/N	Yes	
10		**Safety clearances and personnel safety**		
10.1	10.1.1	• Live parts isolated by means of elevation Y/N	Yes	
10.2	10.2.2	Safe working procedure compliance to OHS Act Y/N	Yes	
11		**Insulation requirements**		
11.1	11.1.1	• Hollow insulators		
11.2	11.2.2	- Insulator material	Silicone rubber composite	
11.3	11.3.3	- Insulator country of origin	State	
11.4	11.4.4	Ceramic (porcelain) type insulators in accordance with SANS 62155 and 60815-2, where applicable Y/N	Yes	
11.5	11.5.5	Silicone rubber composite type insulators in accordance with SANS 61462 and SANS 60815-3 where applicable Y/N	Yes	
11.6	11.6.6	Circuit-breaker tested at KIPTS or Any equivalent Insulator pollution test perfomed	State	
11.7	11.7.7	• Test certificate & Test report for Insulator Pollution testing submitted with this Tender Documentation Y/N	Yes	
11.8	11.8.8	• Minimum insulation creepage distances (SANS 60815-1)	State	
11.9	11.9.9	Minimum external unified specific creepage distance (SCD) mm/kV	57,7	
11.10	11.10.10	Minimum external s ecific cree a e distance SCD mm/k/V	31	
11.11	11.11.11	• Clearances in air		
11.12	11.11.12	Phase to phase clearance in air mm	State	
11.13	11.11.13	Phase to earth clearance in air	State	
12		**Position / status indication**		
12.1	12.12.1	• Circuit-breaker position indication	State	
12.2	12.2.2	Position indication to SANS 62271-100 clause 5.12 Y/N	Yes	
12.3	12.3.3	Position indication visible with operating mechanism enclosure front access door closed Y/N	Yes	
12.4	12.4.4	Closed position: "I" in white lettering on a red background Y/N	Yes	
12.5	12.5.5	Open position: "0" in white lettering on a green Y/N	Yes	
12.6	12.6.6	Lettering (symbol) size (min) mm	30	

12.7	12.7.7	• Closing spring status indication mm	State	
12.8	12.8.8	Status indicated by "SPRING CHARGED" and "SPRING DISCHARCHED Y/N	Yes	
12.9	12.9.9	Lettering size (min) mm	15	
12.10	12.12.10	• Type of non-resettable circuit-breaker operation counter offered	Mechanical/Electrical	
12.11	12.12.11	• Pressure gauge provided (compensated for temperature and responding to insulation and/or extinguising meduim density)- where applicable Y/N	Yes	
12.12	12.12.12	• Pressure gauge sheltered from the elements - where applicable Y/N	Yes	
12.13	12.13.13	• All indicating devices clearly visible and legible by persons with normal vision standing at ground level Y/N	Yes	
13		**Labels**		
13.1	1.13.1	• Operating labels	State	
13.2	13.2.2.	Instructions for tripping ("TO TRIP") and closing ("TO CLOSE") the circuit-breaker Y/N	Yes	
13.3	13.3.3	Instructions for charging closing springs ("TO CHARGE SPRING") Y/N	Yes	
13.4	13.13.4	• Actuator(s) for local opening and closing of the circuit- breaker labelled in accordance with 240-56063756, NOTE The trip/close actuator colour differ from IEC 60073 Y/N	Yes	
13.5	13.13.5	• Appropriate warning label for performing manual operation without adequate amount of SF6 inside DCB Y/N	Yes	
13.6	13.6.6	• Appropriate warning label for mechanical trip facility Y/N	Yes	
13.7	13.7.7	• Appropriate warning labels for interval between repeated CO's at testing Y/N	Yes	
13.8	13.8.8	• Function labels Function labels provided to identify all LV (secondary) contol equipment Y/N	Yes	
13.9	13.9.9	Function label text height (min) - text in bleck letters on white background mm	5	
13.10	1.13.10	• Labels manufactured to 240-56062515, using inherently corrosion-resistant rivets or self-tapping screws Y/N	Yes	
14		**Requirements for SF 6 gas where applicable Note the supplier shall provide details of other enviromental friendly insulation and/ for extinguishing meduim, if applicable**		
14.1	14.1.1	• SF6 in accordance with IEC 60376 Y/N	Yes	

14.2	14.2.2	The maximum SF6 gas leakage rate (NB: provide details if if other enviro-friendly insulation and/or extinguising meduim) %	0.5 year	
	14.2.2.a	. SF6 gas purity		
14.3	14.3.3	SF6 content %	>98	
14.4	14.4.4	Dew point at rated filling pressure (max) (at +20°C) at commissioning 0C	>10	
	14.4.4 a	Moisture content (volume concentration of moisture expressed in microliters per liter at commissioning pUL	State	
	14.4.4.b	Dew point at rated filling pressure (max) (at +20°C) limit when in services	>5	
	14.4.4.c	Moisture content (volume concentration of moisture expressed in microliters limit when in service pUL	State	
	14.4.4.d	SF6 gas contamination (by-products) by volume, limit when in service ppmv	State	
	14.4.4.e	• SF6 gas-filled circuit-breaker filling and pressure monitoring (NB: provider details if other enviro-friendly insulation ans/or extinguishing meduim	State	
14.5	14.5.5	central gas/filling evacuation point connection provided	DILO DN20	
14.6	14.6.6	height of gas filling/evacuation point above ground (max) mm	2400	
14.7	14.7.7	gas filling point and the gas pressure gauge separated Y/N	Yes	
14.8	14.8.8	dial type gauge responding to Density and indicating pressure compensated for temperature provided Y/N	Yes	
14.9	14.9.9	Density monitoring device (density switch) contact requirements	0.54/07529	
14.10	14.10.10	Density monitoring device suitable for outdoor operation Y/N	Yes	
14.11	14.11.11	method/system used to prevent corrosion of moving parts and conatcts	State	
14.12	14.12.12	Density monitoring device shielded against direct sunshine Y/N	Yes	
14.13	14.13.13	non-return valves fitted on all DNB (for 1.45132k\O / DN20 (Un>220Kv) fittings and pipe work to allow removal of poles and or density monitoring devices while maintaining system pressure Y/N	Yes	
14.14	14.14.14	details of arrangement offered supplied with tender documentation Y/N	Yes	
14.15	14.15.15	pipe work material	stainless steel/ factory painted Cu	
14.16	14.16.16	separate/common filling/evacuating and density monitoring point per pole provided (i.e .3Por 1P design)	Separate	
14.17	14.17.17	type of electrical connections to the density-monitoring device Y/N	Yes	

14.18	14.18.18	electrical connections to the density monitoring device shall preferebly not be plug-in-type Y/N	Yes	
14.19	14.19.19	density-monitoring devices with locking facilities (preferred) Y/N	Yes	
14.20	14.20.20	cabling protected using compression glands/ rubber grommts Y/N	Yes	
14.21	14.21.21	details of all pressure devices provided with tender documentation Y/N	Yes	
14.22	14.22.22	Density monitoring device electrical Interlocks and alarm requirements	Yes 2 alarm & 2 lockout contacts	
14.23	14.23.23	• Management of SF6 gas in accordance with NRS 087 Y/N	Yes	
15		**Requirements for simultaneity of poles during single closing and single opening operations**		
15.1	15.1.1	Contact synchronism retained within rated values during the expected maintenance interval of circuit-breaker Y/N	Yes	
15.2	15.2.2	time interval between contact touch for all poles of the circuit-breaker ms	<5	
15.3	15.3.3	time interval between contact touch for interrupters in the same pole ms	<3.3	
15.4	1.1.38	time interval between contact touch for individual closing resistors-where applicable ms	<10	
15.5	15.5.5	time interval between contact touch for individual closing resistors in the same pole (series connected)- where applicable ms ms	<6.6	
15.6	15.6.6	time interval between contact separation for all poles of the circuit breaker ms	<3.3	
15.7	15.7.7	time interval between contact separation for interrupters in the same pole ms	<2.5	

SECTION 5: PARTICULARS & GUARRANTEES

PART 3.1: DISCONNECTORS AND EARTHING SWITCHES

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
4	**Horizontal break isolators rated 2 500A with an earth switch on one side**			
4.1	Details of disconnector			
4.1.1	Manufacturer		State	
4.1.2	Type designation		State	
4.1.3	Number of breaks	no	Double Breaks	
4.1.4	Isolating distance	mm	State	
4.1.5	Main contacts			
4.1.5.1	entry (see also 4.5.1 NRS 031)		xxxxxxxxxxxx	
4.1.5.2	Type		xxxxxxxxxxxx	
4.1.5.3	Materials		xxxxxxxxxxxx	
4.1.5.4	Wear allowance		xxxxxxxxxxxx	
4,2	Details of earthing switch			
4.2.1	Manufacturer		State	
4.2.2	Type designation		State	
4.2.3	Number of breaks		State	
4.2.4	main contacts		xxxxxxxxxxx	
4.2.4.1	Entry		xxxxxxxxxxx	

4.2.4.2	Type		xxxxxxxxxxx	
4.2.4.3	Materials		xxxxxxxxxxx	
4.2.4.4	Wear allowance		xxxxxxxxxxx	
4.3	Disconnector rating			
4.3.1	Rated voltage	kV	132	
4.3.2	Rated current	A	2 500	
4.3.3	Rated short-time withstand current	kA	31,5	
4.3.4	Short-time withstand current duration	s	3	
4.3.5	Rated peak withstand current	kA	78	
4.4	Earthing Switch Ratings			
4.4.1	Rated voltage	kV	132	
4.4.2	Rated short-time withstand current	kA	31,5	
4.4.3	Rated short-time withstand current duration	s	3	
4.4.4	Rated peak withstand current	kA	78	
4,5	Mounting of disconnectors			
4.5.1	upright, horizontal / vertical		upright	
4.5.2	phase spacing	mm	3 000	
4.5.3	arrangement of phases, in-line or transverse		in-line	
4.5.4	is a support structure to be provided?		Yes	
	if YES			
4.5.5	minimum mounting height (lowest part of insulator above ground level)	mm	2 500	
4.5.6	are necessary fixing bolts, shims, etc., to be provided?		Required	
4.6	Method of operation, i.e. hand, electric motor or other			
4.6.1	For hand operation		xxxxxxxxxx	
4.6.1.1	horizontal / vertical movement offered?		xxxxxxxxxx	

4.6.1.2	are interlocking facilities required?		Yes	
4.6.1.3	If YES, details		see spec.	
4.6.1.4	requirements for earthing of operating handle		strap	
4.6.2	For electric motor operation			
4.6.2.1	control voltage	V	110 dc	
4.6.2.2	rated power	W	xxxxxxxxx	
4.6.2.3	starting current	A	xxxxxxxxx	
4.6.2.4	alternative control switch labelling			
4.6.2.5	are special interlocking arrangements required?		Yes	
4.6.2.6	If Yes, details		see spec.	
4.6.3	For other method of operation			
4.6.3.1	requirements			
4.6.3.2	details			
4,7	Are spark gaps and arcing horns required for disconnectors		No	
4,8	Auxiliary switches			
4.8.1	number of contacts for disconnectors			
4.8.1.1	Type G		8	
4.8.1.2	Type M		8	
4.8.1.3	Type F		2	
4.8.1.4	Type N		6	
4.8.1.5	Type D		0	
4.8.2	number of contacts for earthing switches			
4.8.2.1	Type M		4	
4.8.2.2	Type N		4	
4.8.3	rating of auxiliary switches			

4.8.3.1	continuous current	A	5	
4.8.3.2	current overload for 1 s	A	100	
4,9	Main terminals			
4.9.1	type, stem of pad?		stem	
4.9.2	orientation : horizontal / vertical?		hor	
4.9.3	if stems			
4.9.3.1	diameter	mm	38	
4.9.3.2	length	mm	xxxxxxxxxxx	
4.9.4	if pads			
4.9.4.1	number of holes			
4.9.4.2	diameter of holes	mm	xxxxxxxxxxx	
4.9.4.3	pitch of holes	mm	xxxxxxxxxxx	
4.9.4.4	thickness of pad	mm	xxxxxxxxxxx	
4,10	Secondary terminals if other than spring-loaded			
4.10.1	type required		xxxxxxxxxxx	
4.10.2	type and make offered for approval		xxxxxxxxxxx	
4,11	Minimum size for gland plate	mm	150 x 100	
4,12	Metal finish			
4.12.1	is electrogalvanizing, sherardizing or metal spraying of ferrous parts acceptable?		No	
4.12.2	finish offered on ferrous parts (to be approved)			
4.12.3	finish offered on non-ferrous parts (to be approved)			
4.12.4	method of rectifying damaged galvanizing (to be approved)			
4,13	Insulators			
4.13.1	Details of insulators offered			

4.13.1.1	manufacturer		State	
4.13.1.2	type designation		State	
4.13.1.3	number of units in stack		State	
4.13.1.4	cantilever strength class	N	4 000	
4.13.1.5	torsional strength	N.m	6 000	
4,14	Insulator test voltages			
4.14.1	peak value of impulse voltage referred to sea level	kV	650	
4.14.1.1	to earth and between phases in the open position	kV	750	
4.14.1.2	Across the isolating distance		xxxxxxxxxxxxxxx	
4.14.2	characteristic waveshape of impulse		xxxxxxxxxxxxxxx	
4.14.2.1	(LIW = Lightning Impulse Withstand)	æs	1/50	
4.14.2.2	(SIW = Switching Impulse Withstand)	æs	-	
4.14.3	60 s power frequency wet withstand voltage referred to sea level			
4.14.3.1	to earth and between phases in the open position	kV	275	
4.14.3.2	across the isolating distance	kV		
4,15	insulator dimensions			
4.15.1	top flange PCD	mm	xxxxxxxxxxxxxxx	
4.15.2	bottom flange PCD	mm	xxxxxxxxxxxxxxx	
4.15.3	overall height	mm	xxxxxxxxxxxxxxx	
4,16	Insulator arcing distances	mm		
4,17	Creepage distance			
4.17.1	minimum creepage distance for other than medium pollution level	mm	3 625	
4,18	Recommended spare parts			
4,19	Special tools required			

4,20	Tests			
4.20.1	What type test certification for similar equipment is available?			
4,21	Period and value for short-time current test	s		
4,22	Marking/ labelling / documentation			
4.22.1	language(s) for labels, drawings, certificates and manuals			
4.22.2	number of instruction manuals required		3	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5,1	Details of disconnector			
5.1.1	Manufacturer		State	
5.1.2	Type designation		State	
5.1.3	Number of breaks		2	
5.1.4	Isolating distance	mm	State	
5.1.5	main contacts		1 150	
5.1.5.1	entry (see also 4.5.1 NRS 031)			
5.1.5.2	type		xxxxxxxxxxxxx	
5.1.5.3	materials		xxxxxxxxxxxxx	
5.1.5.4	wear allowance		xxxxxxxxxxxxx	
5,2	Details of earthing switch			
5.2.1	manufacturer		xxxxxxxxxxxxx	
5.2.2	type designation		xxxxxxxxxxxxx	
5.2.3	number of breaks		xxxxxxxxxxxxx	
5.2.4	main contacts			
5.2.4.1	entry		xxxxxxxxxxxxx	
5.2.4.2	type		xxxxxxxxxxxxx	
5.2.4.3	materials		xxxxxxxxxxxxx	
5.2.4.4	wear allowance			
5,3	Disconnector rating			
5.3.1	rated voltage	kV	132	
5.3.2	rated current	A	2 500	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5.3.3	rated short-time withstand current	kA	31,5	
5.3.4	short-time withstand current duration	s	3	
5.3.5	rated peak withstand current	kA	78	
5,4	Earthing switch ratings			
5.4.1	rated voltage	kV	132	
5.4.2	rated short-time withstand current	kA	31,5	
5.4.3	rated short-time withstand current duration	s	3	
5.4.4	rated peak withstand current	kA	78	
5,5	Mounting of disconnectors			
5.5.1	upright, horizontal / vertical		upright	
5.5.2	phase spacing	mm	3 000	
5.5.3	arrangement of phases, in-line or transverse		in-line	
5.5.4	is a support structure to be provided?		Yes	
	if YES			
5.5.5	minimum mounting height (lowest part of insulator above ground level)	mm	2 500	
5.5.6	are necessary fixing bolts, shims, etc., to be provided?		see spec.	
5.5.7	other details			
5,6	Method of operation, i.e. hand, electric motor or other			
5.6.1	For hand operation			
5.6.1.1	horizontal / vertical movement offered?			
5.6.1.2	are interlocking facilities required?		Yes	
5.6.1.3	If YES, details		see spec.	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5.6.1.4	requirements for earthing of operating handle		strap	
5.6.2	For electric motor operation			
5.6.2.1	control voltage	V	110 dc	
5.6.2.2	rated power	W	xxxxxxxxxxxxx	
5.6.2.3	starting current	A	xxxxxxxxxxxxx	
5.6.2.4	alternative control switch labelling			
5.6.2.5	are special interlocking arrangements required?		Yes	
5.6.2.6	If Yes, details		see spec.	
5.6.3	For other method of operation			
5.6.3.1	requirements		xxxxxxxxxxxxx	
5.6.3.2	details		xxxxxxxxxxxxx	
5,7	Are spark gaps and arcing horns required for disconnectors		No	
5,8	Auxiliary switches			
5.8.1	number of contacts for disconnectors			
5.8.1.1	Type G		8	
5.8.1.2	Type M		8	
5.8.1.3	Type F		2	
5.8.1.4	Type N		6	
5.8.1.5	Type D		0	
5.8.2	number of contacts for earthing switches			
5.8.2.1	Type M		4	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5.8.2.2	Type N		4	
5.8.3	rating of auxiliary switches			
5.8.3.1	continuous current	A	5	
5.8.3.2	current overload for 1 s	A	100	
5,9	Main terminals			
5.9.1	type, stem of pad?		stem	
5.9.2	orientation : horizontal / vertical?		hor	
5.9.3	if stems			
5.9.3.1	diameter	mm	38	
5.9.3.2	length	mm		
5.9.4	if pads			
5.9.4.1	number of holes			
5.9.4.2	diameter of holes	mm	xxxxxxxxxxxx	
5.9.4.3	pitch of holes	mm	xxxxxxxxxxxx	
5.9.4.4	thickness of pad	mm	xxxxxxxxxxxx	
5,10	Secondary terminals if other than spring-loaded			
5.10.1	type required		xxxxxxxxxxxx	
5.10.2	type and make offered for approval		xxxxxxxxxxxx	
5,11	Minimum size for gland plate	mm	150 x 100	
5,12	Metal finish			
5.12.1	is electrogalvanizing, sherardizing or metal spraying of ferrous parts acceptable?		No	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5.12.2	finish offered on ferrous parts (to be approved)			
5.12.3	finish offered on non-ferrous parts (to be approved)			
5.12.4	method of rectifying damaged galvanizing (to be approved)			
5,13	Insulators			
5.13.1	Details of insulators offered			
5.13.1.1	manufacturer		xxxxxxxxxxxxx	
5.13.1.2	type designation		xxxxxxxxxxxxx	
5.13.1.3	number of units in stack		xxxxxxxxxxxxx	
5.13.1.4	cantilever strength class	N	4 000	
5.13.1.5	torsional strength	N.m	6 000	
5,14	Insulator test voltages			
5.14.1	peak value of impulse voltage referred to sea level			
5.14.1.1	to earth and between phases in the open position	kV	650	
5.14.1.2	Across the isolating distance	kV	750	
5.14.2	characteristic waveshape of impulse			
5.14.2.1	(LIW = Lightning Impulse Withstand)	æs	1/50	
5.14.2.2	(SIW = Switching Impulse Withstand)	æs	-	
5.14.3	60 s power frequency wet withstand voltage referred to sea level			
5.14.3.1	to earth and between phases in the open position	kV	275	
5.14.3.2	across the isolating distance	kV		
5,15	Insulator dimensions			
5.15.1	top flange PCD	mm	xxxxxxxxxxxxx	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
5	**Horizontal break isolators rated 2 500 A with an earth switch on both sides**			
5.15.2	bottom flange PCD	mm	xxxxxxxxxxxxx	
5.15.3	overall height	mm	xxxxxxxxxxxxx	
5,16	Insulator arcing distances	mm	xxxxxxxxxxxxx	
5,17	Creepage distance			
5.17.1	minimum creepage distance for other than medium pollution level	mm	3 625	
5,18	Recommended spare parts			
5,19	Special tools required			
5,20	Tests			
5.20.1	What type test certification for similar equipment is available?			
5,21	Period and value for short-time current test	s		
5,22	Marking/ labelling / documentation			
5.22.1	language(s) for labels, drawings, certificates and manuals			
5.22.2	number of instruction manuals required		3	

SECTION 5: PARTICULARS & GUARRANTEES

PART 3.1: DISCONNECTORS AND EARTHING

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3	**DISCONNECTORS AND EARTHING SWITCHES**			
6	**Pantograph isolators rated 1 600 A without an earth switch**			
6,1	Details of disconnector			
6.1.1	Manufacturer		State	
6.1.2	Type designation		State	
6.1.3	Number of breaks		State	
6.1.4	Isolating distance	mm		
6.1.5	Main contacts		1 150	
6.5.1.1	entry (see also 4.5.1 NRS 031)			
6.1.5.2	Type		xxxxxxxxxxxxxx	
6.1.5.3	Contact force	N	xxxxxxxxxxxxxx	
6.1.5.4	Materials		xxxxxxxxxxxxxx	
6.1.5.5	wear allowance		xxxxxxxxxxxxxx	
6,2	Details of earthing switch			
6.2.1	manufacturer		State	
6.2.2	type designation		State	
6.2.3	number of breaks		State	
6.2.4	main contacts		State	
6.2.4.1	entry		State	
6.2.4.2	type		State	

6.2.4.3	contact force	N	State	
6.2.4.4	materials		State	
6.2.4.5	wear allowance		State	
6.3	Disconnector rating			
6.3.1	rated voltage	kV	132	
6.3.2	rated current	A	1600	
6.3.3	rated short-time withstand current	kA	31,5	
6.3.4	short-time withstand current duration	s	3	
6.3.5	rated peak withstand current	kA	78	
6,4	Earthing switch ratings			
6.4.1	rated voltage	kV	132	
6.4.12	rated short-time withstand current	kA	31,5	
6.4.3	rated short-time withstand current duration	s	3	
6.4.4	rated peak withstand current	kA	78	
6,5	Mounting of disconnectors			
6.5.1	upright, horizontal / vertical		upright	
6.5.2	phase spacing	mm	3 000	
6.5.3	arrangement of phases, in-line or transverse		in-line	
6.5.4	is a support structure to be provided?		Yes	
	if YES			
6.5.5	minimum mounting height (lowest part of insulator above ground level)	mm	2 500	
6.5.6	are neccessary fixing bolts, shims, etc., to be provided?		see spec.	
6.5.7	other details			
6,6	Method of operation, i.e. hand, electric motor or other		xxxxxxxxxxx	
6.6.1	For hand operation		xxxxxxxxxxx	
6.6.1.1	horizontal / vertical movement offered?		xxxxxxxxxxx	

6.6.1.2	are interlocking facilities required?		Yes	
6.6.1.3	If YES, details		see spec.	
6.6.1.4	requirements for earthing of operating handle		strap	
6.6.2	For electric motor operation			
6.6.2.1	control voltage	V	110 dc	
6.6.2.2	rated power	W	xxxxxxxxxxxx	
6.6.2.3	starting current	A	xxxxxxxxxxxx	
6.6.2.4	alternative control switch labelling			
6.6.2.5	are special interlocking arrangements required?		Yes	
6.6.2.6	If Yes, details		see spec.	
6.6.3	For other method of operation			
6.6.3.1	requirements		xxxxxxxxxxxxxxx	
6.6.3.2	details		xxxxxxxxxxxxxxx	
6,7	Are spark gaps and arcing horns required for disconnectors		No	
6,8	Auxiliary switches			
6.8.1	number of contacts for disconnectors			
6.8.1.1	Type G		8	
6.8.1.2	Type M		8	
6.8.1.3	Type F		2	
6.8.1.4	Type N		6	
6.8.1.5	Type D		0	
6.8.2	number of contacts for earthing switches			
6.8.2.1	Type M		4	
6.8.2.2	Type N		4	
6.8.3	rating of auxiliary switches			
6.8.3.1	continuous current	A	5	
6.8.3.2	current overload for 1 s	A	100	

6,9	Main terminals			
6.9.1	type, stem of pad?		stem	
6.9.2	orientation : horizontal / vertical?		hor	
6.9.3	if stems			
6.9.3.1	diameter	mm	38	
6.9.3.2	length	mm	xxxxxxxxxxxxx	
6.9.4	if pads			
6.9.4.1	number of holes			
6.9.4.2	diameter of holes	mm	xxxxxxxxxxxxx	
6.9.4.3	pitch of holes	mm	xxxxxxxxxxxxx	
6.9.4.4	thickness of pad	mm	xxxxxxxxxxxxx	
6,10	Secondary terminals if other than spring-loaded			
6.10.1	type required			
6.10.2	type and make offered for approval			
6,11	Minimum size for gland plate	mm	150 x 100	
6,12	Metal finish			
6.12.1	Is electrogalvanizing, sherardizing or metal spraying of ferrous parts acceptable?		No	
6.12.2	finish offered on ferrous parts (to be approved)			
6.12.3	finish offered on non-ferrous parts (to be approved)			
6.12.4	method of rectifying damaged galvanizing (to be approved)			
6,13	Insulators			
6.13.1	Details of insulators offered			
6.13.1.1	manufacturer		State	
6.13.1.2	type designation		State	
6.13.1.3	number of units in stack		State	
6.13.1.4	cantilever strength class	N	4 000	
6.13.1.5	torsional strength	N.m	6 000	

6,14	Insulator test voltages			
6.14.1	peak value of impulse voltage referred to sea level			
6.14.1.1	to earth and between phases in the open positon	kV	xxxxxxxxxxxxx	
6.14.1.2	Across the isolating distance	kV	xxxxxxxxxxxxx	
6.14.2	characteristic waveshape of impulse			
6.14.2.1	(LIW = Lightning Impulse Withstand)	æs	1/50	
6.14.2.2	(SIW = Switching Impulse Withstand)	æs	-	
6.14.3	60 s power frequency wet withstand voltage referred to sea level			
6.14.3.1	to earth and between phases in the open position	kV	275	
6.14.3.2	across the isolating distance	kV		
6,15	Insulator dimensions			
6.15.1	top flange PCD	mm	xxxxxxxxxx	
6.15.2	bottom flange PCD	mm	xxxxxxxxxx	
6.15.3	overall height	mm	xxxxxxxxxx	
6,16	Insulator arcing distances	mm	xxxxxxxxxx	
6,17	Creepage distance			
6.17.1	minimum creepage distance for other than medium pollution level (see also R.2)	mm	3 625	
6,18	Recommended spare parts			
6,19	Special tools required			
6,20	Tests			
6.20.1	What type test certification for similar equipment is available?			
6,21	Period and value for short-time current test	s		
6,22	Marking/ labelling / documentation			
6.22.1	language(s) for labels, drawings, certificates and manuals			
6.22.2	number of instruction manuals required		3	

SECTION 5: PARTICULARS & GUARRANTEES
PART 3.1: DISCONNECTORS AND EARTHING SWITCHES

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
Item 3 7	**DISCONNECTORS AND EARTHING SWITCHES Pantograph isolators rated 1 600 A with an earth switch**			
7,1	Details of disconnector			
7.1.1	manufacturer		State	
7.1.2	type designation		State	
7.1.3	number of breaks		State	
7.1.4	isolating distance	mm	1 150	
7.1.5	main contacts		xxxxxxxxxxx	
7.1.5.1	entry (see also 4.5.1 NRS 031)		xxxxxxxxxxx	
7.1.5.2	type		xxxxxxxxxxx	
7.1.5.3	contact force	N	xxxxxxxxxxx	
7.1.5.4	materials		xxxxxxxxxxx	
7.1.5.5	wear allowance		xxxxxxxxxxx	
7,2	Details of earthing switch			
7.2.1	manufacturer		State	
7.2.2	type designation		State	
7.2.3	number of breaks		State	
7.2.4	main contacts		State	
7.2.4.1	entry		State	
7.2.4.2	type		State	
7.2.4.3	contact force	N	State	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
7.2.4.4	materials		State	
7.2.4.5	wear allowance		State	
7,3	Disconnector rating			
7.3.1	rated voltage	kV	132	
7.3.2	rated current	A	1600	
7.3.3	rated short-time withstand current	kA	31,5	
7.3.4	short-time withstand current duration	s	3	
7.3.4	rated peak withstand current	kA	78	
7,4	Earthing switch ratings			
7.4.1	rated voltage	kV	132	
7.4.2	rated short-time withstand current	kA	31,5	
7.4.3	rated short-time withstand current duration	s	3	
7.4.4	rated peak withstand current	kA	78	
7,5	Mounting of disconnectors			
7.5.1	upright, horizontal / vertical		upright	
7.5.2	phase spacing	mm	3 000	
7.5.3	arrangement of phases, in-line or transverse		in-line	
7.5.4	is a support structure to be provided?		Yes	
	if YES			
7.5.5	minimum mounting height (lowest part of insulator above ground level)	mm	2 500	
7.5.6	are neccessary fixing bolts, shims, etc., to be provided?		see spec.	
7.5.7	other details			
7,6	Method of operation, i.e. hand, electric motor or other			
7.6.1	For hand operation			

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
7.6.1.1	horizontal / vertical movement offered?			
7.6.1.2	are interlocking facilities required?		Yes	
7.6.1.3	If YES, details		see spec.	
7.6.1.4	requirements for earthing of operating handle		strap	
7.6.2	For electric motor operation			
7.6.2.1	control voltage	V	110 dc	
7.6.2.2	rated power	W	xxxxxxxxxxx	
7.6.2.3	starting current	A	xxxxxxxxxxx	
7.6.2.4	alternative control switch labelling			
7.6.2.5	are special interlocking arrangements required?		Yes	
7.6.2.6	If Yes, details		see spec.	
7.6.3	For other method of operation			
7.6.3.1	requirements		xxxxxxxx	
7.6.3.2	details			
7,7	Are spark gaps and arcing horns required for disconnectors		No	
7,8	Auxiliary switches			
7.8.1	number of contacts for disconnectors			
7.8.1.1	Type G		8	
7.8.1.2	Type M		8	
7.8.1.3	Type F		2	
7.8.1.4	Type N		6	
7.8.1.5	Type D		0	
7.8.2	number of contacts for earthing switches			

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
7.8.2.1	Type M		4	
7.8.2.2	Type N		4	
7.8.3	rating of auxiliary switches			
7.8.3.1	continuous current	A	5	
7.8.3.2	current overload for 1 s	A	100	
7,9	Main terminals			
7.9.1	type, stem of pad?		stem	
7.9.2	orientation : horizontal / vertical?		hor	
7.9.3	if stems			
7.9.3.1	diameter	mm	38	
7.9.3.2	length	mm	xxxxxxxx	
7.9.4	if pads			
7.9.4.1	number of holes			
7.9.4.2	diameter of holes	mm	xxxxxxxx	
7.9.4.3	pitch of holes	mm	xxxxxxxx	
7.9.4.4	thickness of pad	mm	xxxxxxxx	
7,10	Secondary terminals if other than spring-loaded			
7.10.1	type required			
7.10.2	type and make offered for approval			
7,11	Minimum size for gland plat	mm	150 x 100	
7,12	Metal finish			
7.12.1	is electrogalvanizing, sherardizing or metal spraying of ferrous parts acceptable?		No	
7.12.2	finish offered on ferrous parts (to be approved)			

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
7.12.3	finish offered on non-ferrous parts (to be approved)			
7.12.4	method of rectifying damaged galvanizing (to be approved)			
7,13	Insulators			
7.13.1	Details of insulators offered			
7.13.1.1	manufacturer		State	
7.13.1.2	type designation		State	
7.13.1.3	number of units in stack		State	
7.13.1.4	cantilever strength class	N	4 000	
7.13.1.5	torsional strength	N.m	6 000	
7,14	Insulator test voltages			
7.14.1	peak value of impulse voltage referred to sea level			
7.14.1.1	to earth and between phases in the open positon	kV	xxxxxxxxxxxx	
7.14.1.2	Across the isolating distance	kV	xxxxxxxxxxxx	
7.14.2	characteristic waveshape of impulse			
7.14.2.1	(LIW = Lightning Impulse Withstand)	æs	1/50	
7.14.2.2	(SIW = Switching Impulse Withstand)	æs	xxxxxxxxxxxx	
7.14.3	60 s power frequency wet withstand voltage referred to sea level			
7.14.3.1	to earth and between phases in the open position	kV	275	
7.14.3.2	across the isolating distance	kV	xxxxxxxxxxxxx	
7,15	Insulator dimensions			
7.15.1	top flange PCD	mm	xxxxxxxxxxxxx	
7.15.2	bottom flange PCD	mm	xxxxxxxxxxxxx	
7.15.3	overall height	mm	xxxxxxxxxxxxx	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
7,16	Insulator arcing distances	mm	xxxxxxxxxxxxx	
7,17	Creepage distance			
7.17.1	minimum creepage distance for other than medium pollution level	mm	3 625	
7,18	Recommended spare parts			
7,19	Special tools required			
7,20	Tests			
7.20.1	What type test certification for similar equipment is available?			
7,21	Period and value for short-time current test	s		
7,22	Marking/ labelling / documentation			
7.22.1	language(s) for labels, drawings, certificates and manuals			
7.22.2	number of instruction manuals required		3	

SECTION 5: PARTICULARS & GUARRANTEES

PART 4.1: SURGE DIVERTORS

SPECIFICATION NO:

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMEN	OFFERED AND GUARANTEED
1	**VOLTAGE LEVELS**			
1,1	Impulse withstand at sea-level (BIL)	kV	650	
1,2	Impulse withstand at Pretoria	kV	550	
1,3	System voltage	kV	132	
1,4	Earthing configuration		solid neutral	
2	**ELECTRICAL CLEARANCES**			
2,1	Minimum distance between live grading and earth (flash-over distance)	mm	min 1 450	
2,2	Total creepage distance to earth	mm	xxxxxxxx	
2,3	Total protected creepage distance to earth	mm	xxxxxxxx	
3	**GENERAL DESIGN DETAILS**			
3,1	Make and type / model		State	
3,2	Place of manufacture		State	
3,3	Type of surge diverter		Station type, pedestal mounted	
3,4	Active material of diverter :			
3,5	Grading rings		Preferred	
3,6	Line terminal			
3.6.1	To take stranded Aluminium		25 mm	
3.6.2	Bi-metal interface		If required	
3.6.3	Approach		Vertical	
3,7	Earth terminals - To take copper strap		50 x 3,5 mm	
3,8	Surge diverter rated voltage	kV	120	
3,9	Nominal discharge current rating (8/20 microsecond)	kA	10	
3,10	Duty class of surge diverter		Heavy duty	
3,11	Application class of surge diverter		Station type	
3,12	Diverter reseal voltage (phase to phase)	kV r.m.s.	Min 120	
3,13	Peak residual voltage for 8/20 microsecond current impulse of the following magnitudes :			
3.13.1	1 000 A	V		
3.13.2	2 000 A	V		
3.13.3	5 000 A	V		
3.13.4	10 000 A	V	maximum 400V	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMEN	OFFERED AND GUARANTEED
3,14	Conditions of high current impulse tests on surge diverter :			
3.14.1	Waveshape of impulse current	micro sec	4/10	
3.14.2	Magnitude of impulse current	kA	100 minimum	
3.14.3	Number of applications		2	
3,15	Conditions for long duration impulse current test on surge diverter :			
3.15.1	Magnitude of impulse current	A	500 minimum	
3.15.2	Duration of rectangular current wave		2 000	
3.15.3	Total number of applications		20	
3.15.4	Number of groups of applications		4	
3.15.5	Number of applications in each group		5	
3.15.6	Interval between applications in group	s	50 - 60	
3.15.7	Interval between groups of applications	minutes	25 - 30	
3,16	Long duration discharge class (Table 3 BS 2914)		2	
3,17	Conditions for operating duty test on diverter or diverter units :			
3.17.1	Wave shape of impulse current	micro sec	8/20	
3.17.2	Peak value of impulse discharge current	kA	10	
3.17.3	Total number of applications		20	
3.17.4	Number of groups of applications		4	
3.17.5	Number of applications in each group		4	
3.17.6	Interval between applications in group	s	50 - 60	
3.17.7	Interval between groups of applications	minutes	25 - 30	
3.17.8	Peak magnitude of follow current			
3.17.9	Power-frequency voltage across diverter terminals during flow of follow current not less than		100% rated voltage	
3,18	Pressure relief class rating	Class A	State	
3,19	Minimum prospective symmetrical fault current	kA	40	
3,20	Surge diverter insulation voltage withstand tests with internal parts removed (at sea-level) :		xxxxxxxx	
3.20.1	1,2/50 microsecond wave shape impulse	kA peak	650	
3.20.2	'60 second wet 50 Hz voltage	kV r.m.s.	xxxxxxxx	
3,21	Leakage current through complete surge diverter at rated system phase voltage	kA	xxxxxxxx	
3,22	Voltage grading achieved by means of (non-linear resistors, capacitance etc.)		xxxxxxxx	
3,23	State voltage distribution uniform or non-uniform		xxxxxxxx	
3,24	Rated voltage of pro-rated diverter units stacked to form complete arrester		xxxxxxxx	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMEN	OFFERED AND GUARANTEED
3,25	Number of resistor blocks in each prorated diverter unit (valve resistor) in each			
3.25.1	Top unit :			
	a) In series		xxxxxxxxx	
	b) In parallel		xxxxxxxxx	
	c) Total		xxxxxxxxx	
3.25.2	Bottom unit :			
	a) In series		xxxxxxxx	
	b) In parallel		xxxxxxxx	
	c) Total		xxxxxxxx	
3,26	Dimensions of resistor blocks:			
3.26.1	Outside diameter	mm	xxxxxxxx	
3.26.2	Length	mm	xxxxxxxx	
3,27	Radio noise influence 1,0 MHz of single-phase diverter measured in accordancewith NEMA Publication 107 when diverter is energised to :			
3.27.1	80% of diverter rated voltage	micro-sec.	xxxxxxxx	
3.27.2	100% of diverter rated voltage	micro-sec.	xxxxxxxx	
3,28	Number of diverter units stacked in complete surge diverter		xxxxxxxx	
3,29	Total mass assembled arrester complete surge diverter	kg	Maximum	
3,30	Total mass assembled arrester complete surge diverter	kg	xxxxxxxx	
3,31	Overall height of assembled diverter above mounting level	mm	xxxxxxxx	
3,32	Largest major diameter over porcelain sheds	mm	xxxxxxxx	
3,33	Largest minor diameter over porcelain sheds	mm	xxxxxxxx	
3,34	Smallest major diameter over porcelain sheds	mm	xxxxxxxx	
3,35	Smallest minor diameter over porcelai sheds	mm	xxxxxxxx	
3,36	Filling medium of surge arrestor housing (nitrogen, air, etc.)		xxxxxxxx	
3,37	Method of sealing surge arrestor units	m	xxxxxxxx	
3,38	Altitude above sea-level corresponding to internal pressure of sealed surge arrester	m		
3,39	Maximum ambient temperature rating of diverter	Deg C	xxxxxxxx	
3,40	Maximum ambient temperature rating of diverter	Deg C	xxxxxxxx	
3,41	Maximum wind speeds that complete surge diverter mounted on insulating base will withstand :			
3.41.1	Steady wind conditions	km/h	xxxxxxxx	
3.41.2	Gusty conditions	km/h	xxxxxxxx	
3,42	Ultimate bending moment rating for surge diverter	Nm	xxxxxxxx	

SECTION 5: PARTICULARS & GUARRANTEES

PART 5.1: 132KV VOLTAGE TRANSFORMERS (OUTDOOR)

SPECIFICATION:

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
1	**132kV OUTDDOR VOLTAGE TRANSFORMERS**			
	Manufacturer		State	
	Type number		State	
5.1				
5.1.1	General requirements			
	a) indoor or outdoor use		outdoor	
	b) measuring core		xxxxxxxx	
	Measuring			
	1. rated burden per phase	VA	100	
	2. accuracy class	VA	0,2	
	c) protection core			
	1. rated burden per phase	VA	100	
	2. accuracy class	VA	3P	
	d) 3-phase voltage transformers		no	
	1. HV neutral earthed		yes	
	e) single-phase voltage transformers		yes	
	f) symmetrical 3-phase fault current (only applies when HV fuses are	kA	NA	
	g) fault current phase-to-earth (only applies when HV fuses are required)	kV	NA	
	h) basic insulation level	kV	650	
	I) Ratio	kV	[132/sqrt3]/[11/sqrt3]	
5.1.2	Is a power winding required ? If yes,		no	
	a) rated secondary voltage	V	xxxxxxxxxx	

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
	b) rated continious current of secondary winding	A	xxxxxxxxxx	
5.1.3	Creepage distance			
	Minimum creepage distance for other than medium pollution level	mm	xxxxxxxxxx	
5.1.4	Outdoor-type voltage transformers			
	1) primary insulation medium		xxxxxxxxxx	
	2) secondary insulation medium		xxxxxxxxxx	
	3) core insulation medium		xxxxxxxxxx	
	4) main insulation (oil, gas or resin)		xxxxxxxxxx	
5.1.5	Oil-insulated voltage transformers quantity of oil		xxxxxxxxxx	
	Details to be supplied for approval			
	a) sealing arrangement		yes	
	b) oil-level indicators		yes	
5.1.6	Dry-type insulation			
	Is this core included in the encapsulation ?		xxxxxxxxxx	
5.1.7	Gas-insulted voltrage transformers			
	Method of sealing		NA	
	Type of densing meter		xxxxxxxxxx	
	Number of contacts		xxxxxxxxxx	
	Operating densities		xxxxxxxxxx	
5.1.8	Voltage factor		2.0	
	Time for voltage factor	s	xxxxxxxxxx	
5.1.9	Short circuit protection			
	Are primary fuses required ?		NO	
	if YES,			
	a) rating	A	xxxxxxxxxx	

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
	b) location		xxxxxxxxxx	
5.1.10	If secondary protection required ?		YES	
	If YES,			
	a) by means of fuses/MCCBs ?		fuses	
	b) current rating	A		
	c) make and type of protection			
5.1.11	Short-circuit currents			
	a) calculated secondary short circuit current	A	xxxxxxxxxx	
	b) maximum permissible duration of secondary short-circuit current	s	1	
	c) operating time for secondary short circuit	s	xxxxxxxxxx	
	d) calculated primary current for a secondary short-circuit assuming zero	A	xxxxxxxxxx	
	e) drawing showing method of mounting secondary fuses/MCCBs		xxxxxxxxxx	
5.1.12	Windings and connections		xxxxxxxxxx	
	Is a residual voltage winding required ?		NO	
	If YES,			
	a) rated burden	V.A.	100	
	b) rated secondary voltage	V	110/sqrt3	
	c) are tapped windings for providing both rated secondary residual voltages required?		no	
5.1.13	Details of primary winding neutral (earth) terminal		xxxxxxxxxx	
5.1.14	Cores			
	Number of core limbs for for 3-phase voltage transformer with residual voltage output		N.A.	

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
	a) drawing number of magnetization curve showing voltage/magnetizing current for built-up core		xxxxxxxxxx	
	b) core steel details required		xxxxxxxxxx	
	1) B/H curve			
	2) core steel thickness	mm		
5.1.15	Secondary terminal box			
	Number of fuses/MCCBs		xxxxxxxxxx	
	Manufacturer of fuses/MCCBs		xxxxxxxxxx	
	Type of fuses/MCCBs		xxxxxxxxxx	
	Current rating of fuses/MCCBs	A	xxxxxxxxxx	
	Diameter of secondary earthing terminal	mm	xxxxxxxxxx	
	HV winding earth end to be brought out, with link to earth terminal		yes	
	Dimension of terminal box			
	length	mm	xxxxxxxxxx	
	height	mm	xxxxxxxxxx	
	depth	mm	xxxxxxxxxx	
5.1.16	Mounting arrangement (outdoor type voltage transformer)			
	a) holding-down bolts to be arranged to fall within a square of maximum dimensions	mm	xxxxxxxxxx	
	b) mass of transformer (including oil)	kg	xxxxxxxxxx	
5.1.17	Is electrogalvanizing, sherardizing or metal spraying of ferrous parts acceptable ?		Hot dipped galvanised	
	Finish offered on ferrous parts		xxxxxxxxxx	
	Finish offered on non-ferrous parts		xxxxxxxxxx	
5.1.18	a) type of primary terminal material of primary terminal			
	b) overall dimensions of primary terminal			

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
	stem : length	mm	120	
	diameter	mm	26	
	pad : hole arrangement	mm	xxxxxxxxxx	NA
	hole spacing	mm	xxxxxxxxxx	
	length	mm	xxxxxxxxxx	
	thickness	mm	xxxxxxxxxx	
	c) diameter of tank earthing terminal	mm	xxxxxxxxxx	
5.1..19	Spare fuses			
	Primary fuses quantity required		NA	
	Secondary fuses quantity required		2 per VT	
5.1.20	Type tests			
	Are type test results available ?		Required	
	If no, are type tests to be performed ?		yes	
	If required, where are type tests to be carried out ?		State	
5.1.21	Routine tests			
	Is a tangent delta test required ?		yes	
	Partial discharge test		yes	
5.1.22	Test procedure for cast resin-encapsulated voltage transformers		NA	
5.1.23	Marking/labelling/documentation			
	a) materials used for rating plates		xxxxxxxxxx	
	b) material used for diagram plates		xxxxxxxxxx	
	c) method of fixing plates		xxxxxxxxxx	
5.1.24	Core material details and B/H curve required with tender		yes	
5.1.25	Drawing numbers for post-type voltage transformers			

ITEM	DESCRIPTION	UNITS	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
	a) outline dimension		xxxxxxxxxx	
	b) assembly		xxxxxxxxxx	
	c) terminal box		xxxxxxxxxx	
	d) terminal marking		xxxxxxxxxx	
	e) rating plate		xxxxxxxxxx	
	f) diagram plate		xxxxxxxxxx	
	Quantity required for tender		1	
	Quantity required for contract		3	
5.1.26	Drawing numbers for voltage transformers built into switchgear			
	a) rating plate		xxxxxxxxxx	
	b) diagram plate		xxxxxxxxxx	
	Quantity required			
5.1.27	Number of instruction books for voltage transformers if other than three		3	
5.1.28	Number of copies of routine test certificates		xxxxxxxxxx	
5.1.29	Storage for outdoor-type voltage transformers			
	Guides on a) storage			
	b) transportation		xxxxxxxxxx	
	c) handling and slinging		xxxxxxxxxx	

SECTION 5: PARTICULARS & GUARRANTEES

PART 5.2: 132KV CURRENT TRANSFORMER

SPECIFICATION NO:

ITEM	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
5.2	**132kV Outdoor Current**			
	Manufacturer		State	
	Type number		State	
5.2.1	*Electrical parameters*			
5.2.1.1	Total creepage distance to earth	mm	3625	
5.2.1.2	Rated short-duration primary current / time	kA/S	31.5/3	
5.2.1.3	Voltage described in NRS 029 clause 4.2.1.2	kV	xxxxxxxxx	
5.2.1.4	Voltage described in NRS 029 clause 4.2.1.3	kV	xxxxxxxxx	
5.2.1.5	Is a capacitive tap terminal required?		Yes	
5.2.1.6	Ratio on which routine tests shall be carried out		State	
5.2.1.7	Is a tangent delta test required		Yes	
5.2.1.8	Method of earthing system neutral		Solid	
5.2.2	*Mechanical requirements*			
5.2.2.1	Primary terminals stem diameter	mm	38	
5.2.2.2	Type of bushing		xxxxxxxx	
5.2.2.3	Quantity of oil in CT	lt.	State	
5.2.2.4	Type of cable box		State	
5.2.2.5	Minimum area of gland plate	mm	75 x 50	
5.2.2.6	Foundation bolt diameter	mm	xxxxxxxx	
5.2.2.7	Foundation bolt plan	mm	xxxxxxxx	
5.2.2.8	Sets of tender drawings		1	
5.2.2.9	Sets of contract drawings		3	

ITEM	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
5.2.3.	*Current transformer particulars:*			
5.2.3.1	**Current transformer**			
	Core 1			
	a) Ratio		2400/1600/1200/1	
	b) Accuracy class		X	
	c) Knee point		State	
	d) Magnetising current at knee point		State	
	e) Secondary resistance		State	
	Core 2			
	a) Ratio		2400/1600/1200/1	
	b) Accuracy class		X	
	c) Burden	VA	10	
	Core 3			
	a) Ratio		1/1200	
	b) Accuracy class		5P15	
	c) Burden		10VA	
	Core 4			
	a) Ratio		2400/1600/1200/1	
	b) Accuracy class		State	
	c) Knee point		State	
	d) Magnetising current at knee point		State	
	e) Secondary resistance		State	
	Core 5			
	a) Ratio		2400/1600/1200/1	
	b) Accuracy class		X	
	c) Burden		State	
	Core 6			
	a) Ratio		2400/1600/1200/1	
	b) Accuracy class		X	
	c) Knee point		State	
	d) Magnetising current at knee point		State	
	e) Secondary resistance		State	

ITEM	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
5.2.4.1	Oil level indicator of prismatic or other approved type, where applicable		Yes	
5.2.4.2	Oil sampling device of approved type located at bottom of tank, where applicable		Yes	
5.2.4.3	Two valves, one at the top and one at the bottom of tank with a coupling for a flexible hose for connecting to the oil filtering plant, when applicable			
5.2.4.4	Lifting and jacking lugs which shall be welded or riveted to the tank		Yes	
	Robust underbase of the skid type.			
5.2.4.5	Rollers are not required		Yes	
5.2.4.6	Details of gas pressure instrumentation, where applicable			
5.2.4.7	Gas pressure indicator. where applicable		Yes	
5.2.4.8	Insulation medium (gas), where applicable		Yes	
5.2.4.9	Mass of gas per voltage transformer, where applicable		Yes	
5.2.4.10	Insulation material (outer body), where applicable		Porcelain	

Technical Schedules A and B for 400kV Post type Current Transformer

Item	NRS 029 Sub-clause	Description		Schedule A	Schedule B
C.1	4.1	**General requirements:**			
		Service conditions (if non-standard)			
		Ambient air temperature (average)	°C	-10 to +40	
		Altitude	m	1800	
		Average humidity	%	95	
		Wind pressure	Pa	700	
		Polution level			
		1) Heavy -creepage distances	mm	Heavy	
		arcing distances	mm	Heavy	
		2) Extra heavy - creepage distances	mm	Extra heavy	
		arcing distances	mm	Extra heavy	
C.2	4.1	**Application Details**			
		Nominal r.m.s. voltage (U_n)	kV	400	
		Nominal primary current		3150	
	4.1.4	Rated insulation level (switching impulse)	kV	1050	
	4.1.4	Basic insulation level (lightning impulse)	kV	1425	
		Nominal short-time current			
		a) thermal rating (r.m.s.)	kA	50	
		b) time applicable to thermal rating	s	1	
		c) dynamic rating	kA	127,5	
		Frequency	Hz	50	
		Maximum radio noise influence voltage	µV	500	
C.3	4,1	**Type of current transformer offered**			
		Provide Manufacturer name		Yes	
		Provide Manufacturer's type designation		Yes	
C.4	4,3	**Details of high voltage insulator**			
		Manufacturer of HV porcelain insulators		No	
		Manufacturer of HV composite insulators		Yes	
	5.3.3	Provide detailed drawing of HV insulator		Yes	
		Compliance with Specification: IEC 60815.		Yes	
C.5	4.1.7	**Details of oil-insulated current transformers**			
	4.1.7.1	Provide Type of oil		Mineral oil	
		Is the oil certified free from polychlorinated biphenyls (Zero count)		Yes	
	4.1.7.3	Quantity of oil required	kg	Yes	
	4.1.7.4	Sealing arrangements required		Yes	
	4.1.7.7	Provide expansion accommodation method		Yes	
	4.1.7.8	Provide oil-level indicator		Yes	
	4.1.7.9	Provide oil sample valve and drawing		Yes	
C.6	4.1.8	**Gas-insulated current transformers**			
		Provide details of filling/evacuation valves		Yes	
		Provide details of density meter		Yes	
		Provide weight of SF6 gas	kg	Yes	
		Provide certificate of SF6 gas compliance		Yes	
	4.1.8.5	Method of sealing		Yes	
C.7	4.1.5	**Primary terminals (pad type)**			
	4.1.5.1	Materials:			
		a) aluminium or		Aluminium	
		b) electrotinned copper		-	
	4.1.5.1	Details of pad type terminal (IEC 60518)			
		a) number of holes		8	
		b) hole centres	mm	50	
		c) hole size	dia	14	
		d) Orienation		Horizontal	
C.8	4,3	**Constructional requirements**			
	4.3.1.2	Secondary terminals (Spring-loaded screw clamp type: size 10mm)		Yes	
	4.3.2.1	Provide drawing of terminal box		Yes	

	4.3.2.2	Minimum effective gland area of secondary terminal box/gland plate: lengh x width	mm	130 x 75	
	4.3.2.7	Provide capacitive tap		Yes	
C.9	4.3.5	**Mounting arrangement**			
		Holding down bolts to be arranged to fall within a square of maximum dimensions	mm	706	
C10	4.3.6	**Metal finish**			
		Finish offered on ferrous parts		xxxxxxxxxx	
		Finish offered on non-ferrous parts		xxxxxxxxxx	
C.11	4,4	**Rating plates and diagram plates**			
	4.4.3	Provide details of materials used for rating plates		Yes	
	4.4.4	Provide details of material used for diagram plates		Yes	
	4.4.5	Provide details of method of fixing diagram and rating plates		Yes	
C.12	5,3	**Drawings and instruction manuals in English and in PDF format**			
	4.5.1	Quantity of drawings and literature required with tender		1	
	5.3.1 & 5.3.2	Provide Outline drawing		Yes	
	5.3.5	Number of instruction books required with tender		1	
		Number of descriptive pamphlets required with tender		1	
C.13	4.3.7	Provide details of compliance of safety design features: Proof of Internal arc withstand capability test		Yes	
C.14	4.2.2	**Details of measuring current transformers**		**M32**	
		a) purpose		Metering	
	4.2.1.2	b) relative position of the core (see annex C)		Comply	
		c) nominal current ratio (Page 2 of Schedules A&B)		3200/1	
		d) number of cores (Page 3 of Schedules A&B)		Comply	
		e) tap points at (Page 2 of Schedules A&B)		Comply	
	4.2.1.1	f) ratio selection on secondary		Comply	
		g) nominal continuous current			
		1) primary	A	3150	
		2) secondary	A	2	
		h) short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	-	
		3) ratio for which (h)(2) applies		-	
		4) time	s	1	
		j) burden	VA	10	
		k) accuracy class		0,2	
		l) ratio for which (j) and (k) apply		400/1	
		m) maximum secondary winding resistance at 75 °C	Ω	-	
		Instrument security factor (FS)		20	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6,9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.15	4.2.2	**Details of measuring current transformers**		**M24**	
		a) purpose		Metering	
	4.2.1.2	b) relative position of the core (see annex C)		Comply	
		c) nominal current ratio (Page 2 of Schedules A&B)		2400/1	
		d) number of cores (Page 3 of Schedules A&B)		Comply	
		e) tap points at (Page 2 of Schedules A&B)		Comply	
	4.2.1.1	f) ratio selection on secondary		Comply	
		g) nominal continuous current			
		1) primary	A	2500	
		2) secondary	A	2	
		h) short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	-	
		3) ratio for which (h)(2) applies		-	

		4) time	s	1	
		j) burden	VA	10	
		k) accuracy class		0,2	
		l) ratio for which (j) and (k) apply		400/1	
		m) maximum secondary winding resistance at 75 °C	Ω	-	
		Instrument security factor (FS)		20	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.16	4.2.3	**Details of protective current transformers**		**P32**	
		a) purpose		Protection	
	4.2.3.2	b) accuracy class:		PX	
	4.2.1.2	c) relative position of the core (see annex C)		Comply	
	4.2.3.1	d) nominal turns ratio (Page 2 of Schedules A&B)		3200/1	
		e) number of cores (Page 3 of Schedules A&B)		Comply	
		f) tap points (Page 2 of Schedules A&B)		Comply	
	4.2.1.1	g) ratio selection on secondary		Secondary	
		h) nominal continuous thermal r.m.s. current			
		1) primary	A	3150	
		2) secondary	A	2	
		j) short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	-	
		3) ratio for which (j)(2) applies		-	
		4) time	s	1	
		k) burden	VA		
		l) accuracy limit factor (class P cores)			
		m) E al or knee-point r.m.s. voltage	V	3200	
		n) maximum magnetization current at E al or knee-point	mA	32	
		p) ratio for which (b), (m) and (n) apply		3200/1	
		q) maximum secondary winding resistance at 75 °C	Ω	12,8	
		r) maximum voltage on terminals of windings(s)			
		not connected to the burden		-	
		Provide drawing number of magnetization curve		Yes	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.17	4.2.3	**Details of protective current transformers**		**P24**	
		a) purpose		Protection	
	4.2.3.2	b) accuracy class:		PX	
	4.2.1.2	c) relative position of the core (see annex C)		Comply	
	4.2.3.1	d) nominal turns ratio (Page 2 of Schedules A&B)		2400/1	
		e) number of cores (Page 3 of Schedules A&B)		Comply	
		f) tap points (Page 2 of Schedules A&B)		Comply	
	4.2.1.1	g) ratio selection on		Secondary	
		h) nominal continuous thermal r.m.s. current			
		1) primary	A	2500	
		2) secondary	A	2	
		j) short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	-	
		3) ratio for which (j)(2) applies		-	
		4) time	s	1	
		k) burden	VA		
		l) accuracy limit factor (class P cores)			

		m) E_{al} or knee-point r.m.s. voltage	V	2400	
		n) maximum magnetization current at E_{al} or knee-point	mA	42	
		p) ratio for which (b), (m) and (n) apply		2400/1	
		q) maximum secondary winding resistance at 75 °C	Ω	9,6	
		r) maximum voltage on terminals of windings(s) not connected to the burden		-	
		Provide drawing number of magnetization curve		Yes	
		Provide core steel details		Yes	
		a) grade		Yes	
		b) thickness of lamina	mm	Yes	
		c) annealed?		Yes	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.18	4.2.3.3	**Details of bus zone cores**		**B24**	
		a) purpose		Bus zone	
	4.2.3.3	b) accuracy class: (note that (l) apply)		PX	
	4.2.1.4	c) relative position of the core (see annex C)		Comply	
	4.2.3.1	d) nominal turns ratio		2400/1	
		e) number of cores (Page 2 of Schedules A&B)		See page 2	
		f) tap point		2400/1	
	4.2.1.1	g) ratio selection on secondary		Yes	
		h) nominal continuous thermal r.m.s. current			
		1) primary	A	3150	
		2) secondary	A	2	
		j) nominal short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	20,8	
		3) ratio for which (j)(2) applies		2400/1	
		4) time	s	1	
	4.2.3.3	k) E_{al} or knee-point r.m.s. voltage	V	550	
		l) maximum magnetization r.m.s. current	mA	50	
		m) ratio at which (k) and (l) apply		2400/1	
		n) maximum secondary winding resistance at 75 °C	Ω	2	
		Provide drawing number of magnetization curve		Yes	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.19	4.2.3.3	**Details of bus zone cores**		**B24/16**	
		a) purpose		Bus zone	
	4.2.3.3	b) accuracy class: (note that (l) apply)		PX	
	4.2.1.4	c) relative position of the core (see annex C)		Comply	
	4.2.3.1	d) nominal turns ratio		2400/1	
		e) number of cores (Summary of item requirements)		Comply	
		f) tap points		1600/1	
	4.2.1.1	g) ratio selection on secondary		Yes	
		h) nominal continuous thermal r.m.s. current			
		1) primary			
		Item 56 to 59 and 142 to 145	A	2500	
		Item 68 to 71 and 154 to 157	A	3150	
		2) secondary	A	2	
		j) nominal short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	20,8	
		3) ratio for which (j)(2) applies		2400/1	
		4) time	s	3	
	4.2.3.3	k) E_{al} or knee-point r.m.s. voltage	V	550	
		l) maximum magnetization r.m.s. current	mA	50	
		m) ratio at which (k) and (l) apply		1600/1	

		n) maximum secondary winding resistance at 75 °C	Ω	2	
		Provide drawing number of magnetization curve		Yes	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.20	4.2.3.3	**Details of bus zone cores**		**B16/12**	
		a) purpose		Bus zone	
	4.2.3.3	b) accuracy class: (note that (l) apply)		PX	
	4.2.1.4	c) relative position of the core (see annex C)		Comply	
	4.2.3.1	d) nominal turns ratio		1600/1	
		e) number of cores (Summary of item requirements)		Comply	
		f) tap points		1200/1000/1	
	4.2.1.1	g) ratio selection on secondary		Yes	
		h) nominal continuous thermal r.m.s. current			
		1) primary			
		a) Item 60 to 63 and Item 146 to 149	A	2500	
		b) Item 72 to 75 and Items 158 to 161	A	3150	
		2) secondary	A	2	
		j) nominal short-time thermal r.m.s. current			
		1) primary	kA	50	
		2) secondary (highest value)	A	31,3	
		3) ratio for which (j)(2) applies		1600/1	
		4) time	s	3	
	4.2.3.3	k) E_{al} or knee-point r.m.s. voltage	V	550	
		l) maximum magnetization r.m.s. current	mA	50	
		m) ratio at which (k) and (l) apply		1200/1	
		n) maximum secondary winding resistance at 75 °C	Ω	2	
		Provide drawing number of magnetization curve		Yes	
		Provide core steel details			
		a) grade		On request	
		b) thickness of lamina	mm	On request	
		c) annealed?		On request	
		d) B/H curve		Yes	
	6.9	Test certificates of individual routine tests are required and copies shall be placed in the terminal box		Comply	
C.21	6.2	**Tests**			
		Provide valid type test certificates		Yes	
C.22	6.2	**Impulse tests on primary winding**			
		a) minimum crest value of full-wave impulse type test voltage at sea level	kV	1425	
		b) Indicate the test impulse wave shape used	µs	1/50 or 1.2/50 or 1,5/40	
C.23	6.3	**High-voltage power-frequency withstand tests**			
		Minimum 60 s power-frequency wet withstand type test voltage at sea level	kV	630	
		Minimum 60 s power-frequency dry withstand routine test voltage at sea level	kV	630	
C.24	6.2	**Short-time current test (see C.2)**			
		a) short-time withstand current	kA	50	
		b) time	s	1	
C.25		Ratio for accuracy test		Yes	
C.26	6.3.2.2	**Method used for determining gas leakage rate**		On request	
	4.1.8.5	Leakage rate		Comply	
C.27	6.4	**Special test requirements**			
	6.4.2	Impulse test		Yes	
	6.5	Mechanical strength and sealing test		Yes	
	6.6	Dielectric dissipation factor test		Yes	
	6.7	Long duration voltage test		Yes	

		Chopped impulse tests		Yes	
	6.8	Internal arc withstand capability test		Yes	
	6.9	Provide valid test certificates for the special tests		Yes	

SECTION 5: PARTICULAR & GUARRANTEES

PART 6.1: BUSBARS, CONNECTIONS & CLAMPS

SPECIFICATION NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1	**Conductor tube**			
1,1	Type		Aluminium tube	
1,2	Place of application		Main & Reserve Bar	
1,3	Maximum current carrying capacity (continuous)	A	2370 at 65deg C	
1,4	Short circuit rating (3 s)	kA		
1.4.1	Max dynamic forces exerted in short circuit	N		
1.4.2	Maximum deflection of busbar and support insulators under short circuit conditions	mm		
1,5	Material		Aluminium	
1,6	Diameter	mm	120	
1,7	Wall thickness	mm	6	
1,8	Max span	m	12 (max.)	
1,9	Sag under gravity	mm		
1,10	Other	mm		
2	**Stranded conductor**			
2,1	Place of application			
2,2	Size of conductor			
2,3	Material			
2,4	Maximum current carrying capacity (continuous)	A		
2,5	Short circuit rating (3 s)	A		
3	**Clamps** (with potensial clips)			
3,1	Types being offered :			
3.1.1	Drawings numbers			
3.1.2	Current rating - continuous	A	2370 (min.)	
3.1.3	Manufacturer			
3,2	Types being offered :			
3.2.1	Drawings numbers			
3.2.2	Current rating - continuous	A	2370 (min.)	
3.2.3	Manufacturer			
3,3	Types being offered :			
3.3.1	Drawings numbers			
3.3.2	Current rating - continuous	A	2370 (min.)	
3.3.3	Manufacturer			

SECTION 5: PARTICULARS & GUARRENTEES

PART 7.1: INSULATORS 33 & 132KV

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1	**Post insulators 132 kV**			
1,01	Manufacturer		Sate	
1,02	Type		State	
1,03	Details of connections - description		State	
1,04	Material			
1,05	Voltage continuous / BIL rating	kV / kV		
1,06	Strength			
1,06	Cantilever	kN		
1.06.1	Torque	kN		
1.07.2	Sheds			
1,07	Creepage distance	mm		
1,07	Flashover distance	mm	> 1200	
1,08	Fixing - Top			
1,09	Fixing - Bottom			
1,10	Drawing number			
1,11	Dimensions	mm		
2	**132 kV Suspension insulators**			
2,01	Manufacturer			
2,02	Type			
2,03	Details of connections - description			
2,04	Material			
2,05	Voltage continuous / BIL rating	kV/kV		
2,06	Strength in tension	kN		
2,07	Sheds			
2.07.1	Creepage distance	mm		
2.07.2	Flashover distance	mm		
2,08	Fixing - Details			
2,09	Drawing number			
2,10	Dimensions			

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
3	**Other 132 kV insulators - Tenderer to list**			
3,01	Manufacturer		State	
3,02	Type		State	
3,03	Details of connections - description			
3,04	Material			
3,05	Voltage continuous / BIL rating	kV/kV		
3,06	Strength in tension	kN		
3,07	Sheds			
3.07.1	Creepage distance	mm		
3.07.1	Flashover distance	mm		
3,08	Fixing - Details			
3,09	Drawing number			
3,10	Dimensions			
4	**Post insulators 33 kV**			
4,01	Manufacturer		State	
4,02	Type		State	
4,03	Details of connections - description			
4,04	Material			
4,05	Voltage continuous / BIL rating	kV / kV		
4,06	Strength			
4.06.1	Cantilever	kN		
4.06.2	Torque	kN		
4,07	Sheds			
4.07.1	Creepage distance	mm		
4.07.2	Flashover distance	mm		
4,08	Fixing - Top			
4,09	Fixing - Bottom			
4,10	Drawing number			
4,11	Dimensions	mm		
5	**33 kV Suspension insulators**			
5,01	Manufacturer		State	
5,02	Type		State	
5,03	Details of connections - description			
5,04	Material			
5,05	Voltage continuous / BIL rating	kV/kV		

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
5,06	Strength in tension	kN		
5,07	Sheds			
5.07.1	Creepage distance	mm		
5.07.2	Flashover distance	mm		
5,08	Fixing - Details			
5,09	Drawing number			
5,10	Dimensions			
6	**Other 33 kV insulators - Tenderer to list**			
6,01	Manufacturer		State	
6,02	Type		State	
6,03	Details of connections - description			
6,04	Material			
6,05	Voltage continuous / BIL rating	kV/kV		
6,06	Strength	kN		
6,07	Sheds			
6.07.1	Creepage distance	mm		
6.07.2	Flashover distance	mm		
6,08	Fixing - Details			
6,09	Drawing number			
6,10	Dimensions			

SECTION 5: PARTICULARS & GUARANTEES

PART 7.1: INSULATORS 400KV

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1	**400kV Post insulators**			
1.1	Manufacturer		State	
1.2	Type		State	
1.3	Details of connections - description		State	
1.4	Material		State	
1.5	Voltage continuous / BIL rating	kV / kV	State	
1.6	Strength		State	
1.7	Cantilever	kN	State	
1.8	Torque	kN	State	
1.9	Sheds		State	
1.10	Creepage distance	mm	State	
1.11	Flashover distance	mm	State	
1.12	Fixing - Top		State	
1.13	Fixing - Bottom		State	
1.14	Drawing number		State	
1.15	Dimensions	mm	State	
2	**400kV Suspension insulators**			
2.1	Manufacturer		State	
2.2	Type		State	
2.3	Details of connections - description		State	
2.4	Material		State	
2.5	Voltage continuous / BIL rating	kV/kV	State	
2.6	Strength in tension	kN	State	
2.7	Sheds		State	
2.8	Creepage distance	mm	State	
2.9	Flashover distance	mm	State	
2.10	Fixing - Details		State	
2.11	Drawing number		State	
2.12	Dimensions		State	

3	**Other 400 kV insulators - Tenderer to list**			
3.1	Manufacturer		State	
3.2	Type		State	
3.3	Details of connections - description			
3.4	Material		State	
3.5	Voltage continuous / BIL rating	kV/kV	State	
3.6	Strength in tension	kN	State	
3.7	Sheds		State	
3.8	Creepage distance	mm	State	
3.9	Flashover distance	mm	State	
3.10	Fixing - Details		State	
3.11	Drawing number		State	
3.12	Dimensions		State	

SECTION 5: PARTICULARS & GUARRANTEES

PART 8.1: CABLE 11KV FROM TRF

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENT	OFFERED
8,1	**11 kV Cable Connections from 40MVA Transformers to 11kV Switchgear**			
1	Total length of cable required	m	1200	
2	Type of cable required (SABS 97-1970, Appendix B Clause B-1(b)		Single-core PILC PVC	
2,1	Number of cables in parallel		4	
3	Voltage rating (r.m.s.line to line)	kV	11	
4	Configuration		Earthed through NEC	
5	Rated conductor size	sq mm	630	
6	Number and diameter of wires in core			
7	Minimum radial thickness of dielectric	mm		
8	Thickness of each paper insulating tape	mm		
9	Number of layers of paper on core			
10	State type of impregnation			
11	State type of impregnation			
12	State whether draining or non-draining type cable is offered		non-draining	
13	Minimum radial thickness of lead sheath	mm		
14	Nominal diameter over lead insulated core	mm		
15	Nominal diameter over insulated core	mm		
16	Nominal diameter over lead sheath	mm		
17	Nominal diameter over PVC over sheath	mm		
18	Minimum radial thickness of PVC over sheath	mm		
19	Mass of copper per 1000 m of cable	kg		
20	Mass of lead per 1000 m of cable	kg		
21	mass of completed cable per 1000 m	kg		
22	Cable will be supplied in drum lengths of	m		
23	Gross weight of drum and cable	kg		
24	Overall dimentions of cable drum :			
24,1	a) Overall width	mm		
24,2	b) Overall diameter	mm		
25	Conductor DC resistance at 20°C per 1000 m	ohms		

ITEM	DESCRIPTION	UNIT	REQUIREMENT	OFFERED
26	Capacitance core to sheath per 1000 m	micro-farad		
27	Positive - negative sequence shunt capacitive reactance at 50 Hz per 1000 m	ohms		
28	Zero sequence series reactance at 50Hz per 1000 m *	ohms		
29	Zero sequence series resistance per 1000 m *	ohms		
30	Zero sequence shunt capacitive reactance at 40Hz per 1000 m	ohms		
31	Manufacturer			
31,1	Type and model			
31,2	County of origin			
	* In the case of item 28 and 29, the reactance and resistance shall be based on all return current in the sheath and none in the ground. Assume trefoil formation.			

SECTION 5: PARTICULARS & GUARRANTEES

PART 8.2: MULTI-CORE CABLES

SPEC NO:

ITEM	DESCRIPTION	UNIT	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6
	600 V PVC-SWA PVC, Multi-Core Control Cable							
1	Total length of cable	m						
2	Number of cores							
3	Cross-sectional area/core	sq mm						
4	Number of strands per core							
5	Diameter of each strand	mm						
6	Conductor material							
7	Type of insulation							
8	Radial thickness of conductor insulation							
9	Minimum average	mm						
10	Minimum	mm						
11	Maximum conductor resistance at 20°C	ohm/km						
12	Guaranteed minimum insulation resistance at 20°C in Megohm/km							
13	Diameter over laid-up cores	mm						
14	Radial thickness of sheath:							
14	Minimum average	mm						
14	Minimum	mm						
15	Nominal diameter over sheath	mm						
16	Sheath material							
17	Number of armour wires							
18	Diameter of size of armour wires							
19	Nominal diameter over armour	mm						

ITEM	DESCRIPTION	UNIT	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6
20	Serving material							
21	Radial thickness of serving:							
21	Minimum average	mm						
21	Minimum	mm						
22	Nominal outside diameter	mm						
23	Mass of completed cable per 100 m							
24	Mass of copper per 100 m							
25	Gross weight of cable and drum							
26	Cable length on drum							
27	Place of manufacture							
28	Make or trade-mark							
29	Full details of core identification							

SECTION 5: PARTUCULARS & GUARRANTEES

PART 9.1: EARTHING GRID

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	EARTHING GRID			
1	**Earth resistance survey**			
1,1	Name of subcontractor for earth resistance survey		State	
1,2	Method proposed for measurement (Tenderer to submit description)		State	
1,3	Target resistance	ohm	1	
2	**Earth mat**			
2,1	Cross section of earth mat	sq mm	2 x Steel rods	
2,2	Material of earth mat		Steel rod Cu plated SABS1063&0199	
2,3	Drawing number of proposed earth mat			
3	**Earthing electrodes**			
3,1	Dimensions :			
3.1.1	diameter	mm	16mm dia	
3.1.2	area	sq. mm		
3.1.3	length	m		
3,2	Construction			
4	**Connections to equipment**			
4,1	Outdoor		exothermic welds	
4,2	Stainless steel type and cross		exothermic welds	
4,3	Stainless steel type and cross section - Complex runs, bends, etc.		exothermic welds	
4.3.1	Indoor		exothermic welds	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
4.3.2	Copper	sq mm	150	
5	**Method of connection and fixing**			
5,1	Earth mat to earth electrode		exothermic welds	
5,2	Earth mat to copper earthing strap for indoor earthing		exothermic welds	
5,3	Earth mat to stainless steel strap for outdoor earthing		exothermic welds	
5,4	How electrolytic corrosion will be prevented		exothermic welds	
5,5	Stainless steel strap to outdoor equipment		exothermic welds	

SECTION 5: PARTICULARS & GUARRANTEES

PART 12.1: PROTECTION & CONTROL EQUIPMENT

SPECIFICATION No: Infranet – PS05-002SZ – Rev 11

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
12A	**SUBSTATION CONTROL SYSTEM**			
	Where has the system, as tendered, been installed in a similar environment?		State	
	Where may the system, as tendered, be demonstrated?		State	
12B	**BAY ICAP & CONTROL CUBICLES** (See Section 4 Part 12.1 for general specifications)			
	Height of bay ICAP cubicle	mm	Max 2 100 including kick-flat	
	Height of bay SMMI cubicle	mm	Max 2 400 including kick-flat	
	Width of cubicle	mm	600 to 800	
	Depth of cubicle	mm	700	
	Access to Bay ICAP cubicle		Front door, swing frame	
	Access to Control cubicle			
	Mass of the heaviest, fully equipped cubicle	kg	State	
	Thickness of sheet steel used for cubicle	mm	2.0	
	General arrangement drawings to be provided for : a) Control/protection cubicle b) Busbar protection cubicle c) Cubicle(s) for SMMI, printer, etc.		Provide drawing numbers Provide drawing numbers Provide drawing numbers	
	Type of door lock and door latch		Two latches for padlock	
	Type of lamp and fitting for cubicle interior illumination		Edison-type lamp fitting	
	Voltage of cubicle lamp	V	230 AC	
	Type of switch used to control cubicle interior illumination		Door switch	
	Cubicle arranged for bottom cable entry		Yes	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Mounting height of gland plate	mm	Minimum 200	
	Unobstructed space required above gland plate	mm	Minimum 300	
	Material of which gland plate is made		Sheet steel	
	Thickness of gland plate	mm	Minimum 2.0	
	Gland plate size (area available for cable glands) : a) Length b) Width	 mm mm	 State State	
	Access to cable (below cubicles)		Covered inspection hole	
	Size of earth bar fitted : a) Length b) Width c) Thickness	 mm mm mm	 Minimum 30 Minimum 3.5	
	Provision for connecting station earth		Yes	
	Material of which labels are made, size and method of fixing to cubicles : a) Main labels on top of relay/control cubicle suite b) Other designation labels on protection/control cubicles c) Labels for individual items of equipment on cubicles d) Labels for individual items of equipment inside cubicles e) Terminal labels			
	Type and size of lettering a) Main labels on top of relay/control cubicle suite b) Other designation labels on protection/control cubicles c) Labels for individual items of equipment on cubicles d) Labels for individual items of equipment inside cubicles e) Terminal labels			
	Provision for mounting of equipment		Standard 19” rack	
	Name and standard number of paint finish to be applied on cubicle exteriors		Cloud Grey SABS F48	
	Name and standard number of paint finish to be applied on cubicle interiors		Cloud Grey SABS F48, removable back plates white	
12C	**DIGITAL DIFFERENTIAL PROTECTION RELAY**			
	Manufacturer			

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN		Yes	
	Number of user-definable protection setting groups available on relay		2	
	Device has integral event recording with 1ms accuracy		Yes	
	General device ratings: a) Nominal rated current b) Nominal supply voltage c) Rated frequency d) Tripping mode e) Setting range f) Insulation test voltage g) Impulse test voltage (surge) h) Relay operating time for in-zone fault i) Output relay make and carry for 0,2s j) Output relay carry continuously k) Output relay break (DC) l) Output relay break (AC)	 A AC V DC Hz kV ms A A W VA	 1 110 50 3 phase To suit given system 2 kV for 1 minute 5 5 - 10 30 5 50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s) 1250	
	Auxiliary communications channel for transfer trip signalling, with external input activation.		Yes	
	Facility to communicate with remote terminal directly over dedicated single mode optic fibres		Yes	
12D	**TRANSFORMER COMBINED BIASED DIFFERENTIAL, OVER CURRENT EARTH FAULT & RESTRICTED EARTH FAULT PROTECTION RELAY**			

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN		Yes	
	Number of user-definable protection setting groups available on relay		2	
	Device has integral event recording with 1ms accuracy		Yes	
	General device ratings: a) Nominal rated current b) Nominal supply voltage c) Rated frequency d) Setting range e) Insulation test voltage f) Impulse test voltage (surge) g) Relay operating time for in-zone fault h) Output relay make & carry for 0,2 s i) Output relay carry continuously j) Output relay break (DC) k) Output relay break (AC)	 A AC V DC Hz kV ms A A W VA	 1 110 50 To suit given system 2 kV for 1 minute 5 < 40 30 5 50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s) 1250	
12E	**132k LOW IMPEDANCE BUSBAR PROTECTION SCHEME**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI			
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
			fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN			
	Number of user-definable protection setting groups available on relay			
	Device has integral event recording with 1ms accuracy			
	General device ratings: a) Nominal rated current b) Nominal supply voltage c) Rated frequency d) Setting range e) Insulation test voltage f) Impulse test voltage (surge) g) Tripping arrangement h) Differential current sensitivity i) Relay operating time for in-zone fault j) Output relay make & carry for 0,2 s k) Output relay carry continuously l) Output relay break (DC) m) Output relay break (AC)	 A AC V DC Hz kV ms A A W VA	 1 110 50 To suit given system 2 kV for 1 minute 5 Individual trip relays, dual trip ccts ± 20 % of nominal rated current 5 - 15 30 5 50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s) 1250	
12E/1	**400kV LOW IMPEDANCE BUSBAR PROTECTION SCHEME**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI			
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN			
	Number of user-definable protection setting groups available on relay			
	Device has integral event recording with 1ms accuracy			

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	General device ratings:			
	a) Nominal rated current	A AC		
	b) Nominal rated voltage	V AC		
	c) Nominal supply voltage	V DC		
	d) Rated frequency	Hz		
	e) Setting range			
	f) Insulation test voltage			
	g) Impulse test voltage (surge)	kV		
	h) Output relay make & carry for 0,2 s	A		
	i) Output relay carry continuously	A		
	j) Output relay break (DC)	W		
	k) Output relay break (AC)	VA		
12G	**TRANSFORMER STANDBY EARTH FAULT RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN		Yes	
	Number of user-definable protection setting groups available on relay		2	
	Device has integral event recording with 1ms accuracy		Yes	
	General device ratings:			
	a) Nominal rated current	A AC	1	
	b) Nominal supply voltage	V DC	110	
	c) Rated frequency	Hz	50	
	d) Setting range		To suit given system	
	e) Insulation test voltage		2 kV for 1 minute	
	f) Impulse test voltage (surge)	kV	5	
	g) Output relay make & carry for 0,2 s	A	30	
	h) Output relay carry continuously	A	5	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	i) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	j) Output relay break (AC)	VA	1250	
12H	**TRANSFORMER VOLTAGE REGULATING RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and protection settings via the SMMI and E-LAN		Yes	
	Device has integral event recording with 1 ms accuracy		Yes	
	General device ratings:			
	a) Nominal rated current	A AC	1	
	b) Nominal supply voltage	V DC	110	
	c) Rated frequency	Hz	50	
	d) Setting range		To suit given system	
	e) Insulation test voltage		2 kV for 1 minute	
	f) Impulse test voltage (surge)	kV	5	
	g) Output relay make & carry for 0,2 s	A	30	
	h) Output relay carry continuously	A	5	
	i) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	j) Output relay break (AC)	VA	1250	
12I	**SYNCHRONISM CHECK RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and settings via the SMMI and E-LAN		Yes	
	Device has integral event recording with 1 ms accuracy		Yes	
	General device ratings:			
	a) Nominal rated voltage	V AC	110	
	b) Nominal supply voltage	V DC	110	
	c) Rated frequency	Hz	50	
	d) Insulation test voltage		2 kV for 1 minute	
	e) Impulse test voltage (surge)	kV	5	
	f) Output relay make & carry for 0,2 s	A	30	
	g) Output relay carry continuously	A	5	
	h) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	i) Output relay break (AC)	VA	1250	
12J	**AUTOMATIC RECLOSE RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Analogue values and detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and settings via the SMMI and E-LAN		Yes	
	Device has integral event recording with 1 ms accuracy		Yes	
	General device ratings:			
	a) Nominal rated voltage	V AC	110	
	b) Nominal supply voltage	V DC	110	
	c) Rated frequency	Hz	50	
	d) Insulation test voltage		2 kV for 1 minute	
	e) Impulse test voltage (surge)	kV	5	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	f) Output relay make and carry for 0,2s	A	30	
	g) Output relay carry continuously	A	5	
	h) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	i) Output relay break (AC)	VA	1250	
	The relay shall have the following time settings:			
	a) Close pulse	s	0,1 to 2	
	b) Dead time 1	s	0,25 to 180	
	c) Dead time 2	s	1 to 180	
	d) Dead time 3 and 4	s	10 to 200	
	e) Reclaim time	s	1 to 180	
12K	**PILOTWIRE-BASED BIASED DIFFERENTIAL RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	General device ratings:			
	a) Nominal rated voltage	V AC	110	
	b) Nominal rated current	A AC	5	
	c) Rated frequency	Hz	50	
	d) Operating time	ms	Typically 30	
12L	**TRIP CIRCUIT SUPERVISION RELAY**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	General device ratings:			
	a) Nominal rated voltage	V DC	110	
	b) Rated frequency	Hz	50	
12M	**AUXILIARY LATCHING AND FLAGGING TRIP RELAYS**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	General device ratings:			
	a) Nominal supply voltage	V DC	110	
	b) Rated frequency	Hz	50	
	c) Insulation test voltage		2 kV for 1 minute	
	d) Impulse test voltage (surge)	kV	5	
	e) Output relay make & carry for 0,2 s	A	30	
	f) Output relay carry continuously	A	5	
	g) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	h) Output relay break (AC)	VA	1250	
	i) Operating time	ms	< 10	
	j) Relay and flag resetting		by hand	
12N	**INTER-TRIP RECEIVE REPEAT RELAYS**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	General device ratings:			
	a) Nominal supply voltage	V DC	110	
	b) Rated frequency	Hz	50	
	c) Insulation test voltage		2 kV for 1 minute	
	d) Impulse test voltage (surge)	kV	5	
	e) Output relay make & carry for 0,2 s	A	30	
	f) Output relay carry continuously	A	5	
	g) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	h) Output relay break (AC)	VA	1250	
	i) Operating time	ms	< 10	
12O	**BAY CONTROLLER (BYC)**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
	Number of events which may be stored on the BYC			
	Memory available for programs			
	Estimated memory required for this implementation (worst case)			
	Number of primary elements status which may be presented on the on-board mimic display		7	
	Number of primary elements which may be controlled by the on-board mimic display		7	
	General device ratings:			
	a) Nominal supply voltage	V DC	110	
	b) Insulation test voltage		2 kV for 1 minute	
	c) Impulse test voltage (surge)	kV	5	
	d) Output relay make & carry for 0,2 s	A	30	
	e) Output relay carry continuously	A	5	
	f) Output relay break (DC)	W	50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s)	
	g) Output relay break (AC)	VA	1250	
12P	**I/O CONTROL MODULE**			
	Manufacturer		State	
	Device name		State	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Part ordering code		State	
	Device supports communication and interrogation by SMMI		Yes	
	Detailed device status and operation are uploaded to the SMMI		Yes	
	Communication protocol		DNP 3 level 3 (Parts of), IEC61850	
	Communication medium to SMMI		External to cubicle: optic fibre Internal to cubicle: optic fibre or screened twisted pair copper	
	Device supports complete re-programming of configuration and Settings via the SMMI and E-LAN		Yes	
	Device has integral event recording with 1ms accuracy		Yes	
	Number of control inputs		Minimum 8	
	Number of control outputs		Minimum 5	
	Default display analogue values can be selected		Yes	
	General device ratings: a) Nominal supply voltage b) Insulation test voltage c) Impulse test voltage (surge) d) Output relay make & carry for 0,2 s e) Output relay carry continuously f) Output relay break (DC) g) Output relay break (AC)	 V DC kV A A W VA	 110 2 kV for 1 minute 5 30 5 50 (R), 25 (R/L) ($^{L}/_{R}$ = 0,04s) 1250	
12Q	**TEST TERMINALS**			
	Manufacturer		State	
	Device name		State	
	Part ordering code		State	
12R	**LOW RESOLUTION DISTURBANCE RECORDER (PREFERABLY INTEGRAL TO COMBINED OVER-CURRENT & EARTH FAULT PROTECTION RELAY)**			
	Manufacturer and model			
	Number of binary inputs		Minimum 8 general inputs	
	Number of analogue inputs		Minimum 4	
	Disturbance recorder sampling rate	Hz	400	
	Disturbance recorder recording bandwidth			
	Over- and under-current triggering		Yes	
	Over- and under-voltage triggering		Yes	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Pre-fault time	ms		
	Post-fault time	ms		
	Limit time	ms		
	Number of stored disturbance records			
	Voltage channels a) Dynamic range b) Resolution c) Accuracy			
	Voltage channels a) Dynamic range without DC offset b) Dynamic range with full DC offset c) Resolution d) Accuracy			
	Minimum total disturbance recording time with 10 analogue and 48 digital signals recorded			
	Built-in clock/calendar, setable via substation network			
12S	**MEDIUM RESOLUTION DISTURBANCE RECORDER**			
	Manufacturer and model			
	Number of binary inputs			
	Number of analogue inputs			
	Sampling rate	Hz	1 kHz effective, fixed	
	Recording bandwidth	Hz	5 - 300	
	Over- and under-current triggering		(0.00 to 50) x I_r	
	Over-voltage triggering		(1.00 to 2.00) x U_r	
	Under-voltage triggering		(1.00 to -1.00) x U_r	
	Pre-fault time	ms	50 to 300	
	Post-fault time	ms	100 to 3000	
	Limit time	ms	2 000 to 5 000	
	Number of recorder disturbances		Minimum 10, fixed	
	Voltage channels a) Dynamic range b) Resolution c) Accuracy		 (0.1 to 110) x U_r 0.1% $\leq$ 2.5% x U_r	
	Current channels dynamic range a) Without DC offset b) With full DC offset c) Resolution d) Accuracy		 (0.01 to 110) x I_r (0.01 to 60) x I_r 0.1% x I_n $\leq$ 2.5% x I_n	
	Minimum total recording time with 10 analogue and 48 digital signals recorded	s	10	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Built-in clock/calenar		For 30 years with leap years	
12T	**SUBSTATION CONTROL COMPUTER**			
	Processor		NX9420 Intel® Core™ Duo T2600 2.16GHz 667FSB 2048K Processor	
	Motherboard and auxiliary cards		Energy Star compliant Industrial type	
	Case and power supply		19” rack mount	
	IP rating of case, all equipment installed			
	Monitor		17”	
	Hard disk drive		Dual mirrored hard disk drives, at least 200 Gb formatted capacity	
	DVD ROM		±RW multi writer	
	Random access memory (RAM)		2048kb	
	Mouse		Optical	
	Printer		Laser auto feed paper	
	Keyboard		101 key QWERTY keyboard with dust-proof interchangeable membrane cover	
	Connectors		Non-corrosive Gold-plated	
	MTBF: a) Motherboard b) Auxiliary cards c) Power supply d) Monitor e) Hard disk drive f) DVD ROM writer			
	Operating system			
	MMI application software			
	a)			
	b)			
	Interlocking programming software			
	Engineering software			
	Other software packages required to allow complete user configuration and setting : a) b) c)			

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	d) e)			
	Global positioning system for accurate time synchronisation			
	Control computer and peripherals power supply unit			
	Supply standby time in event of AC supply failure	h	8.0	
	Facility on Computer to automatically shut down the monitor		Yes	
	Trending data archiving facilities for later retrieval		Yes	
	Number of cubicles			
	Size of cubicle(s)			
	Description of cubicle(s)			
	Cubicle(s) fan and filter		Accessible for service personnel	
	Installation position of substation control computer			
	Number of control module inputs			
	Number of control module outputs			
	Inputs for time synchronisation			
	Total system boot up time after emergency power-down			
12U	**SUBSTATION NETWORK AND COMMUNICATION EQUIPMENT**			
	Substation local network a) Architecture b) Redundancy at network supervisor level c) Power supply redundancy d) Route redundancy		Provide network architecture drawing	
	Method of connection to SCADA system			
	Remote engineering workstation connection			
	Communications protocols : a) Substation LAN (S-LAN) b) Engineering LAN (E-LAN) c) SCADA		DNP 3 level 3 as specified	
	Network communication medium : a) Substation LAN (S-LAN) b) Engineering LAN (E-LAN)		Optic Fibre RG-58 coaxial cable	
12V	**OPTIC FIBRES**			
	Optic fibres for connection of		Single Mode (SM)	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	equipment to OPGW		Armoured cable	
	Optic fibre connectors for connection to patch panels		ST-type	
	Optic Fibre for S-LAN		Armoured where installed in trench	
12	ARC PROTECTION RELAY			N/A
	Manufacturer		State	N/A
	Device name		State	N/A
	Part ordering code		State	N/A
	General device ratings: a) Nominal supply voltage b) Rated frequency c) Insulation test voltage d) Impulse test voltage (surge) e) Output relay make & carry for 0,2 s f) Output relay carry continuously g) Output relay break (DC) h) Output relay break (AC) i) Operating time	 V DC Hz kV A A W VA ms	 110 50 2 kV for 1 minute 5 30 5 50 (R), 25 (R/L) (L/R = 0,04s) 1250 < 10	N/A

SECTION 5: PARTICULARS & GUARANTEES

PART 13.1: LV AC CHANGE-OVER & DB'S

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1	**Low Voltage Alternating Current Wall Mounted Panel** Applicable Standards :			
1.1	Board according to drawings C 86			
1.2	Breakers			
2	Size of board h x w x d	mm	735 x 1300 x 365	
3	Mass of board	kg		
4	Mounting		Wall	
5	Protection class			
6	Make of :			
6.1	auto changeover switch		State	
6.2	supervision relay / type		State	
6.3	MCB's		State	
6.4	terminals		KLIPPON RSFI or equivalent	
7	Sheet steel cubicle manufacturer			
8	Sheet steel, thickness	mm	2	
9	Number x ratings of MCB's :			
10	Continuous current rating of incomers and busbars	A	200	
11	Short time rating, 3 second	kA	5	
12	Section of busbars (mm by mm)	mm^2		
13	Busbar material			
14	Number of separate gland plates		13	
15	Gland plate size			
16	Paint finish required		Cloud grey F48 to SABS 1091 1975	
			Numsell ref. 2.5 PB 7,5/2	

SECTION 5: PARTICULARS & GUARRANTEES

PART 13.2: BATTERY CHARGER & DC DB

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	Battery Charger Unit with Distribution Board			
1	**BATTERY CHARGERS**			
1,1	Is a DC distribution board to be supplied?		Yes (See A1)	
1,2	Application for which chargers are required		Floating and trickle charging of station batteries	
1,3	Type of load connected		Relays, control modules, instruments, indications, solenoids, motors, emergency lighting	
1,4	Are chargers to operate in parallel?		No	
1,5	Type of battery and number of cells for which charger is required		52 lead-acid cells	
1,6	Nominal battery voltage	V	110	
1,7	Type of battery chargers		Rectifier, automatic regulated type	
1,8	AC supply :			
1.8.1	Number of phases		Three or single-phase	
1.8.2	Nominal AC supply voltage	V	400/230	
1.8.3	Nominal system frequency	Hz	50	
1,9	Limits of AC supply variations expressed as a percentage of nominal values of 400/231 V AC :			
1.9.1	Maximum supply voltage	%	110	
1.9.2	Minimum supply voltage	%	90	
1.9.3	Variation in system frequency	%	2	
1,10	Insulation material used on transformer windings			
1,11	Insulation class		-	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1,12	Is an earthed shield provided between primary and secondary windings?		-	
1,13	Transformer nominal primary voltage	V	-	
1,14	Transformer nominal secondary voltage	V	-	
1,15	Voltage ratio of transformer on :			
1.15.1	Principal tap		-	
1.15.2	Tap		-	
1.15.3	Tap		-	
1.15.4	Tap		-	
1,16	Is a centre tap secondary winding employed?		-	
1,17	VA rating of transformers	VA	-	
1,18	Type of rectifier element used (i.e. rectifying diode, thyristor etc.)			
1,19	Rectifier rated current as a percentage of the designated circuit current	%	300 minimum	
1,2	Material of which rectifier element(s) are made		Silicon	
1,21	Connection arrangement of rectifier elements (i.e. bridge, parallel, etc.)		-	
1,22	Forward voltage rating of rectifier element	V	-	
1,23	Maximum working peak inverse voltage or rectifier element	V	-	
1,24	Maximum continuous forward current of rectifier element	A	-	
1,25	Maximum peak forward current of rectifier element	A		
1,26	Leakage current of rectifier element	A		
1,27	Type and method of surge suppression employed			
1,28	Maximum 1/50 micro-second lightning impulse voltage that charger will withstand	kV (peak)		
1,29	Maximum 1/2 000 micro-second lightning impulse voltage that charger will withstand	kV (peak)	-	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1,3	Maximum over voltage that charger will withstand for 0,5 seconds	V	-	
1,31	Type of voltage regulator used and principle of operation			
1,32	Type of voltage / current sensing element used (transductor, transistor, etc.)			
1,33	Type of regulation element used (thyristor, transistor, etc.)			
1,34	Limits of voltage regulation (expressed as a percentage of no-load output voltage with nominal input with nominal input voltage supplied) with :			
1.34.1	Nominal input voltage at full load	%	-	
1.34.2	90% nominal input voltage at :			
	a) No load	%	-	
	b) Full load	%	-	
1.34.3	110% nominal input voltage at :			
	a) No load	%	-	
	b) Full load	%	-	
1,35	Is constant output voltage adjustable?			
1,36	Limits of adjustment of output voltage:			
1.36.1	Maximum output voltage	V	132,0	
1.36.2	Minimum output voltage	V	101,75	
1,37	Output voltage setting for supplying the load and battery specified under 1 and 2 above	V	123,75	
1,38	Maximum ripple voltage peak-to-peak when :	%	0,4	
1.38.1	Battery disconnected no-load	mV		
1.38.2	Battery connected no-load	mV		
1.38.3	Battery connected, charger delivery maximum output current	A		
1,39	Limit of electromagnetic interference level	dB(A)	20	
1,40	Rated output current of charger	A		
1,41	Maximum output current for :			
1.41.1	float charge	A		
1.41.2	boost charge	A		
1.41.3	equilize charge	A		

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1.41.4	initial charge	A		
1.41.5	No. of output circuits			
	a) 20A		6	
	b) 10A		4	
1.41.6	Maximum output current into short circuit	A		
1,42	Method of current limiting			
1,43	Output current of charger at nominal voltage when supplying load plus discharged battery	A		
1,44	Time taken to recharge battery under condition 3.42 above	h	< 24 hours	
1,45	Type of protection and setting provided on input side			
1,46	Type of protection and setting provided on output			
1,47	Means of isolation on input side			
1,48	Means of isolating load from charger			
1,49	Type of charger fail protection			
1,5	Type of undervoltage relay			
1,51	Type of earth relay			
1,52	Voltage setting range undervoltage relay	V		
1,53	Current consumption of :			
1.53.1	Undervoltage relay	mA		
1.53.2	Associated alarm equipment	mA		
1,54	Minimum leakage current required to operate earth fault relay	mA		
1,55	Principle and type of earth fault relay		-	
1,56	Current consumption of earth fault alarm	mA		
1,57	Type of ammeter used to indicate charger output		Analogue Prefered	
1,58	Length of ammeter scale and angle of deflection	mm/degs		
1,59	Type of voltmeter used to indicate battery terminal voltage		Analogue Prefered	
1,6	Length of voltmeter scale and angle of deflection	mm/degs		
1,61	Are boost charging facilities provided on charger?		Manual/SCADA	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1,62	Earthing arrangement		Battery centre tap earthed through high resistance	
1,63	Method of indicating abnormal operating conditions		Both visual and audible	
1,64	Is a test facility for LEDs required?		Yes	
1,65	Are alarm indications to remain until manually reset?		Yes	
1,66	Audible alarm requirements		By beeper	
1,67	Type of alarm display required orproposed by the supplier, e.g.LCD, VDUs, print-outsSupervisory alarms and indicatorsrequired(Listed as a, b, c, etc., of clau		As proposed by supplier	
1.67.1	(a) number of alarm changeover contacts required		One	
1.67.2	(b) type of contacts		N/C N/O	
1.67.3	(c) rating of contacts		5A/DC	
1.67.4	Supervisory alarms and indicatorsrequired(Listed as a, b, c, etc., of clause 4.3.13)		a, b, c, f, g, J, n	
1,68	Overall dimensions of cubicle :			
1.68.1	Overall height	mm	1 950 maximum	
1.68.2	Overall length	mm	900 maximum	
1.68.3	Overall depth	mm	600 maximum	
1,69	Type of cubicle		Free standing floor mounted over cable duct	
1,70	Width of cable duct	mm	300 to 400	
1,71	Position of cable duct		Nearest edge 500 mm from back wall	
1,72	Position of cable entry		bottom	
1,73	Position of cable gland plate		bottom	
1,74	Maximum number of 4mm2/2-core PVC insulated wire-armoured cables that can be accommodated on a cable gland plate section			
1,75	Number of removable gland plate sections			
1,76	Dimensions of a single gland plate section	mm	-	
1,77	Type of access to charger for maintenance:		lift-off hinged door	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
1.77.1	Front, rear, side or all		front	
1,78	Is enclosure to be lockable?		Yes	
1,79	Is forced ventilation acceptable?		No	
1,80	Thickness of sheet steel of which cubicle is made	mm	2	
1,81	Mass of cubicle with charging equipment	kg	-	
1,82	Finish of cubicle		Cloud Grey F48 to SABS 1091 of 1975	
1,83	Is reversed battery connectionprotection required?If YES, details of protectionmethod.		Yes	
1,84	Which unusual service conditionsapply (list a, b, etc.)?		b, j, l, q, s	
1,85	Type tests required (list (a), (b),(c), etc., as detailed in the text)		b, c, d, f, g, j	
1,86	Other routine tests required		a, b, c, d	
2	**DC DISTRIBUTION BOARD**		Separate wall mounted unit	
2,1	Minimum size of copper conductor between battery/charger unit and DC distribution board	sq. mm	25	
2,2	Size of DC busbars			
2,3	Busbar material			
2,4	Conductor type and size of outgoing cables		2 core 4 sq mm Cu PVC SWA cable	
2,5	Number of poles and rating of main incoming moulded case circuit-breaker on distribution board		Double pole 80 A DC minimum	
2,6	Current rating of double pole moulded case circuit breakers to be provided on distribution board for outgoing circuits			
2,7	Type and rating of MCB for incomers			
2,8	Type and rating of MCB for feeders		20 A - DC	
2,9	Number of circuit-breakers to be provided for immediate use on each busbar circuit :		10 A - DC	
2.9.1	20 A		6	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
2.9.2	10 A		4	
2,10	Number of blank labels to be provided on distribution board for outgoing DC circuits on each busbar		10	
2,11	Number of spare outlet circuit-breakers to be provided for future use		0	
2,12	Current rating of MCB's for spare outlets		N/A	
2,13	Dimensions of DC distribution board h x w x d	mm		

SECTION 5: PARTICULARS

PART 13.3: BATTERY 110V & STAND

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	110V Batteries and Battery Stands			
1	**GENERAL INFORMATION**			
1,1	Scope of supply		2 batteries with 2 chargers and dual distribution boards	
1,2	Duration of peak current loading	sec	1,0 sec	
1,3	Location of batteries		Battery room	
1,4	Battery stand or a battery cabinet?		Battery stand	
1,5	Battery stand material			
1,6	Battery stand Drawing number			
1,7	Battery designation(s)		Protection batteries	
1,8	Particulars of load connected to battery/charger unit busbars			
1,9	Battery deterioration factor		0,8	
1,10	Battery capacity required	A-h	>110	
1,11	Maximum peak current to be supplied by battery / charger unit at any time	A	80 minimum	
2	**BATTERIES**			
2,1	Purpose for which batteries are required		Station/protection batteries	
2,2	Capacity range of battery		Medium capacity	
2,3	Type of operating duty		Protection stationary	
2,4	Period of discharge	hours	8	
2,5	Battery charging mode and duty (BS 440 Clause 2.15)		Float trickle charge	
2,6	Number of batteries		2	
2,7	Nominal voltage of battery	V	110	
2,8	Number of cells in battery		52	
2,9	Type of cell		Lead acid	
2,10	Type of plate		Plante	
2,11	Type of plate construction (e.g. flat plate, pasted plate, tubular plate)			
2,12	Number of plates in cell			
2,13	Material of which plate straps are made		-	
2,14	Type of plate separator and material of which separator is made		-	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
2,15	Method of supporting element in jar		-	
2,16	Clearance between plates and bottom of jar	mm	-	
2,17	Material of which jar or container is made		-	
2,18	Is jar transparent?		Preferred	
2,19	Overall dimensions of jar :			
2.19.1	Height	mm	-	
2.19.2	Width	mm	-	
2.19.3	Depth	mm	-	
2,20	Overall height of cell including vent and terminal post	mm	-	
2,21	Cell centre distance	mm	-	
2,22	Approximate quantity of electrolyte in cell at 25øC	litres	-	
2,23	Height of electrolyte above plates:	mm		
2,24	Total mass of cell complete with electrolyte	kg	-	
2,25	Rating of positive plates (see BS 440 Clause 5)	A-h	-	
2,26	Ampere-hour rating of battery at 25C on 8-hour discharge period	A-h	To be determined by the Tenderer (>110)	
2.26.1	Estimated continuous load :			
	a) Total continuous discharge current including inverter (including all filter and present equipment)	A	To be determined by the tenderer for his specific equipment	
	b) Allow 30% safety factor of estimated load	A-h	- do -	
	c) Battery capacity required to supply continuous loads	A-h	- do -	
2.26.2	Estimated intermittent loads over a 10-hour period :			
	a) Intermittent load	A-h	- do -	
	b) Average of total intermittent load over 8 hours on battery	A-h	- do -	
2.26.3	TOTAL DRAIN EFFECT ON BATTERY	A-h		
2,27	Battery voltage when fully charged	V DC		
2,28	Battery voltage at 25C on 8-hour discharge at rated 8-hour current	V DC		
2.28.1	Operation voltages :			
	a) Discharged	V/cell	1,85 minimum	
	b) Normal float	V/cell	2,24	
	c) Boost charge	V/cell		
2.29.1	Internal resistance of battery at 25C when fully charged (new condition) :			
2.29.2	Per cell	milli-ohms	-	

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
2,29	Complete battery	milli-ohms	-	
2,30	Ampere-hour efficiency of battery when new	%	-	
2,31	Watt-hour efficiency of battery when new	%	-	
2,32	Maximum recommended charging current	A	-	
2,33	Minimum trickle charging current to keep battery fully charged	A	-	
2,34	Life expectancy of battery assuming maintenance is carried out in accordance with manufacturer's recommendation	Years	20	
2,35	Guarantee period of battery only	Years	-	
2,36	Battery manufactured by		-	
2,37	Place and country of manufacture		-	
2,38	Make type / model number of cell		-	
2,39	What accessories are to be supplied with battery:		-	
2.39.1	Intercell connections		Yes	
2.39.2	Instruction card		Yes	
2.39.3	Maintenance record book		Yes	
2.39.4	Hydrometers		No	
2.39.5	Cell voltmeter		No	
2.39.6	Electrolyte test tube		No	
2.39.7	Electrolyte thermometer		No	
2.39.8	Cell bridging connector		Yes	
2.39.9	Additional electrolyte		No	
2.39.10	Distilled water		No	
2,40	In what condition is battery to be supplied?		Fully charged	
2,41	Recommended maintenance program - Description number		-	
3	**BATTERY STAND**			
3,1	Material of Stand		Wood/Plastic	

ITEM NO	DESCRIPTION	UNIT	SPECIFIED REQUIREMENTS	OFFERED AND GUARANTEED
14.1	**CIVIL WORKS**			
	All Civil works		According to The Standard Specifications for Municipal Civil Engineering Works	
	Building according to drawing and specifications		YES	

SECTION 5: PARTICULARS & GUARRANTEES

PART 15.1: ELECTRICAL INSTALLATION

SPEC NO:

ITEM		UNIT	REQUIREMENTS	OFFERED
	Electical Installation of Substation Building, Yard Lighting and Lightning Protection			
1	**DISTRIBUTION BOARD**			
1,1	Type		Semi-recessed with door	
1.1.1	Rating	kA	10	
1.1.2	Manufacturer			
1,2	Main Switch		60 Amp S.P. with solidly bolted	
1.2.1	Manufacturer and Cat. No.			
1,3	Earth		60 Amp Single phase	
1.3.1	Manufacturer and Cat. No.		M&G	
1,4	Busbars	A	60	
1,5	Lighting circuit-breakers	A	10	
1.5.1	Manufacturer and Cat. No.		M&G	
1,6	Socket outlet circuit-breakers	A	30	
1.6.1	Manufacturer and Cat. No.		M&G	
1,7	Fan circuit-breaker	A	5	
1.7.1	Manufacturer and Cat. No.		M&G	
1,8	Outside Lighting circuit-breaker	A	5	
1.8.1	Manufacturer and Cat. No.		M&G	
1,8	Photocell Bypass circuit-breaker	A	5	
1.8.1	Manufacturer and Cat. No.		M&G	
2	**LAMPS**			
2,1	Switchgear room		LED type A	
2.1.1	Manufacturer			
2,2	Battery room		LED Class 1, Type B	
2.2.1	Manufacturer			
2,3	Control room		LED type A	
2.3.1	Manufacturer			
2,4	Outside lamps		LED 15W Type C	
2.4.1	Manufacurer			
2,5	Toilets and passage		LED Class 1, Type B	
2.5.1	Manufacturer			

ITEM		UNIT	REQUIREMENTS	OFFERED
3	**SOCKET OUTLETS**			
3,1	Manufacturer			
3,2	Switchgear room		16 Amp, 3 pin, flush mounted	
3,3	Control room		16 Amp, 3 pin flush mounted	
4	**LIGHT SWITCHES**			
4,1	Manufacturer		State	
4,2	Switchgear room:			
4.2.1	2-way			
4.2.2	1-way			
4,3	Battery room		1-way, Ex proof	
4,4	Control room			
4.4.1	2-way			
4.4.2	1-way			
5	**FLEXIBLE CONDUIT**			
5,1	Battery room		Flexible weatherproof between fan and wall outlet and fluorescent and ceiling outlet	
6	**EXTRACTOR FAN**			
6,1	Type		Built in wall extractor fan, Ex proof, Fan to be continuous rated	
6,2	Fan diameter		250mm	
6,3	Make			
6,4	kW Rating			
6,5	Voltage rating		240 V AC single phase	
6,6	Continuous current rating			
6,7	Starting current			
8	**OTHER**			
8,1	Floodlighting		Type D-LED 215W	
8,2	Photocell and accessories		National or similar	
8,3	Welding outlet		63 A 4- pole and switch socket	
8,4	Lightning protection masts - Complete		As per Specification	

SECTION 5: PARTICULARS & GUARRANTEES

PART 17.1: OPTICAL FIBRE BASED TELEPHONE PROTECTION & COMMUNICATION EQUIPMENT

SPEC NO: **Txfot697.wpd/ss**

ITEM	DESCRIPTION	REQUIREMENTS	OFFERED
1.	**ENVIRONMENTAL CONDITIONS (applicable to all equipment)**		
1.1	Operating temperature range	-10/C to 50/C	
1.2	Transport temperature range	-40/C to 70/C	
1.3	Storage temperature range	-25/C to 55/C	
1.4	Humidity	Up to 95%	
1.5	EMC	According to EN55022 or better	
1.6	Safety	According to EN60950 or better	
2.	**TELEPROTECTION**		
2.1	**Power Supply**		
2.1.1	Type	Chopper type power supply	
2.1.2	Power	50 Watts	
2.1.3	Input Voltage range	90-264V_{ac} at 47-440Hz 88-230V_{dc}	
2.2	**Multiplexer**		
2.2.1	Current consumption	50mA @ 5V_{dc} 15mA @ 15V_{dc}	
2.2.2	Frame length	32 bits	
2.2.3	Frame characteristic	Adaptive Delta Modulation	
2.2.4	Multiplex signal bit-rate	2048kbits/s @ ±50ppm	
2.2.5	Frame repetition rate	64kHz	
2.2.6	Channel bit-rate	64kbits/s	
2.2.7	Data bits per frame	20 bits	
2.2.8	Synchronizing bits per frame	8 bits	
2.2.9	Signalling bits per frame	4 bits comprising of 1 Parity bit, 1 Control bit, 1 Remote alarm transfer bit and 1 8 kHz super frame	
2.2.10	Frame loss verification	For each frame	
2.2.11	Clock switch over	Automatic switch over	
2.2.12	Maximum switch over time for 2	16ms	

ITEM	DESCRIPTION	REQUIREMENTS	OFFERED
	Mbit/s signal		
2.2.13	Alarms	Synchronization loss Frame bit-error rate; Failure of Drop/Insert clock; Parity error; Total outage of transmit clock; AIS in Main and Standby path.	
2.2.14	Common alarms	Priority and deferred alarm; Remote-alarm from demultiplexer; Remote-alarm from Drop/ Insert; Operation blocking. Alarm/oscilator unit	
2.2.15	Current consumption	580mA @ 5Vdc 20mA @ -5V_{dc} 20mA @ 15V_{dc}	
2.2.16	Voltage monitoring - At 5V_{dc} - At - 5V_{dc} - At 15V_{dc}	 4.3V_{dc} - 4.3V_{dc} 13.5V_{dc}	
2.3	**Optical Transmission Interface**		
2.3.1	Optical code	MCMI	
2.3.2	Optical bit rate	4096kb/s	
2.3.3	Type of fibre	Single mode (9/125μm)	
2.3.4	Operating wavelength	1300nm	
2.3.5	Optical connector	FC	
2.3.6	Optical transmitter power	≥20dBm	
2.3.7	Receiver sensitivity	≤ 40dBm	
2.4	**Digital Protection Interface**		
2.4.1	Power supply voltage	15V_{dc}, 0.5V	
2.4.2	Current consumption	20-30mA	
2.4.3	Transmit command input voltage	24, 48, 110, 220 or 250V_{dc}	
2.4.4	Receive command input voltage	Solid state output relay 250V_{dc}, 1A	
2.4.5	Command transmission time	<2ms	
2.4.6	Command prolongation	20ms (standard), adjustable from 1-200ms	
2.4.7	Protection	Direct and indirect tripping blocking	
2.4.8	Isolation test voltage	IEC 255-5, Series C	
2.5	**Asynchronous Data Interface**		
2.5.1	Supply voltage	15V_{dc}, ±0.5V	

ITEM	DESCRIPTION	REQUIREMENTS	OFFERED
2.5.2	Current consumption	45mA, ±5mA	
2.5.3	Asynchronous modulation rate	4800 Baud, normal operation, 9600 Baud, maximum operation	
2.5.4	Input interface	CCITT V.28 single/double current	
2.5.5	Input impedance	1kΩ, 5kΩ, 7.8kΩ and 11kΩ	
2.5.6	Switching threshold	+2.5V_{dc} to -2.5V_{dc} with a hysteresis of 1.2V_{dc}	
2.5.7	Output interface	CCITT V.28 single/double current, ±10V @ 20mA, CCITT V.10 single/double current, ±5V @ 20mA	
2.5.8	Maximum phase carrier delay	1ms (±4 bits @ 4800 baud)	
2.5.9	Telex without carrier	±20V @ ±20mA, ±10V @ ±40mA	
2.6	**Binary Interface**		
2.6.1	Power supply voltage	5V_{dc}, ±0.3V @ <50mA 15V_{dc}, ±0.3V @ <280mA	
2.6.2	Input logical levels - Logic 0 - Logic 1	 -72V ≤ V_{in} ≤7.2V 9V ≤ V_{in} ≤ 72V	
2.6.3	Input current range	3mA ≤ I_{in} ≤ 10mA	
2.6.4	Auxiliary voltage source	12V, ±5 % @ 80mA, short-circuit protected and not galvanically isolated	
2.6.5	Total inputs/outputs	8	
2.6.6	Switching delay time	<15ms	
2.6.7	EMC immunity	According to IEC 870-3	
2.7	**Back Plane**		
2.7.1	Local Clock Source : Frequency Output Impedance	 2048kHz, ± 50ppm HCMOS compatible	
2.7.2	External Clock Input : Compatibility Frequency Permissible level variation@2048kHz Impedance Reflected Attenuation Isolation test Voltage Impulse Voltage withstand	 ITU-T Reg. G.703 2048kHz, ± 50ppm ≤ 6dB 120Ω symmetrical ≥ 15dB 0.5kVAC/1min 0.5kV Differential mode 1kV Common mode	
2.7.3	Relay Outputs : Switching Voltage Switching Current Contact Power Rating Drop off Delay Pick up Delay	 ≤250VAC & ≤ 250VDC ≤ 1A mean & ≤ 16A peak AC ≤ 100VA, DC ≤ 100W typically 5s typically 100ms 1.5kVAC / 1min	

ITEM	DESCRIPTION	REQUIREMENTS	OFFERED
	Isolation test voltage Impulse Voltage withstand	1kV differential mode, 2.5kV common mode	
2.8	**Mechanical Design**		
2.8.1	Construction	19" rack mountable	
2.8.2	Protection class of housing	IP54	
2.8.3	External connections	Screw Terminals	
3.	**COMMUNICATIONS**		
3.1	**Power supply**		
3.1.1	Type	Chopper type power supply	
3.1.2	Power output rating	26.5Watts	
3.1.3	Input voltage range	90-264V_{ac} at 47-440Hz, or 88-230V_{dc}	
3.1.4	Output voltage	±5V Regulated -3%...+6%	
3.1.5	Output current +5V -5V	 4.2A maximum 1.1A maximum	
3.1.6	Efficiency	≥65% @ full load	
3.2	**64kb/s Data Interface**		
3.2.1	Bit Rate	64kb/s synchronous	
3.2.2	Interface	CCITT X.21, adaptable for RS232	
3.2.3	Number of Channels	4	
3.3	**Universal Data Interface**		
3.3.1	Synchronous Data Interfaces Definition Electrical Rates	 X.21/X.24 V.11 0.6....n*64kb/s	
3.3.2	Asynchronous Data Interfaces Definition Electrical Rates	 V.24 V.28 (RS232) 0.6....38.4kb/s	
3.3.3	Number of Circuits	4	
3.4	**Telephone Subscriber Interface**		
3.4.1	CODEC Coding	CCITT A-Law (G.711)	
3.4.2	Input	-5dBr to +4dBr	
3.4.3	Output	-7.5dBr to -3dBr (in 0.5dB increments)	
3.4.4	Crosstalk Attenuation	70dB minimum	
3.5	**Telephone Exchange Interface**		

ITEM	DESCRIPTION	REQUIREMENTS	OFFERED
3.5.1	CODEC Coding	CCITT A-Law (G.711)	
3.5.2	Input	-5dBr to +4dBr	
3.5.3	Output	-7.5dBr to -3dBr (in 0.5dB increments)	
3.5.4	Crosstalk Attenuation	65dB minimum	
3.5.5	Functions Supported	Seizure, Ringing and Ring Tripping	
3.6	**Ring Generator**		
3.6.1	Output voltage	$66V_{AC}$ - $70V_{AC}$	
3.6.2	Output frequency	25Hz ± 3Hz	
3.6.3	Output current	0 to $460mA_{AC}$	
3.6.4	Power consumption : Quiescent Full load	 8W 50W	
3.7	**Optical Transmission Interface**		
3.7.1	Multiplexing method	CCITT G.742	
3.7.2	Transmission code	MCMI	
3.7.3	Input sensitivity	-46dBm	
3.7.4	Optical power output	-3dBm minimum	
3.7.5	Number of ports	2	
3.8	**2Mb/s Interface**		
3.8.1	CCITT Recommendation	G.703, G.704, G.823	
3.8.2	Bit Rate	2048kb/s	
3.8.3	Number of Ports	2	
3.8.4	Line Code	HDB3	
3.8.5	Impedance	120Ω balanced or 75Ω unbalanced	

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SECTION 5: PARTICULARS & GUARRANTEES

PART 18.1: SCADA INTERFACE

SPEC NO:

ITEM	DESCRIPTION	UNIT	REQUIREMENTS	OFFERED
	SCADA INTERFACE			
1	Type of interface		Harris D20++	
2	Protocol offered at the SCADA Access Point on the SMMI			
3	Mounting of SCADA Interface Unit		In 19" Communication Equipment rack	
4	Modes of Operation		Polled Report by Exception Operation	
5	Testing		Contractors responsibility to the front end processor at Capital Park	
6	Pre-testing Contractors must pre- test their SCADA equipment with the TSHWANE system to prove compatibility		Contractors to pre-test and sign document. YES	

PART C2.2
ACTIVITY, QUANTITIES & BILL SCHEDULES

CONTENTS

PART	DESCRIPTION	APPLICABLE
1	PRELIMINARY & GENERAL	Yes
2	ELECTRICAL WORKS	Yes
3	CIVIL WORKS	Yes
4	MINOR WORKS	Yes
5	COMMUNITY LIASON OFFICER	Yes
6	ENGINEERING CHANGE	Yes

PART C2: PRICING DATA

PART C2.2: ACTIVITY, QUANTITY & PRICE SCHEDULES

TENDER NO: EEBU 13-2025.26

BILL NO 1: PRELIMINARY & GENERAL

ITEM NO	DESCRIPTION	UNIT	QUANTITY (1)	PRICE PER UNIT (Excl. VAT) (2)	TOTAL PRICE (Excl. VAT) (1) x (2)
1	**PRELIMINARY & GENERAL** (Must include all the costs for the the construction of the infeed station and its associated 132kV overhead power line works)				
1.1	**SITE ESTABLISHMENT**				
1.1.1	**Establish temporary works and remove on completion**: Contractor`s site yard, offices, sanitation facilities, material stores, temporary water and electricity supplies, drainage and waste disposal systems, telecoms/telephone facilities and staff accomodation. Remove on completion and rehabilitate the site.	sum	1		
1.1.2	**Site Boardroom:** Fully equiped with table and chairs to accommodate at least 15 people. Provide drawing rails, white board, air conditioner.	sum	1		
1.1.3	**Storage of equipment:** Safe and protected storage on site of all items (including free-issue items) must be provided. Substation buildings must not be used for storage.	sum	1		
1.2	**SITE COSTS AND OVERHEADS**				
1.2.1	**Civil Works:** Site and Overhead costs	sum	1		
1.2.2	**Electrical Works:** Site and Overhead costs	sum	1		
1.3	**WORKS INFORMATION**				
1.3.1	**Construction Programme:** A schedule with a work-breakdown structure with at least three levels of detail (1st - Overview of main elements, 2nd - each main element broken up into sub-elements, 3rd - detail description of each sub-element / works-order).	sum	1		
1.3.2	**Contractors Insurance:** Insurance for contract works must be taken out by main contractor. All risk insurance cover, including SASRIA and public liability, with regard to all plant, material and equipment under this contract including free issue equipments until final construction hand-over.	sum	1		
1.3.3	**Environmental Management Plan (EMP):** As per specification.	sum	1		
1.3.4	**Quality Management Plan (QMP):** As per specification.	sum	1		
1.3.5	**Operating & Maintanance Manuals (O&M M's):** Provide O&M Manuals including "As-Built" drawings of the substation. All the technical information, civil and eletrical works drawings, test reports, specifications, must be submitted in hard copy files and soft copy (USB).	set	3		
1.4	**OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENT**				
	Provision must be made to comply with the Occupational Heath and Safety Act (Act 85 of 93) and the Construction Regulation 2014 or the latest updated acts/regulations or the replacement thereof.				
1.4.1	Safety Training & Supervision	sum	1		
1.4.2	Environmental Compliance Officer (ECO)	sum	1		
1.4.3	Safety Officer (SACPCMP Registration Manadatory)	sum	1		
1.4.4	Safety Implementation Plan	sum	1		
1.4.5	OHS File	sum	1		

ITEM NO	DESCRIPTION	UNIT	QUANTITY (1)	PRICE PER UNIT (Excl. VAT) (2)	TOTAL PRICE (Excl. VAT) (1) x (2)
1.4.6	**Safety nets, earths & signs:** Provision must be made to fence off working (dead/swithced-out) areas from live areas and put up warning signs. Contractor supply all nets, earths and signs. Nets must be minimun 1.8m high PVC orange coloured. The contractor must erect the nets, earths and signs after the CoT Operator give the instruction. Portable earths must be applied to equipment to be worked on. The placing of the nets, earths and warning signs must be approved by the CoT Operator before a permit will be issued. The Contractor must maintain the nets, earths and warning signs at all times until instructions are received from the CoT Operator.	sum	1		
1.5	**COMMISSIONING & TESTING:**				
	Supply all test equipment and labour for testing, commissioning and adjustments of the final installation as well as being in attendance for any inspections and tests that the Engineer may call for.				
1.5.1	**Commissioning & testing:** 400/132kV Transformer bay complete including all equipment	each	2		
1.5.2	**Commissioning & testing:** 132kV Line bay complete including all equipment	each	10		
1.5.3	**Commissioning & testing:** 132kV Bus-coupler/section bay complete including all equipment	each	4		
1.5.4	**Commissioning & testing:** 132kV Buszone complete including all equipment	each	2		
1.5.5	**Commissioning & testing:** 132kV Capacitor banks complete including all equipment	each	2		
1.5.6	**Commissioning & testing:** 400/132kV Metering Panels complete including all equipment	each	4		
1.5.7	**Commissioning & testing:** Substation equipment and remote-end equipment protection and control complete including all equipment. All line inter-trips, auto-reclosing, etc.	sum	1		
1.5.8	**Commisioning & testing:** Substation Micro-Scada (HMI), Remote (Capital Park) Scada control and monitoring system complete including all equipment (communication).	sum	1		
1.6	**SECURITY SERVICES**				
1.6.1	Provide for 24 hour security services during the construction work with armed response. The security company must be registered with PSIRA. The security guards must be Grade B. At least 6 guards at night and 4 during the day. Provide for tempoary guard house.	sum	1		
1.6.2	Provide for 24 hour surveliance system that covers the entire station according to CoT specification.	PI	1	R 1 500 000,00	R 1 500 000,00
1.6.3	**Security system:** Provide for an intruder detection system	sum	1		
1.7	**FACTORY INSPECTION AND TESTING OF EQUIPMENT**				
1.7.1	Conduct factory inspection and attend to routine and type tests of equipment at the factories outside Gauteng area, including overseas trip. All cost for 3 technical staff members from CoT (travel, accommodation and subsistance allowance) to carry out factory inspections and witness testing of equipment.	sum	1		
	TOTAL OF SECTION 1 (Total carried forward to Price Summary)				

PART C2: PRICING DATA

PART C2.2: ACTIVITY, QUANTITY & PRICE SCHEDULES

TENDER NO: EEBU 13-2025.26

BILL NO 2: ELECTRICAL WORKS

ITEM NO	DESCRIPTION	UNIT	IMPORTED CONTENT		PRICE PER UNIT (Excl. VAT)			QUANTITY	TOTAL PRICE (Excl. VAT)
			Imported Content Value (In Rands)	FOREX Currency	Supply & Delivery (1)	Installation & Commissioning (2)	Total (1) + (2) (3)	(4)	(3) x (4) (5)
2	**ELECTRICAL WORKS**								
2.1	**400kV AND 132kV CIRCUIT BREAKERS**								
2.1.1	**400kV Outdoor Circuit breaker 3150A:** Supply, delivery, installation, gas-filling, integration and commissioning of cirucit breaker (Including Operating & Maintenance Manuals).	each						2	
2.1.2	**132kV Outdoor Circuit breaker 4000A:** Supply, delivery, installation, gas-filling, integration and commissioning of cirucit breaker (Including Operating & Maintenance Manuals).	each						4	
2.1.3	**132kV Outdoor Circuit breaker 3150A:** Supply, delivery, installation, gas-filling, integration and commissioning of cirucit breaker (Including Operating & Maintenance Manuals).	each						14	
2.1.4	**Support Structures:** For 400kV Outdoor Circuit breakers	each						2	
2.1.5	**Support Structures:** For 132kV Outdoor Circuit breakers	each						18	
2.2	**132kV DISCONNECTORS & EARTH SWITCHES**								
2.2.1	**132kV Disconnector 4000A, complete with 2 x Earthing Switches:** Supply, delivery, installation and commissioning of horizontal double side break disconnectors (Including Operating & Maintenance Manuals).	each						4	
2.2.2	**132kV Disconnector 4000A, complete with 1 x Earthing Switch:** Supply, delivery, installation and commissioning of horizontal double side break disconnectors (Including Operating & Maintenance Manuals).	each						4	
2.2.3	**132kV Disconnector 1600A, complete with 2 x Earthing Switches:** Supply, delivery, installation and commissioning of horizontal double side break disconnectors (Including Operating & Maintenance Manuals).	each						12	
2.2.4	**132kV Disconnector 1600A, complete with 1 x Earthing Switch:** Supply, delivery, installation and commissioning of horizontal double side break disconnectors (Including Operating & Maintenance Manuals).	each						2	
2.2.5	**132kV Disconnector 1600A, without earthing switches** (Disconnector with staggered arrangement):Supply, delivery, installation and commissioning of pantograph disconnectors (Including Operating & Maintenance Manuals).	each						2	
2.2.6	**132kV Pantograph Disconnector 1600A, with earthing swithches:** Supply, delivery, installation and commissioning of pantograph disconnectors (Including Operating & Maintenance Manuals).	set						12	
2.2.7	**132kV Pantograph Disconnector 1600A, without earthing swithches:** Supply, delivery, installation and commissioning of pantograph disconnectors (Including Operating & Maintenance Manuals).	set						12	
2.2.8	**Support structures:** For Standard Disconnectors 4000A (Complete wiith 1 and 2 Earthing switches)**:** Supply, delivery, installation and perform quality checks.	each						8	
2.2.9	**Support structures:** For Standard Disconnectors 1600A (Complete wiith 1 and 2 Earthing switches)**:** Supply, delivery, installation and quality perform checks.	each						14	
2.2.10	**Support structures:** For Standard Disconnectors 1600A (Disconnector with staggered arrangement)**:** Supply, delivery, installation and quality perform checks.	each						2	
2.2.11	**Support structures:** For Pantograph Disconnectors 1600A**:** Supply, delivery, installation and perform quality checks.	set						24	
2.3	**400kV AND 132kV SURGE ARRESTORS**								
2.3.1	**400kV Surge arresters:** Free-standing type	each						12	
2.3.2	**132kV Surge arresters:** Free-standing type	each						48	
2.3.3	**Support Structures:** For free-standing 400kV Surge Arresters	each						12	
2.3.4	**Support Structures:** For free-standing 132kV Surge Arresters	each						48	
2.3.5	**Transformer brackets:** For surge diverters (To be mounted on the power transformers for installing 132kV Surge arrestors)	each						2	
2.4	**400kV AND 132kV INSTRUMENT TRANSFORMERS:**								
2.4.1	**OUTDOOR VOLTAGE TRANSFORMERS (VT):**								
2.4.1.2	**400kV Voltage Transformers**: Transformer Bays	each						6	
2.4.1.3	**132kV Voltage Transformers**: Line Bays, Main & Reserve Busbars and Transformers	each						34	
2.4.1.4	**Support structures**: For 400kV Voltage Transformers: Each Voltage Transformer structure requires a galvanised junction box with terminals/links on the middle structure.	each						6	
2.4.1.5	**Support structures**: For 132kV Voltage Transformers: Each Voltage Transformer structure requires a galvanised junction box with terminals/links on the middle structure.	each						34	
2.4.2	**OUTDOOR CURRENT TRANSFORMERS (CT)**								
2.4.2.1	**400kV Outdoor Current Transformers with 6 x Cores:** Transformer Bays	each						6	
2.4.2.2	**132kV Outdoor Current Transformers with 6 x Cores:** Transformer Bays	each						6	
2.4.2.3	**132kV Outdoor Current Transformers with 5 x Cores:** Line Bays	each						30	
2.4.2.4	**132kV Outdoor Current Transformers with 4 x Cores:** Bus Coupler/Section & Capacitor bank Bays	each						18	
2.4.2.5	**Support structures:** For 400kV Current Transformers: Each Current Transformer structure requires a galvanised junction box with terminals/links on the middle structure.	each						6	
2.4.2.6	**Support structures:** For 132kV Current Transformers: Each Current Transformer structure requires a galvanised junction box with terminals/links on the middle structure.	each						54	
2.5	**400kV/132kV BUSBAR SYSTEM WITH ALL ACCESORIES**								

ITEM NO	DESCRIPTION	UNIT	IMPORTED CONTENT		PRICE PER UNIT (Excl. VAT)			QUANTITY	TOTAL PRICE (Excl. VAT)
			Imported Content Value (In Rands)	FOREX Currency	Supply & Delivery (1)	Installation & Commissioning (2)	Total (1) + (2) (3)	(4)	(3) x (4) (5)
2.5.1	**400kV Conductors, Clamps & Fittings:**								
2.5.1.1	**Transformer Bays (315MVA):** Supply, delivery and installation of the conductors, clamps and fittings for connecting the 2 x 400/132kV, 315MVA Power Transformers to link with the 400kV Eskom Transsmission Station as per substation layour drawing (Drawing no:). For both the 400kV and 132kV bus bar connections	each						2	
2.5.2	**132kV Tubular Busbars, Conductors, Clamps & Fittings:** Supply, delivery and install all the alluminium tubular and conductor bus bars, clamps and fittings as per substation layout drawing (Drawing no:).								
2.5.2.1	**Main & Reserve Busbars (4 000A):** Supply, delivery and installatin of all the (200 x 5mm) alluminium tubular busbars, clamps and fittings. A complete set of new 132kV busbars must be installed for the whole substation	lot						1	
2.5.2.2	**Line Bays:**	each						10	
2.5.2.3	**Transformer Bays:**	each						2	
2.5.2.4	**Bus Coupler Bays:**	each						2	
2.5.2.5	**Bus Section Bays:**	each						2	
2.5.2.6	**Capacitor Bank Bay:**	each						2	
2.6	**BUSBAR SUPPORT STRUCTURES**								
2.6.1	**132kV Main / Reserve Busbar:** Each structure to carry all three phases as a set **(Drawing no:)**	each						48	
2.6.2	**132kV Bus Coupler Bays:** Each structure to carry all three phases as a set **(Drawing no:)**	each						2	
2.6.3	**132kV Bus Coupler Bays:** Each structure to carry one post insulator **(Drawing no:)**	each						14	
2.7	**STEEL LATTICE CONSTRUCTION PORTAL TYPE GANTRIES FOR OVERHEAD BUSBARS**								
2.7.1	**400kV Steel Lattice Gantries For Transformer Bays**								
2.7.1.1	Vertical columns.	each						12	
2.7.1.2	Horizontal beams.	each						6	
2.7.1.3	Gantry peaks: Peaks to fit on top of beams for earth-wires.	each						12	
2.7.2	**132kV Steel Lattice Gantries For Transformer and Overhead Power Line Bays**								
2.7.2.1	Vertical columns.	each						23	
2.7.2.2	Horizontal beams.	each						14	
2.7.2.3	Gantry peaks: Peaks to fit on top of beams for earth-wires.	each						23	
2.8	**INSULATORS**								
2.8.1	**400kV String composite insulators:** For overhead flexible conductor busbars **(Drawing no:)**	each						30	
2.8.2	**132kV String composite insulators:** For flexible overhead busbars and overhead flexible conductors between the towers and gantry structures (Drawing no:)	each						24	
2.8.3	**132kV Post insulators:** For Tubular busbar for all the bays	each						164	
2.9	**INSULATED CABLES**								
2.9.1	**22kV Cable and Termination**								
2.9.9.1	70mm² Copper three-core PILC Cable	m						50	
2.9.2	**22kV Terminations per terminal**								
2.9.2.1	70mm² Copper three-core.	each						12	
2.9.3	**Multi-core Control Cables:** Underground, PVC-Insulated: Supply and install terminations for the following power and control cables from their respective equipment to the bay marshalling kiosk to the panel in the control building inside 200mm diameter class HDPE sleeve-pipes (maximum of ten multi-core cables per 200mm diameter pipe), complete with cable gland, shroud and core identification in accordance with the specification.								
2.9.3.1	**2,5 mm² multi-core cable:**								
2.9.3.1.1	- 2 core	m						4000	
2.9.3.1.2	- 4 core	m						4000	
2.9.3.1.3	- 7 core	m						4000	
2.9.3.1.4	- 12 core	m						5000	
2.9.3.1.5	- 19 core	m						6000	
2.9.3.1.6	- 27 core	m						4000	
2.9.3.1.7	- 37 core	m						4000	
2.9.3.2	**4 mm² multi-core cable :**								
2.9.3..2.1	- 4 core	m						3000	
2.9.3..2.2	- 7 core	m						4000	
2.9.3.3	**6 mm² multi-core cable :**								
2.9.3.3.1	- 3 core	m						500	
2.9.3.3.2	- 4 core	m						1000	

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2.9.3.4	**16 mm² multi-core cable :**								
2.9.3.4.1	- 2 core	m						500	
2.9.3.4.2	- 4 core	m						500	
2.9.3.5	**35 mm² multi-core cable :**								
2.9.3.5.1	- 4 core	m						300	
2.9.4	**Galvanized cable tray:** Supply and install galvanised steel heavy duty cable trays and cable ladders in the floor trench in the control building, complete with all O-line P1000 (41mm x 41mm) heavy duty galvanised steel trunking and supporting components.								
2.9.4.1	- 100 mm wide	m						500	
2.9.4.2	- 150 mm wide	m						500	
2.9.4.3	- 300 mm wide	m						500	
2.9.4.4	- 500 mm wide	m						500	
2.9.5	Supply and install 32mm diameter galvanised steel conduit pipe, vertically between ground level and the cable termination for the protection of all the cables to the instrument transformers and cement sand mixture at base	m						100	
2.10	**EARTH SYSTEM**								
	Earth Grid: Earth grid installation must include, excavation, trenching, backfilling and all earth mat conductor connections/exowelds as per specification.								
2.10.1	Bare solid Cu conductor 10mm.	m						3500	:
2.10.2	50 x 3mm flat Cu conductor for the earth grid.	m						4000	
2.10.3	Steel Cu plated rod 16mm thick and 1,2m long. Additional earthing at various point as required on the earth grid (this is not a connection to equipment structures)	each						300	
2.10.4	Connections to structures and equipment above-ground must be of steel Cu plated rods 16mm thick. Two connections per structure as a set. Including all steel Cu plated rods and connections.	set						200	
2.10.5	Supply and installation of earth test points in the 132kV yard	each						20	
2.10.6	**Soil Resistivity:** Provisional Item (PI): Site survey of soil resistivity (virgin site.)	PI					**R20 000,00**	1	R20 000,00
2.10.7	**Earth Grid Survey:** Provisional Item (PI): Site survey of copper earth resistivity after installation.	PI					**R20 000,00**	1	R20 000,00
2.10.8	**Lightning Mast with earth mat.** 30degree protection/coverage. A minimum height of 23m. Complete including plinths, earthmat and 4 connections to the substation earth grid. According to SANS spec.	each						16	
2.11	**315MVA 400/132kV TRANSFORMER:**								
2.11.1.1	**One complete transformer oil re-cycle** with filtering plant 108 000 Liters of transformer oil for one cycle	sum						2	
2.11.1.2	**One complete transformer oil heat re-cycle** after the oil was heated up to 60 Deg C 108 000 Liters of transformer oil for one cycle	sum						2	
2.11.2	**TRF site tests before transport:**								
2.11.2.1	Site routine testing (Ratio, Megger,Sfra,Tan delta and impedance test)	sum						2	
2.11.3	**Specialized site testing of transformers before transport:**								
2.11.3.1	Induced overvoltage at 120% with PD readings to IEC specificaton	sum						2	
2.11.3.2	Separate source voltage withstand test 60%	sum						2	
2.11.4	**Drain Transformer of oil** (108 000 Litres) and transport to Wildebees site as specified in the scope**.**	sum						2	
2.11.5	**Dismantle transformer** and crate of bushings, radiators conservator and all associated parts for transportation from existing storage site to Wildebees Infeed Station Site	sum						2	
2.11.6	Transport of transformer and all parts from Njala to Wildebees substation site. Two disturbance recorders must be fitted during transport Transformers is to be transported under dry air	sum						2	
2.11.7	Transport of transformer and all parts from Njala to nearest factory for repairs if required. Two disturbance recorders must be fitted during transport Transformers is to be transported under dry air	PI					R3 000 000,00	1	R3 000 000,00
2.11.8	Transport of transformer and all parts from nearest factory to Wildebees for installation. Two disturbance recorders must be fitted during transport Transformers is to be transported under dry air	PI					R3 000 000,00	1	R3 000 000,00
2.11.9	Transport of NEC from Njala to Wildebees substation site.	sum						2	
2.11.10	Install, replace all gaskets, assemble and fill transformer with oil under vacuum conditions at the Wildebees site	sum						2	
2.11.11	Replace all silica-gel breathers on transformer	sum						2	
2.11.12	Transformer earthing: Provide earthing of TRF up to earth mat adjacent to plinth.	sum						2	
2.11.13	Routine tests and commissioning of power transformers	sum						2	
2.11.14	Install Neutral Earthing Compensator/Resistor (NEC):	each						2	
2.11.15	Replace all silica-gel breathers on and NEC	each						2	
2.11.16	Routine tests and commissining of NEC as specified	sum						2	
2.11.17	Dissolved gas analyser (DGA) for transformer oil and PD measurements on transformer bushings as specified in Section 4 Specification GR.01/0-12-Rev 0	each						2	
2.11.18	Supply and install a dissolved gas analyser (8 gasses) for transformer and tap changer oil with transformer monitoring system ,monitoring bushing PD measurements, transformer temperatures and load measurements including software and online monitoring	each						2	
2.11.23	**Spare bushing: The bushings to be silicone composite insulated with an accessible capacitive tap (Specifiation:)**								
2.11.23.1	Spare 400kV Transformer bushing	each						3	

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2.11.23.2	Spare 132kV Transformer bushing	each						3	
2.11.23.3	Spare 22kV Transformer bushing	each						3	
2.11.24	**Transformer oil: (Inhabited high grade oil IEC 60296)**								
2.11.24.1	Mineral insulating inhabited transformer oil - comply to IEC60295	litre						210	
2.11.24.2	Natural transformer oil equivalent to Engen60U- comply to IEC60296	litre						210	
2.11.24.3	Oil Sampling: Conduct gas analysis, de-electric and moisture tests on the power transformer including the tap changer	lot						1	
2.12	**CONTROL & PROTECTION (C&P) EQUIPMENT**								
2.12.1	**400/132kV Power Transformer Bay C&P System IEC61850 enabled:** Panel complete with wiring, installation, configuration and mimic of all devices with the following functionalities:	each						2	
	(a) Bay controller: With integrated switchgear mimic control diagram.								
	(b) Main protection: Combined differential and earth fault relay/function.								
	(c) Back-up protection: Combined over-current and earth fault protection relay/function.								
	(d) Local controls: Included with Mimic/Baycontroller								
	(g) Test Blocks: Multi CT/VT connections.								
	(e) Maximum Demand Ammeter: In Bay controller.								
	(f) Trip circuit supervision:								
	(g) Emergency trip button:								
2.12.2	**132kV Overhead Line Bay C&P System IEC61850 enabled:** Panel complete with wiring, installation, configuration and mimic of all devices, including the following functionalities.	each						10	
	(a) Bay controller: With integrated switchgear mimic control diagram.								
	(b) Main protection: Distance, directional overcurrent multifunctional with optic fibre communication.								
	(c) Back-up protection: Combined over-current and earth fault.								
	(d) Check-synchronisation:								
	(e) Automatic reclose:								
	(f) Local controls: Included with Mimic/Bay controller.								
	(g) 4 x Test Blocks: Multi CT/VT connections.								
	(h) Maximum Demand Ammeter: In BYC.								
	(i) Medium resolution disturbance recorder:								
	(j) Intertrip receive repeat relay or functionality:								
	(k) Emergency trip button:								
2.12.3	**132kV Bus-Coupler/Section Bay C&P System IEC61850 enabled: Panel** complete with wiring, installation, configuration and mimic of all devices with the following functionalities.	each						4	
	(a) Bay controller: With integrated switchgear mimic control diagram.								
	(b) Protection: Directional Overcurrent and Earth Fault Multifunctional with optic fiber communication.								
	(c) Check synchronisation:								
	(d) Trip circuit supervision:								
	(e) Local controls: Included with Mimic/Bay controller.								
	(f) 4 x Test Blocks: Multi CT/VT connections.								
	(g) Maximum Demand Ammeter: In Bay controller.								
	(h) Medium resolution disturbance recorder:								
	(i) Emergency trip button:								
2.12.4	**132kV Busbar Protection Scheme IEC61850 enabled:** Panel complete central unit, panel, wiring, assembly, configuration and mimic of all devices with the following functionalities for all the bay modules:	each						2	
	(a) Low impedance busbar protection scheme: Configured and wired for 4 zones, and all present and future bays (min 35 bays), implemented with all bays measuring modules.								
	(b) Check zone: Integral in low impedance system.								
	(c) Distributed system prefered with dead zone protection.								
	(d) Engineering communications to HMI enable.								
	(e) Test Blocks: Multi CT/VT connections.								
	(f) Medium resolution disturbance recorder:								
	(g) Trip circuit supervision:								
	(h) Emergency trip button:								
2.12.5	**132kV Capacitor Bank Scheme IEC61850 enabled:**	each						2	
2.12.6	**400/132kV Metering Panel: SCADA comms enabled:** Complete panel, wiring, assembly, including configuration of all devices. Each panel must contain TWO metering circuits which operate independently. Each circuit must have main and back-up meter. **The panels must be similar in size and color to the Protection and Control panel**	each						4	

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2.12.7	**Yard Marshalling Kiosks:** Supply and install surface standing, vermin and weather proof kiosk with 250 spring loaded terminals and 2 x power terminals. A 230V 16A industrial plug wired through and earth leakage, anti-condensation heater and 2 x interior lights.	each						18	
2.12.9	**Substation Software and Configuration:**								
2.12.9.1	All necessary software to provide complete substation control functionality, disturbance recording analysis, relay setting and other functions.	lot						1	
2.11.9.2	Configuration of complete substation control system and software to provide complete functionality required.	lot						1	
2.11.10	**Spare Relays:**								
2.11.10.1	132kV Bay controller	each						1	
2.11.10.2	132kV Multi-function directional over-current relay	each						1	
2.11.10.3	132kV Combined differential & earth fault protection relay	each						1	
2.11.10.4	132kV Combined overcurrent & earth fault protection relay	each						1	
2.12	**AUXILLIARY EQUIPMENT**								
2.12.1	**Low Voltage (LV) Supplies:**								
2.12.1.1	LV AC Board with chop over: Supply, delivery, installation, testing and commissioning of the low-voltage AC wall mounted automatic change-over & distribution panel in the AC/DC equipment rooms	each						2	
2.12.1.2	Dual DC board with selector switch: To be connected to two chargers and two battery banks	each						2	
2.12.2	**110V Batteries & Battery Stands:**								
2.12.2.1	110V Lead acid battery (52 cell) >160 A/H	lot						4	
2.12.2.2	110V Battery Stands	lot						4	
2.12.3	**110V Battery Charger:**								
2.12.3.1	Battery charger unit: Single chargers each rated output 50A.	each						4	
2.12.4	**Generator:**								
2.12.4	20kVA Three Phase, Diesel Generator with chop over	each						1	
2.13	**YARD LIGHTING**								
2.13.1	**Yard lighting:** Provide for 26 x LED lights fitted to gantries or lightning masts at a height of 6m.	each						26	
2.13.2	Supply and install IP65 weatherproof daylight sensor switch and junction box.	each						10	
2.13.3	Supply, install, excavate and compact class HDPE sleeve-pipe 100mm diameter at a depth of 1,5m below station platform level, backfill and compacting.	m						600	
2.13.4	Supply and install 25mm2 x 4 core PVC/PVC/SWA/PVC cable with aluminium conductors between the AC control panels and the lighting masts (2 x drums).	m						1000	
2.13.5	Supply and install cable terminations for 25mm2 x 4 core PVC/PVC/SWA/PVC cable with aluminium conductors.	each						30	
2.14	**OPTICAL FIBRE BASED TELEPROTECTION- AND COMMUNICATION EQUIPMENT**								
2.14.1	**Fiber Optic based Tele-protection Signal equipment:**								
2.14.1.1	Fox 615 rack, complete with dual POSUS power supply, COBUX processor, etc.	each						1	
2.14.1.2	Sync interface	each						2	
2.14.1.3	Synio optical interface	each						2	
2.14.1.4	Synam interface cards	each						2	
2.14.1.5	TUPON 8448 optical interface units	each						1	
2.14.1.6	TUNOS optical interface units	each						2	
2.14.1.7	SUBLA subscriber line interface units	each						1	
2.14.1.8	RIGEN ringer generators	each						1	
2.14.1.9	Unida 431 data interface cards	each						2	
2.14.1.10	Unida 434 data interface cards	each						2	
2.14.1.11	LAWA4 interface Card	each						1	
2.14.1.12	Ethub interface card	each						1	
2.14.1.13	Tebit - Teleprotection interface cards	each						4	
2.14.1.14	Cisco equivalent router with 4 * E1 WAN ports, Ethernet 10/100BaseT port, complete	each						1	
2.14.1.15	LESA8 HDSL line interface unit	each						1	
2.14.1.16	HDSL surge protection unit complete with isolation transformer, line termination units, line conditioner, etc.	each						1	
2.14.1.17	110V / 48V Power supply converter unit	each						1	
2.14.1.18	Power supply surge protection	each						1	
2.14.1.19	Equipment cabinet, floor mounting, complete with sub racks, marshalling compartment, cable gland plate, ventilation system, panels and doors - swingframe and any accessories to complete a FOX 615 installation with provision for differential protection for the 132kV overhead lines.	each						1	
2.14.2	**Patch Panels:** 48 Way with LC SM pigtails and midcouplers.	each						1	
2.14.3	Supply, delivery and installation of 48-way fibre outdoor splice domes on steel lattice gantries.	each						1	

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2.14.4	**Installation, commissioning and testing** of communication equipment/system.	lot						1	
2.14.5	**New fibre optic cable:** From the 132kV tower/pylon to the Control and Protection panel.	m						200	
2.14.6	**Joining/Splicing existing fibre optic cable to substation:** Contractor to confirm the number of fibres.	each						4	
2.15	**SCADA INTERFACE**								
2.15.1	**Harris D20 ++ Processor Card**: **OR Alternative Intellegent device (gateway):** Specify in a covering letter the detail of the SCADA system offered. Including installation and configuration of all devices and the SCADA Access port of the SMMI. Proof of successful testing in operation with the CoT SCADA system to the Capital Park Control Centre.	lot						1	
2.16	**SUBSTATION LABELING & SIGNS:**								
2.16.1	**Equipment Labels**: All equipment, bays, busbars, etc in the 400kV and 132kV yard, equipment/panels in the buildings must be labeled including the buildings. See label drawings in part C4.								
2.16.1.1	Type 1.1: Bay indentification	each						14	
2.16.1.2	Type 1.2: 132kV Equipment identification	each						210	
2.16.1.3	Type 1.3: Transformer identification, buildings, etc.	each						16	
2.16.1.4	Type 1.4: Phase R W B identification	each						164	
2.16.1.5	Type 1.2: 400kV Equipment identification	each						50	
2.16.2	**Safety Signs:** See drawings in Part C4.								
2.16.2.1	Type NC75: Outside building	each						8	
2.16.2.2	Type NC1: Inside doors	each						8	
2.16.2.3	Type NC58 & NC60: Fire Extinguisher	each						5	
2.16.2.4	Type NC76: Battery room	each						2	
2.16.2.5	Type MV5,9&10: Battery room	each						2	
2.16.2.6	Type WW23: Sub Yard Gate	each						4	
2.16.2.7	Type NC2: Sub Yard Gate	each						6	
2.16.2.8	Type NC7, 70 & PV4, 8: 132kV Yard Gates	each						6	
2.16.2.9	Type WW23: Sub outside fences	each						110	
2.16.2.10	Road octagonal stop signs	each						3	
	TOTAL OF SECTION 2 (Total carried forward to Price Summary)								R0,00

PART C2: PRICING DATA

PART C2.2: ACTIVITY, QUANTITY & PRICE SCHEDULES **TENDER NO: EEBU 13-2025.26**

BILL NO 3: CIVIL WORKS

Notes: 1. All quantities are provisional and subject to remeasurement during the project.
2. For pricing purposes all items are to be read in conjunction with the tender drawings. No additional compensation will be made for any information shown on the drawings but not mentioned in the Bills of Quantities - the drawings take precedence over the Bills of Quantities.
3. All 'Imported Material' for earthworks must be obtained from a commercial source, as selected by the contractor and shall be regarded as freehaul.
4. All surplus excavated material is to be disposed of at a registered, designated dumping site, as selected by the contractor.
5. All cut and fill materials will be regarded as freehaul, ie. haulage, loading and offloading of material shall be included in the rates submitted by the contractor - No additional compensation whatsoever will be entertained, or additional monies paid in this regard.

ITEM NO	DESCRIPTION	UNIT	QUANTITY (1)	PRICE PER UNIT (Excl. VAT) (2)	TOTAL PRICE (Excl. VAT) (1) x (2) (3)
3	**CIVIL WORKS**				
3.1	**EARTHWORKS NEW TERRACE**				
3.1.1	**Site Preparation:**				
3.1.1.1	Clear and strip site (including disposal to a suitable site)	hectares	22		
3.1.1.2	Remove and grub large trees and tree stumps of girth (inclding disposal to a suitable site)	sum	1		
3.1.1.3	Remove topsoil to a nominal depth of 150 mm, stockpile and maintain for later use.	m3	7 545		
3.1.1.4	Cut to terrace level	m3	10 970		
3.1.1.5	Over excavate 1,5m below terrace level	m3	35 525		
3.1.1.6	Fill to terrace level. Contractor must fill with G5 material to final terrace level, compacted in 150mm level layers to a minimum of 93% Mod. AASHTO.	m3	45 030		
3.1.1.7	Backfill over excavation to 150mm below terrace level	m3	33 470		
3.1.1.8	Import G5 material (If required). Contractor must make provision for importing G5 material from commercial sources to fill excavation to final terrace level.	m3	25 000		
3.1.1.9	Import 150mm gravel wearing course	m3	6 995		
3.1.1.10	Temporary construction fence: 1.8m Diamond mesh wire fence around the substation site	lot	1		
3.1.2	**Extra-over for:**				
3.1.2.1	Intermediate excavation	m3	2 000		
3.1.2.2	Hard rock excavation	m3	2 000		
3.1.2.3	Boulder excavation, Class A	m3	2 000		
3.1.2.4	Boulder excavation, Class B	m3	2 000		
3.1.2.5	Backfill stabilised with 5% cement	m3	100		
3.1.3	**Embankments:**	lot	1		
3.1.3.1	The embankments must be protected from erosion by paving or concrete (As per substation layout drawings)	lot	1		
3.1.4	**Stormwater Drainage System**				

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3.1.4.1	Stormwater drainage system: A Stormwater canal must be built along the substation yard to take the water to the municipal stormwater pipe that will be installed in the future by others outside the infeed station yard.	lot	1		
3.1.4.2	Subsoil drainage system (as per substaion layout drawing)	lot	1		
3.1.5	**Access Roads**				
3.1.5.1	Road (inside the substation): Access road as per station layout drawings. Plans must be submitted to the engineer for approval. The roads must include paving, kerbing, etc. The road must be compacted for a lowbed with transformer filled with oil.	lot	1		
3.1.5.2	Road (outside the station): Access road to substation. Plans must be submitted to the engineer for approval. The road must be asphalt, kerbing, etc. All roads must be compacted for a lowbed with transformer filled with oil. (As per drawing)	lot	1		
3.1.5.3	Kerbing: 400mm tall concrete edge beams for yard station area	m	100		
3.1.5.4	Paving: Concrete interlocking paving 75mm thick.	m2	500		
3.1.6	**400/132kV Yard & Common area around building**				
3.1.12.1	Fence: Install 2.4m in height with a thickness of 150mm closed pre-cast wall with a further 500mm flat razor wire with horizontal support strands around the Station perimeter as indicated on the drawings.	m	1 624		
3.1.12.2	Fence: Install 2.4m Clearview fence, sliding gates, removable panels and pedestrian gates around the Station perimeter as indicated on the drawings.	m	1 558		
3.1.12.3	Fence: Install 2.4m Clearview fence, sliding gates, removable panels and pedestrian gates around the 400kV and 132kV yard as indicated on the drawings.	m	733		
3.1.12.4	Galvanised steel sliding gates with two 3m sections as indicated on the drawings.	lot	1		
3.1.12.5	Cable Trenches for multi-core cables: Cable trenches must be constructed as indicated on the yard layout drawing.	m	500		
3.1.12.6	200mm diameter HDPE Cable sleeves, complete with couplings.	m	2 000	1	2000
3.1.12.7	Encasing of pipes in concrete, class 20MPA.	m3	1 000	1	1000
3.1.12.8	400/132kV Yard Stoning: The 400/132kV yard must be covered with 25mm crusher-stone approximately 100mm thick.	m3	1 000		
3.1.7	Civil & Structual Engineers design & report: Allow for professional engineer's design of all civil, building & mechanical structures. Hour rates	hour	300		
3.1.8	Geotechnical survey & report: Allow for geotechnical survey and report.	lot	1		
3.2	**SUBSTATION BUILDINGS**				
	Building: Construct the new infeed station building as per the building draiwngs. Full building plans according to national building regulations must be submitted to the engineer and City of Tshwane Buliding Control Department for approval. As-built drawings must be submitted at handover (electronic & hard copies).				
3.2.1	**Preliminary and General:** 60% Payment with at floor level stage. 30% Payment at roof level stage. 10% Payment at handover.	lot	1		
3.2.2	Foudations and building up to floor level	lot	1		
3.2.3	Floors not including the skreet.	lot	1		
3.2.4	Walls, gables, doors and windows up to roof level.	lot	1		
3.2.5	Roofs, bargeboars, gutters, downpipes complete.	lot	1		

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3.2.6	**Complete finishing:** Water, electricity, glazing, doors, painting, screed with epoxy or polyurethane (cloud grey - F48), fibre grid trench covers with solid top cover, fire exstinguishers, LED lighting etc.	lot	1		
3.2.7	**Guardhouse to be constructed as per the attached drawings.** With complete finishings including water, electricity, glazing, doors, fire exstinguishers, LED lighting, etc.	lot	1		
3.2.8	**Borehole:** Include for the drilling of a borehole up to a depth of 150m. The pump, motor, pipes, taps and motor housing must be included.	lot	2		
3.2.9	**Septic tank:** Include a new 5000L septic tank with a septic tank management plan.	lot	2		
3.2.10	**Water Tank and stand:** A water tank and stand must be supplied to a height of 6m. It must be designed for the storage of 5000L.	lot	2		
3.2.11	**Substation Furniture**				
3.2.11.1	**Cabinets:** Steel cabinet to file one set of O&M Manuals, A1 drawings, etc.	each	2		
3.2.11.2	**Table & chairs:** Fixed steel table with drawer for A1 plans and 4 chairs (approximately 1.2m high)**.**	sum	1		
3.2.11.3	**Drawing rails:** Provide for 6m long drawing rail mounted on the wall to be indicated by the Engineer. Include as built A0, one each, laminated single line	sum	1		
3.2.11.4	**Air conditioner:** Install in control/relay room (3200BTU/hr)	sum	4		
3.3	**HIGH VOLTAGE YARD EQUIPMENT FOUNDATIONS**				
3.3.1	**400/132kV CIRCUIT BREAKERS**				
3.3.1.1	**Concrete Plinth:** For 400kV Circuit Breaker: Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing steel and cast concrete plinth.	each	2		
3.3.1.2	**Concrete Plinth**: For 132kV Circuit Breaker: Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing steel and cast concrete plinth.	each	18		
3.3.2	**132KV DISCONNECTORS & EARTH SWITCHES:**				
3.3.2.1	**Concrete Plinth:** For 132kV Disconnectors 4000A with earthing switches. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	8		
3.3.2.2	**Concrete Plinth:** For 132kV Disconnectors 1600A. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	14		
3.3.2.3	**Concrete Plinth:** For 132kV Disconnectors 1600A (Disconnector with staggered arrangement) . Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	2		
3.3.2.4	**Concrete Plinth:** For 132kV Pantograph Disconnector 1600A. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	24		
3.3.3	**132KV SURGE ARRESTORS:**				
3.3.3.1	**Concrete Plinth:** For 400kV Free standing surge arresters. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	12		
3.3.3.2	**Concrete Plinth:** For 132kV Free standing surge arresters. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	48		
3.3.4	**Outdoor Voltage Transformers (VT):**				
3.3.4.1	**Concrete Plinth:** For 400kV Voltage Transformers. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	6		

ITEM NO	DESCRIPTION	UNIT	QUANTITY (1)	PRICE PER UNIT (Excl. VAT) (2)	TOTAL PRICE (Excl. VAT) (1) x (2) (3)
3.3.4.2	**Concrete Plinth:** For 132kV Voltage Transformers. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	34		
3.3.5	**Current Transformers (CT)**				
3.3.5.1	**Concrete Plinth:** For 400kV Current Transformers. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	6		
3.3.5.2	**Concrete Plinth:** For 132kV Current Transformers. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	54		
3.3.6	**Power Transformers**				
3.3.6.1	Transformer and Kiosk Plinth: Digging to the bottom of concrete slab/plinth, remove soil, compact, install reinforcing and cast concrete slab/plinth.	each	2		
3.3.6.2	NEC Plinth: Digging to the bottom of concrete slab/plinth, remove soil, compact, install reinforcing and cast concrete slab/plinth.	each	2		
3.3.6.3	Radiator Plinth: Digging to the bottom of concrete slab/plinth, remove soil, compact, install reinforcing and cast concrete slab/plinth.	each	2		
3.3.6.4	Transformer Oil Pit: Digging to the bottom of concrete slab, remove soil, compact, install reinforcing and cast concrete slab/plinth. Built oil pit walls, sump, drain, etc. As per drawing included.	each	1		
3.3.7	**132kV BUSBAR SUPPORT STRUCTURES**				
3.3.7.1	132kV Main & Reserve Busbar: Concrete Plinth For Busbar Support Structure. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	48		
3.3.7.2	132kV Bus Coupler Bay: Concrete Plinth For Busbar Support Structure. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	2		
3.3.7.3	132kV Bus Coupler Bay: Concrete Plinth For post insulator support structure. Digging to the bottom of concrete plinth, remove soil, compact, install reinforcing and cast concrete plinth.	each	14		
3.3.8	**LIGHTNING MAST**				
3.3.8.1	**Lightning Mast:** Concrete Plinth for 23m pole. Complete including 4 connections to the substation earth grid.	each	16		
3.3.9	**400kV Steel Lattice Gantries For Transformer Bays**				
3.3.9.1	Vertical Columns	each	12		
3.3.10	**132kV Steel Latties Gantries For Transformer and Overhead Power Line Bays**				
3.3.10.1	Vertical Columns	each	22		
	TOTAL OF SECTION 3 (Total carried forward to Price Summary)				0

PART C2: PRICING DATA

PART C2.2: ACTIVITY, QUANTITY & PRICE SCHEDULES

TENDER NO: EEBU 13-2025.26

BILL NO 4: MINOR WORKS

ITEM NO	DESCRIPTION	UNIT	ESTIMATED QUANTITY (1)	UNIT PRICE (EXCL. VAT) (2)	TOTAL PRICE (EXCL. VAT) (1)*(2)
4	**MINOR WORKS**				
4	**UNIT RATES (Additional and only applicable when required by the Engineer)**				
4.1	**LABOUR:**				
4.1.1	**Engineer:** Civl/Mechanical/Electrical.	hour	300		
4.2	**TRAINING:**				
4.2.1	**Expanded Public Works Programme (EPWP)**: Contractors must provide skills development and technical training for workers for an average of number of working days as indicated in brackets as per EPWP on the following programme:				
4.2.1.1	Paving (2 days)	worker	5		
4.2.1.2	Steel Structure Assembling and Erection (2 days)	worker	5		
4.2.1.3	Kerb laying (1 days)	worker	5		
4.2.1.4	Steel reinforcement (3 days)	worker	5		
4.2.1.5	Setting out of works (1 days)	worker	2		
4.2.2	**City of Tshwane Personel**				
4.2.2.1	**Operators** (Switching): One day training course for 8 people.	day	2		
4.2.2.2	**Maintenance:** One day training course for 8 people.	day	2		
4.2.2.3	**Protection:** One day training course for 8 people.	day	2		
4.2.2.4	**SCADA:** One day training course for 8 people.	day	2		
4.2.2.5	**Communication:** One day training course for 8 people.	day	2		
	TOTAL OF SECTION 4 (Total carried forward to Price Summary)				
5	**COMMUNITY LIASON OFFICER**				
5.1	Apointment of CLO: Provision must be made to appoint a CLO for the duration of the project	PI	1	R800 000,00	R800 000,00
	TOTAL FOR ITEM 5 (Total carried over to Price Summary Schedule)				R800 000,00
6	**ENGINEERING CHANGES: CHANGE CONTROL / VARIATION ORDER (VO's)**				
6.1	Contingency sum for unforceen and engineering changes: Allow for 10% of the total sum of Item 1 to 3	sum	1		
	TOTAL FOR ITEM 7 (Total carried over to Price Summary Schedule)				

PART C2: PRICING DATA

PART C2.2: ACTIVITY, QUANTITY & PRICE SCHEDULES **TENDER NO: EEBU 13-2025.26**

PRICE SCHEDULE SUMMARY

ITEM NO	DESCRIPTION	TOTAL PRICE
1	PRELIMINARY & GENERAL	
2	ELECTRICAL WORKS	
3	CIVIL WORKS	
4	MINOR WORKS	
5	COMMUNITY LIASON OFFICER	
6	ENGINEERING CHANGES	
TOTAL TENDER PRICE (Excluding VAT)		
VALUE ADDED TAX (15%)		
TOTAL TENDER PRICE (Including VAT)		

NAME OF PERSON AUTHORISED TO SIGN TENDER: SIGNATURE: CAPACITY OF SIGNATORY:

1 _____ _____ _____

WITNESSES:

1 _____ _____

2 _____ _____

PART C4

SITE INFORMATION / DRAWINGS

CONTENTS

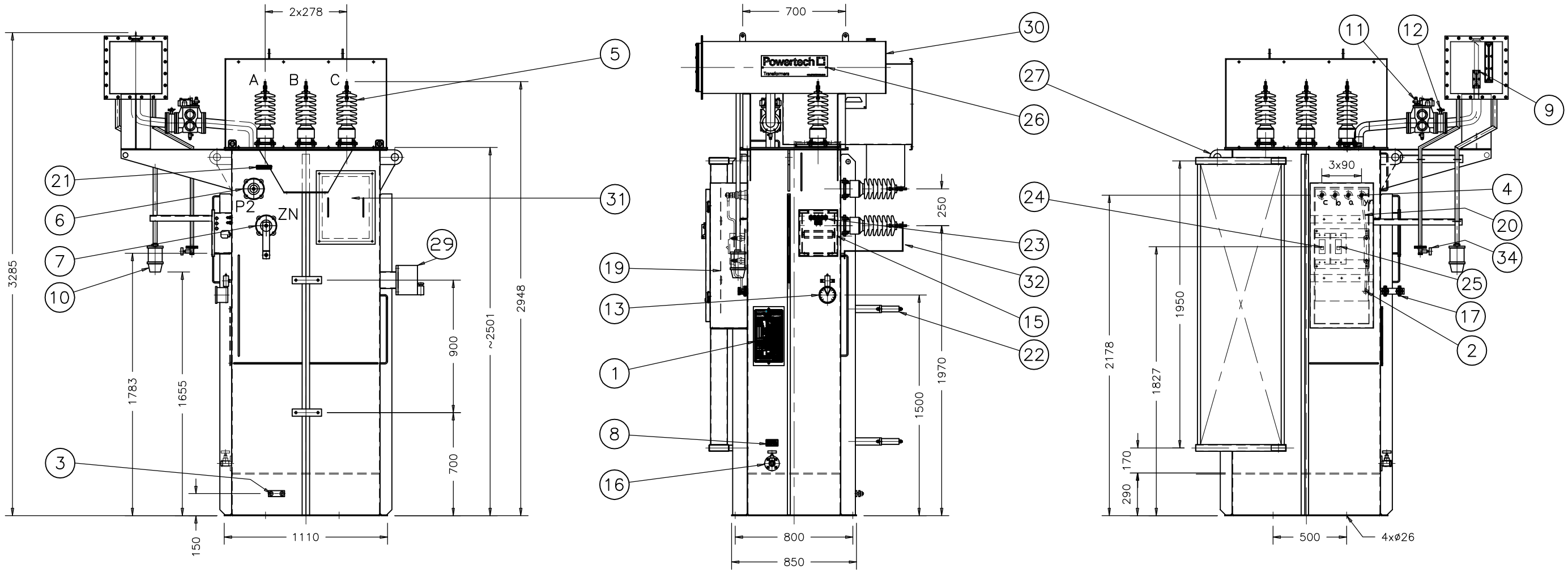
(Drawings submitted by tenderer must be included here)

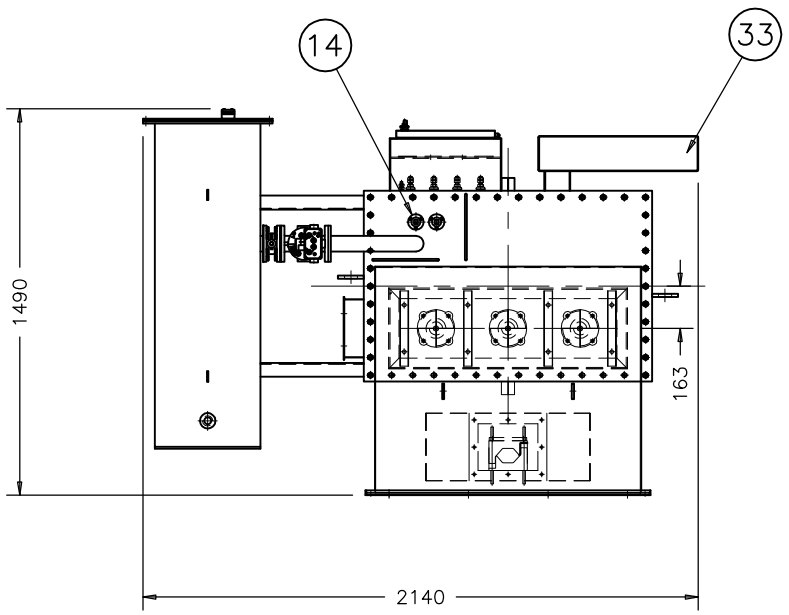
NOTE: Larger drawings are available on request.

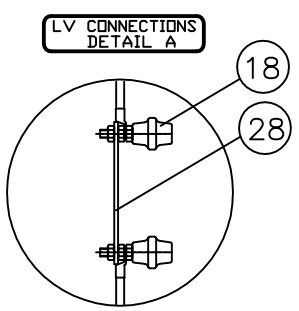
NUMBER	REV	DESCRIPTION
General		
WI01-01		Single Line Diagram
WI02-01		Layout
WI02-02		Sub soil drain layout
WI06-02		Stormwater outlets
WI09-01		Typical Cross section of road and V-drain with a cut embankment
WI09-02		Typical Cross section of road and V-drain with a fill embankment
WI09-03		Typical Cross section of loffelstein retaining wall.
WI09-04		Typical Cross section of link road.
WI09-05		Typical road cross section with stormwater side drain
WI03-01		Sub building floorplan
WI03-02		P&C building small power
WI03-03		Security building
WI08-01		Retaining wall
W15-01		Oilpit/dam
WI15-02		Trf_Coolers_MK plinth-315MVA
STD-YE-001		Lightning mast
Type 05D 002		Gate details for substations
STD-GS-001		Typical 132kV Gantry Steel lattice
WI2A-01		Typical 132kV Feeder bay
WI2A-02		Typical 132kV Transformer bay
WI2A-03		Typical 132kV Bus section bay
WI2A-04A		Typical 132kV Bus coupler bay

NUMBER	REV	DESCRIPTION
WI2A-04B		Typical 132kV Bus coupler bay
Transformer 400/132kV		
1ZXX294001-CLY		Transformer 400/132kV 315MVA
5410-35222		22kV/360A NEC/NER/AUX Transformer
5420-35228		22kV/360A NEC/NER/AUX Transformer
5320-10102		22kV/360A NEC/NER/AUX Transformer
Protection and Control		
WI11-01		Typical 132kV Feeder bay
WI11-02		Typical 132kV Bus Coupler bay
WI11-03		Typical 132kV Transformer bay
WI11-04		Typical 132kV Bus Section bay
WI11-05		Typical 132kV Power Factor Correction bay
WI11-06		Typical LVAC Board - 400V 500A
WI11-07		Battery stand 110V
WI11-08		Junction box-VT
WI11-09		Junction box-CT
Foundations		
STD-FD-001		132kV Equipment-Holding down bolt
STD-FD-002_SH1		132kV Equipment-Busbar Support detail
STD-FD-002_SH2		132kV Equipment-Busbar Support-Reinforcing detail
STD-FD-003_SH1		132kV Equipment-3P CB detail
STD-FD-003_SH2		132kV Equipment-3P CB-Reinforcing detail
STD-FD-004_SH1		132kV Equipment-3P Isolator detail
STD-FD-004_SH2		132kV Equipment-3P Isolator-Reinforcing detail
STD-FD-005_SH1		132kV Equipment-Column Base detail
STD-FD-005_SH2		132kV Equipment-Column Base-Reinforcing detail
STD-FD-006_SH1		132kV Equipment-CT detail
STD-FD-006_SH2		132kV Equipment-CT Reinforcing detail
STD-FD-007_SH1		132kV Equipment-VT detail

NUMBER	REV	DESCRIPTION
STD-FD-007_SH2		132kV Equipment-VT Reinforcing detail
STD_FD-008_SH1		132kV Equipment-SA detail
STD_FD-008_SH2		132kV Equipment-SA Reinforcing detail
STD-FD-009_SH1		132kV Equipment-PI detail
STD-FD-009_SH2		132kV Equipment-PI Reinforcing detail
STD-FD-010_SH1		132kV Equipment-Panto detail
STD-FD-010_SH2		132kV Equipment-Panto Reinforcing detail
STD-FD-011_SH1		132kV Equipment-Lighting mast detail
STD-FD-011_SH2		132kV Equipment-Lighting mast Reinforcing detail
STD-FD-012_SH1		132kV Equipment-Isol-2.5m detail
STD-FD-012_SH2		132kV Equipment-Isol-2.5m Reinforcing detail
STD-FD-013_SH1		132kV Equipment-Isol-3.0m detail
STD-FD-013_SH2		132kV Equipment-Isol-3.0m Reinforcing detail
Labels		
STD-LBS-001		Labels for sub-, in-feed- and substations
STD-LBS-002		Labels for towers and power lines
STD-LBS-003		Labels Substation Building
STD-LBS-004		Labels Substation Yard
C4.1-Type 01-3		Safety signs







FAULT CURRENT	360A
CONTINUOUS CURRENT	10A
SHORT TIME	10 Sec
AUX TRF RATING	100 kVA
MV VOLTAGE	22000 V
LV VOLTAGE	400 V
VECTOR GROUP	Dyn 11

MASSES

CORE & WINDINGS	1125 kg
TANK & FITTINGS	1199 kg
OIL	1161 kg
TOTAL	3485 kg
OIL IN LITRES	1305 L

FITTINGS

1. RATING & DIAGRAM PLATE
2. EARTHING BOSS
3. EARTHING PAD
4. LV BUSHING
5. HV BUSHING
6. P2 BUSHING
7. ZN BUSHING
8. DRAIN & OIL SAMPLE LABEL
9. OIL LEVEL INDICATOR
10. BREATHER
11. BUCHHOLZ RELAY
12. BUCHHOLZ ISOLATING VALVE
13. TOP OIL THERMOMETER
14. THERMOMETER POCKET
15. MARSHALLING BOX
16. DRAIN VALVE & PLUG
17. OIL & GAS RELEASE COCKS
18. POST BUSHING
19. BAKELITE BARRIERS
20. NEUTRAL CABLE
21. P2 LABEL
22. CABLE CLAMP
23. CT TERMINALS
24. MCCB BREAKER 100A
25. MCCB BREAKER 50A
26. POWERTECH LOGO
27. TRANSFOMER LIFTING LUG
28. NEUTRAL LINK
29. PRESSURE RELIEF VALVE
30. CONSERVATOR
31. INSPECTION COVER
32. LINK
33. RADIATOR
34. CONSERVATOR DRAIN VALVE & PLUG

Revision No.	Revision	Rev.by	Check	Week	Year
–					

Powertech Transformers

Powertech Transformers
P.O. BOX 38354
BOOYSENS
2016
TEL. 011-835 1011

Powertech Transformers
P.O. BOX 8627
PRETORIA-WEST
0001
TEL. 012-318 9911

Powertech Transformers
P.O. BOX 44
EPPINDUST
7475
TEL. 021-505 3000

FILE No.		STOCK CODE:		DESCRIPTION:	OULINE & GENERAL ARRANGEMENT
DRAWN BY: TOMMY		CHKD. BY: SIZWE		DESCRIPTION:	22kV/360A NEC/NER/AUX Transformer
BRANCH CPT	YEAR 11	WEEK 47		SHEET SIZE	A3
DRAWING No.				REV. IND.	SHEET No.
5410-35222				0	1
					CONTINUE –

180

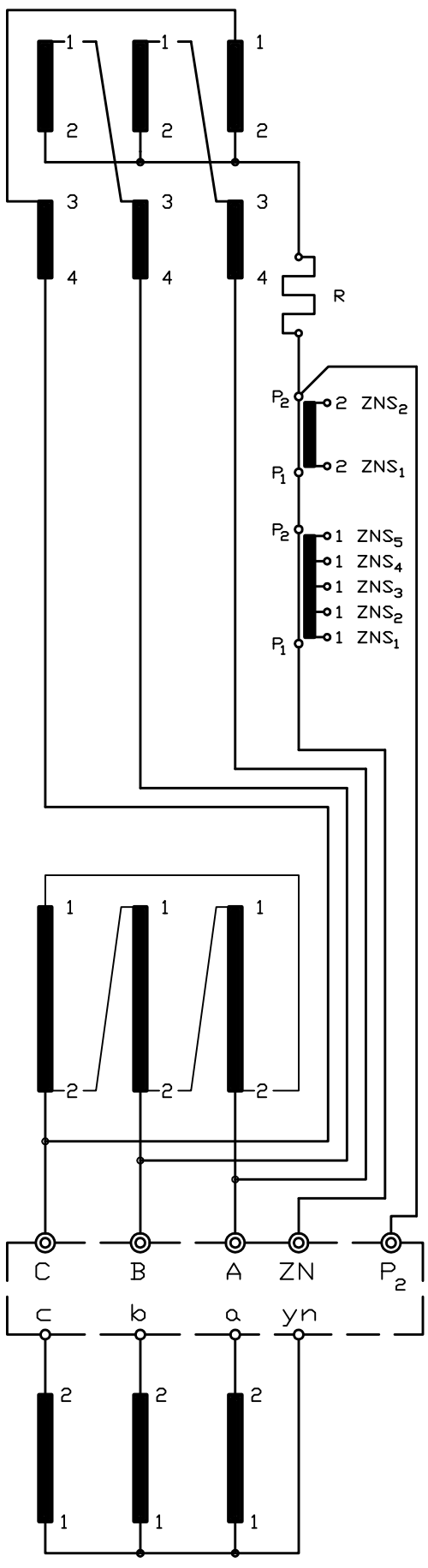
345

Powertech Transformers

COMBINED N.E.C./N.E.R./AUX. TRANSFORMER To 34-1690

FILL UNDER AN INTERNAL PRESSURE BETWEEN [0] & [6,7] kPa ABS ALTITUDE [1800] m

RATED VOLTS [22000] Ph [3] Hz [50] TYPE OF COOL. [ONAN]



N.E.C. TO IEC 60067-6 : 2007			
COMMON H.V. TERMINALS A - B - C			
	NEUTRAL	PHASE	TIME
RATED	360 A	120 A	10 Sec.
CURRENT	10 A	3,333 A	CONT.
ZERO SEQ. REACTANCE			Ω / Ph
INSULATION LEVEL		50 /	150 kV

PROTECTIVE C.T's TO IEC-60044-1					
C.T's REF.				1 ZN	
Sec. TERM.	AMPS RATIO	TURNS RATIO	Rsec Ω @75°C	CLASS PX	
				I mag	VOLTS
S_2-S_3	200/1	1/200			
S_1-S_2	400/1	1/400			
S_1-S_3	600/1	1/600			
S_4-S_5	800/1	1/800			
S_3-S_4	1000/1	1/1000			
S_2-S_4	1200/1	1/1200			
S_1-S_4	1600/1	1/1600			
S_3-S_5	1800/1	1/1800			
S_2-S_5	2000/1	1/2000			
S_1-S_5	2400/1	1/2400			

PROTECTIVE C.T's TO IEC-60044-1					
C.T's REF.				2 ZN	
Sec. TERM.	AMPS RATIO	TURNS RATIO	Rsec Ω @75°C	10-10P-10	
				I mag	VOLTS
S_1-S_2	100/1	1/100			

CURRENT - LIMITING RESISTOR		
RATED VOLTAGE	V	22000 /√3
RESISTANCE AT 100°C	Ω	
RATED CURRENT FOR 10 Sec.	A	360
CONTINUOUS CURRENT	A	10
INSULATION LEVEL	kV	50/150

AUXILIARY TRANSF. TO SANS 780 RATED k.V.A. [100]								
	H.V. - TERMINALS - L.V.							
	A-B-C				a-b-c			
	VOLTS		AMPS		VOLTS		AMPS	
	22000		2.62		400		144	
INS. LEVEL	50	/	150	kV	2,5	/	30	kV
VECTOR GROUP SYMBOL					Dyn 11			
IMPEDANCE VOLTAGE %								

UNTANKING kg [1125] OIL kg [1161] GROSS kg [3485] YEAR MAN. [ ]

CUSTOMER [POWERTECH 1st] ORD. N° [-]

SERIAL No. [T-3918/]

5420-35228 REV 0

ST. STEEL	T=1.2; 180 x 345			DIAGRAM PLATE			
QUAL.	TYPE	SIZE	m	m²	kg	DESCRIPTION	
		MATERIALS					

FILE No.	STOCK CODE:	DESCRIPTION: **RATING & DIAGRAM PLATE**				SHEET SIZE A3	
DRAWN BY: TOMMY	CHKD. BY:	DESCRIPTION: **22kV./360A NEC/NER/AUX Transfomer**				SHEET No. 1	
BRANCH CPT	YEAR 11	WEEK 48	DRAWING No. **5420-35228**		REV. IND. 0	CONTINUE —	

Powertech Transformers P.O. BOX 8627 BOOYSENS 2016 TEL. 011-835 1011	Powertech Transformers P.O. BOX 38354 PRETORIA-WEST 0001 TEL. 012-318 9911	Powertech Transformers P.O. BOX 44 EPPINDUST 7475 TEL. 021-505 3000	

Qty.	ITEM No.	DRWG. No.
1	1	

Powertech Transformers

Revision No.	Revision	App.	Week	Year

PANTONE 3135c

LOGO COLOUR

PANTONE 425c

LETTERING : BLACK
COLOUR
SIZE : AS DRAWN 1:1

METHOD : ETCH & ANODIZE
ALUMINIUM : ENGRAVE
ALTERNATIVE

PT-0003 (Rev. 0)

1ZXX 294001-CLY

Powertech Transformers

3 PHASE POWER TRANSFORMER 50 Hertz

Serial no:	W1163050	Core and windings		122 722 kg
Type:	T-STAR			
Year of manufacture:	2013	Oil	107 786 Litre /	96 468 kg
Standard:	TSP41-87 Rev0	Total mass		313 305 kg
Overload:	I.E.C. 60076-7	Maximum transport mass		
Type of cooling:	ONAN / ONAF	incl / excl. oil	255 006 /	184 173 kg

Suitable for use at 1800 metres above sea level and for filling under full vacuum

Terminals	Insulation Level(kV)	Tapping Switch Connects	Pos.	kV	Max Rated Current A
A11	1425	10 - 9 2 - 3	1	400.0	454.7
		10 - 9 2 - 4	2	395.0	460.4
		10 - 9 2 - 5	3	390.0	466.3
		10 - 9 2 - 6	4	385.0	472.4
		10 - 9 2 - 7	5	380.0	478.6
		10 - 9 2 - 8	6	375.0	485.0
B11		10 - 9 10 - 3 2 - 10	7	370.0	491.5
		10 - 3 2 - 4	8	365.0	498.3
		10 - 3 2 - 5	9	360.0	505.2
C11		10 - 3 2 - 6	10	355.0	512.3
		10 - 3 2 - 7	11	350.0	519.6
		10 - 3 2 - 8	12	345.0	527.1
		10 - 3 2 - 9	13	340.0	534.9
a2 b2 c2	550			132.0	1377.8
YN	110				
3A2 3B2 3C2	150			22.0	52.5

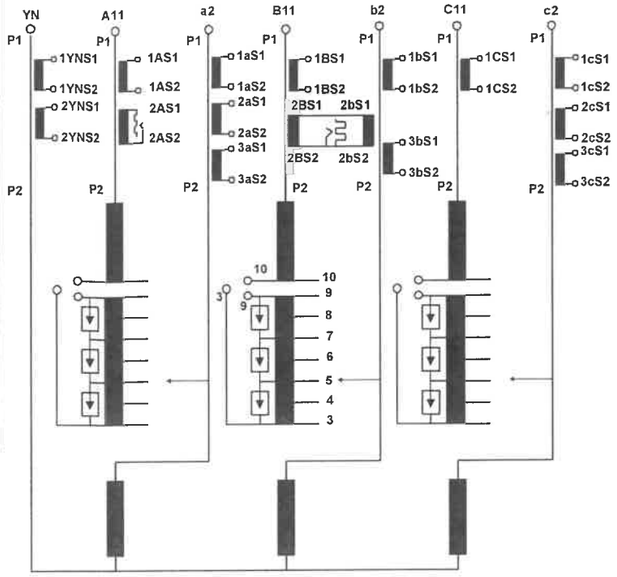
	Tap	Supply	O/C	S/C	Ohms/phase	Meas %
Zero seq. impedance in ohms / phase	1	HV	MV	LV	357.0	70.3
	13	HV	MV	LV	261.0	71.1
	1	HV		MV ; LV	63.0	12.4
	13	HV		MV ; LV	53.6	14.6
	1	MV		HV ; LV	6.3	11.4
	1	MV	HV	LV	35.3	63.7

Windings	HV	MV	LV
Terminals	A11	a 2	3A2
	B11	b 2	3B2
	C11	c 2	3C2
Fault Level kA	Inf.	Inf.	<20
NOMINAL RATING MVA			
ONAN	221	221	2
ONAF	315	315	2

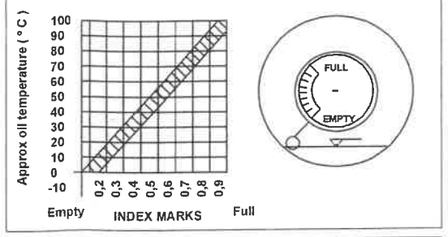
Tertiary winding is mechanically rated for 20MVA but will only be loaded to 2MVA in service.

Impedance %	Tap position 1	Tap position 13	Base MVA
HV / MV	13.5	15.9	315
HV / LV	99.2	101.3	315
MV / LV	83.6		315

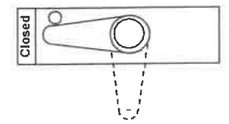
Vector symbol YNa0d1



OIL LEVEL INDICATOR



CHECK RADIATOR VALVES



VALVE OPEN

TRANSFORMER TO BE OIL FILLED UNDER VACUUM

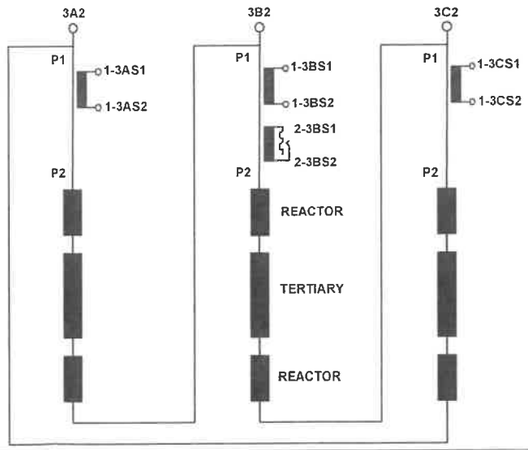
THIS TRANSFORMER (INCLUDING BUSHINGS AND TAPCHANGER) , IS CAPABLE OF CARRYING OVERLOADS IN ACCORDANCE WITH EMERGENCY DUTIES DETAILED IN I.E.C. PUBLICATION 60076-7

RUBBER BAG IN CONSERVATOR , REFER TO

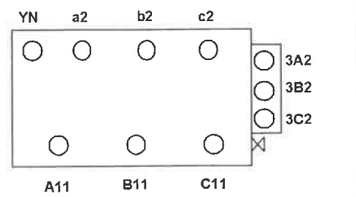
INSTRUCTIONS BEFORE VACUUM TREATMENT

Current Transformer to SANS IEC 60044-1

CT	Terminals	Applications	VA	Output V_k-I_m	Class	ALF	IP or Ratio A	Turns Ratio N/NT	Rs	kA/sec
1A	1AS1 - 1AS2	R.E.F. PROTECTION		400 / 0.015					3.96	
1B	1BS1 - 1BS2			400 / 0.014	X		1600	1 / 1600	4.03	BAR
1C	1CS1 - 1CS2			400 / 0.014					3.99	
1YN	1YNS1 - 1YNS2	E.F. COUNTER		150 / 0.007	X		1200	1 / 1200	2.02	BAR
2YN	2YNS1 - 2YNS2	R.E.F. PROTECTION		400 / 0.006	X		1600	1 / 1600	3.18	BAR
1a	1aS1 - 1aS2	R.E.F. PROTECTION		400 / 0.012					3.16	
1b	1bS1 - 1bS2			400 / 0.012	X		1600	1 / 1600	3.15	BAR
1c	1cS1 - 1cS2			400 / 0.012					3.16	
2a	2aS1 - 2aS2	Tapchanger Block	10		10P	10	1400 / 1		6.54	BAR
2c	2cS1 - 2cS2								6.50	
3a	3aS1 - 3aS2	O.C. PROTECTION	10		10P	10	1400 / 1		6.75	BAR
3b	3bS1 - 3bS2								6.68	
3c	3cS1 - 3cS2								6.62	
1-3A	1-3AS1 - 1-3AS2	O.C.E.F. PROTECTION	10		10P	10	1600 / 1		9.19	BAR
1-3B	1-3BS1 - 1-3BS2								9.02	
1-3C	1-3CS1 - 1-3CS2								8.45	
2A	2AS1 - 2AS2	W.T.I.	10		10P	1.5	600 / 2		0.93	BAR
2B	2BS1 - 2BS2	W.T.I.	10		10P	1.5	600 / 2		0.93	BAR
2b	2bS1 - 2bS2		15		10P	1.5	1400 / 3.5		0.71	
2-3B	2-3BS1 - 2-3BS2	W.T.I.	10		10P	1.5	100 / 2		0.17	BAR



BUSHING INFORMATION				
POSITION	TYPE	DRAWING No	INSULATION LEVEL (kV)	CURRENT (A)
HV	GOE 1550 - 1050 / 2500	1ZZA 275 002-S	1550	2500
MV	GOE 650 - 500 / 3150	1ZZA 275 002-H	650	3150
NVN	GOB 52 - 250 / 800	1ZZA 275 005-B	250	800
LV	CED 38 - 200 / 2500	1ZZA 276 001-LA	200	2500



Relative position of terminals and main drain valve

C T. INFORMATION 1ZXX 460038-CLY

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Cutting line

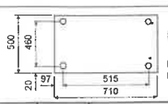
Asset No.

Contract / Order No. CB 43/2008

* Material to BS 1449 Part 2 : 1983

* No. 316 S12

Paint to be resistant to ultra - violet rays



D = 10 (4x FIXING HOLE)

DIMENSIONS FOR MANUFACTURE OF DIAGRAM PLATE

Qty	Item No	Item Weight	*	l = 1.5 ; 500 * 710	st.steel *	Diagram Plate
			Article No	Dimensions	Materials	Name of Item

Rev	Revision	Appd	Date
1	Impedance values added	G.Molabe	2013-07-10

Accepted Quality Control: N/A — Accepted for prod by: N/A

Designed / revised by: A. Gilbert — Drawn by: M.G. Mnkabe

Drawing checked by: A. Gilbert — Est. Design: 11 Dec

Powertech Transformers

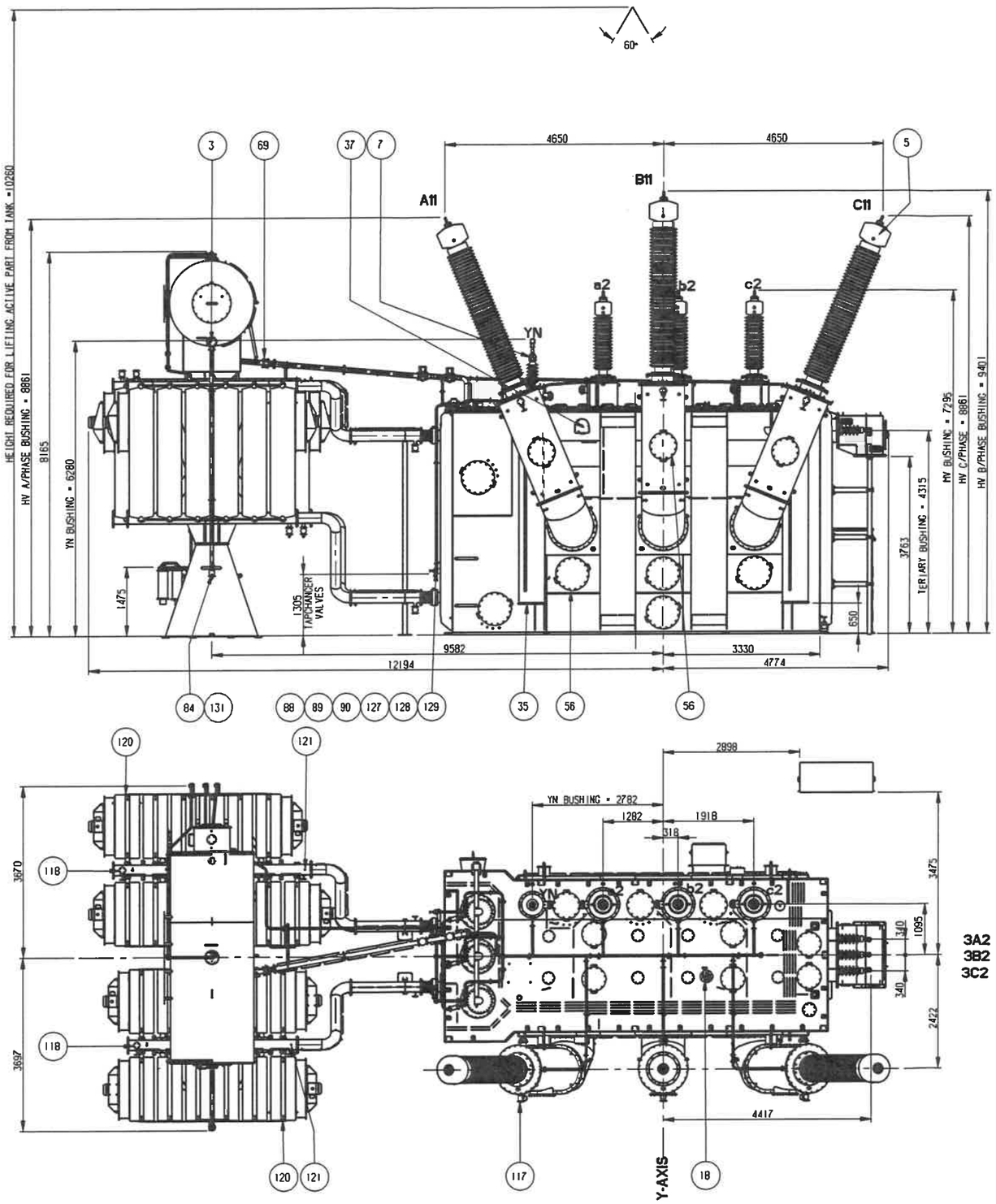
Diagram Plate

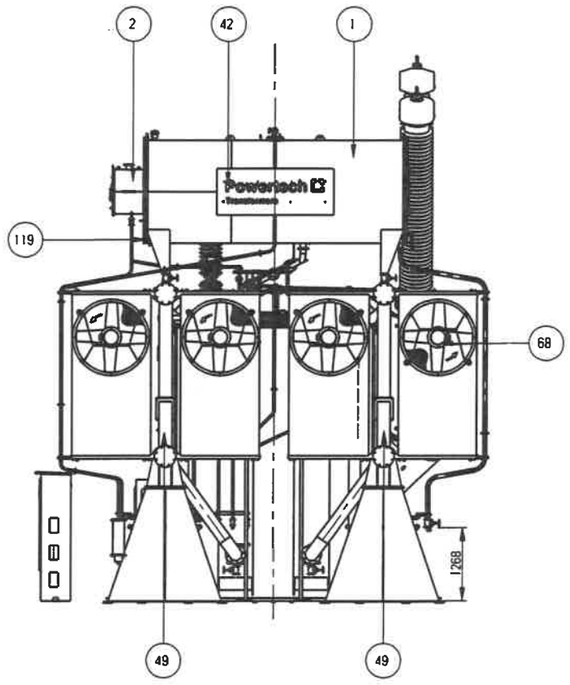
Purchase Drawing

1ZXX 294001-CLY

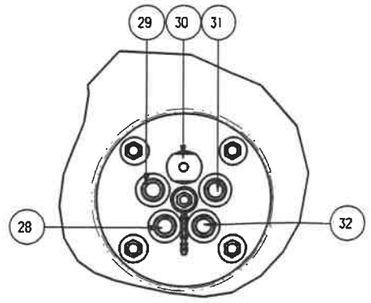
Rev 1 — Sheet 1 — Cont.

FORM T 125 (A1)





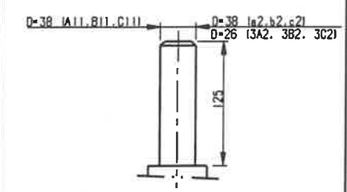
3A2
3B2 X-AXIS
3C2



SCALE 0.300

BUSHING TERMINALS

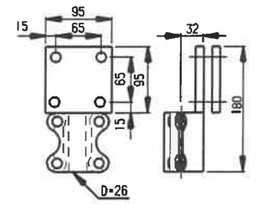
A11 B11 C11 a2 b2 c2 3A2 3B2 3C2



COPPER ALLOY : ELECTRO TINNED

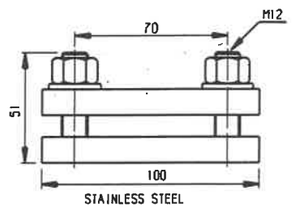
BUSHING TERMINALS

YN BUSHING TERMINAL



BRASS : ELECTRO TINNED

EARTHING TERMINALS



STAINLESS STEEL

REV	DESCRIPTION OF REVISION	DWN	CKD	APP	YEAR	WEEK
A3	TANK SIZE CHANGED AND MASS TABLE UPDATED	M.MAIA	M.MAIA	C.SILAULE	2012	16
A2	TANK SIZE CHANGED AND MASS TABLE UPDATED	M.MAIA	M.MAIA	C.SILAULE	2012	14
A1	FIRST ISSUE FOR APPROVAL	M.MAIA	M.MAIA	C.SILAULE	2012	10

		NAME	SIGN	YEAR	WK
APP	TTM	M. MAIA		2012	10
CHKD	TTM	M.MAIA		2012	10
PREP	TTM	C. KUMST		2012	10
FNCT	DEPT				

Powertech Transformers

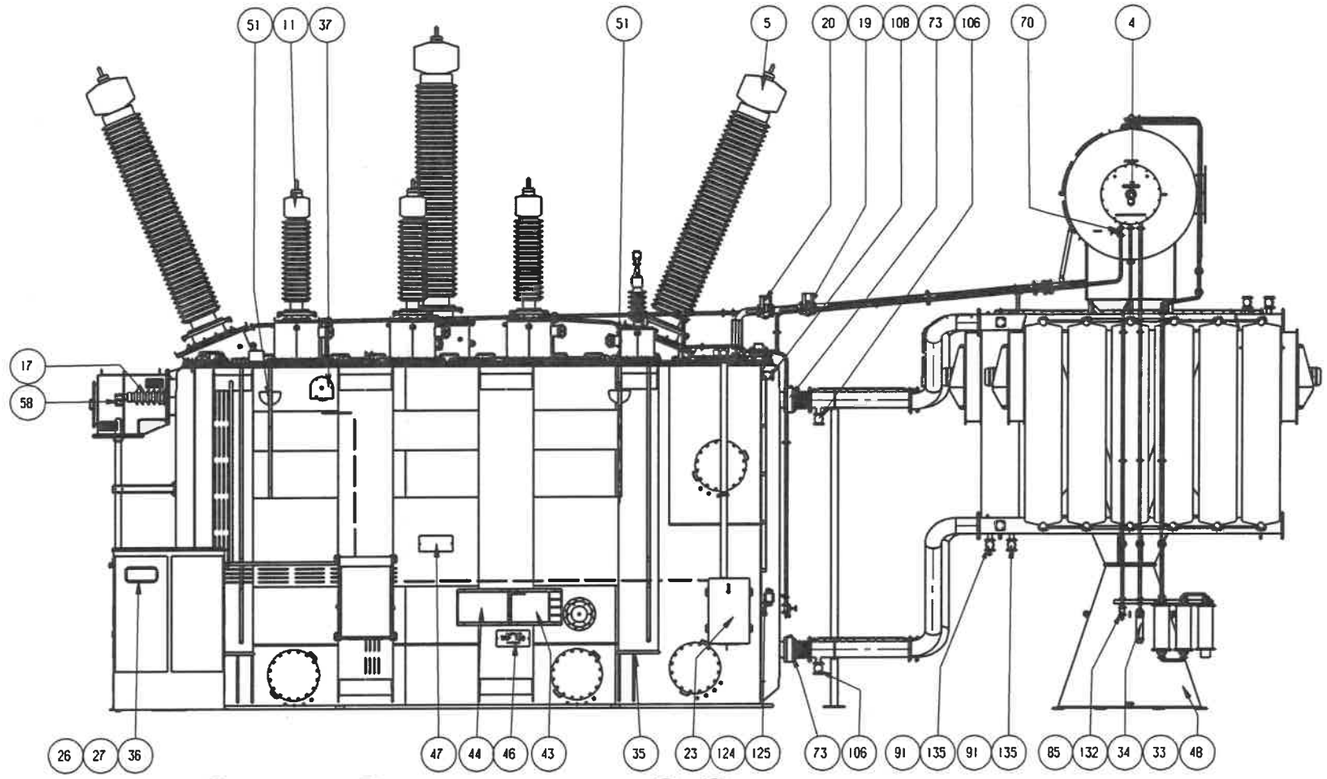
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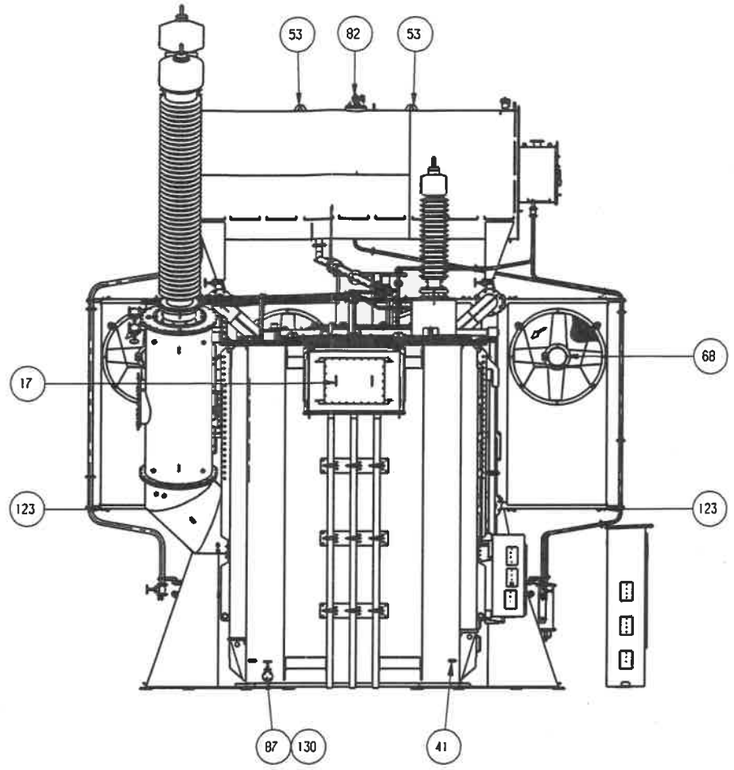
PTI DWG NO: 1ZXX460010-CLY

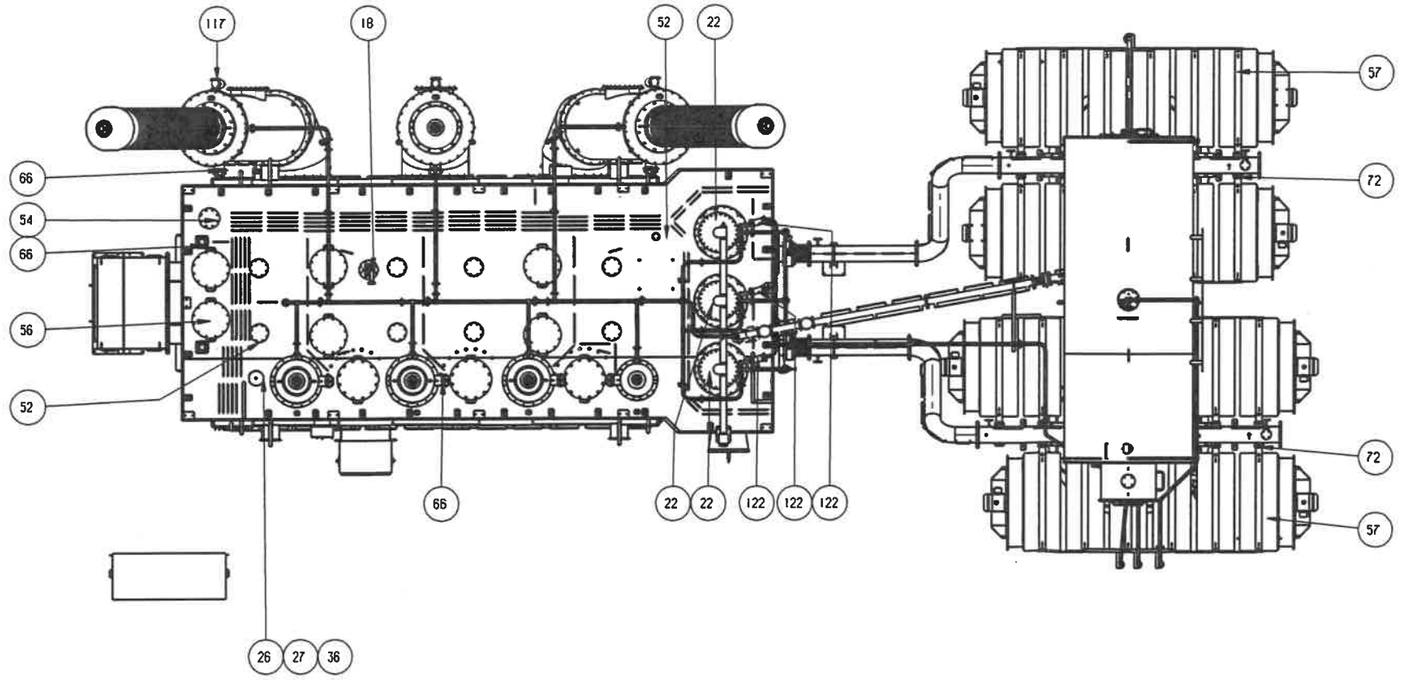
REV A3 | SH 2 | CNT 4

C.SILAULE

FORM T170 (A1)







REV	DESCRIPTION OF REVISION	DWN	CKD	APP	YEAR	WEEK
A3	TANK SIZE CHANGED AND MASS TABLE UPDATED	M.MAIA	M.MAIA	C.SILAULE	2012	16
A2	TANK SIZE CHANGED AND MASS TABLE UPDATED	M.MAIA	M.MAIA	C.SIALULE	2012	14
A1	FIRST ISSUE FOR APPROVAL	M.MAIA	M.MAIA	C.SILAULE	2012	10

APP	TTM	C.SILAULE		2012	10
CHKD	TTM	M.MAIA		2012	10
PREP	TTM	M.MAIA		2012	10
FNCT	DEPT	NAME	SIGN	YEAR	WK

Powertech Transformers

TITLE: OUTLINE DRAWING

PTI DWG NO: 1ZXX460010-CLY

REV A3 | SH 3 | CNT 4

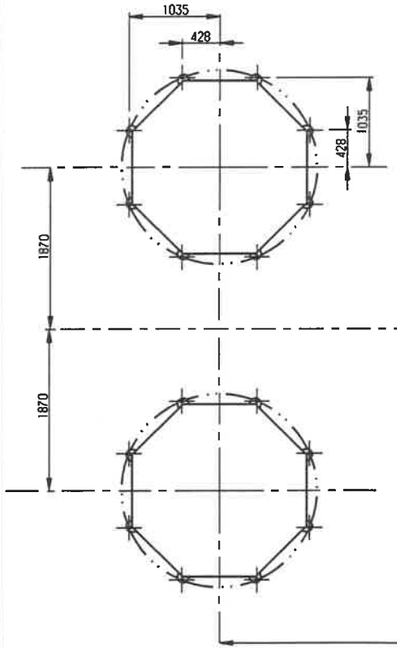
C.SILAULE

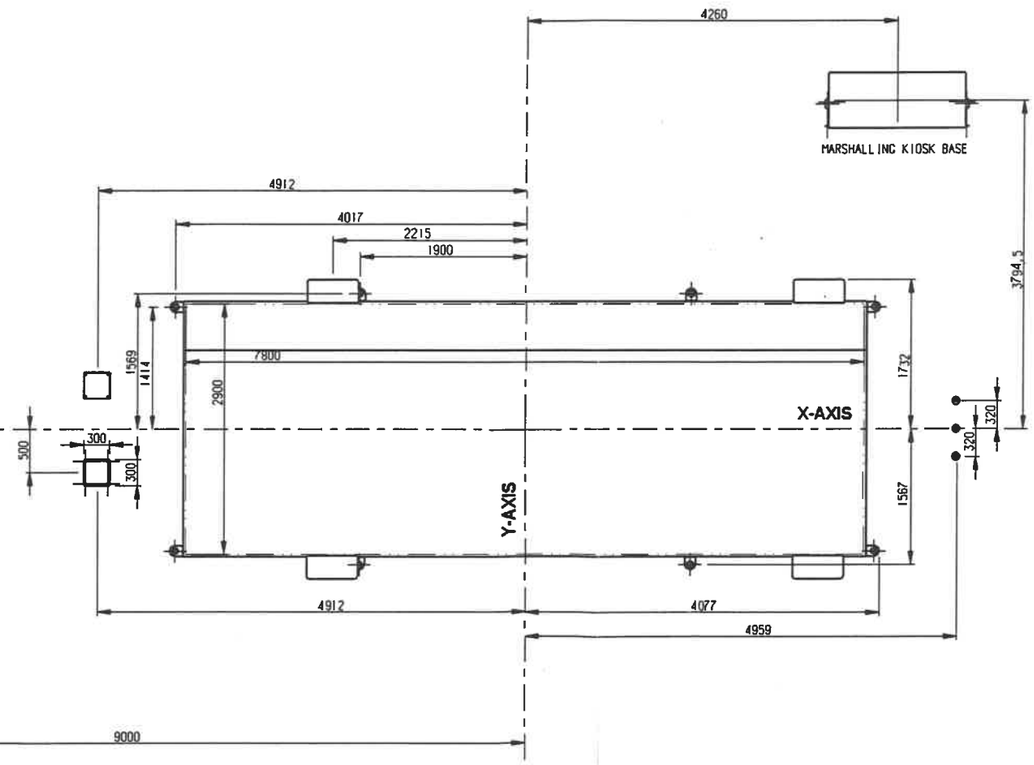
FORM T170 (A1)

ITEM	DESCRIPTION	
135	SAMPLE VALVE - COOLER BANK	1/4" BSP
132	SAMPLE VALVE - TAPCHANGER CONSERVATOR	1/4" BSP
131	SAMPLE VALVE - MAIN CONSERVATOR	1/4" BSP
130	SAMPLE VALVE - MAIN TANK	1/4" BSP
129	SAMPLE VALVE - C PHASE TAPCHANGER DIVERTER	1/4" BSP
128	SAMPLE VALVE - B PHASE TAPCHANGER DIVERTER	1/4" BSP
127	SAMPLE VALVE - A PHASE TAPCHANGER DIVERTER	1/4" BSP
125	TEST AND SAMPLE VALVE - MAIN 2	
124	TEST AND SAMPLE VALVE - MAIN 1	
123	DRAIN PLUG - RADIATOR	
122	AIR RELEASE PLUG - TAPCHANGER TANK	
121	AIR RELEASE PLUG - COOLER BANK / HEADER PIPE	
120	AIR RELEASE PLUG - RADIATOR	
119	AIR RELEASE VALVE - MAIN CONSERVATOR	
118	FILTER VALVE - COOLERBANK	50 NOM
117	FILTER VALVE - CHIMNEY	50 NOM
108	FILTER VALVE - MAIN TANK	50 NOM
106	DRAIN VALVE - COOLER PIPES	25 NOM
91	DRAIN / FILTER VALVE - COOLER BANK	50 NOM
90	DRAIN / FILTER VALVE - C PHASE TAPCHANCER DIVERTER	25 NOM
89	DRAIN / FILTER VALVE - B PHASE TAPCHANCER DIVERTER	25 NOM
88	DRAIN / FILTER VALVE - A PHASE TAPCHANCER DIVERTER	25 NOM
87	DRAIN / FILTER VALVE - MAIN TANK	50 NOM
85	DRAIN / FILTER VALVE - TAPCHANCER CONSERVATOR	25 NOM
84	DRAIN / FILTER VALVE - MAIN CONSERVATOR	50 NOM
82	ISOLATING VALVE - CONSERVATOR RUBBER BAG	
73	ISOLATING VALVE - COOLER BANK (TOP & BOTTOM)	200 NOM
72	ISOLATING VALVE - RADIATOR (TOP & BOTTOM)	
70	ISOLATING VALVE - TAPCHANCER CONSERVATOR	25 NOM
69	ISOLATING VALVE - MAIN CONSERVATOR	80 NOM
68	COOLING FAN	
66	CURRENT TRANSFORMER TERMINAL BOX	
58	MV NEUTRAL BUSHING TERMINAL	
57	DETACHABLE RADIATORS WITH DRAIN AND AIR RELEASE PLUGS	
56	INSPECTION COVERS	
54	MAIN TANK VACUUM FLANGE	
53	LIFTING LUG FOR LIFTING CONSERVATOR ONLY	
52	LIFTING LUG FOR LIFTING COVER ONLY	
51	LIFTING BEAM FOR LIFTING COMPLETE TRANSFORMER	
49	COOLER UNIT	
48	COOLERBANK STAND	
47	ID PLATE	
46	PROB PLATE	
44	VALVE LOCATION PLATE	
43	RATING AND DIAGRAM PLATE	
42	POWERTECH TRANSFORMERS NAME PLATE	
41	EARTHING TERMINALS	
37	MAIN TANK PRESSURE RELIEF DEVICE	
36	MARSHALLING KIOSK	
35	JACKING PAD	
34	TAPCHANGER CONSERVATOR DE - HYDRATING BREATHER	
33	MAIN CONSERVATOR DE - HYDRATING BREATHER	
32	POCKET FOR TERTIARY WINDING INDICATOR	
31	POCKET FOR HV / MV WINDING TEMPERATURE INDICATOR	
30	POCKET FOR CHECKING THERMOMETER	
29	POCKET FOR OIL THERMOMETER	
28	POCKET FOR WINDING THERMOMETER	
27	THERMOMETER FOR OIL TEMPERATURE	
26	THERMOMETER FOR WINDING TEMPERATURE	
23	DRIVE MECHANISM FOR TAPCHANGER	
22	ON LOAD TAPCHANGER	VRC 1701/170/D-14131W
20	GAS OPERATED RELAY - MAIN 2	
19	GAS OPERATED RELAY - MAIN 1	
18	CORE EARTHING BUSHING	
17	TERTIARY BUSHING IN CABLE BOX	GED 36/2500
11	MV BUSHING	GOE 650-500-3150-0.3
7	YN BUSHING	GOB 250/800
5	HV BUSHING	GOE 1550-1050-2500-0.3
4	OIL LEVEL INDICATOR TAPCHANGER CONSERVATOR	
3	OIL LEVEL INDICATOR MAIN CONSERVATOR	
2	TAPCHANGER CONSERVATOR WITH REMOVABLE END AND OIL FILLING HOLE	
1	MAIN CONSERVATOR WITH REMOVABLE END	

MASS TABLE

COMPONENT	kg	Litre
ACTIVE PART	122 722	
TANK . COVER . FITTINGS	70 173	
COOLER BANK 12x1	3 901	
RADIATOERS 125x1	18 825	
FANS 18x1	1 216	
TRANSFORMER COMPLETE EXCLUDING OIL	216 837	
OIL IN TRANSFORMER	84 020	93 878
OIL IN CONSERVATOR 150%1	5 382	6 013
OIL IN COOLER BANK AND PIPES	935	1 045
OIL IN RADIATORS 125x1	6 131	6 850
TOATL OIL	96 468	107 786
TRANSFORMER COMPLTET WITH OIL	313 305	
TRANSPORT MASS WITHOUT OIL	184 173	
TRANSPORT MASS WITH OIL	255 006	





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PREP	TTM	C. KUMST		2012	10	
FNCT	DEPT	NAME	SIGN	YEAR	WK	↓ PTT DWG NO ↓
Powertech Transformers						1ZXX460010-CLY

REV A3 | SH 4 | CNT 4

FORM T110 (A1)

SUBSTATION BUILDING

OUTSIDE THE BUILDING

NC 75 600x600



EACH DOOR

INSIDE/BACK

NC1



FIRE EXTINQUESER

NC 58
500x700mm

TOP 1.3METER FROM GROUND



N60
250x350mm



BOTOM 2.1METER FROM GROUND

BATTERY ROOM

INSIDE DOOR

NC 76



MV 5



MV 9



MV 10



CITY OF TSHWANE
IGNITING EXCELLENCE

PRIMARY 132/11KV SUBSTATIONS

SAFETY SIGNS

Revision: 1 | **Drawing No: TYPE 01-3**

SUBSTATION YARD

OUTSIDE THE SUBSTATION YARD GATE

WW 23



SUBSTATION NAME

WW 23



NC 2 (500X300)



OUTSIDE ON THE YARD GATES AND FENCES

OUTSIDE EACH 132KV YARD GATE

NC 70



MV 7





PV 8



PV 4

OUTSIDE ON THE SUBSTATION FENCE

WW 23



20 METERS APPART

CITY OF TSHWANE
IGNITING EXCELLENCE

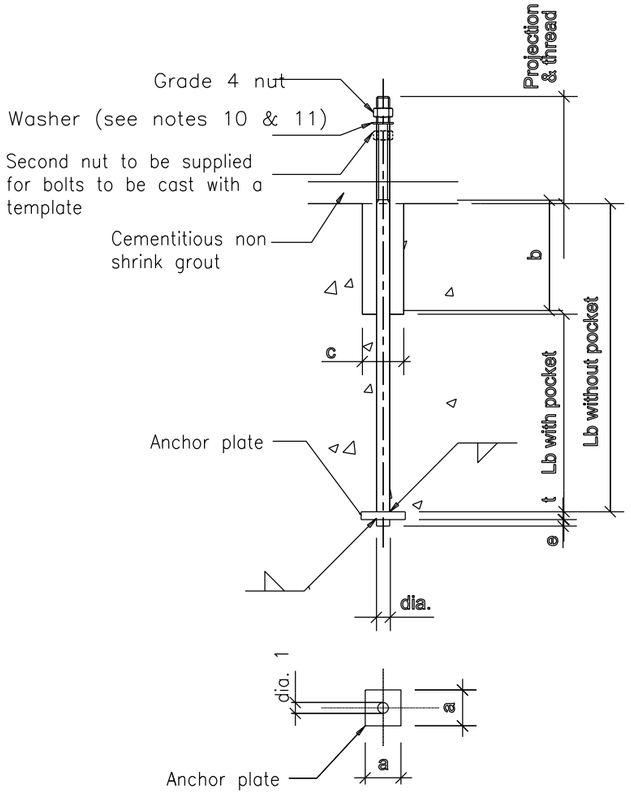
PRIMARY 132/11KV SUBSTATIONS

SAFETY SIGNS

Revision: 1 | **Drawing No: TYPE 01-4**

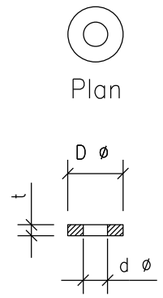

Njala 275/132kV
25°50'53.16"S
28°17'25.45"E
Elephant and Friends - Moreleta Park, Pretoria
THE MEADOWS
MEADOW RIDGE
MEADOW HEIGHTS
Hesketh Dr
Cork Tree St
Hulsboom St
Lucky Bean Cres
Delmas Rd
M31
R50
Njala
Google Earth
Image © 2025 Airbus
N
600 m


Wildebees 400/132kV
25°45'16.69"S
28°25'1.07"E
SKIRLEK SUPER SHOP & C
Wildebees 400/132kV
Kutumela-Molefi Intm. Farm School
Sunbird Aloes Wholesale Nursery, by...
Bronkhorstspruit Rd
Kuhle Lodge and Wedding Resort
R223
Google Earth
Image © 2025 Airbus
N
600 m



PLAN ON ANCHOR PLATE

HOLD DOWN BOLT DETAIL



Section
Oversize Washer
Detail 1
Scale 1:5

Bolt				Anchor plate					Pocket	
Shank Dia.	Nut size	Bond length	Pro-trusion	Size	Thick-ness	Hole dia.	Weld size		Depth	Dia.
dia.	-	Lb	e	a	t	dia. 1	Under-side	Top side	b	c
16	M16	280	10	60	10	18	6	6	120	75
20	M20	320	10	70	12	23	6	6	150	75
24	M24	400	12	85	14	28	6	6	200	75
30	M30	480	12	110	16	36	6	6	250	100
36	M36	640	16	140	20	46	6	6	300	100

Oversize washer			
Bolt size	D	d	t
16	50	18	8
20	50	22	10
24	60	27	12
30	80	33	12
36	90	40	16

1. For position of bolts see general layout drawings
2. All dimensions in millimeters.
3. See concrete layout drawings for size, projection and position of anchor bolts.
4. Unless otherwise noted, all anchor bolt components including nuts, washers and templates to be supplied by the civil contractor.
5. The notes on each equipment foundation drawing will state if bolt templates are to be supplied by the equipment vendor. Unless otherwise noted all anchor bolt templates to be supplied by the civil contractor.
6. Tolerance on bolts to be as per SANS 2001-CC1, degree of accuracy II.
7. The civil contractor is to survey to an accuracy of ± 1mm. As-built positions of anchor bolts in plan and elevation and error diagrams are to be submitted to the engineer within 48 hours of casting.
8. Anchor bolts to be manufactured in accordance with SANS 135. diameter of anchor bolt shank to be same as thread diameter. Tolerance of anchor bolt shank diameters to be as follows :
   < M36 : As per SANS 1700
   > M36 : ± 1mm
9. All anchor bolt components except washers to be manufactured from grade 300 WA steel, complying with the requirements of SANS 1700.
10. Washers to be round flat normal diameter (Grade 2) in accordance with the requirements of SANS 1149.
11. For column base plates and equipment bases where large holes are used for bolt tolerance, washers are to be oversized as per Detail 1.
12. Prior to the manufacture of anchor bolts, the civil contractor is to submit supplier's certificates showing that the proposed materials comply with the material specifications.
13. All bolts are to be cleaned and degreased prior to casting.
14. After the as-built positions of anchor bolts have been shown to be within the specified tolerances, each anchor bolt is to be greased and wrapped securely.
15. Where bolts are at less than 'c' + 50mm centres, pockets are to be continuous.

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
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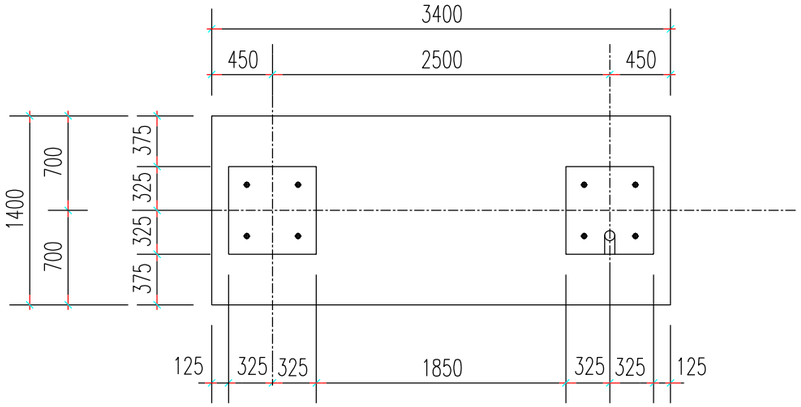
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

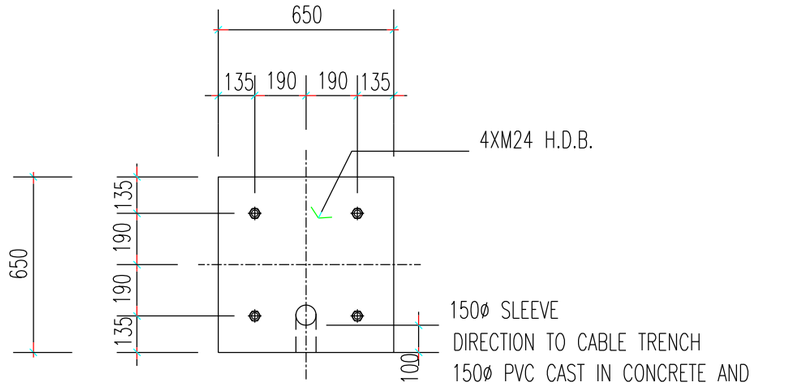
132kV Equipment
Holding down bolt

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-001

Design: J.M. Bosman
Drawn: J.A. Gous
Checked: J. Rustoff
Drawn Date: 2023-03-15
Sheet: 1 of 1



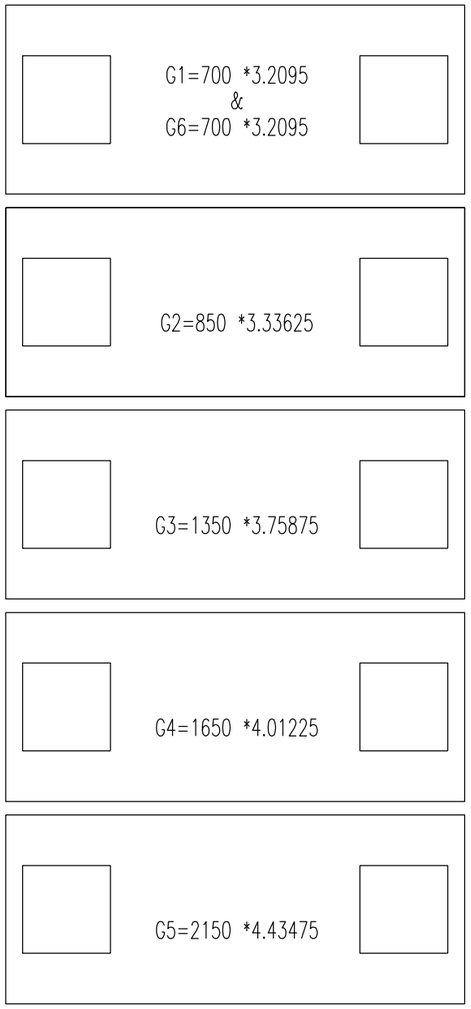
PLAN ON BASE
3400X1400X500 DP
1:50

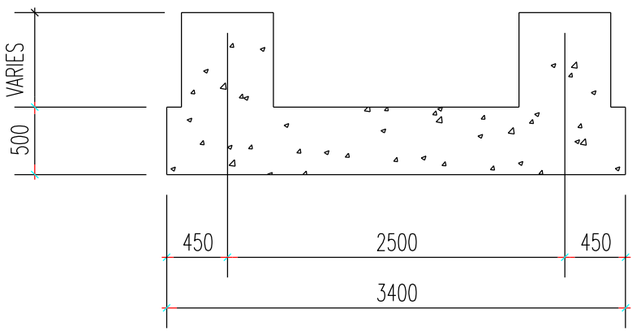


PLAN ON PLINTH
650X650
1:25

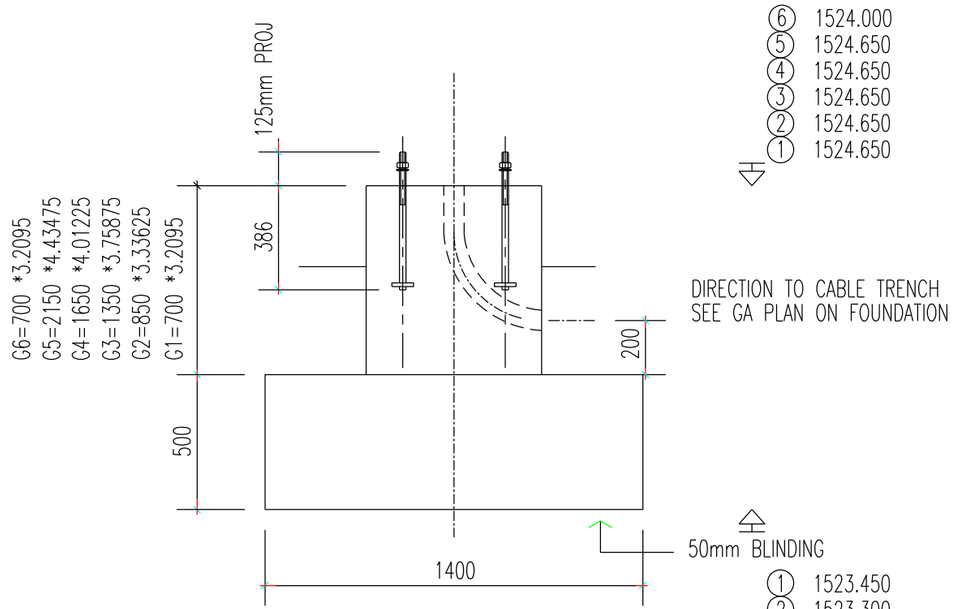
NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= * cubic m.





ELEVATION
1:50



6	1524.000
5	1524.650
4	1524.650
3	1524.650
2	1524.650
1	1524.650

1	1523.450
2	1523.300
3	1522.800
4	1522.500
5	1522.000
6	1522.800

SECTION
1:25

BUSBAR SUPPORT BASE PLINTH REF (G)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

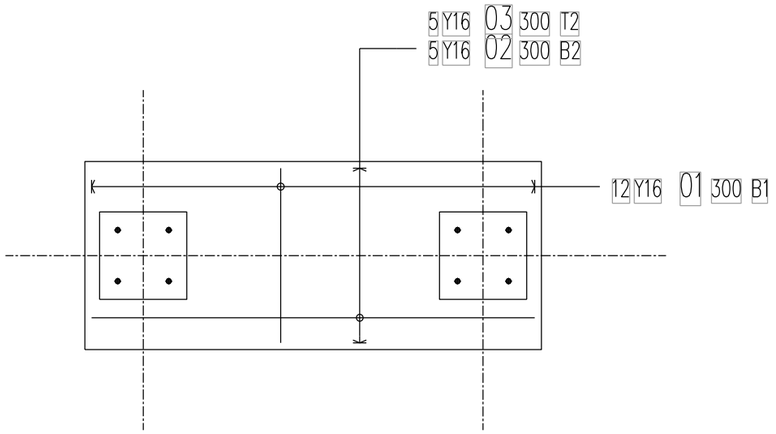
APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
Busbar Support detail

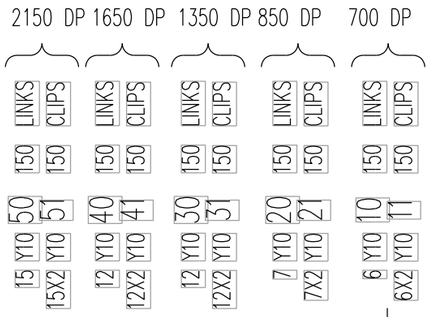
CONTRACTOR DRAWING NO:

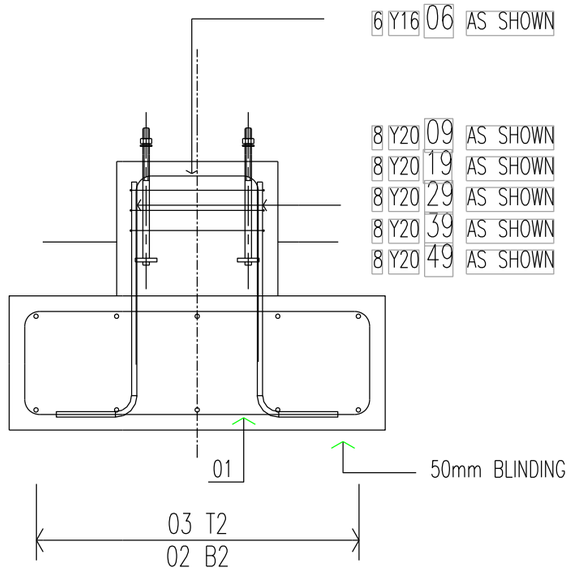
CoT DRAWING NO:
STD-FD-002

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2

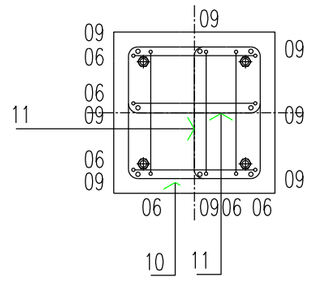


PLAN ON BASE
3400X1400X500 DP
60 No OFF
1:50





SECTION
1:25



PLAN ON PLINTH
1:25

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH G 2150 DP 850 DP 700 TO 1650 DP	01	Y16	60	12	720	3525	60	400	1300				4006
	02	Y16	60	5	300	4875	55	500	360	3300	360		2308
	03	Y16	60	5	300	3550	35	3300					1681
	06	Y16	120	6	720	1850	38	700	520				2102
	09	Y20	82	8	656	1325	37	1075					2144
	10	Y10	82	6	492	2325	60	550	550				705
	11	Y10	82	12	984	750	35	550					455
	19	Y20	8	8	64	1475	37	1225					233
	20	Y10	8	7	56	2325	60	550	550				80
	21	Y10	8	14	112	750	35	550					52
	29	Y20	16	8	128	1975	37	1725					623
	30	Y10	16	12	192	2325	60	550	550				275
	31	Y10	16	24	384	750	35	550					178
	39	Y20	8	8	64	2275	37	2025					359
	40	Y10	8	12	96	2325	60	550	550				138
	41	Y10	8	24	192	750	35	550					89
	49	Y20	12	8	96	2775	37	2525					657
	50	Y10	12	15	180	2325	60	550	550				258
	51	Y10	12	30	360	750	35	550					166

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					2396		10097	4016			

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face EF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PPS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

BUSBAR SUPPORT BASE
PLINTH REF (G)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

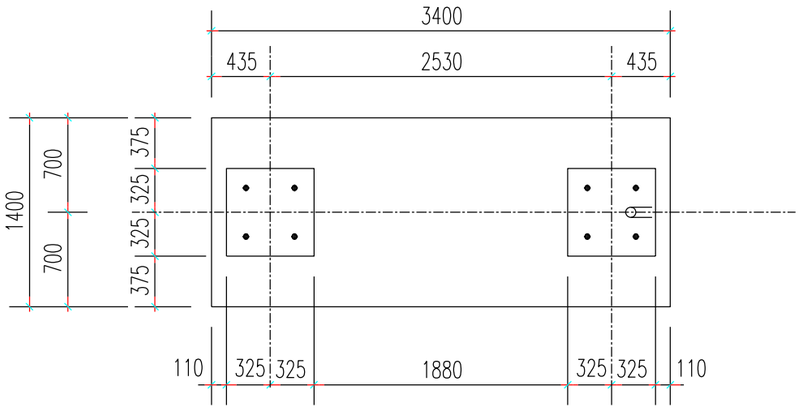
SCALE: N.T.S.

132kV Equipment
Busbar Support
Reinforcement detail

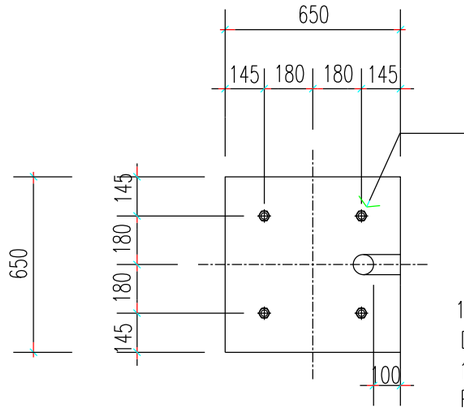
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-002

Design:	J. Bosman
Drawn:	J. Gous
Checked:	J. Rustoff
Drawn Date:	2024-10-15
Sheet:	2 of 2



PLAN ON BASE
3400X1400X500 DP
1:50



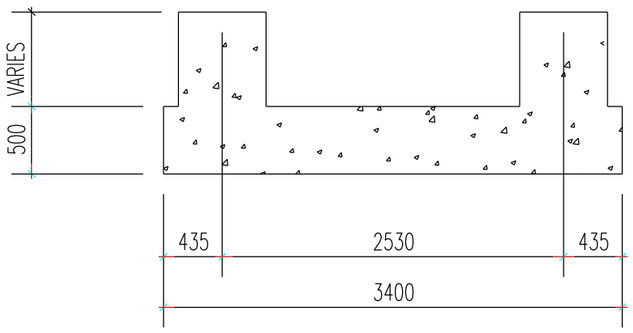
150ø SLEEVE
DIRECTION TO CABLE TRENCH
150ø PVC CAST IN CONCRETE AND
PROTRUDING THROUGH BASE PLATE
SEE ELECTRICAL DWG FOR ORIENTATION
DIRECTION AND POTION TO BE CONFIRMED
ON SITE

PLAN ON PLINTH
650X650
1:25

NOTES :-

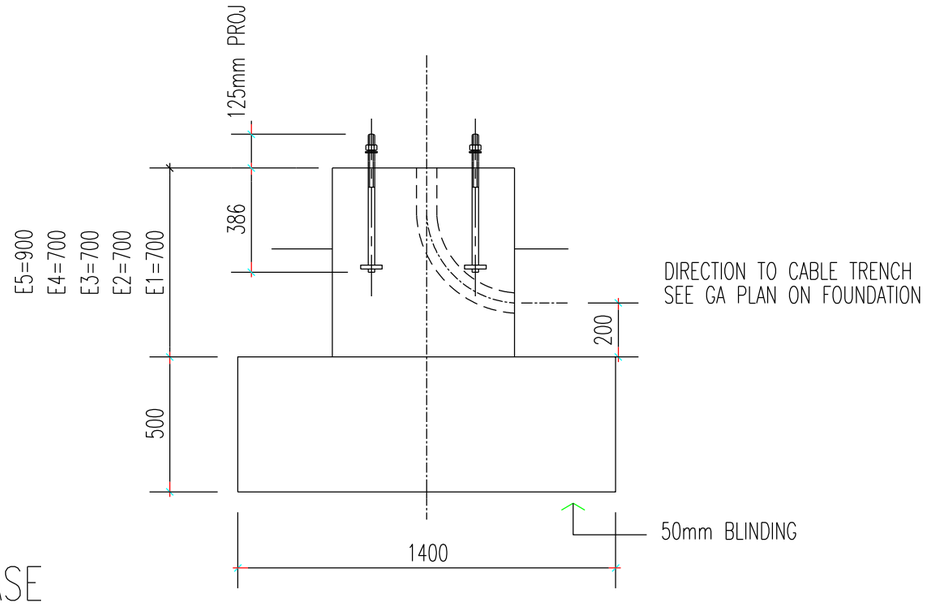
1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= 3.2095 & 3.3785 cubic m.





ELEVATION
1:50

CIRCUIT BREAKER BASE
PLINTH REF (E)

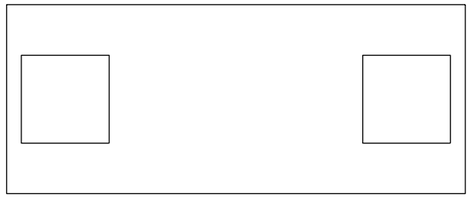


DIRECTION TO CABLE TRENCH
SEE GA PLAN ON FOUNDATION

50mm BLINDING

SECTION
1:25

(5) 1523.700
(4) 1524.550
(3) 1523.700
(2) 1524.000
(1) 1524.800



(1) 1523.600
(2) 1522.800
(3) 1522.500
(4) 1523.350
(5) 1522.300

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

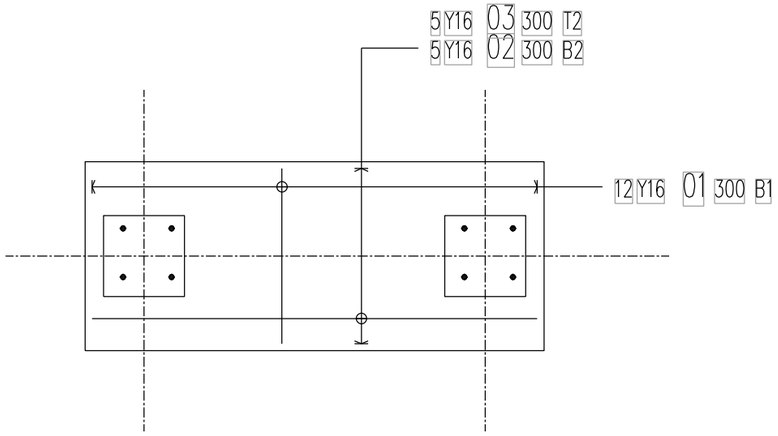
SCALE: N.T.S.

CONTRACTOR DRAWING NO:

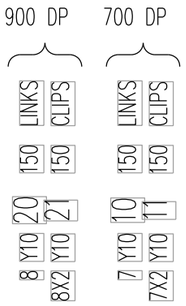
CoT DRAWING NO:
STD-FD-003

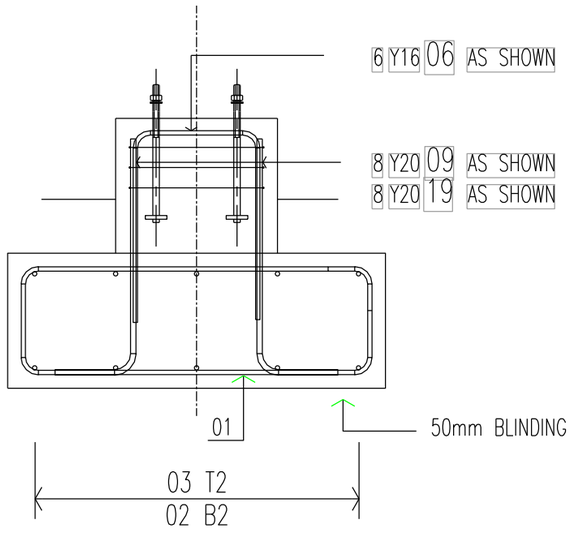
132kV Equipment
3P Circuit Breaker detail

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2

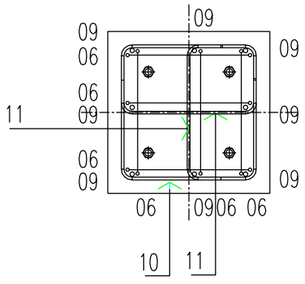


PLAN ON BASE
3400X1400X500 DP
15No OFF
1:50





SECTION
1:25



PLAN ON PLINTH
1:25

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH E	01	Y16	15	12	180	3525	60	400	1300				1001
	02	Y16	15	5	75	4875	55	500	360	3300	360		577
	03	Y16	15	5	75	3550	35	3300					420
	06	Y16	30	6	180	1850	38	700	520				526
700 DP	09	Y20	26	8	208	1325	37	1075					680
	10	Y10	26	7	182	2325	60	550	550				261
	11	Y10	26	14	364	750	35	550					168
900 DP	19	Y20	4	8	32	1525	37	1275					120
	20	Y10	4	8	32	2325	60	550	550				46
	21	Y10	4	16	64	750	35	550					30

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					505		2524	800			

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drowing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

CIRCUIT BREAKER BASE
PLINTH REF (E)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

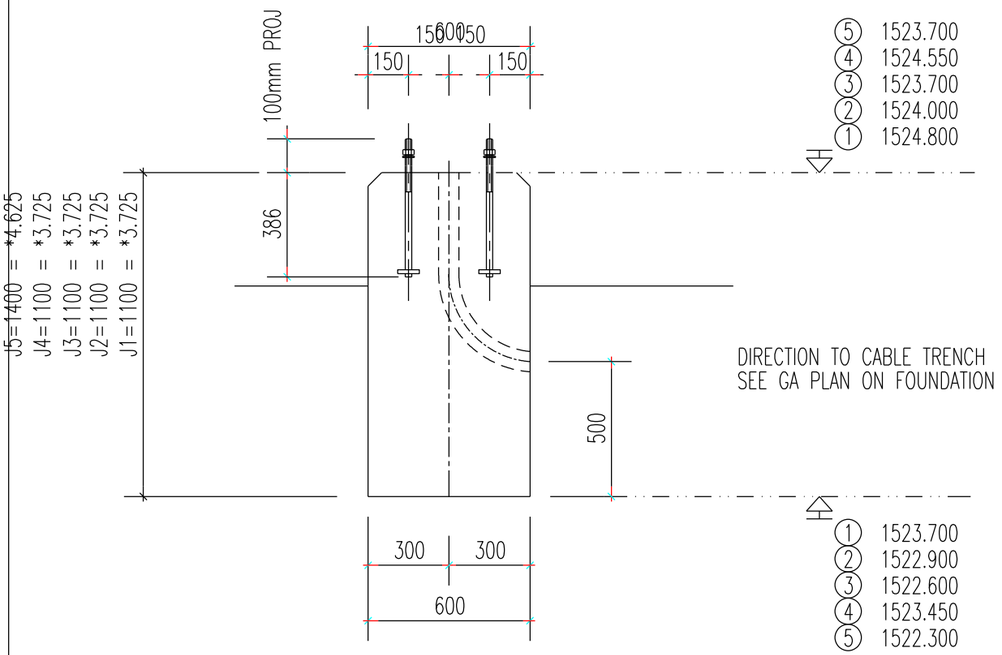
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

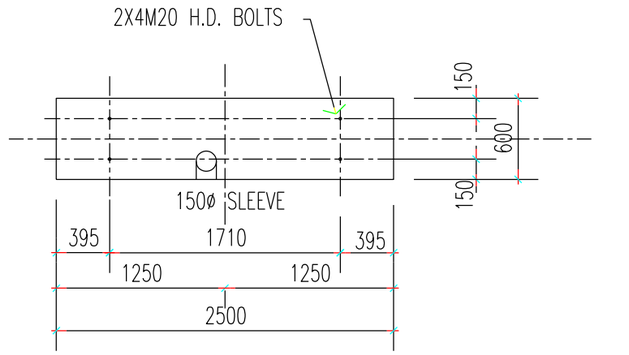
132kV Equipment
3P Circuit Breaker
Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-003

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



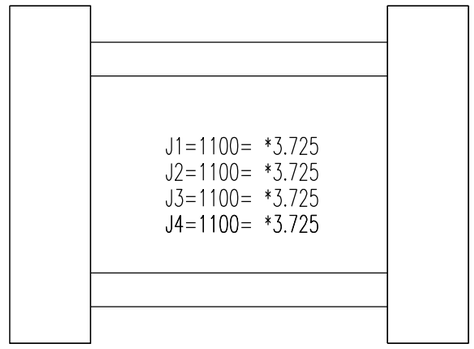
SECTION
1:25

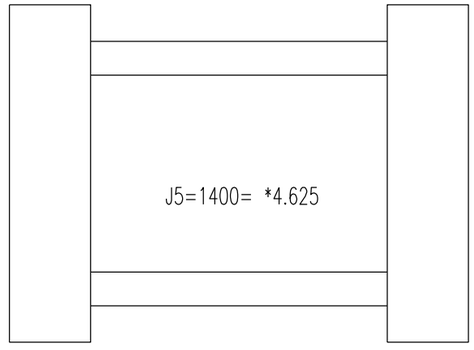


PLAN ON PLINTH
2500X600
2No OFF
1:50

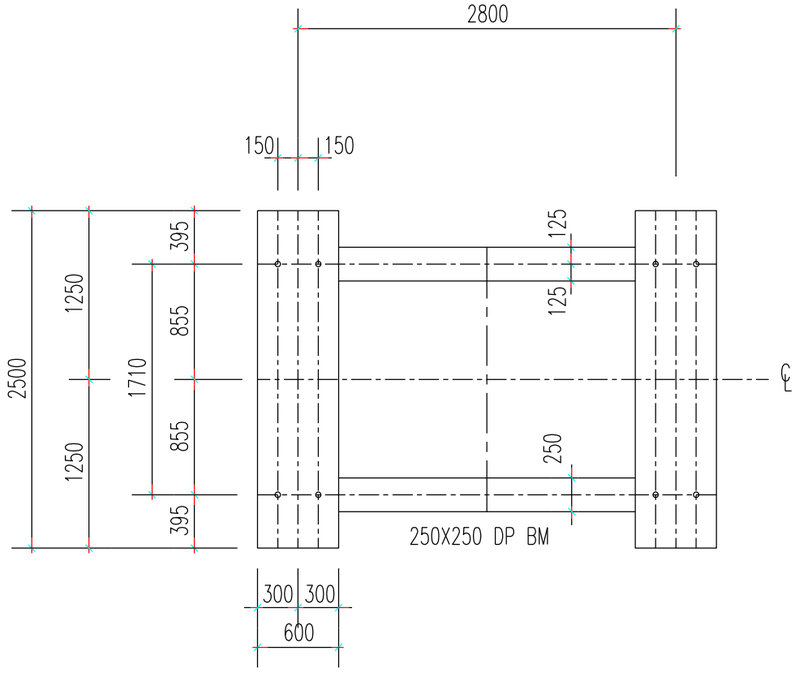
NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= * cubic m.

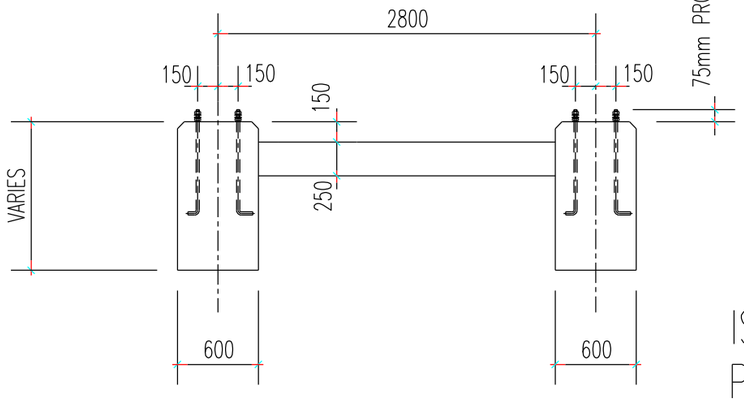




ISOLATOR BASE
PLINTH REF (J)



PLAN ON BASE
2500X600X* DP
1:50



ELEVATION
1:50

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

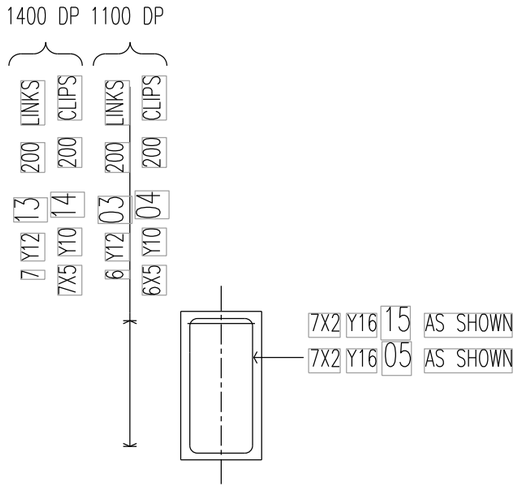
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

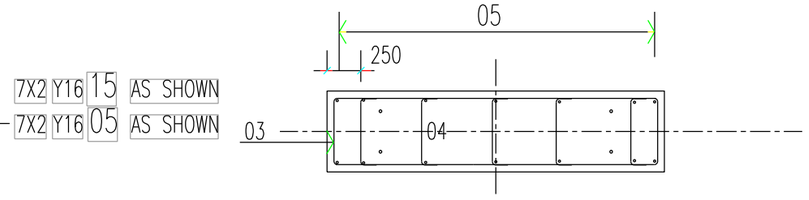
132kV Equipment
3P Isolater

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-004

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



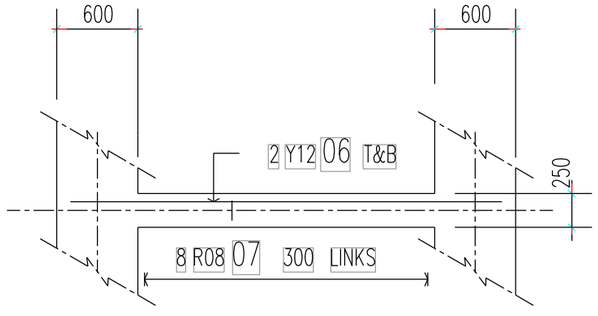
SECTION



PLAN ON PLINTH
2500X600
24 No OFF

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH J													
1100 DP	03	Y12	20	6	120	5925	60	2400	500				631
	04	Y10	20	30	600	700	35	500					259
	05	Y16	20	14	280	2300	38	950	470				1016
1400 DP	13	Y12	4	7	28	5925	60	2400	500				147
	14	Y10	4	35	140	700	35	500					60
	15	Y16	4	14	56	2500	38	1050	470				221
TIE BM	06	Y12	24	4	96	3200	20						273
	07	R08	24	8	192	775	60	150	150				59

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg	59				319	1051	1237				



PLAN ON TIE BEAM
250X250 DP
24 No OFF

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF
AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

ISOLATOR BASE
PLINTH REF (J)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

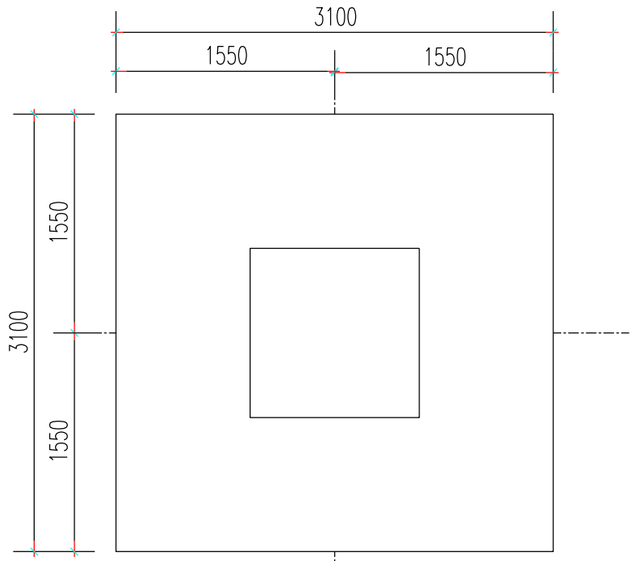
APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

CONTRACTOR DRAWING NO:

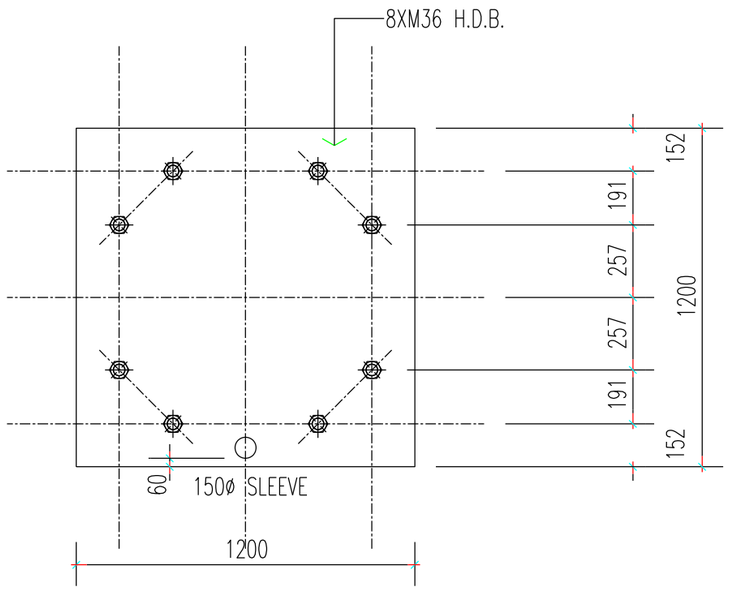
CoT DRAWING NO:
STD-FD-004

132kV Equipment
3P Isolater
Reinforcing detail

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



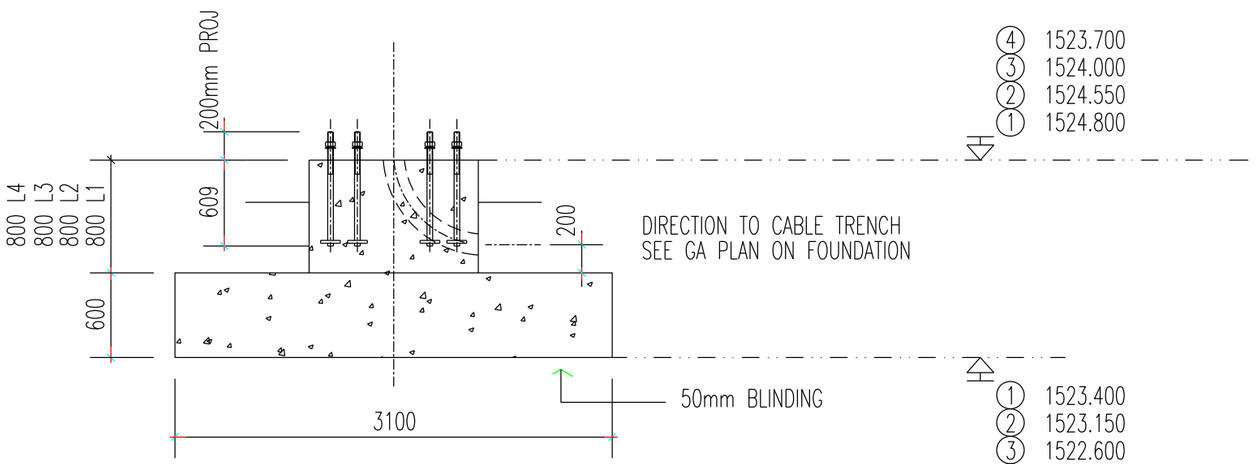
PLAN ON BASE
3100X3100X600 DP
1:50



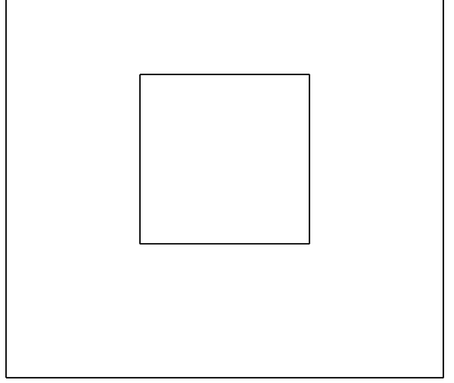
PLAN ON PLINTH
1200X1200
1:25

NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE =7.3985 Cubic m.



ELEVATION
1:50



VOLUME OF CONCRETE =7.3985 Cubic m.

WITH BLINDING

DRAWING ISSUED FOR CONSTRUCTION

COLUMN BASE
PLINTH REF (L)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:

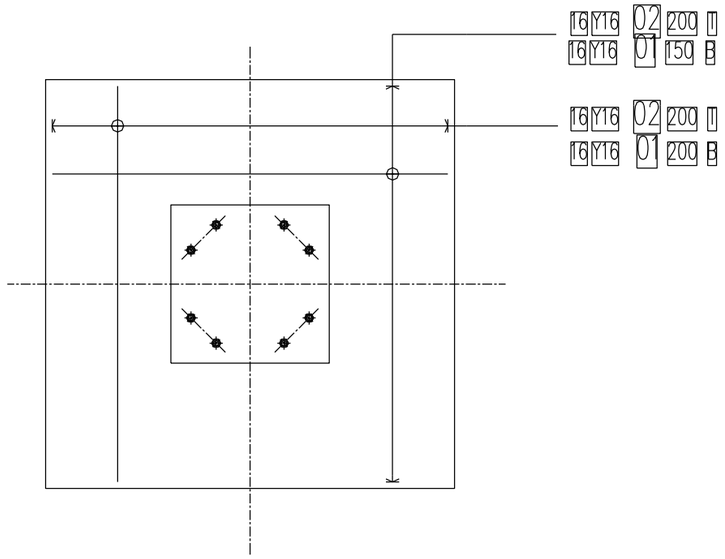
SCALE: N.T.S.

132kV Equipment
Column Base detail

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-005

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



PLAN ON BASE
3100X3100X600 DP
18 No
1:50

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH REF L	01	Y16	18	32	576	4800	55	500	480	3000	480		4364
	02	Y16	18	32	576	3250	35	3000					2955
	03	Y12	18	4	72	1650	83	250	440	300			105
	05	Y25	18	16	288	1850	38	400	1250				2053
	06	Y16	18	10	180	2500	38	750	1060				710
	10	Y10	18	5	90	4550	60	1100	1100				252
	11	Y10	18	10	180	3150	60	1100	400				350
	12	Y10	18	10	180	1300	35	1100					144

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					746	105	8029		2053		

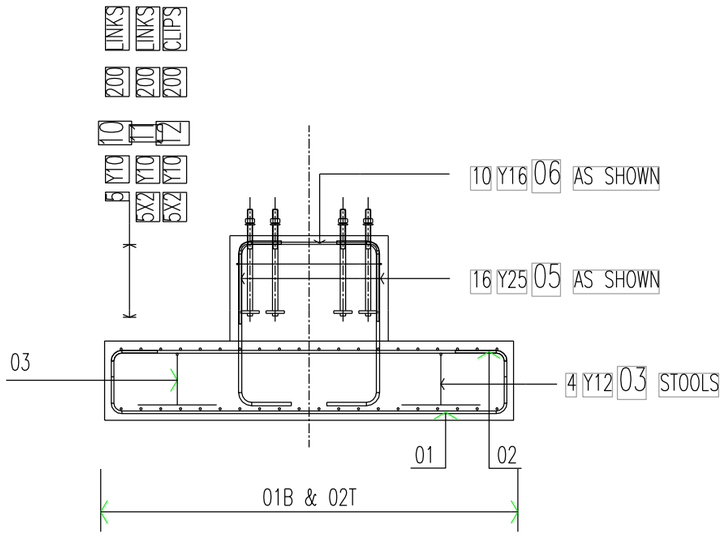
NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF
AT LEAST 20MPa, 28 DAYS AFTER MIXING.

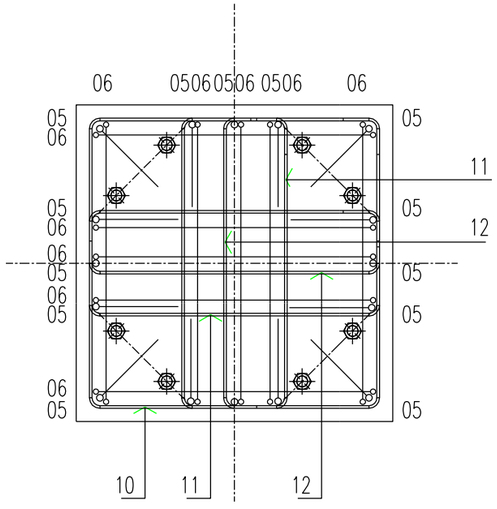
Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
FF each face EF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc



ELEVATION
1:50



PLAN ON PLINTH
1200X1200

DRAWING
ISSUED FOR
CONSTRUCTION

COLUMN BASE
PLINTH REF (L)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

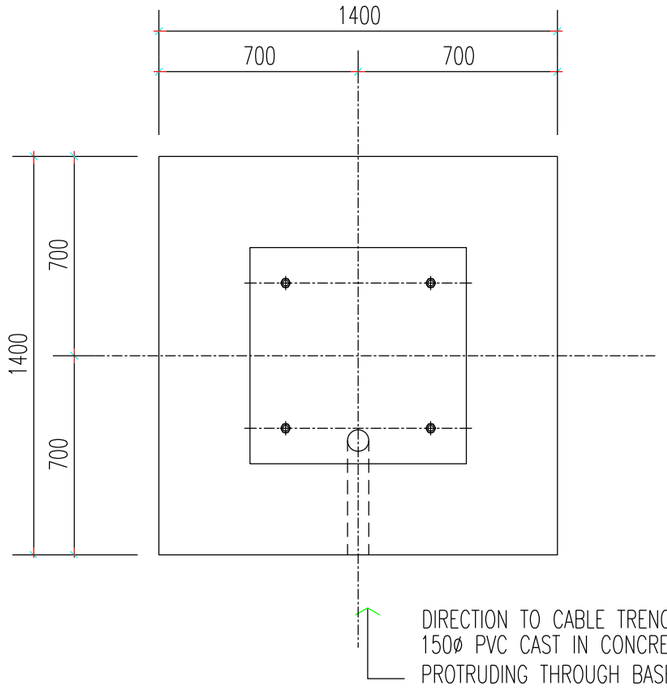
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

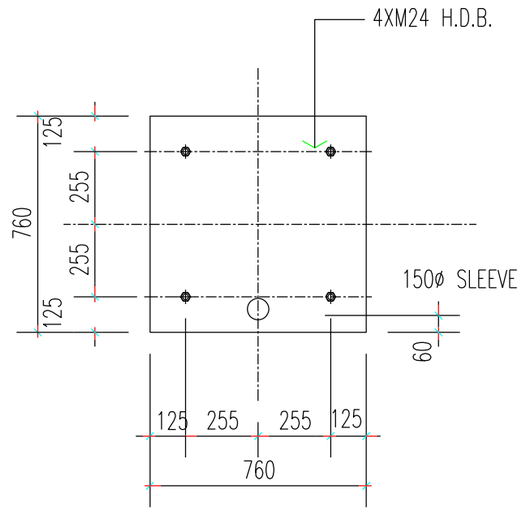
132kV Equipment
Column Base
Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-005

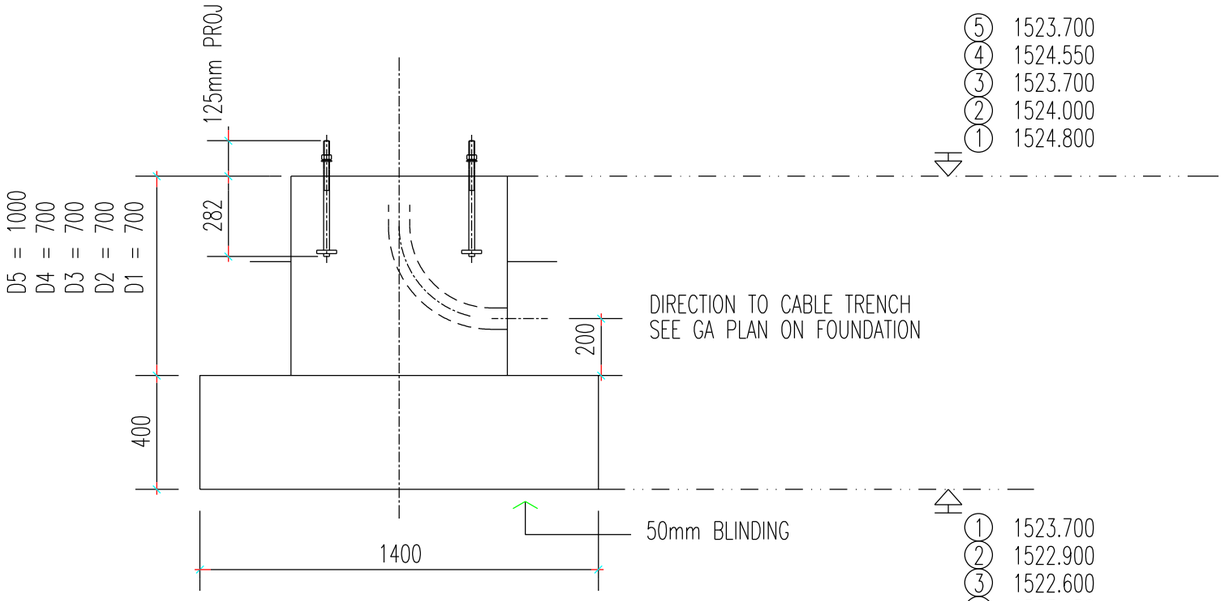
Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



PLAN ON BASE
1400X1400X400 DP
1:25



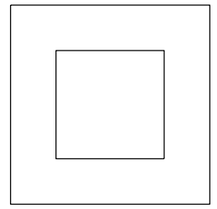
PLAN ON PLINTH
760X760
1:25



ELEVATION
1:25

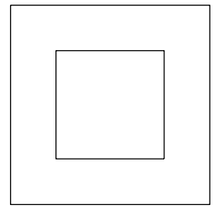
NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= 1.28632 & 1.4596 cubic m.



VOLUME OF CONCRETE =1.28632 Cubic m.

WITH BLINDING



VOLUME OF CONCRETE =1.4596 Cubic m.

WITH BLINDING

CURRENT TRANSFORMER BASE PLINTH REF (D)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

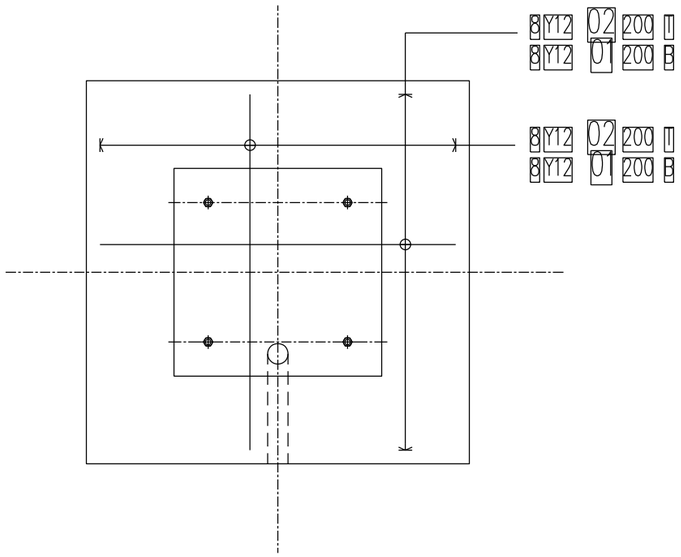
SCALE: N.T.S.

132kV Equipment
CT detail

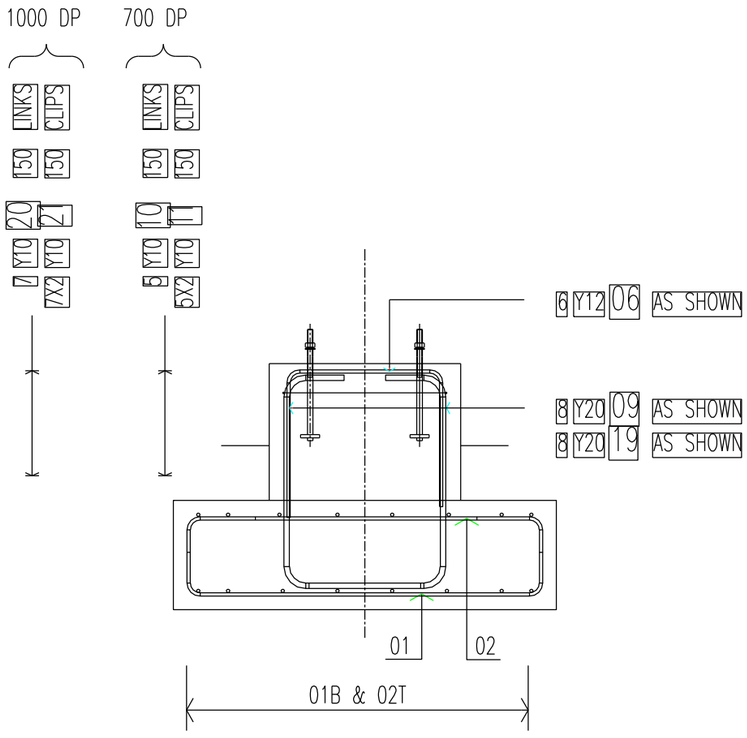
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-006

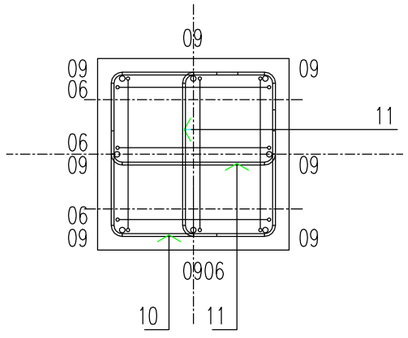
Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



PLAN ON BASE
1400X1400X400 DP
45 No OFF
1:25



ELEVATION
1:25



PLAN ON PLINTH
1:25

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH D	01	Y12	45	16	720	2200	55	250	285	1300	285		1406
	02	Y12	45	16	720	1500	35	1300					959
	06	Y12	45	6	270	1875	38	650	630				449
700 DP	09	Y20	39	8	312	1575	38	500	975				1212
	10	Y10	45	5	225	2775	60	660	660				385
	11	Y10	45	10	450	875	35	660					243
1000 DP	19	Y20	6	8	48	1875	38	500	1275				222
	20	Y10	6	7	42	2775	60	660	660				72
	21	Y10	6	14	84	875	35	660					45

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					745	2815		1434			

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF
AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

CURRENT TRANSFORMER BASE
PLINTH REF (D)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

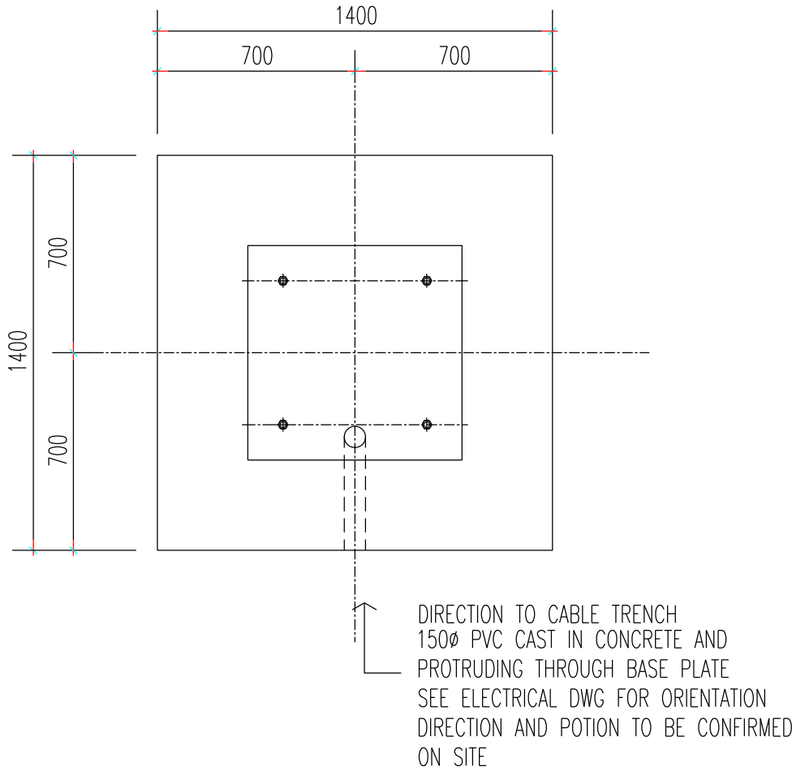
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

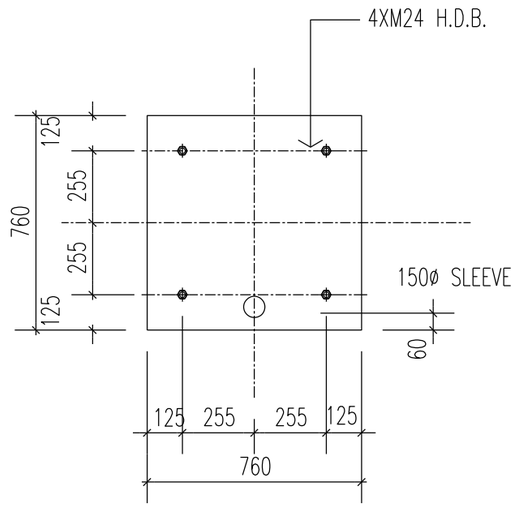
132kV Equipment
CT Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-006

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



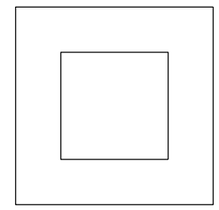
PLAN ON BASE
1400X1400X400 DP
1:25



PLAN ON PLINTH
760X760
1:25

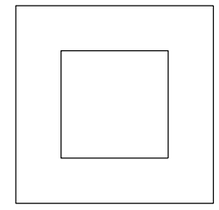
NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= 1.28632 & 1.4596 cubic m.



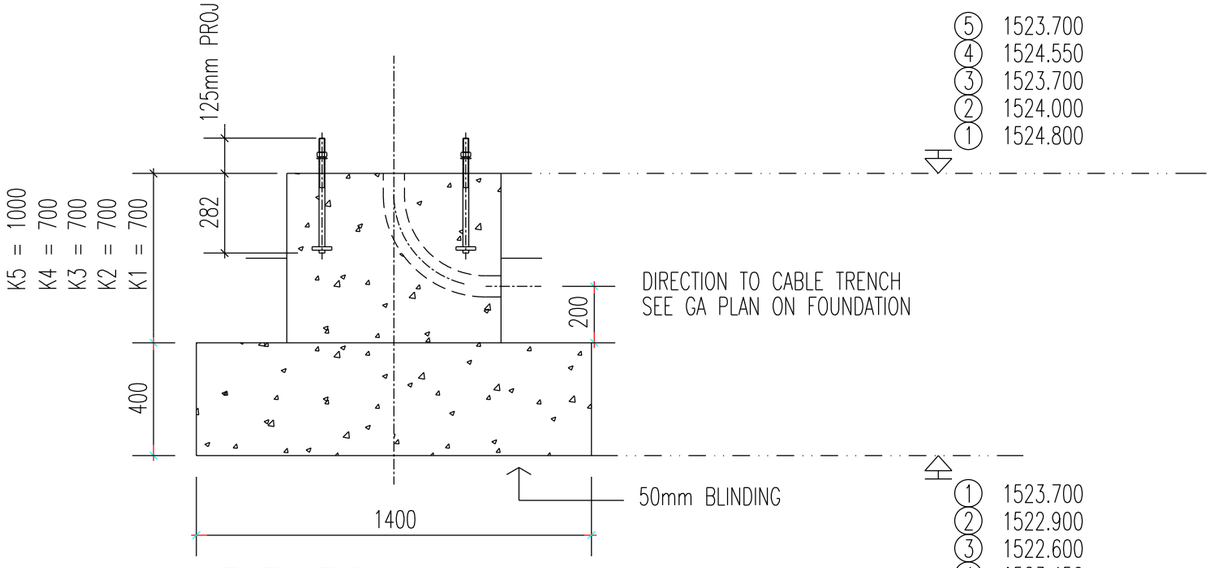
VOLUME OF CONCRETE =1.28632 Cubic m.

WITH BLINDING



VOLUME OF CONCRETE =1.4596 Cubic m.

WITH BLINDING



ELEVATION
1:25

VOLTAGE TRANSFORMER BASE
PLINTH REF (K)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

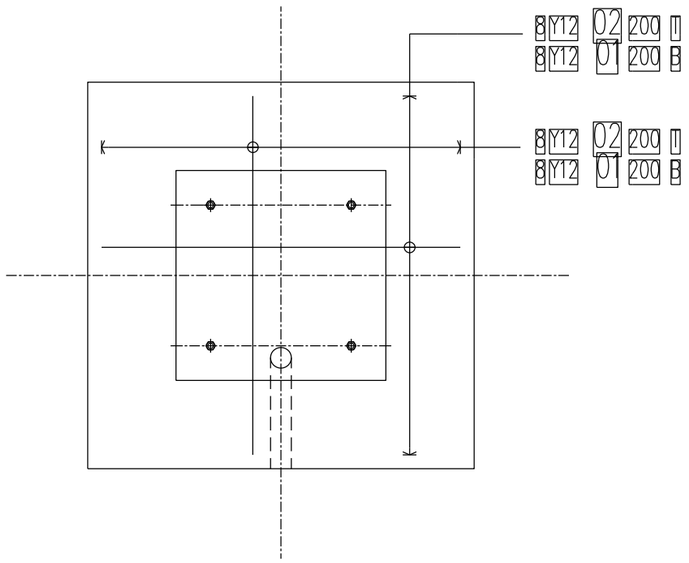
APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
VT detail

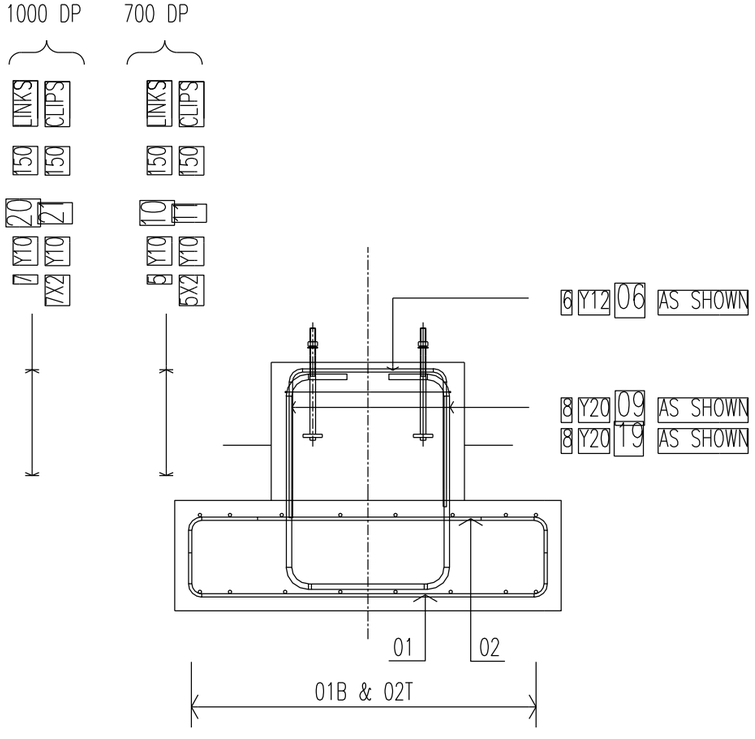
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-007

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



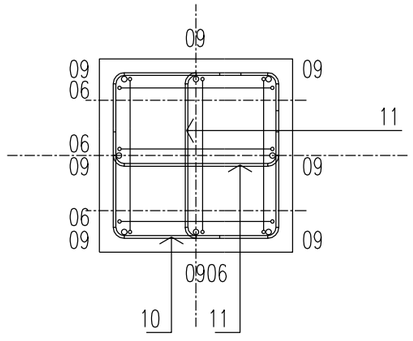
PLAN ON BASE
1400X1400X400 DP
45 No OFF
1:25



ELEVATION
1:25

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH K	01	Y12	45	16	720	2200	55	250	285	1300	285		1406
	02	Y12	45	16	720	1500	35	1300					959
	06	Y12	45	6	270	1875	38	650	630				449
700 DP	09	Y20	39	8	312	1575	38	500	975				1212
	10	Y10	39	5	195	2775	60	660	660				334
	11	Y10	39	10	390	875	35	660					210
1000 DP	19	Y20	6	8	48	1875	38	500	1275				222
	20	Y10	6	7	42	2775	60	660	660				72
	21	Y10	6	14	84	875	35	660					45

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					661	2815		1434			



PLAN ON PLINTH
1:25

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

VOLTAGE TRANSFORMER BASE
PLINTH REF (K)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

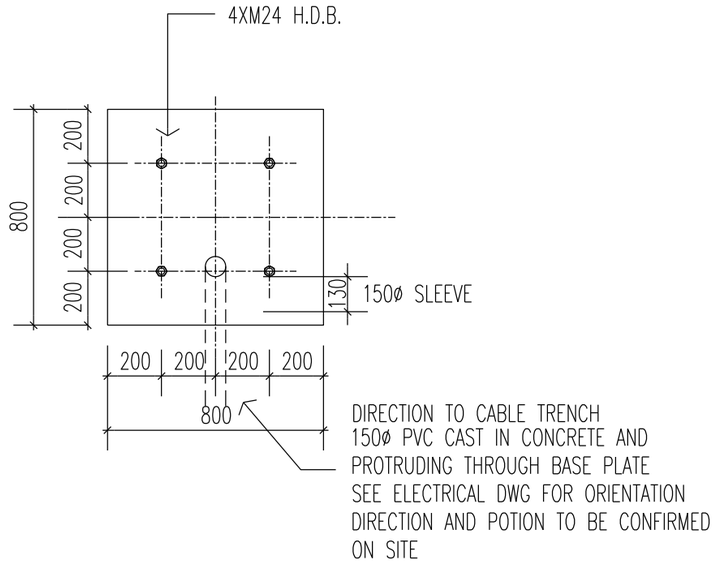
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
CT Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-007

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



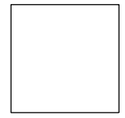
PLAN ON PLINTH

800X800

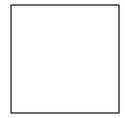
1:25

NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= * cubic m.

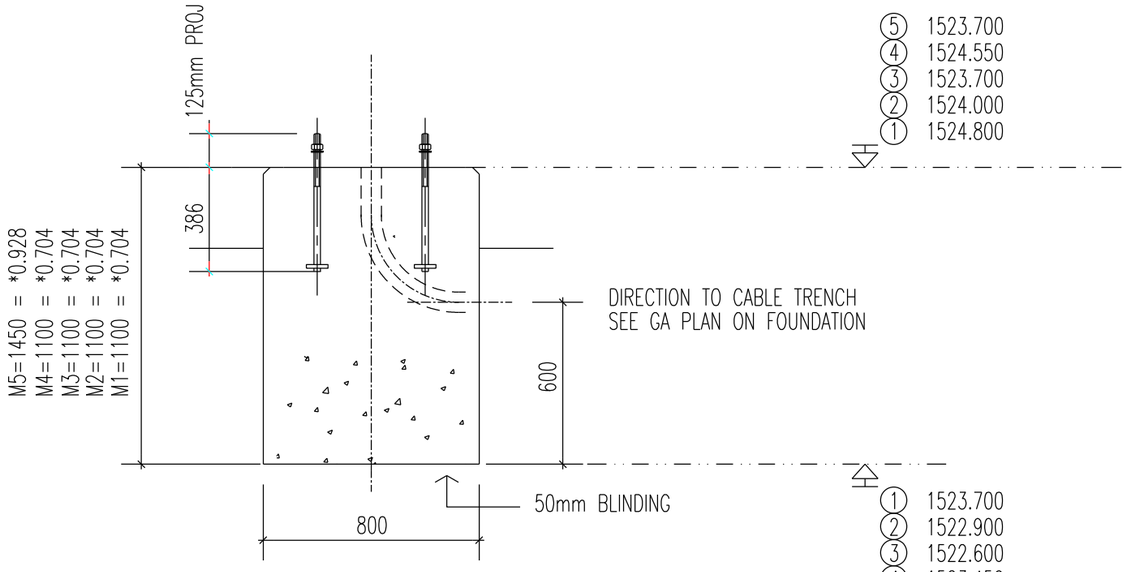


M4=1150 = *0.736
M3=1150 = *0.736
M2=1150 = *0.736
M1=1150 = *0.736



M5=1450 = *0.928

WITH BLINDING



ELEVATION

1:25

SURGE ARRESTOR PLINTH REF (M)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

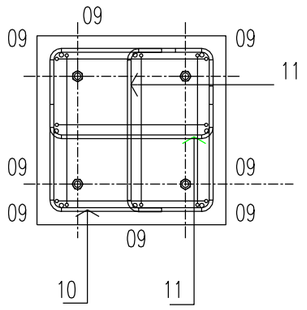
SCALE: N.T.S.

CONTRACTOR DRAWING NO:

CoT DRAWING NO: STD-FD-008

132kV Equipment
SA detail

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



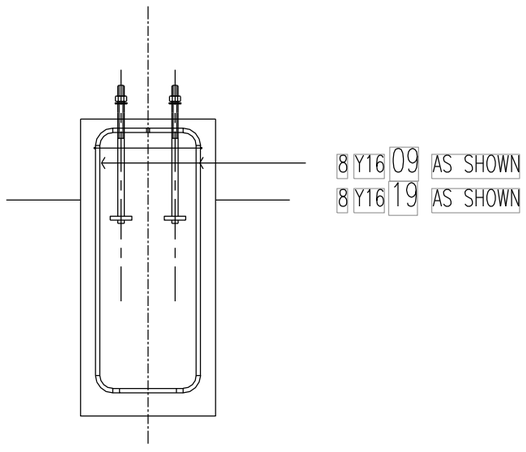
PLAN ON PLINTH
1:25
33 No OFF

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH M 700 DP	09	Y16	27	8	216	2500	38	950	670				852
	10	Y12	27	8	216	2925	60	700	700				561
	11	Y10	27	16	432	900	35	700					240
1100 DP	19	Y16	6	8	48	2800	38	1100	670				212
	20	Y12	6	10	60	2925	60	700	700				156
	21	Y10	6	20	120	800	35	600					59

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					299	717	1064				

1400 DP 1100 DP

1400 DP LINKS	1400 DP CLIPS	1100 DP LINKS	1100 DP CLIPS
150	150	150	150
20	21	10	11
Y12	Y10	Y12	Y10
10	10X2	8	8X2



ELEVATION
1:25

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF for face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

SURGE ARRESTOR PLINTH REF (M)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

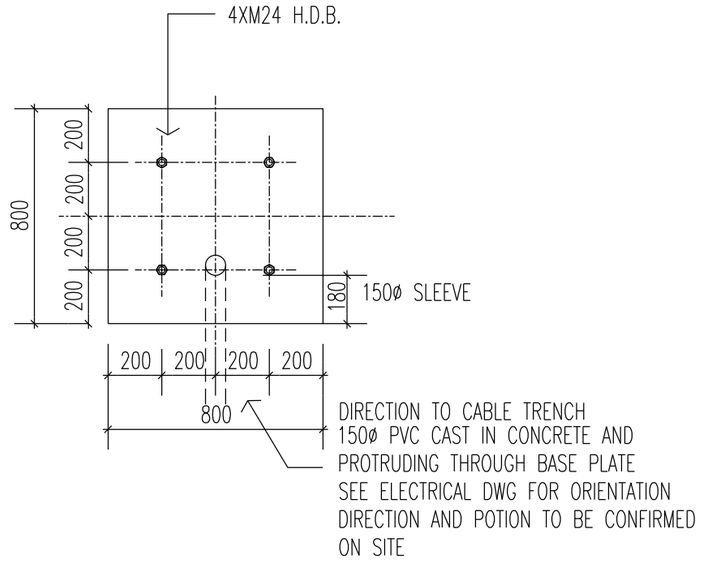
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

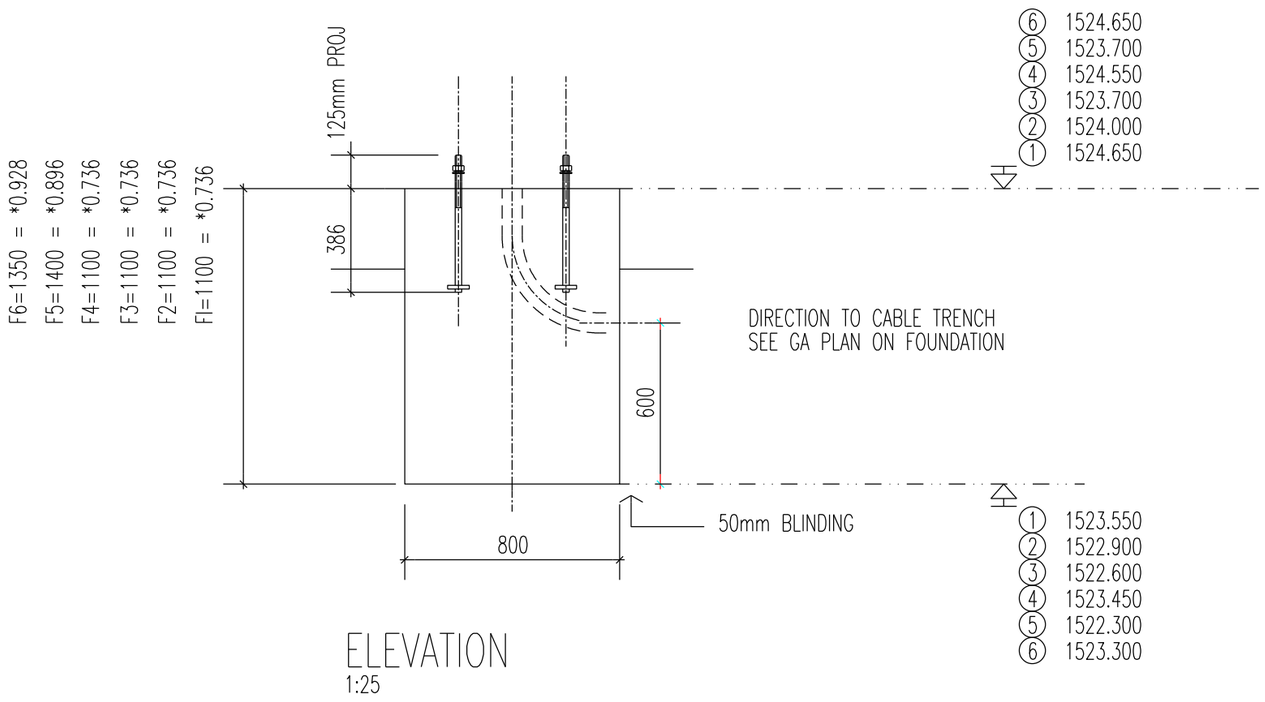
132kV Equipment
SA Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-008

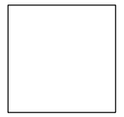
Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2



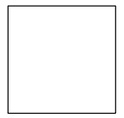
PLAN ON PLINTH
800X800
1:25



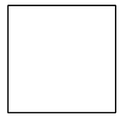
ELEVATION
1:25



F1-F4=1100 = *0.736



F5=1400 = *0.896



F6=1350 = *0.928

NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= * cubic m.

POST INSULATOR BASE PLINTH REF (F)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

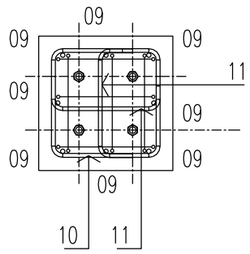
SCALE: N.T.S.

132kV Equipment
PI detail

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-009

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2



PLAN ON PLINTH
1:25
47 No OFF

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH F 1100 DP	09	Y16	36	8	288	2500	38	950	670				1136
	10	Y12	36	8	288	2925	60	700	700				748
	11	Y10	36	16	576	900	35	700					320
1350/1400 DP	19	Y16	11	8	88	2800	38	1100	670				389
	20	Y12	11	10	110	2925	60	700	700				286
	21	Y10	11	20	220	900	35	700					122

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					442	1034	1525				

NOTE

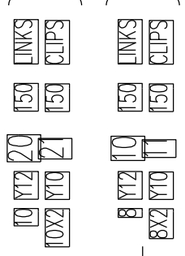
25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

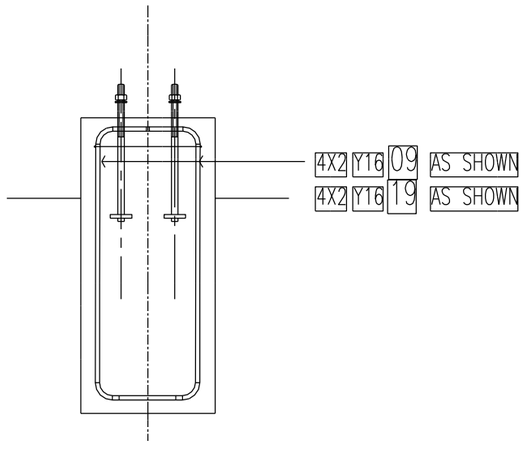
Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face EF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

1350 DP
1400 DP 1100 DP





ELEVATION
1:25

POST INSULATOR BASE
PLINTH REF (F)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

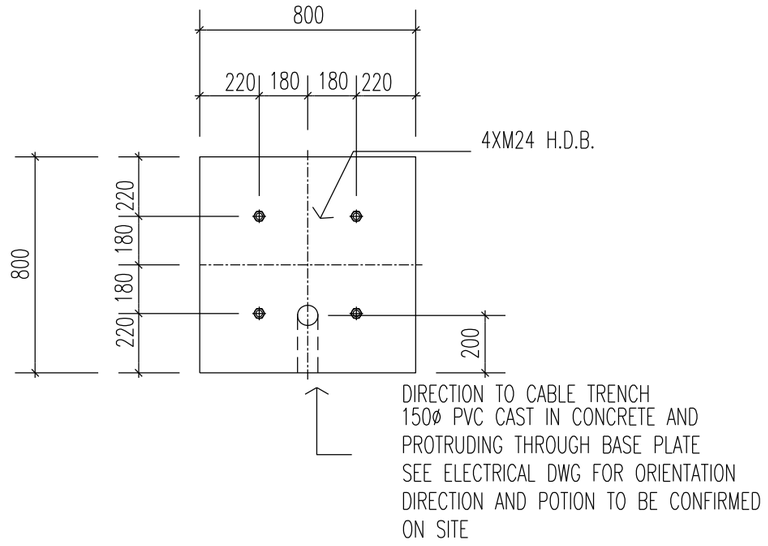
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
PI Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-009

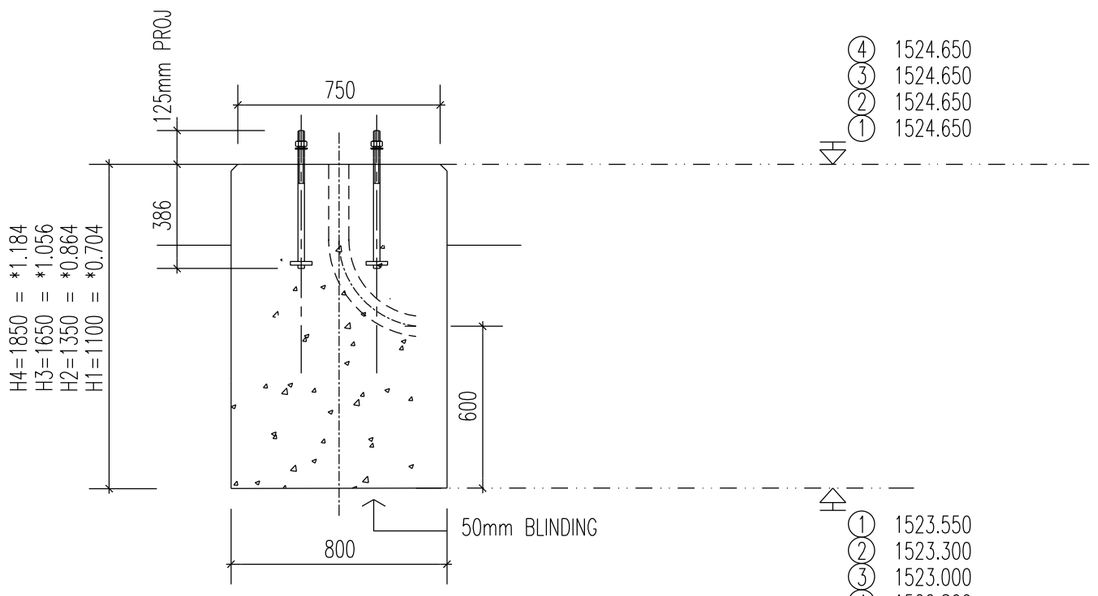
Design:	J. Bosman
Drawn:	J. Gous
Checked:	J. Rustoff
Drawn Date:	2024-10-15
Sheet:	2 of 2



PLAN ON PLINTH

800X800

1:25

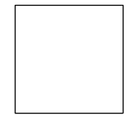


ELEVATION

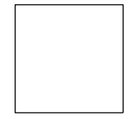
1:25

NOTES :-

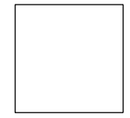
1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= * cubic m.



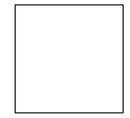
H1=1150 = *0.736



H2=1400 = *0.896



H3=1700 = *1.088



H4=1900 = *1.216

WITH BLINDING FOR 1 PANTOGRAPH

PANTOGRAPH BASE PLINTH REF (H)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
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TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

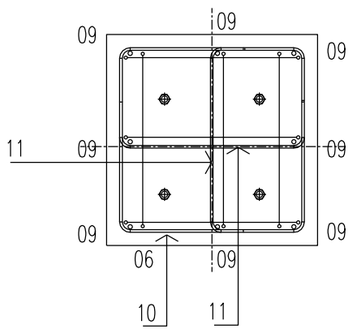
SCALE: N.T.S.

CONTRACTOR DRAWING NO:

CoT DRAWING NO: STD-FD-010

132kV Equipment
Pantograph detail

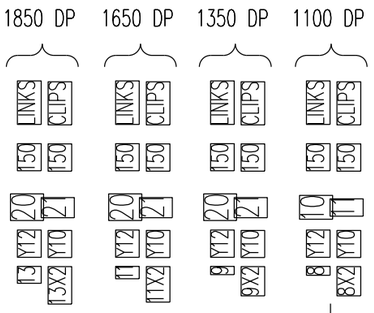
Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2

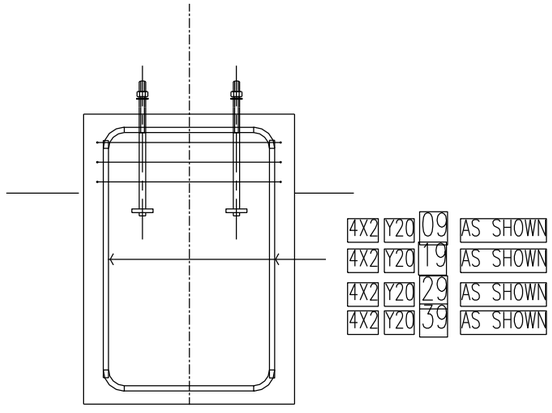


PLAN ON PLINTH
1:25

MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH H	09	Y20	27	8	216	2450	38	950	650				1305
	10	Y12	27	8	216	2925	60	700	700				561
	11	Y10	27	16	432	900	35	700					240
	19	Y20	12	8	96	2850	38	1150	650				675
	20	Y12	12	33	396	2925	60	700	700				1028
	21	Y10	12	66	792	900	35	700					439
	29	Y20	12	8	96	3150	38	1300	650				746
	39	Y20	12	8	96	3350	38	1400	650				793

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					679	1589		3519			





SECTION
1:25

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

PANTOGRAPH BASE
PLINTH REF (H)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
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Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
_____
Date:
_____
SCALE: N.T.S.

132kV Equipment
Pantograph
Reinforcing detail

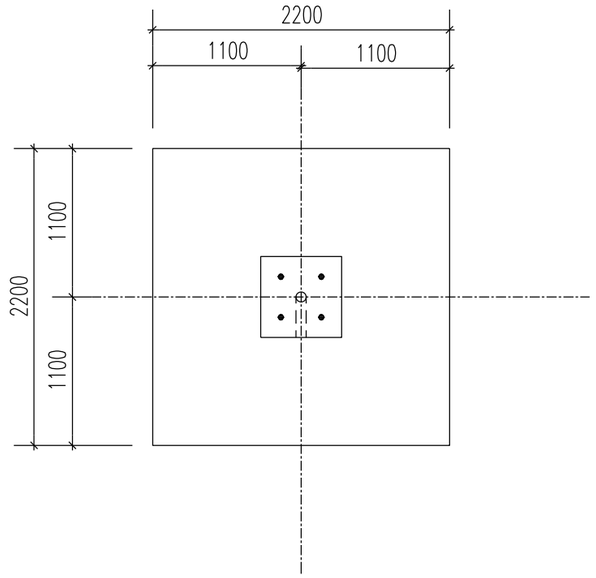
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-FD-010

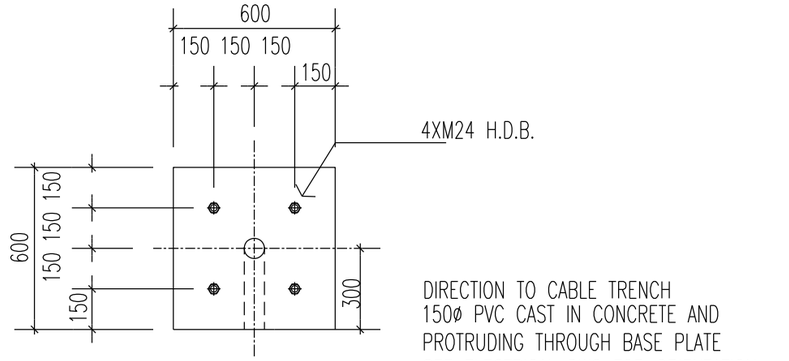
Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2

NOTES :-

1. FOR BOLT INFORMATION SEE DWG STD-FD-001
2. 25 x 45° CHAMFER TO HORIZONTAL EDGES.
3. MINIMUM OF 50mm COVERING TO REINFORCING
4. CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 30 MPa 28 DAYS AFTER MIXING.
5. FOUNDING DEPTH TO BE CHECKED PRIOR TO CASTING.
6. VOLUME OF CONCRETE= *2.726 cubic m.

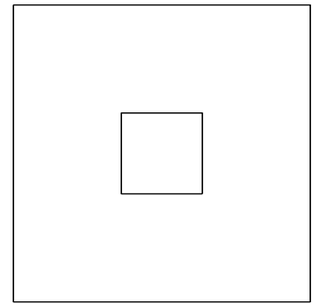


PLAN ON BASE
2200X2200X500 DP
1:50

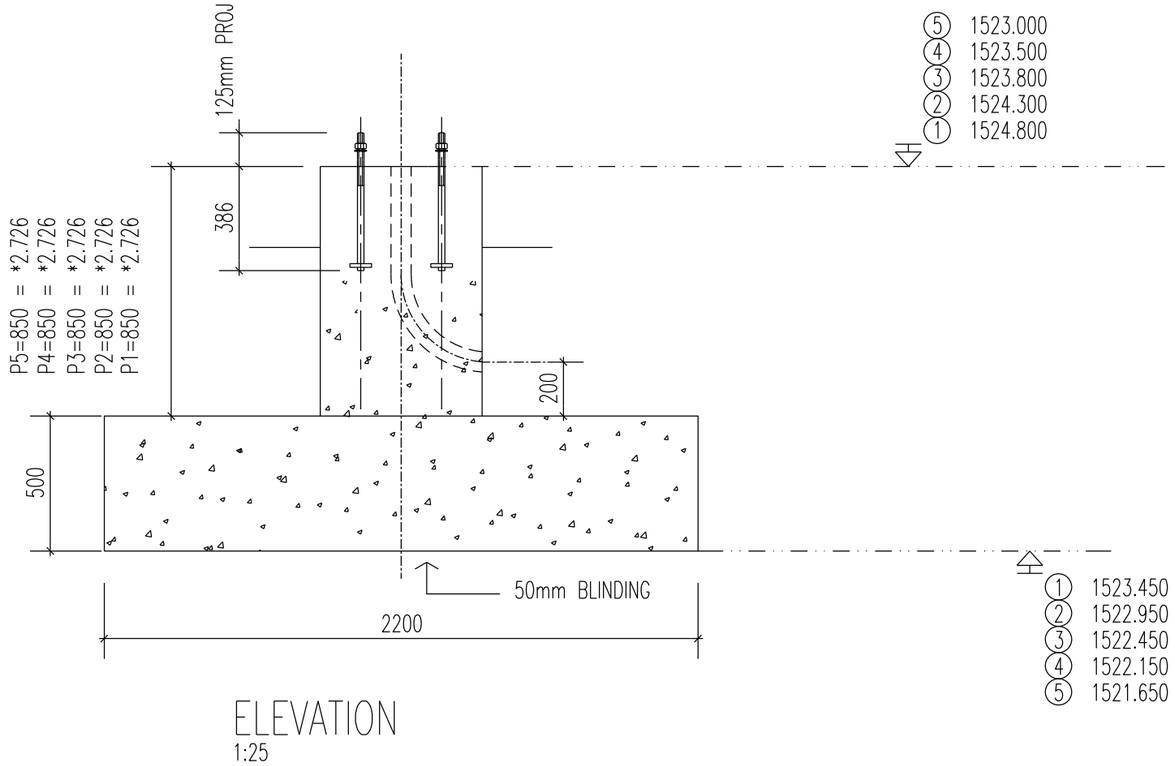


DIRECTION TO CABLE TRENCH
150ø PVC CAST IN CONCRETE AND
PROTRUDING THROUGH BASE PLATE
SEE ELECTRICAL DWG FOR ORIENTATION
DIRECTION AND POTION TO BE CONFIRMED
ON SITE

PLAN ON PLINTH
600X600
1:25



WITH BLINDING



ELEVATION
1:25

LIGHTING MAST BASE
PLINTH REF (P)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

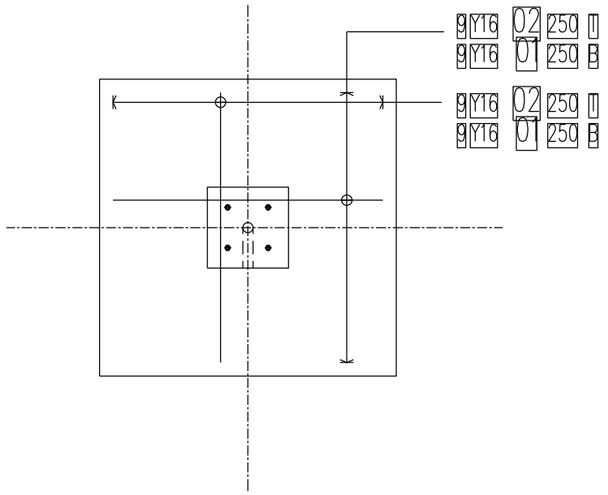
Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
Lighting mast detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-010

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 1 of 2

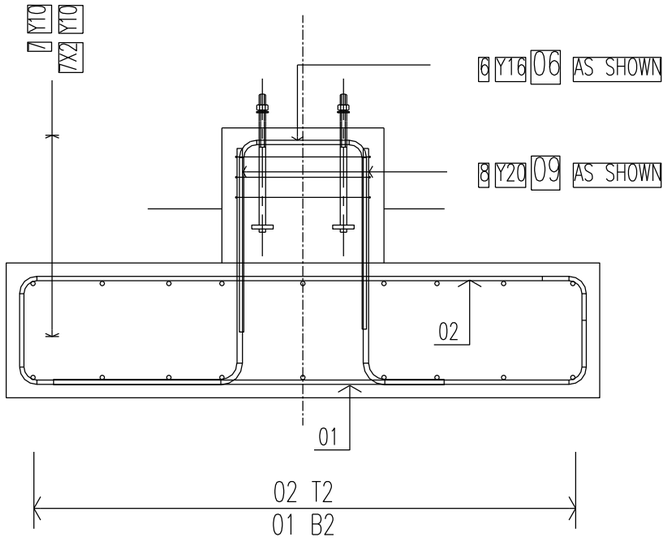


PLAN ON BASE
2200X2200X500 DP
16 No OFF
1:50

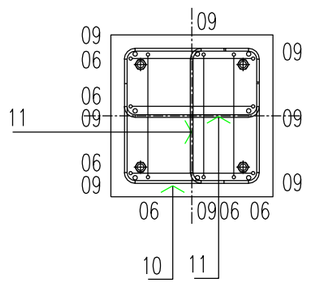
MEMBER	BAR MARK	BAR TYPE	No OFF	PER UNIT	TOTAL No	LENGTH mm	SHAPE CODE	BENDING DIMENSIONS [SABS 82] A mm	B mm	C mm	D mm	E/R mm	WEIGHT
PLINTH P	01	Y16	16	18	288	3200	55	250	380	2100	380		1455
	02	Y16	16	18	288	2350	35	2100					1068
	06	Y16	16	6	96	2200	38	900	470				333
	09	Y20	16	8	128	1475	37	1225					466
	10	Y10	16	7	112	2125	60	500	500				147
	11	Y10	16	14	224	700	35	500					97

BAR DIAMETER	R08	R10	R12	R16	Y10	Y12	Y16	Y20	Y25	Y32	Y40
TOTAL kg					243		2856	466			

LINKS CLIPS
150 150
10 T1
Y10 Y10
7X2



SECTION
1:25



PLAN ON PLINTH
1:25

NOTE

25X25 CHAMFER TO ALL HORIZONTAL EDGES.
CONCRETE TO HAVE A CUBE STRENGTH OF AT LEAST 20MPa, 28 DAYS AFTER MIXING.

Cover.
50 OR AS SHOWN

Plot Scale	Drawing Scale
1:50	1:50 1:25

LEGEND.
EF each face FF far face
ALT alternate T top
STG stagger TOG together
NF near face B bottom
ABR alternate bars reversed
PRS in pairs EW each way
B1 1st lowest layer
T1 1st top most layer
T2 2nd layer down ...etc
B2 2nd layer up ...etc

LIGHTING MAST BASE
PLINTH REF (P)

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
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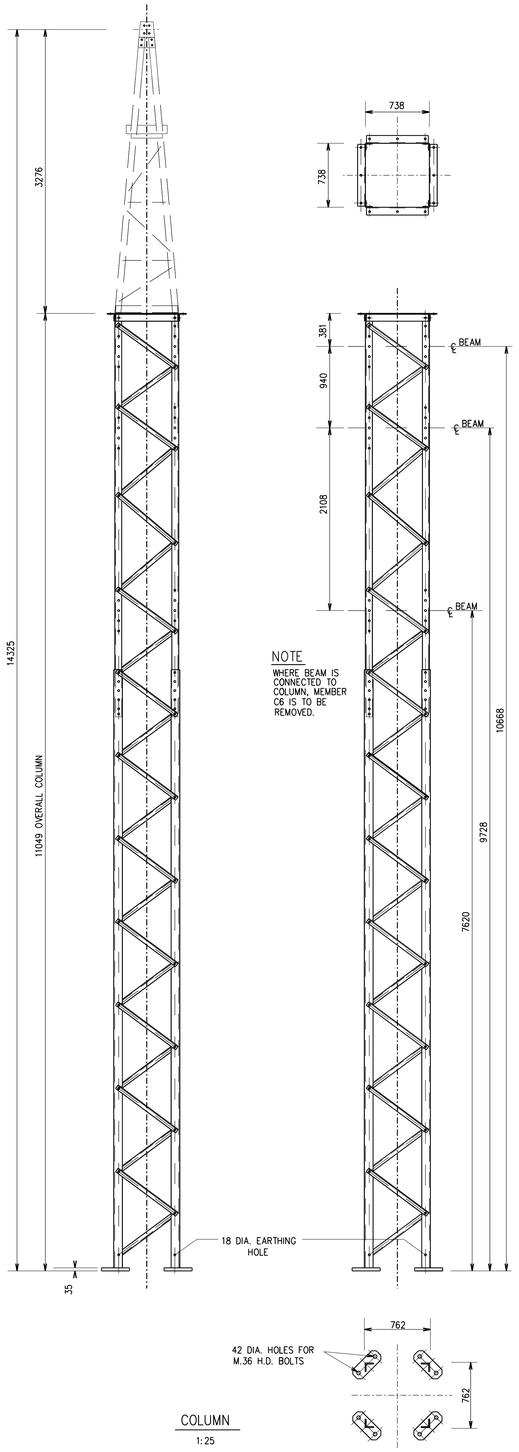
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Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

132kV Equipment
Lighting mast
Reinforcing detail

CONTRACTOR DRAWING NO:
CoT DRAWING NO: STD-FD-010

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2024-10-15
Sheet: 2 of 2

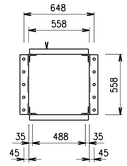


NOTE

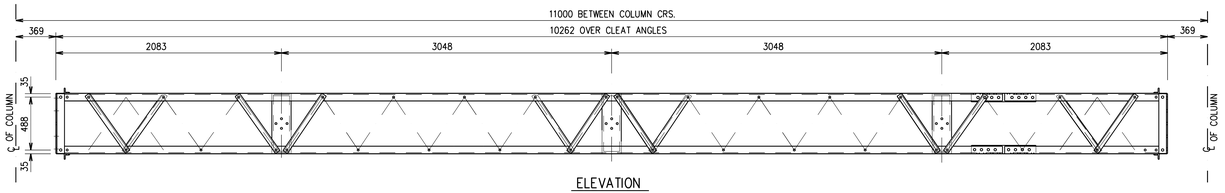
WHERE BEAM IS CONNECTED TO COLUMN, MEMBER C6 IS TO BE REMOVED.

COLUMN

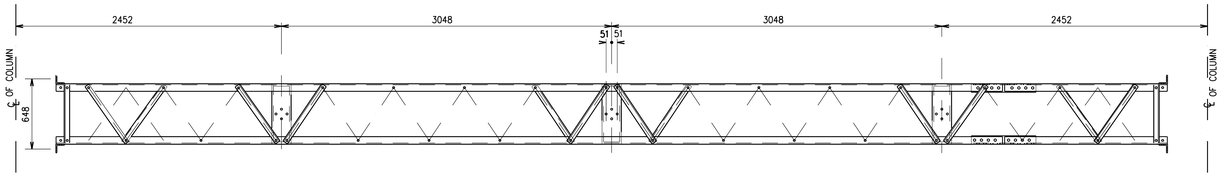
1:25



END VIEW



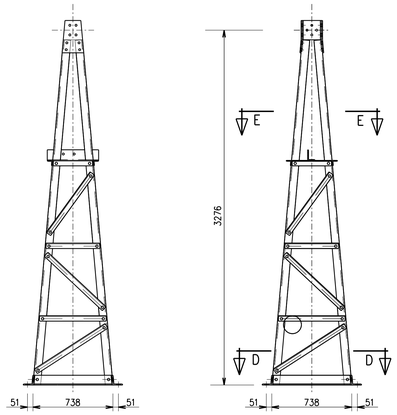
ELEVATION



PLAN

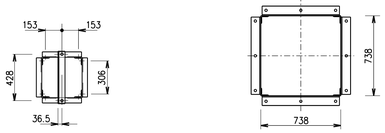
BEAM

1:20



EARTHWIRE SUPPORT

1:20



SECTION E–E

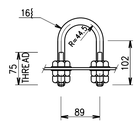
SECTION D–D

MASS SCHEDULE IN kg.		
ITEM	STRUCTURE	BOLTS
COLUMN 132kV	1158	37
BEAM 132kV	800	38
EARTHWIRE SUPPORT	199	22
"U" BOLTS	–	0,9

MASS OF BOLTS IN SCHEDULE INCLUSIVE OF NUTS AND WASHERS.

BOLT SCHEDULE (STRENGTH GRADE 4.8)					
ITEM	MK	DIA	LENGTH	No OF WASHERS	No. OFF
COLUMN – 220kV	1	M20	45	2	4
	2	M20	45	1	12
	3	M20	50	1	60
	4	M20	55	2	48
	5	M20	60	1	8
BEAM MK 220kV	1	M16	40	2	72
	2	M16	40	1	8
	3	M16	45	2	128
	4	M16	50	2	8
	5	M20	50	1	16
	6	M20	55	2	4
EARTHWIRE SUPPORT (WITHOUT LIGHTNING SPIKE)	1	M20	40	2	48
	2	M20	45	1	16
	3	M20	50	1 BEVEL	8
	4	M20	50	1	12

BOLTS NOTES:
1. WASHERS TO BE PLACED UNDER BOLT.
2. ALL BOLTS/WASHERS TO BE HOT DIP GALVANISED.



"U" BOLT DETAIL

1:5

NOTES:

1. QUANTITIES SHOWN ARE FOR ONE ITEM ONLY.
2. ALL STEELWORK TO BE HOT DIP GALVANISED TO S.A.B.S. ISO 1461.
3. FABRICATION TOLERANCE TO BE + OR – 1mm.
4. HOLE DIA. TO BE AS MARKED.
5. THE CONTRACTOR SHALL SUPPLY ALL NUTS, BOLTS, WASHERS, ETC, REQUIRED FOR ERECTION.
6. H.D. BOLTS SUPPLIED UNDER SEPARATE CONTRACT.
7. ALL WELDING SYMBOLS TO S.A.B.S 044.
8. ALL PORTIONS OF WELDED JOINTS, NOT SEALED BY STRUCTURAL WELD, SHALL BE SEAL WELDED.
9. ALL MARKS TO BE STAMPED ONTO STEELWORK AND SHALL BE CLEARLY LEGIBLE AFTER GALVANISING.
10. 25mm GROUT TO ALL BASE PLATES

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

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Primary Planning, Design and Construction
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TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

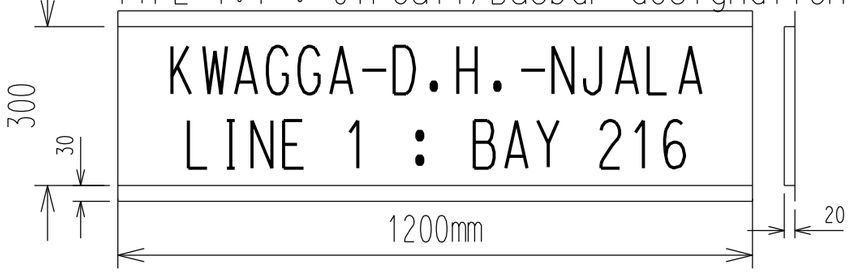
Typical 132kV Gantry Steel lattice 11 meter

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-GS-001

Design: J.M. Bosman
Drawn: J.A. Gous
Checked: J.T. Rustorff
Drawn Date: 2023-01-13
Sheet:

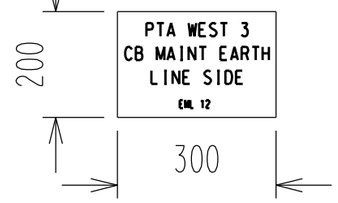
TYPE 1.1 : Circuit/Busbar designation



Letter Details:
Characters: 25max/line
Height : 150mm
Stroke : 20mm

Location :
Circuit : High on gantry beam
(Min. 2 per circuit)
Busbar : Above head on structure
Station name : Eye level

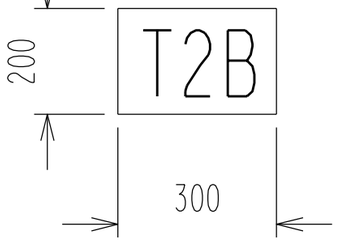
TYPE 1.2 : Equipment identification



Letter Details:
Characters: 15max/line
Height : 25mm
Height : 15mm
Stroke : 20mm

Location :
Equipment : Eye level on structure

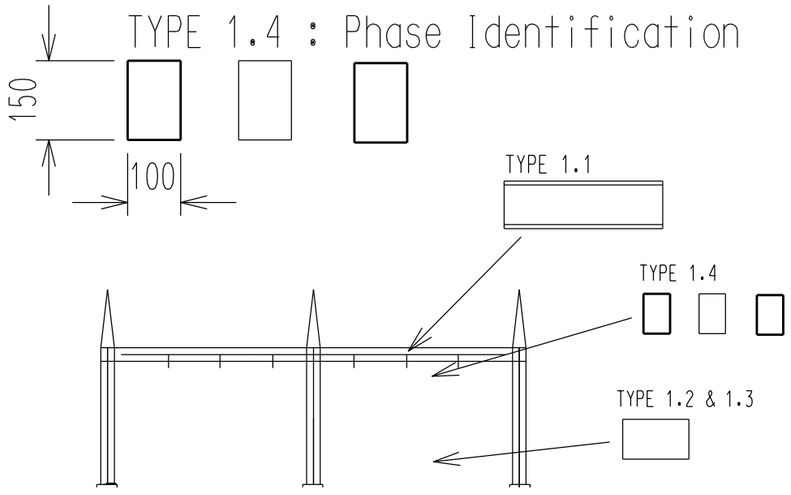
TYPE 1.3 : Trf Numbers designation



Letter Details:
Characters : 25 max
Height : 150mm
Stroke : 20mm

Location :
Bay No. : High on gantry beam
Trf. no. : Eye level on structure

TYPE 1.4 : Phase Identification



Location :
Structure : Above head on structure
Example : Busbars, Towers

GENERAL NOTES :

COLORS :
Type 1.1 - 1.3 :
Board : Yellow Background
Letters : Black
Type 1.4 :
Each Background : Red, Yellow, Blue

FONT :
Folio (Condenced)
Bold

MATERIAL :
For Types 1.1 - 1.4 :
Board : 0,6mm Chromadec
Letters : UV Resistant Vinyl

BRACKETS, BOLTS & NUTS :
Galvanised Steel

LABEL DIRECTION :
All labels to face the same side

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

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Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

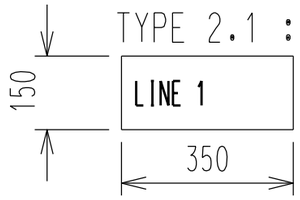
Labels for sub-, In-feed and switch stations

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-LBS-001

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2023-03-15
Sheet:

TYPE 2.1 : Line Identification



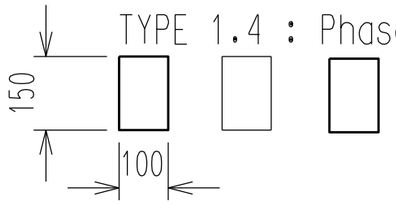
Letter Details :

Characters : 6 max
Height : 150mm
Stroke : 20mm

Location :

Tower : High up on tower
Example: See tower below

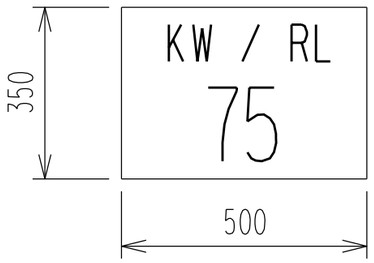
TYPE 1.4 : Phase Identification



location :

Structure: Above head on structure
Example: Busbars, Towers

TYPE 2.2 : Tower Designation



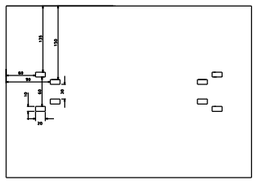
Letter Details :

Characters : 10 max
Height 1 : 90mm (Line Designation)
Height 2 : 190mm (Tower Number)
Stroke : 20mm

Location :

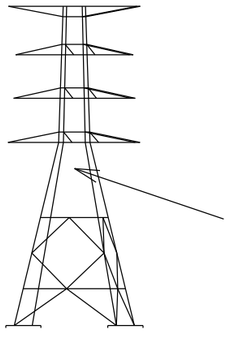
Tower : High up on tower
Example: See tower below

TYPE 2.2 : Tower Designation



Fixure Details :

See dimentions



GENERAL NOTES :

COLORS :
Type 1.4, 2.1 & 2.2 :
Board : Yellow Background
Letters : Black
Type 1.4 :
Each Background : Red, Yellow, Blue

FONT :
Folio (Condenced)
Bold

MATERIAL :
For Types 1.4 - 2.1 :
Board : 0,6mm Chromadec
Letters : UV Resistant Vinyl

For Type 2.2 :
Board : 1mm vitreous enamel (baked)

FRAMES, BRACKETS, BOLTS & NUTS :
Galvanised Steel

LABEL DIRECTION :
All labels to face source
All labels on same side of tower

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

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IGNITING EXCELLENCE

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Primary Planning, Design and Construction
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APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

Labels for towers and power lines

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-LBS-002

Design: J. Bosman
Drawn: J. Gous
Checked: J. Rustoff
Drawn Date: 2023-03-15
Sheet:

SUBSTATION BUILDING

OUTSIDE THE BUILDING

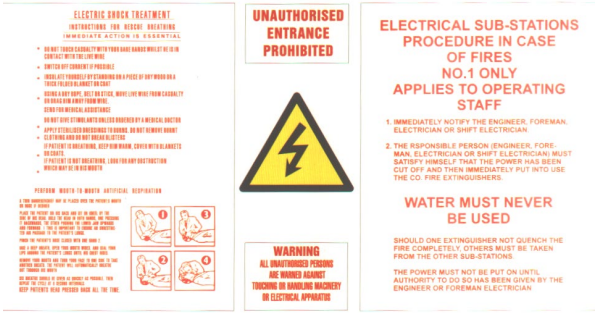
NC 75 600x600



EACH DOOR

INSIDE/BACK

NC1



FIRE EXTINQUESER

NC 58
500x700mm

TOP 1.3METER FROM GROUND



N60
250x350mm



BOTOM 2.1METER FROM GROUND

BATTERY ROOM

INSIDE DOOR

NC 76



MV 5



MV 9



MV 10



CITY OF TSHWANE
IGNITING EXCELLENCE

PRIMARY 132/11KV SUBSTATIONS

SAFETY SIGNS

Revision: 1 | **Drawing No: STD-LBS-003**

SUBSTATION YARD

OUTSIDE THE SUBSTATION YARD GATE

WW 23



SUBSTATION NAME

WW 23



NC 2 (500X300)



OUTSIDE ON THE YARD GATES AND FENCES

OUTSIDE EACH 132KV YARD GATE

NC 70



MV 7





PV 8



PV 4

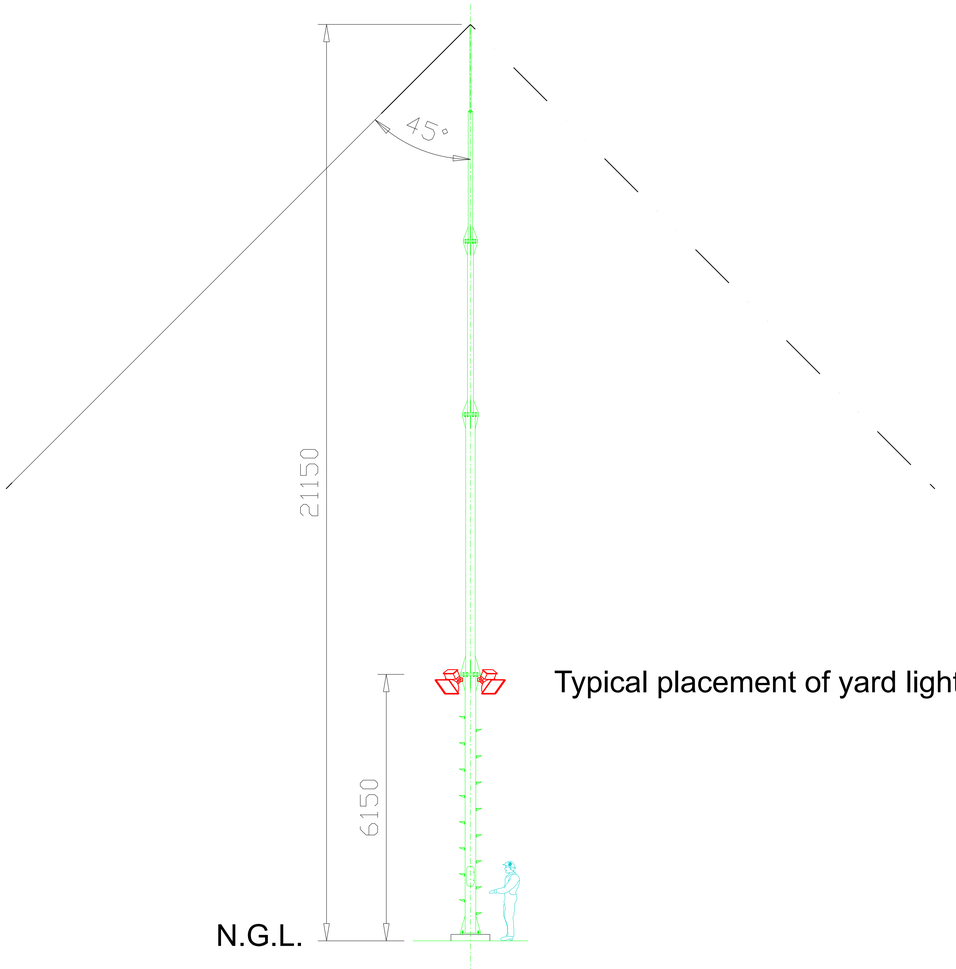
OUTSIDE ON THE SUBSTATION FENCE

WW 23

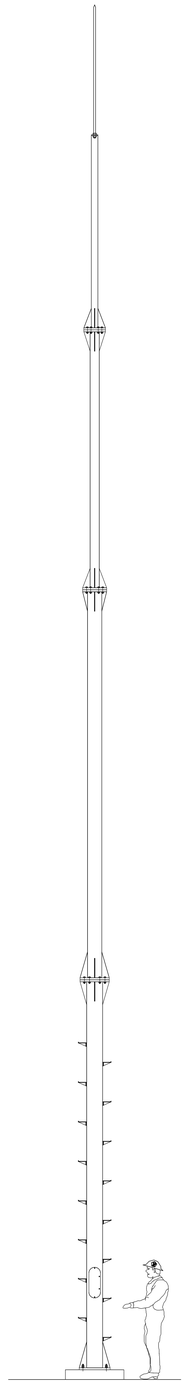


20 METERS APPART

	CITY OF TSHWANE	PRIMARY 132/11KV SUBSTATIONS SAFETY SIGNS
	Revision: 1	Drawing No: STD-LBS-004



Typical placement of yard lighting



OPERATING CLEARANCES		
SYSTEM VOLTAGE		132kV
MINIMUM CLEARANCE TO EARTH	mm	1200
MINIMUM CLEARANCE IN AIR BETWEEN PHASES	mm	1475
CLEARANCE TO THE NEAREST UNSCREENED LIVE CONDUCTOR IN AIR. (SECTION CLEARANCE)	mm	3700
CLEARANCE TO THE NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING A LIVE CONDUCTOR (GROUND CLEARANCE)	mm	2440

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
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Primary Planning, Design and Construction
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APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

Typical Yard Lightning mast

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
STD-YE-001

Design: J.M. Bosman
Drawn: J.A. Gous
Checked: J.T. Rustorff
Drawn Date: 2023-01-13
Sheet:

351

341

331

5.5

8

13

25

50

15

14

147

29.5 40 40 80.5 40 40 29.5

127 137 147

450 DIA RIPE CULVERT CLASS 2(d) ON CLASS B BEDDING WITH HEADWALL

ESKOM-Badimong

LEGEND

- 300 mm CLASS 50D SPIGOT AND SOCKET PIPES WITH NEOPRENE RINGS LAID ON CLASS 'B' BEDDING
- DRAINAGE SYSTEM-VARIOUS DIAMETER CONCRETE PIPES (LI-SCI-TYPE CLASS 50D ON CLASS 'B' BEDDING
- SUB-SOIL DRAIN: xL x2 OR x3 : 150 mm uPVC SLOTTED PIPES WITH FALL 1:200 min.
- SUB-SOIL DRAIN WITH CONCRETE BASE BEHIND STORAGE YARD
- CONCRETE GUTTER GRID INLET
- 25 mm HDPE CLASS 6 FROM HEAD TANK TO CONTROL BLDG AND TO SHC BUILDING (DEPTH 0,75m)
- 160 mm uPVC SEWER PIPE - SEWER MANHOLE
- TYPE 1 BRICK MANHOLE
- PIPE OUTLET STRUCTURE
- CONCRETE LINED GUTTER: SLOPE 1:150 - NEXT TO ROAD and ON EDGE OF TERRACE
- GUTTER WITH GRATING
- WATER RETICULATION PIPES 450 PVC CLASS 18
- IL INVERT LEVEL
- D=600 DEPTH BELOW TERRACE OR NGL = 600mm
- HP HIGHEST POINT

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

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APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

Wildebees 400/132kV Infeed Station

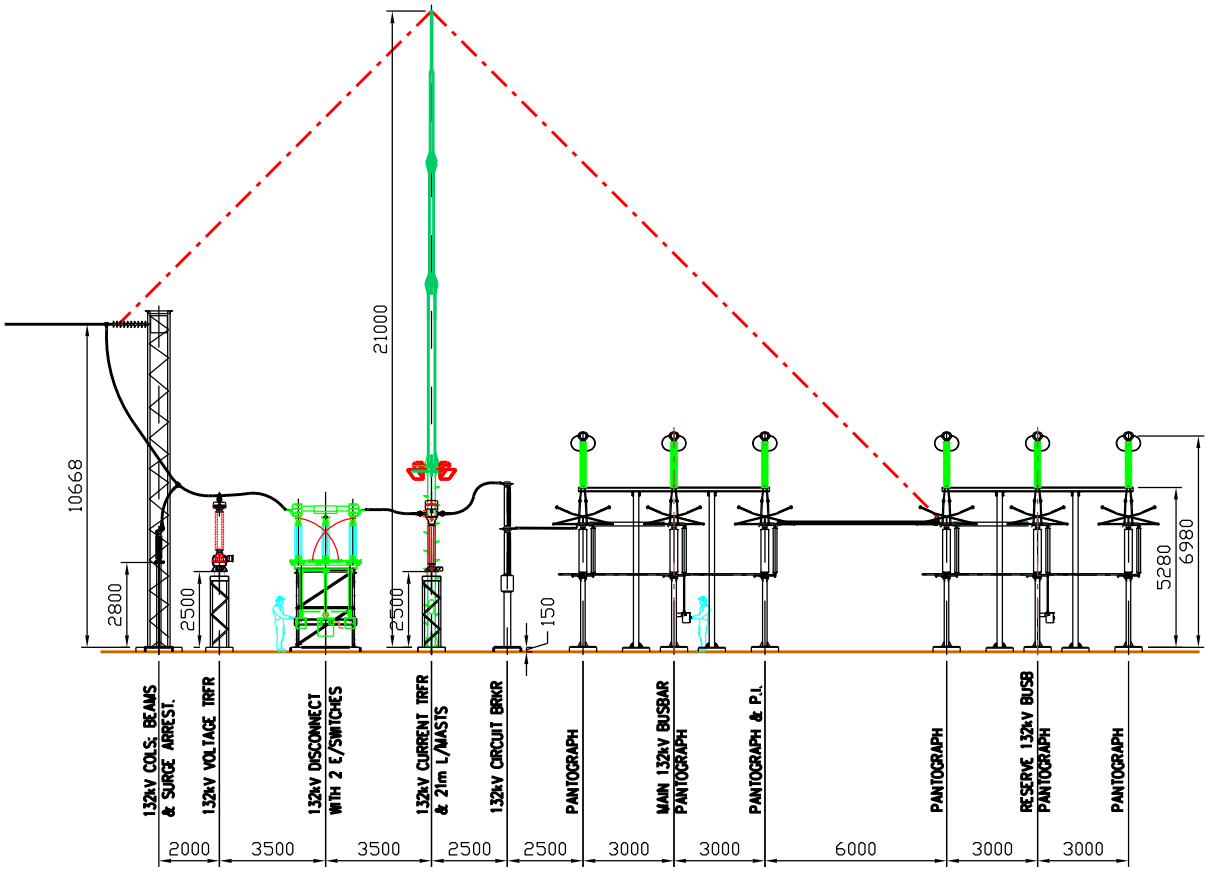
Layout subsoil drainage

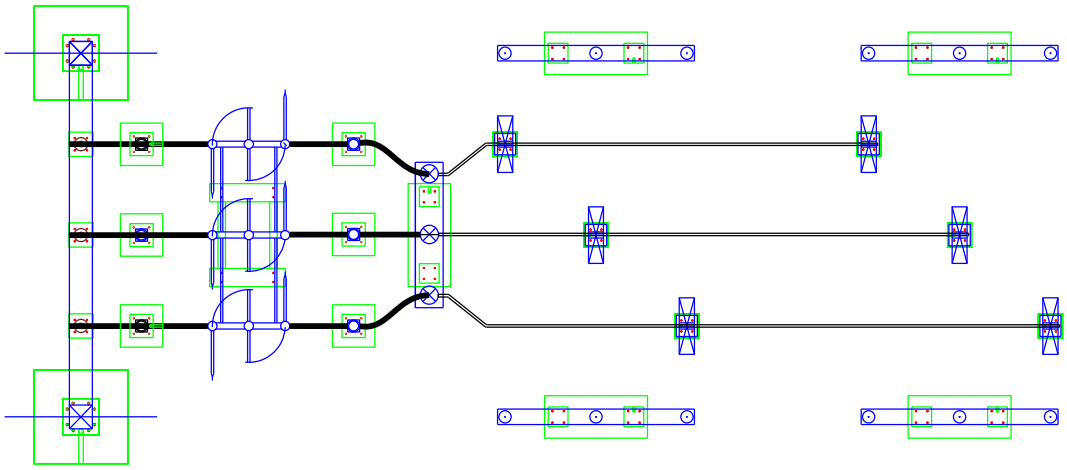
CONTRACTOR DRAWING NO:

CoT DRAWING NO: WI02-02

Design: J.A. Gous
Drawn: J.A. Gous
Checked: J. Rustoff
Drawn Date: 2022-12-06
Sheet:

SECTIONAL VIEW SHOWING TYPICAL OPERATING MECHANISM HEIGHTS OF THE CB & STAGGERED ISOLATORS





DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical 132kV Feeder(line) bay

Side view

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI2A-01

Design: Koos Jooste

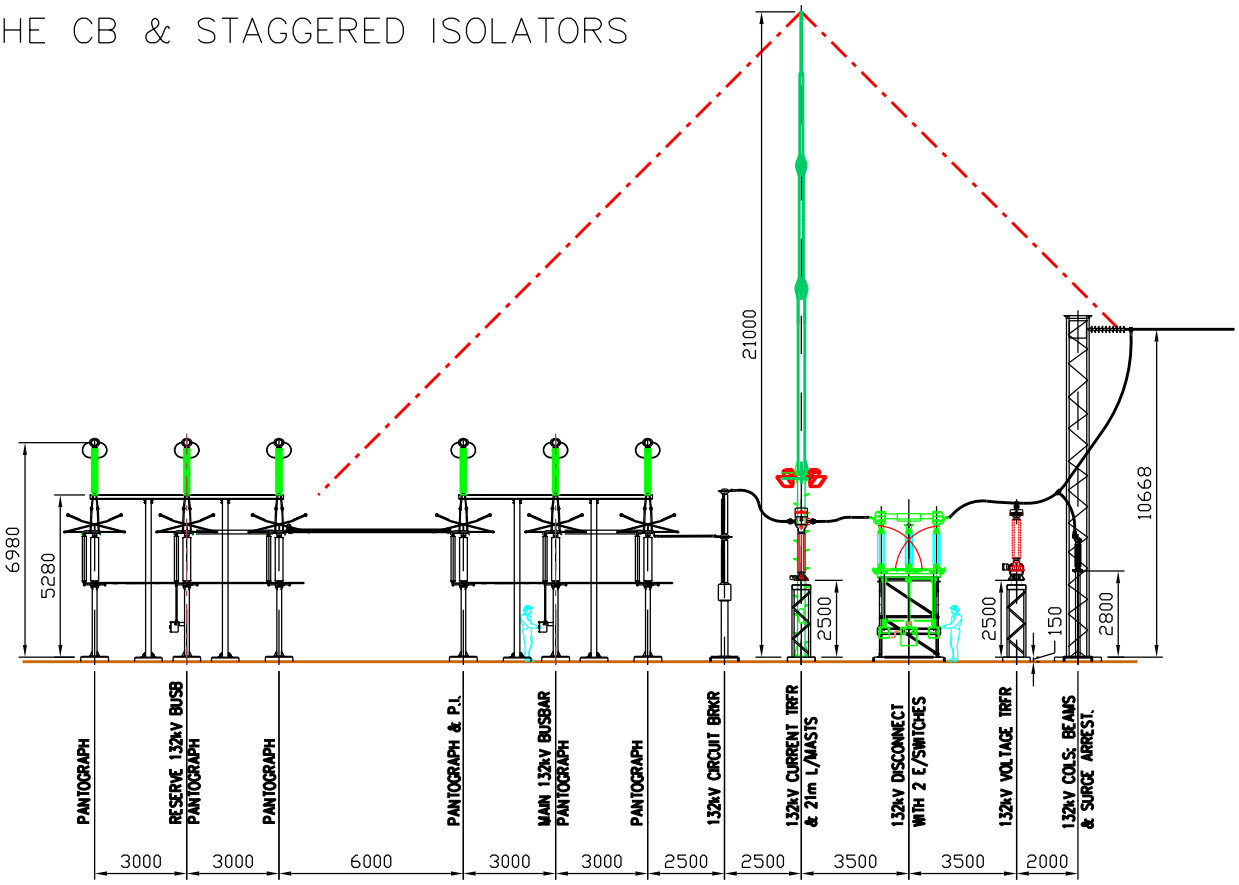
Drawn: Jarrah Gous

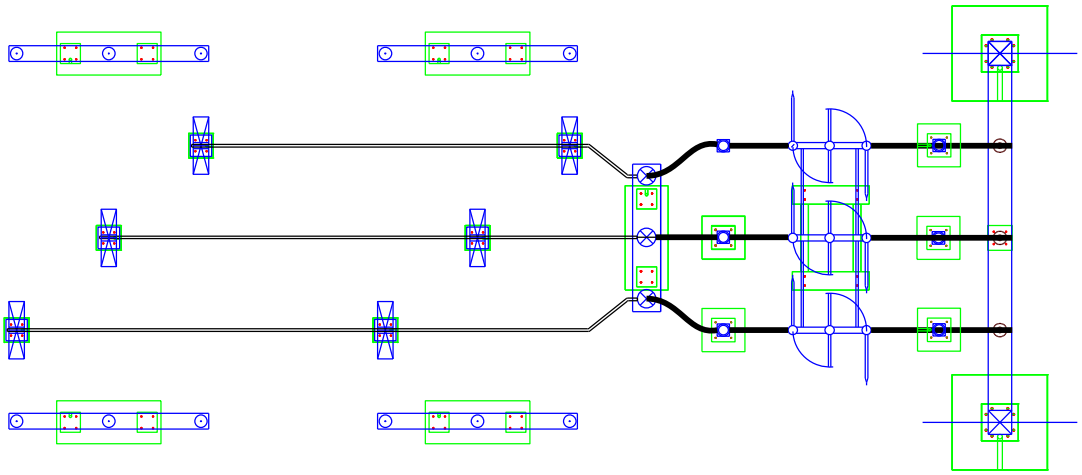
Checked: Jones Rustoff

Date: 25-06-2021

Sheet: ____

SECTIONAL VIEW SHOWING TYPICAL OPERATING MECHANISM HEIGHTS OF THE CB & STAGGERED ISOLATORS





DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
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5					

ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical 132kV Transformer bay

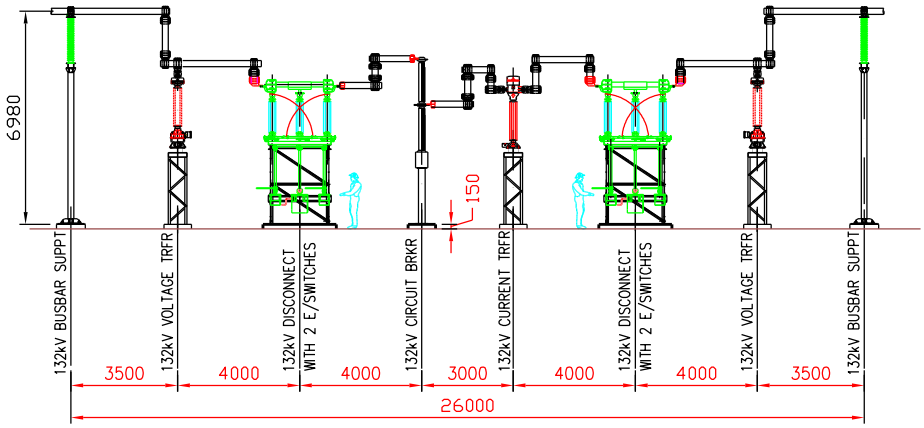
Side view

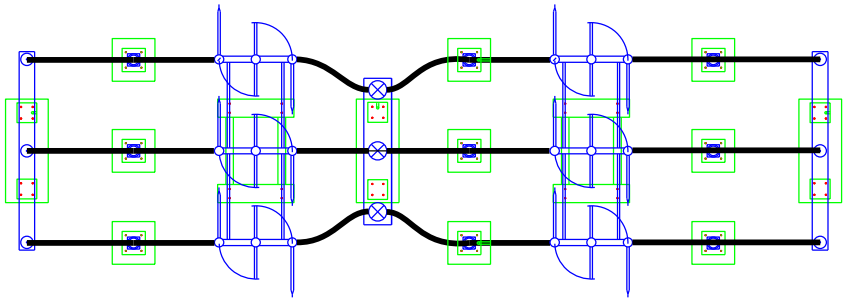
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI2A-02

Design:	Koos Jooste
Drawn:	Jannie Gous
Checked:	Jones Rustoff
Date:	25-06-2021
Sheet:	____

SECTIONAL VIEW SHOWING TYPICAL OPERATING MECHANISM HEIGHTS OF THE CB & STAGGERED ISOLATORS





DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical 132kV Bus section bay

Side view

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI2A-03

Design:
Koos Jooste

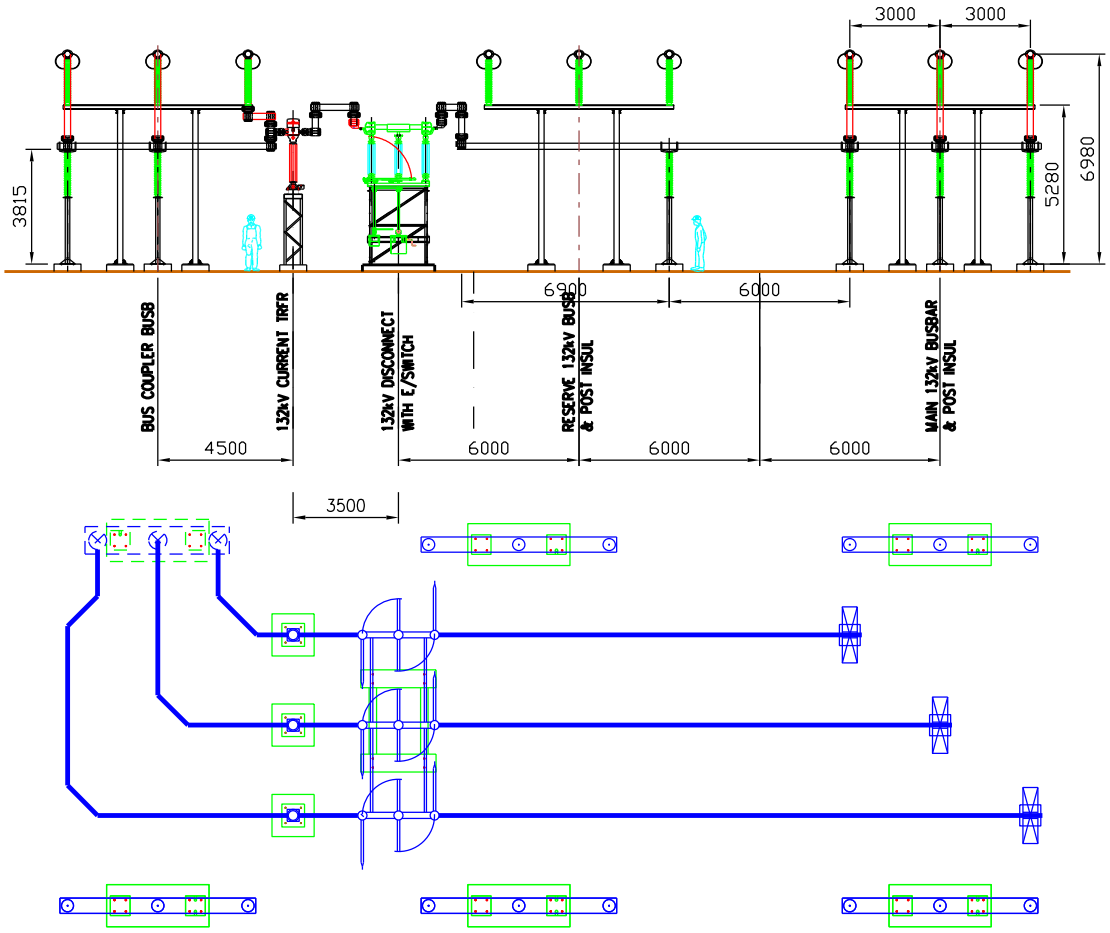
Drawn:
Jannie Gous

Checked:
Jones Rustoff

Date:
25-06-2021

Sheet: ____

SECTIONAL VIEW SHOWING TYPICAL OPERATING MECHANISM HEIGHTS OF THE CB & STAGGERED ISOLATORS



(LOOKING WEST)

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
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PO BOX 423
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TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Wildebees 400/132kV
Infeed station

Typical 132kV Bus coupler bay

Side view

Design: Koos Jooste
Drawn: Jannie Gous
Checked: Jones Rustoff

Date:

CONTRACTOR DRAWING NO:

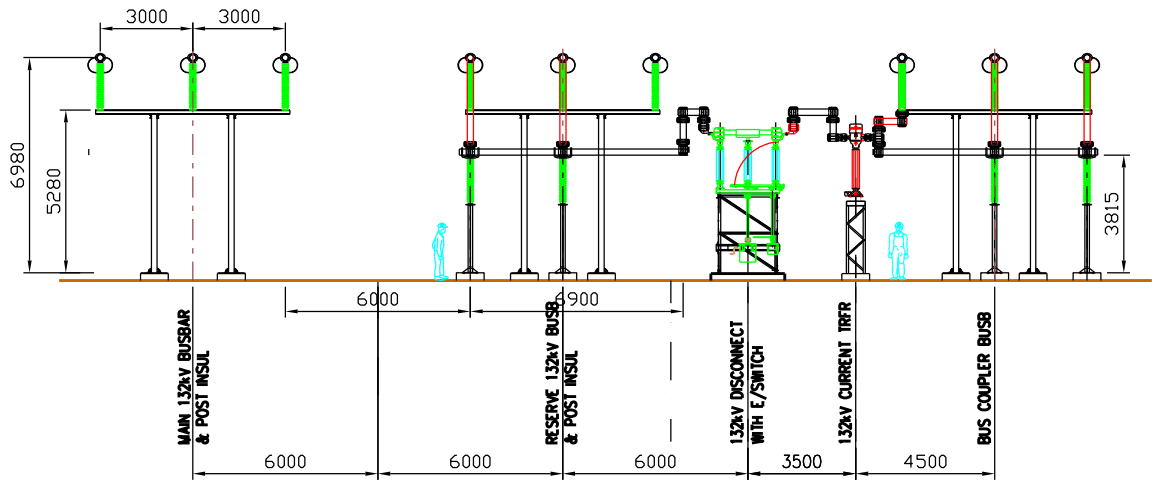
CoT DRAWING NO: WI2A-04A

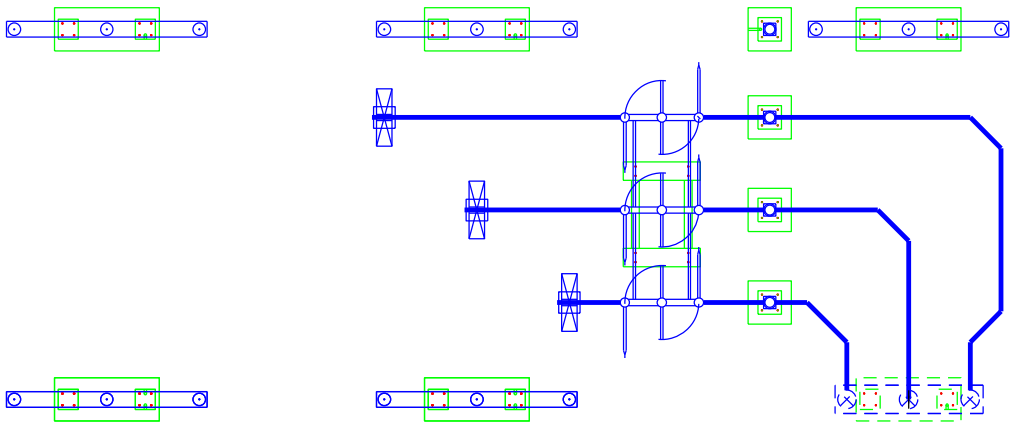
Date: 25-06-2021

SCALE: N.T.S.

Sheet: ____

SECTIONAL VIEW SHOWING TYPICAL OPERATING MECHANISM HEIGHTS OF THE CB & STAGGERED ISOLATORS





(LOOKING EAST)

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
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TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

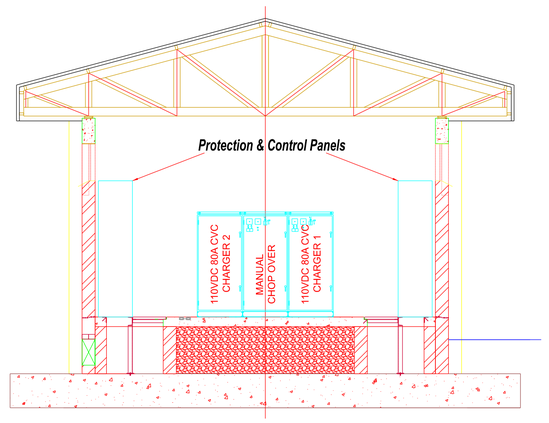
Typical 132kV Bus coupler bay

Side view

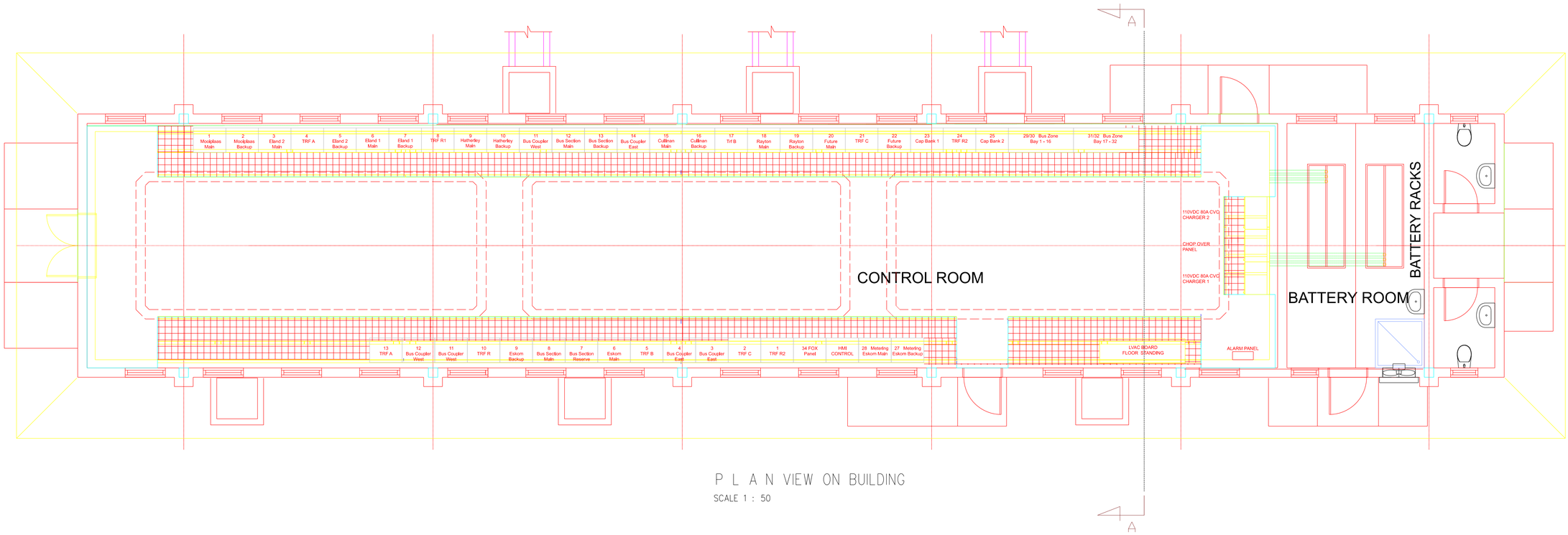
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI2A-04B

Design: Kros Jocete
Drawn: Jannie Gous
Checked: Jones Rustoff
Date: 25-06-2021
Sheet: ____



TYPICAL SECTION THROUGH ARROWS "A-A"



P L A N VIEW ON BUILDING

SCALE 1 : 50

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Control and protection building

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI03-01

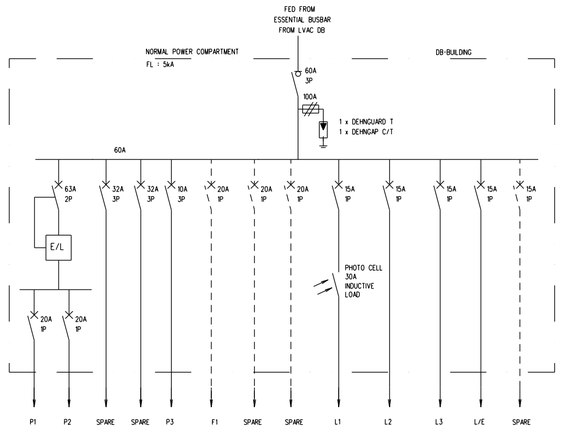
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

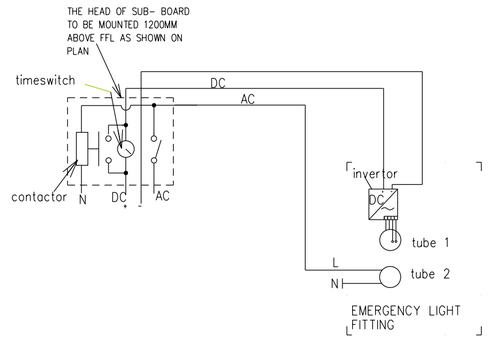
Date: 25-06-2021

Sheet: ____



2 X 4 (W)	2 X 4 (W)	4 x 6 (W)	4 x 6 (W)	4 x 6 (W)	4 x 6 (W)	4 x 6 (W)	2 X 4 (W)			2 x 2.5 (W)	2 x 2.5 (W)	2 x 2.5 (W)		CONDUCTOR (W) CABLE (C) SIZE (mm)
2.5	2.5	4	4	4	4	4	2.5			2.5	2.5	2.5		EARTH WIRE SIZE (mm)
20	20	20	20	20	20	20	20			20	20	20		CONDUIT SIZE (mm)

NOTE:
THIS LV BOARD AND THE COMPLETE LV INSTALLATION SHALL ONLY BE DEEMED COMMISSIONED ONCE A VALID CERTIFICATE OF COMPLIANCE IS RECEIVED BY THE ENGINEER FOR THE COMPLETE INSTALLATION THEREOF



LEGEND

- DISTRIBUTION BOARD - BUILDING
- 32A 5 PIN WELDING SOCKET OUTLET.
- 20A 3 PIN SWITCH SOCKET OUTLET (300 AFFL.)
- 20A 3 POLE ISOLATOR MOUNTED 3000mm ABOVE F.F.L FOR AIRCON UNIT.
- 20A 2 POLE ISOLATOR MOUNTED 3000mm ABOVE F.F.L FOR FAN UNIT.
- OPEN CHANNEL 2 x 58W FLOURESCENT LUMINARE
- OPEN CHANNEL 2 x 58W FLOURESCENT LUMINARE EMERGENCY TYPE
- CLASS 1, DIV 1, 1 x 58W PROTECTED FLUORESCENT LUMINARE
- WALL MOUNTED BULKHEAD 2PL9 MOUNTED 2,95m ABOVE F.F.L.
- CEILING MOUNTED BULKHEAD
- EMERGENCY SINGLE LEVER ONE WAY LIGHT SWITCH (1200 AFFL)
- SINGLE LEVER ONE WAY LIGHT SWITCH (1200 AFFL)
- SINGLE LEVER TWO WAY LIGHT SWITCH (1200 AFFL)
- PHOTO CELL

EMERGENCY LIGHTING

Fitting No. E is the emergency fittings :
One tube in the fitting is to have an additional conduit run from the DC side of the distribution board which will include 1 positive, 1 switched positive & one negative wire. Contractor to supply & install a 110 V DC to 220 V AC invertor in the fitting and contactor rated at 10A in the Sub board.

Affected fittings end caps to be painted red to differentiate between fittings. Contractor to supply and fit switch and timer on wall as shown. Wiring to be connected by City of Tshwane to AC/DC board.

INVERTERS TO AFFECTED LIGHT FITTINGS :Inverter to be fixed into fitting and replace the normal ballast. Inverter to be 110V. DC input and 1 X 60W output.

AIR CONDITIONING

2 x Air Conditioners @ 60000 BTU Each
To Be Installed and Fed from LVAC DB

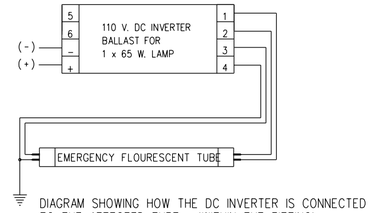
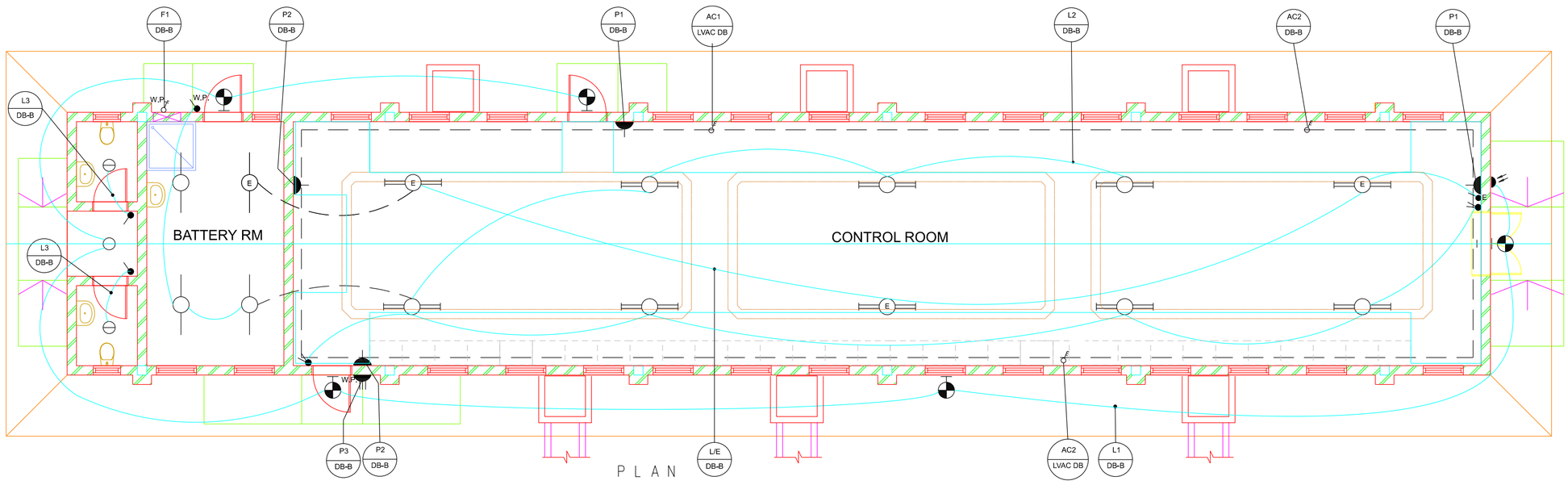


DIAGRAM SHOWING HOW THE DC INVERTER IS CONNECTED TO THE AFFECTED TUBE. (WITHIN THE FITTING).



PLAN

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Protection and Control building

Small power

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI03-02

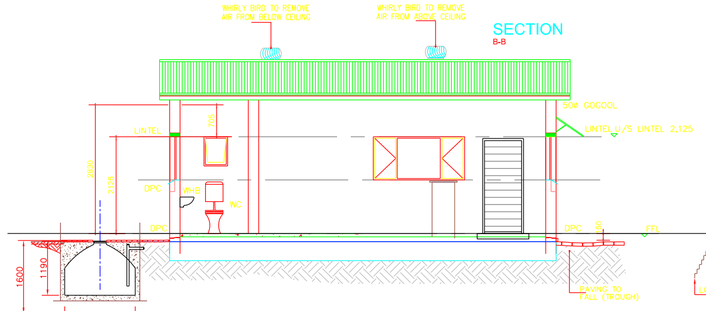
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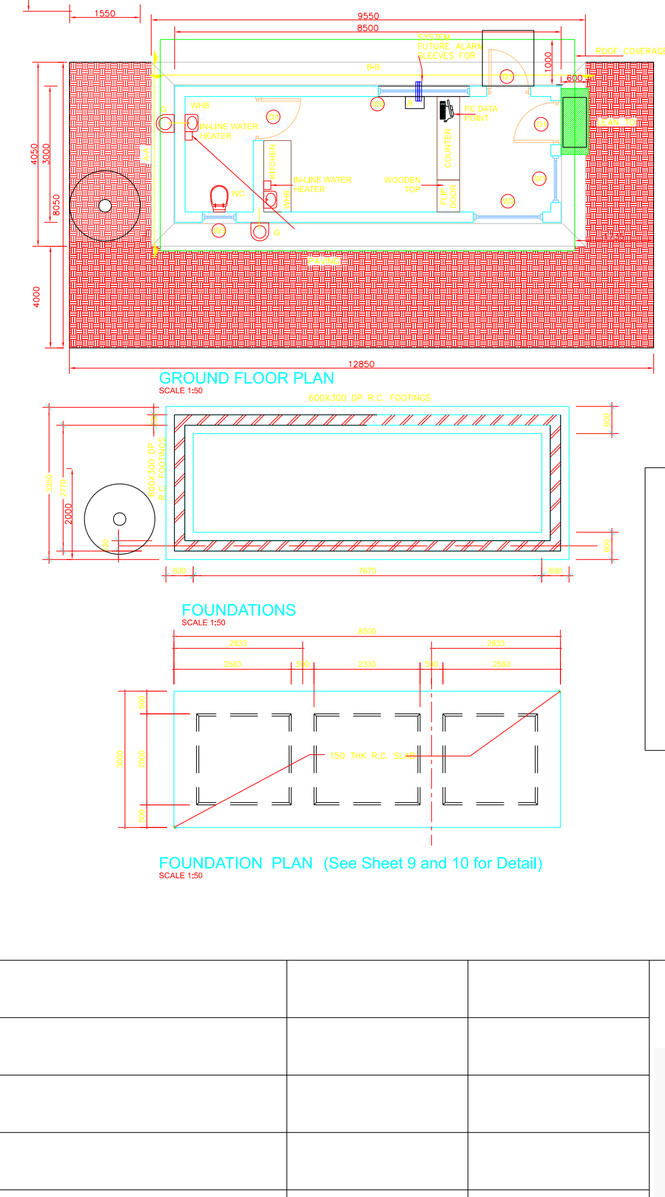
Drawn: Jannie Gous

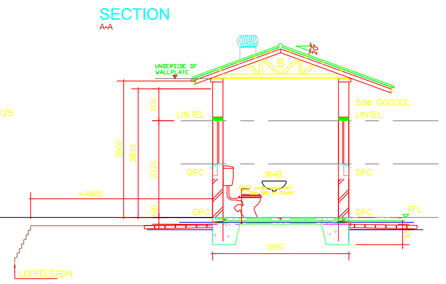
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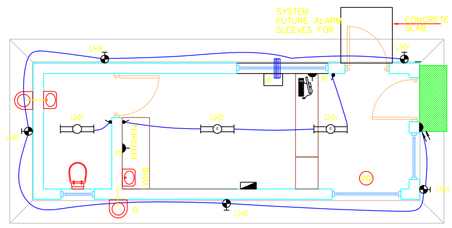
Date: 25-06-2021

Sheet: _____









NOTES

GENERAL

1. All work to be done in accordance with National Building Regulations and Building Standard Act No 103 of 1977,
2. The final levels of excavation to be determined by the contractor on site.
3. Provide brick force on every fourth course, width to suit wall thickness
4. Install DPC to all walls at damp proof level

FLOORS

1. Internal floor to be epoxy coat finished, colours to match control room specifications.
2. Floor slab to a minimum of 150mm thick (30Mpa concrete) placed on a
3. 150mm thick G5 layer compacted to 75% Mod AASHTO
4. Foundations to be 30Mpa concrete

WALLS

1. Outside - Facebrick to match control building.
2. Inside- finished with smooth plaster and steel float finish
3. Prepare walls as specified by paint manufacturer and finish with two
4. coats of white PVA

ROOF STRUCTURE

1. 20 degree pitched roof.
2. Prepare ceilings as specified by paint manufactures and finish with two coats of PVA paint.
3. Roof sheeting to be JRR dilplock. colour to match control room..
4. Gutter and dampers to match control room.
5. Roof insulation to be 130-150mm thick on ceiling .
6. Sisalation under roof zinc

PAVING

1. Paving as shown must be concrete interlocking laid around the building and be braided to fall, minimum 75mm thick apron 15Mpa concrete.

BRICKS

1. Load bearing brickwork to consist of bricks with a minimum crushing strength of 14mpa and mortar to be class ii mortar iiuls to have a minimum crushing strength of 5mpa at 28 days

BUILDING INFORMATION

SIZE 25,5m²

DOORS & WINDOWS

1. Duro Industries steel transformer crash doors (hot dipped galvanized paint doors) to comply with sans 1129, colour to match control room
2. Doors- minimum height 2130mm width 813mm
3. Pre painted metal with 1 coat of red oxide primer and 2 coats of enamel paint, Doors to be installed with tower bolts on the inside and night latch or slide bolt on the outside. All doors to have 50mm sill across the opening to prevent ingress of water.
4. The room must have adequate ventilation at all time.
5. Windows to me 6mm thick safety glass with 30% glazing.

ELECTRICAL

1. Electrical Installation to be flush mounted and must comply with sans 10142. The light switch sockets and socket outlets to be mounted next to the first opening leaf side of door, Minimum lighting level to room to be 100 lux.
2. Recessed 10 way distribution board with earth leakage, 5kA rated circuit breakers and contractor, 20mm steel conduit to:
3. Photo cell controls
4. 1,5m duo fluorescent lights
5. 125W mercury vapour external lights
6. 16AMPS sockets and association switches to SABS approval

SERVICES

1. Sewerage reticulation to be connected to septic tank, site.
2. Potable water supply to the new building to be tapped from existing potable reticulation supply on site.

FITTINGS DETAILS

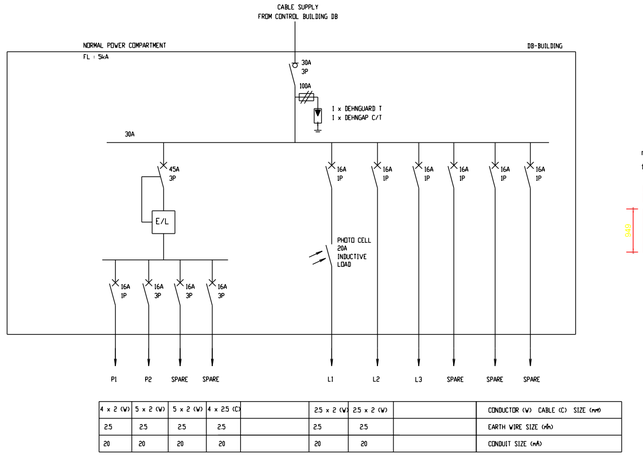
Toilet
Type : E7594
Height : 810mm
Width : 405mm
length : 560mm

Basin
Type : LFS01S
Height : 265mm
Width : 499mm
length : 548mm

Cupboards
Type : Standard Kitchen Cupboards
Height : 850mm
Width : 600mm
length : 1570mm

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES AND MUST BE CONSIDERED AS A BUILD LINE ONLY.
CONSTRUCTION DRAWING TO BE APPROVED BY CITY OF TSHWANE , THIS DRAWING DOES NOT OVERRIDE ANY RELEVANT BUILDING BY-LAWS.

LIGHTING AND SMALL POWER

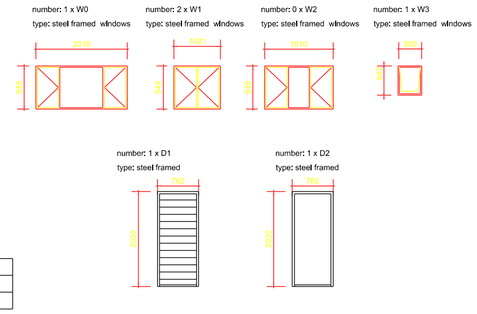


4 x 2 (V)	5 x 2 (V)	5 x 2 (V)	4 x 2.5 (C)		2.5 x 2 (V)	2.5 x 2 (V)		CONDUCTOR (V) CABLE (C) SIZE (mm)	
2.5	2.5	2.5	2.5		2.5	2.5		EARTH WIRE SIZE (mm)	
20	20	20	20		20	20		CONDUIT SIZE (mm)	

LEGEND ELECTRICAL

SYMBOL	QTY	DESCRIPTION
	1	DISTRIBUTION BOARD - BUILDING
	2	20A 3 PIN SWITCH SOCKET OUTLET (300 AFFL.)
	1	OPEN CHANNEL 2 x 58W FLOURESCENT LUMINAIRE
	1	OPEN CHANNEL 2 x 58W FLOURESCENT LUMINAIRE EMERGENCY TYPE (WITH BATTERIES)
	6	WALL MOUNTED BULKHEAD 2PL9
	3	EMERGENCY SINGLE LEVER ONE WAY LIGHT SWITCH (1200 AFFL)
	1	PHOTO CELL

LEGEND WINDOWS AND DOORS



DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
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ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY

Jan Mboyane

for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Security building

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI03-03

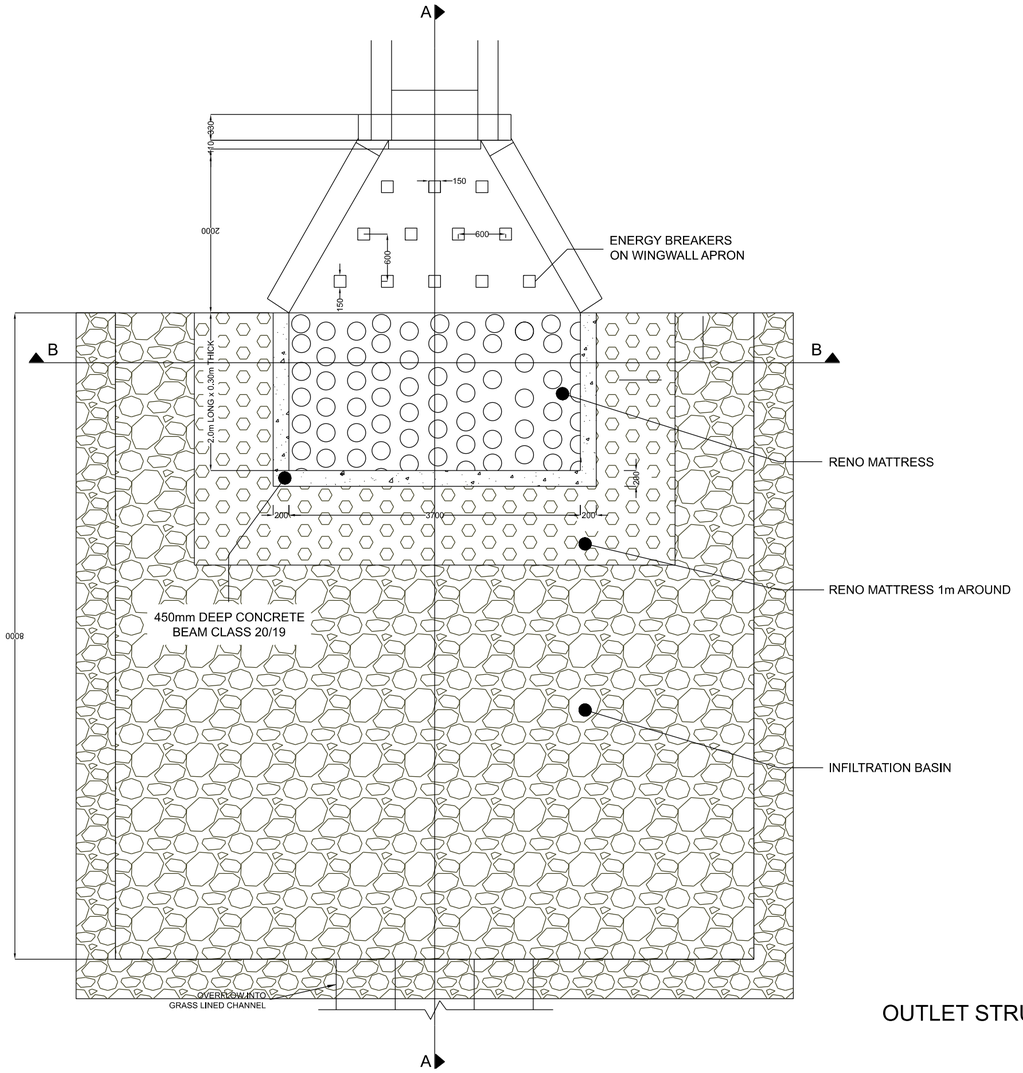
Design: Koos Jooste

Drawn: Jannie Gous

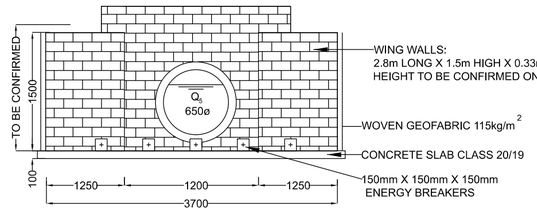
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Date: 25-06-2021

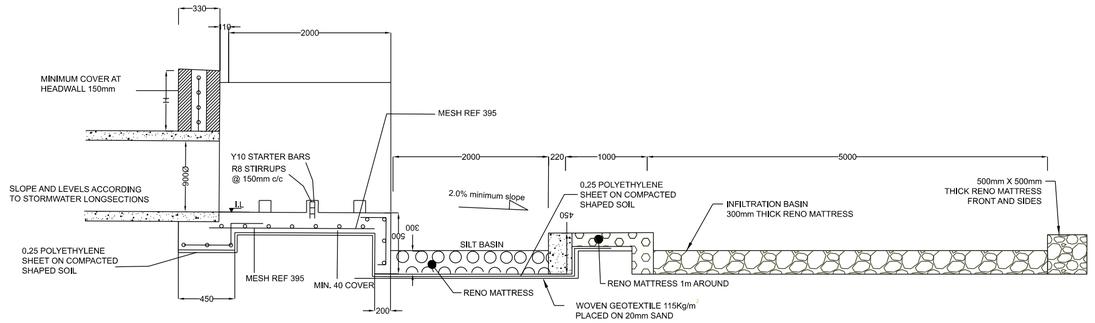
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PLAN VIEW:
OUTLET STRUCTURE



SECTION B-B:
CROSS SECTION OF OUTLET STRUCTURE



SECTION A-A:
CROSS SECTION OF OUTLET STRUCTURE

OUTLET STRUCTURE OUT04 & OUT06: ENERGY BREAKERS AND RENO MATTRESSES ARE INSTALLED TO PREVENT EROSION AND INPROVE WATER QUALITY

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
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5					

ELECTRICITY DEPARTMENT
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PO BOX 423
PRETORIA
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APPROVED BY
Jan Mboyane
for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical Stormwater outlets

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI06-01

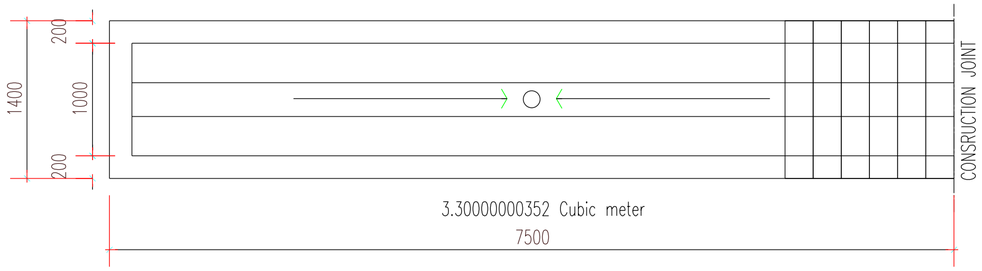
Design: Koos Jooste

Drawn: Jannie Gous

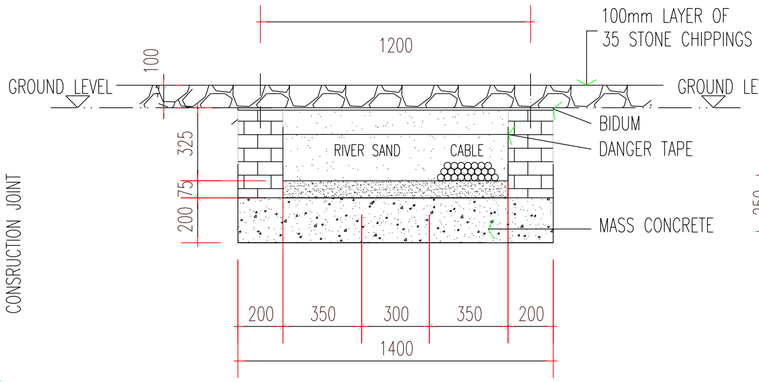
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Date: 25-06-2021

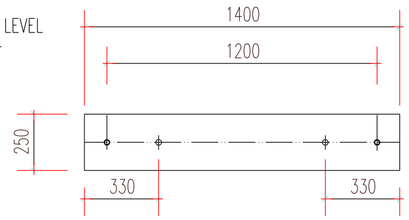
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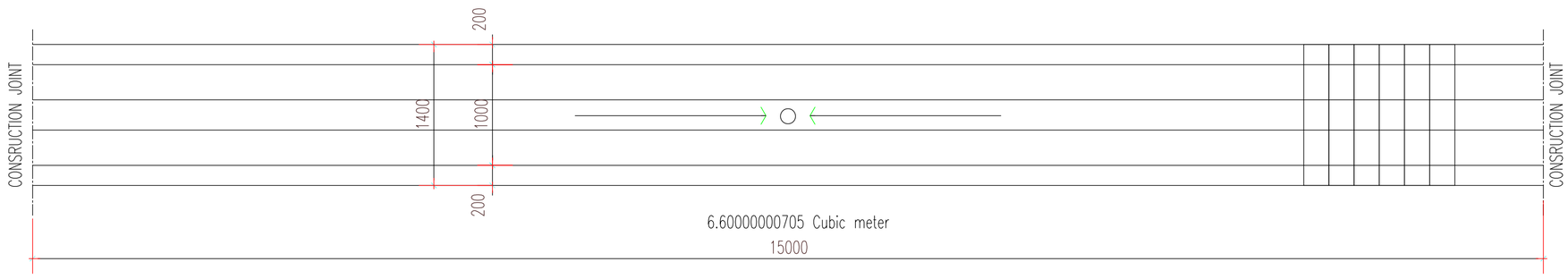
PLAN ON TRENCH 2



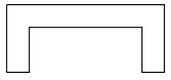
TYPICAL SECTION
1:25

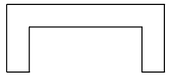


PLAN VIEW OF TRENCH COVER
1200 No OFF
1:25



PLAN ON TRENCH 1





1000 WIDE TRENCH

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
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ELECTRICITY DEPARTMENT
ELECTRICITY

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Cable trench
1m wide

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI07-01

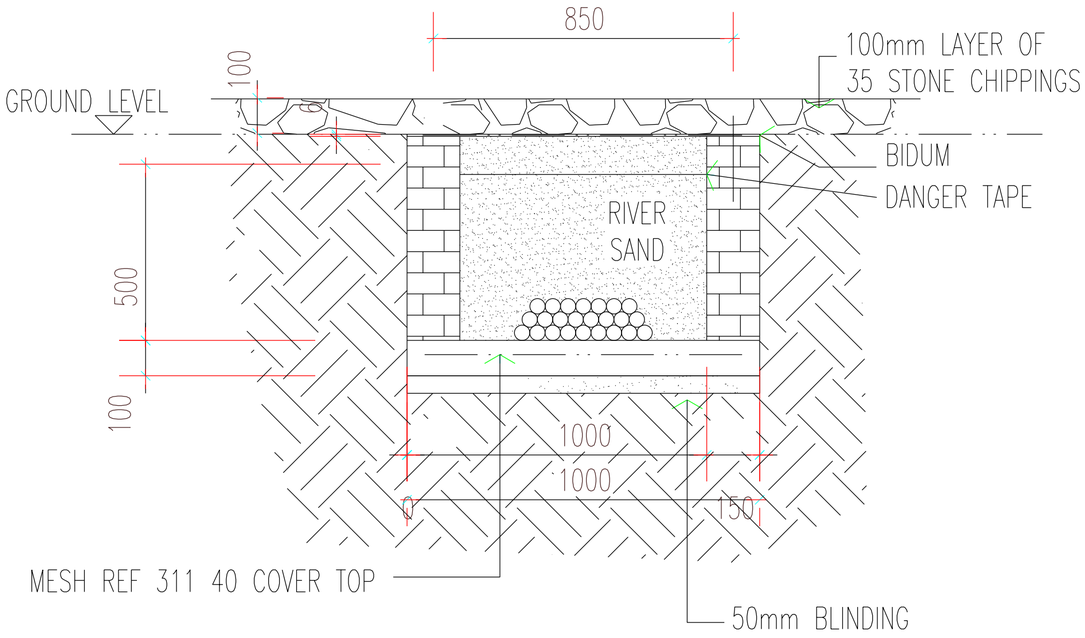
Design: Koos Jooste

Drawn: Jannie Gous

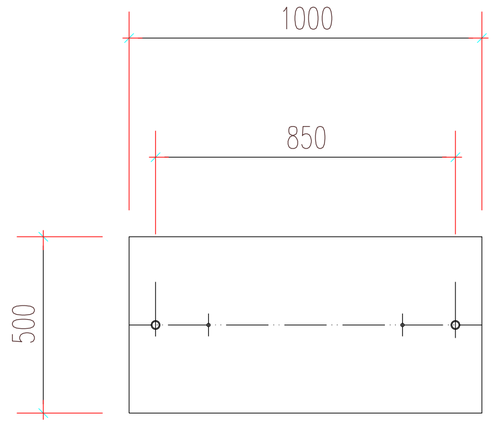
Checked: Jones Rustoff

Date: 25-06-2021

Sheet:



SECTION THROUGH 700mm WIDE TRENCH



COVER DETAIL

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
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ELECTRICITY

PO BOX 423
PRETORIA
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APPROVED BY

Jan Mboyane

for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Cable trench
700mm wide

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI07-02

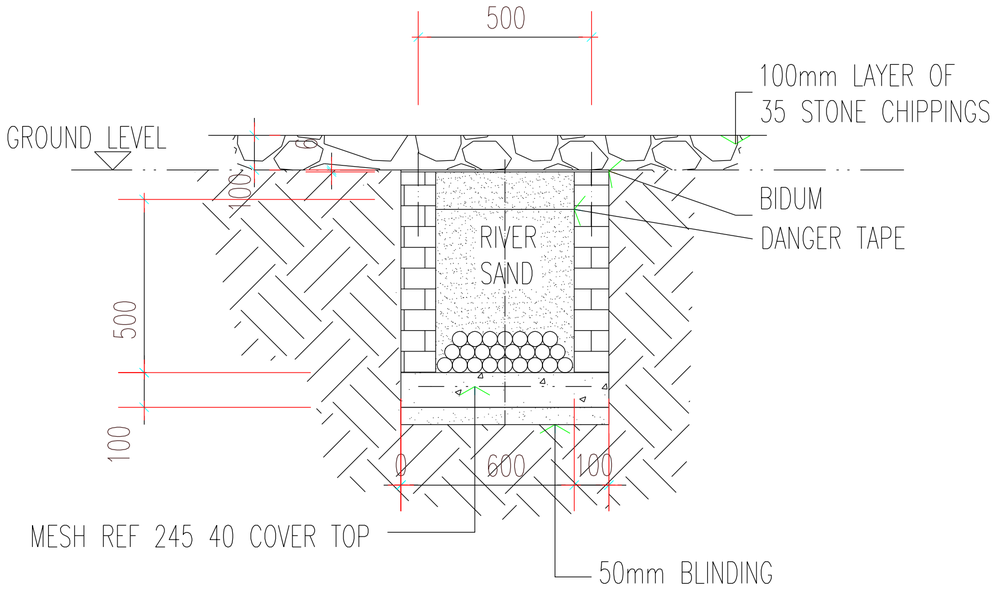
Design: Koos Jooste

Drawn: Jannie Gous

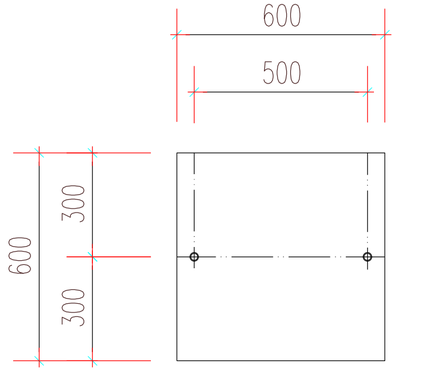
Checked: Jones Rustoff

Date: 25-06-2021

Sheet: _____



SECTION THROUGH 400mm WIDE TRENCH



COVER DETAIL

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
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ELECTRICITY DEPARTMENT
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Jan Mboyane

for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Cable trench
400mm wide

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI07-03

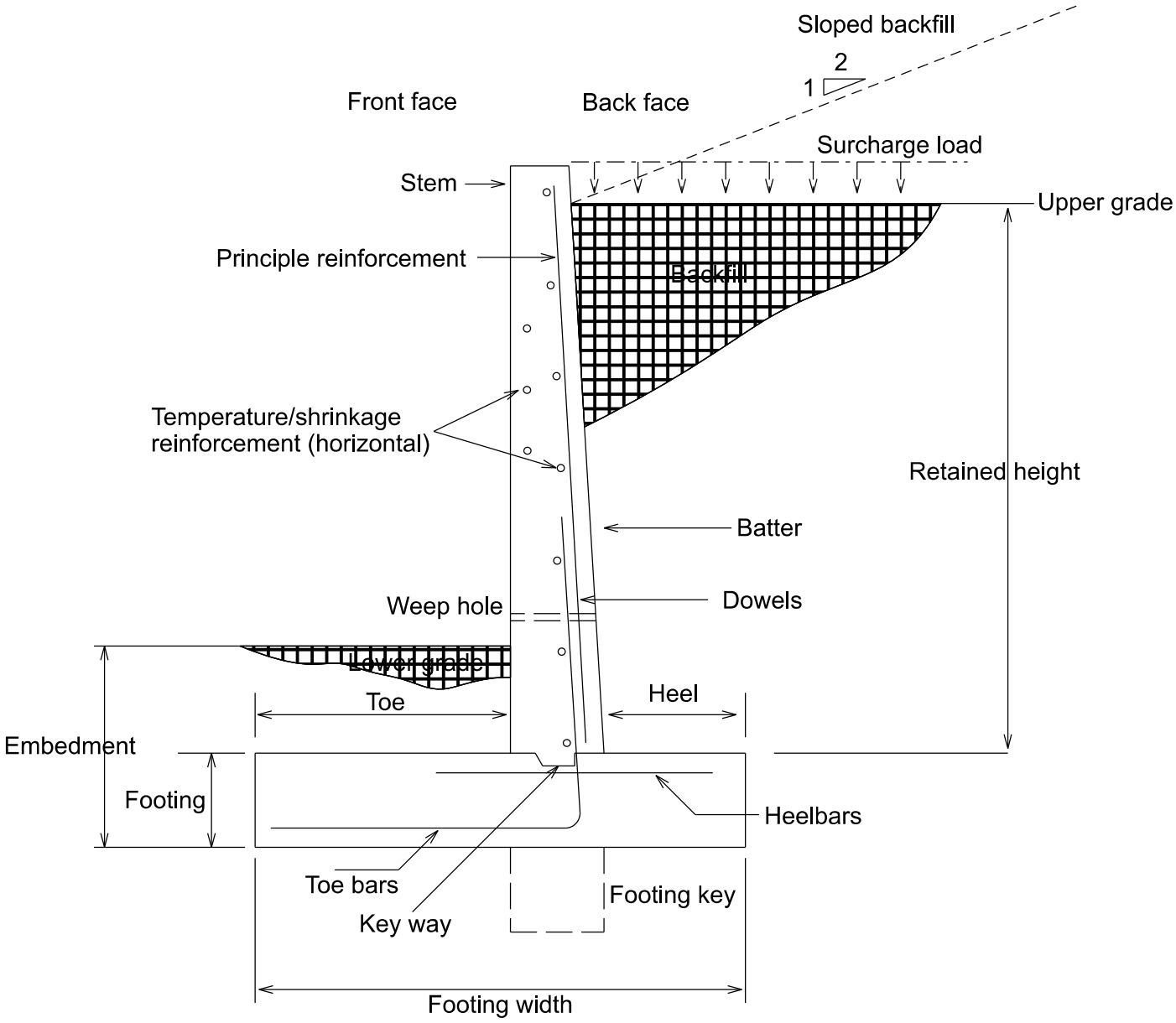
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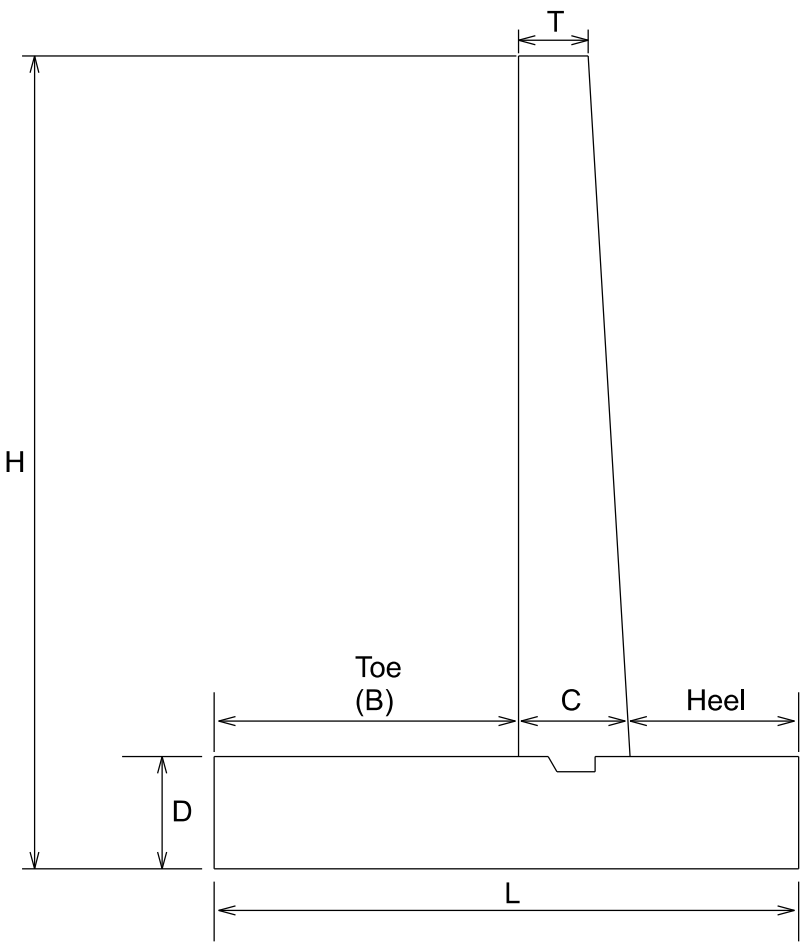
Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: _____





H: Height of retaingn wall
L: Width of the base
D: Thickness of the base
B: Width of the toe
C: Stem thickness at the bottom
T: Stem thickness at the top

Guidelines:
Stem: Top width 200-400mm
Base slab width (L): 0.6-0.75H
Base slab thickness (D): H/10 to H/14
Toe projection (B) 1/3 - 1/4 of base width (L)

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
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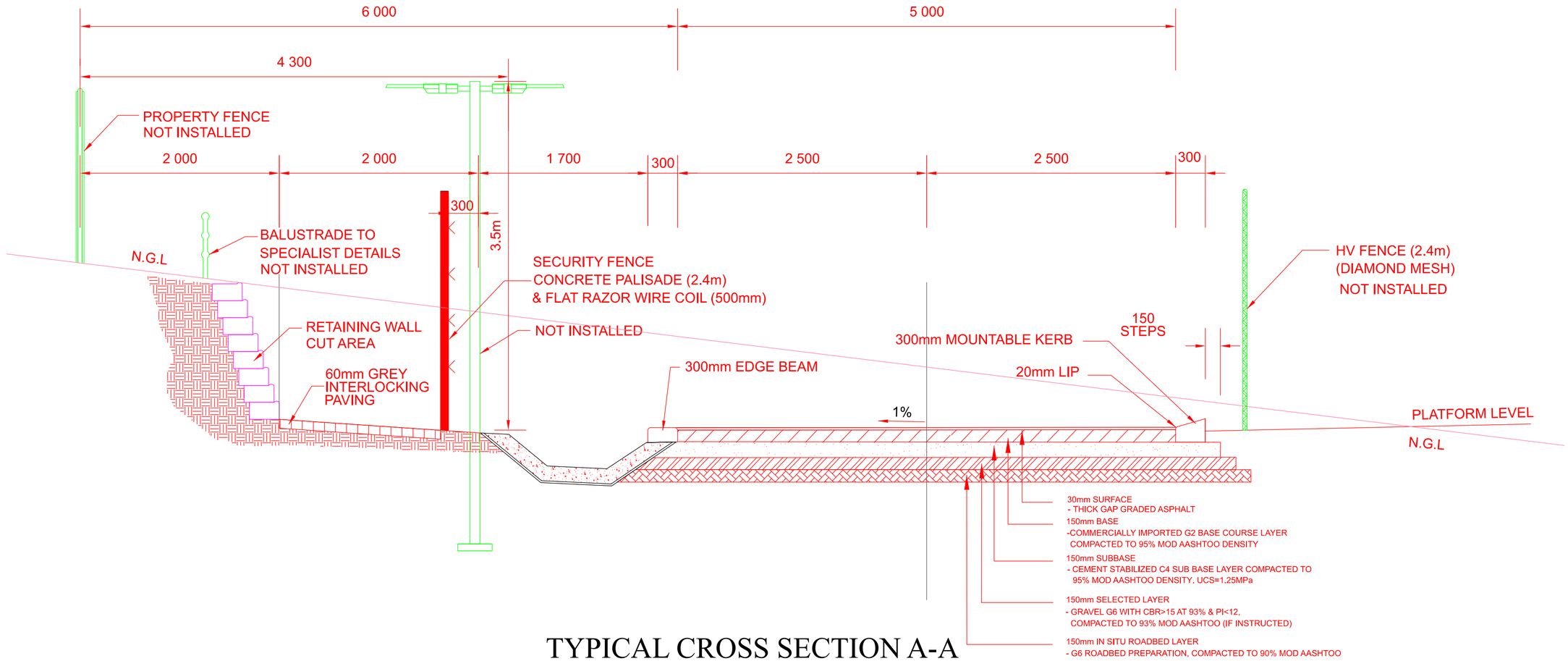
Wildebees 400/132kV
Infeed station

Typical Cantilevered, gravity type retaining wall

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI08-01

Design: Koos Jooste
Drawn: Jannie Gous
Checked: Jones Rustoff
Date: 25-06-2021
Sheet: ____



TYPICAL CROSS SECTION A-A
5,0m ROAD

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
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4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

CITY OF TSHWANE
IGNITING EXCELLENCE

PO BOX 423
PRETORIA
0001

TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY

Jan Mboyane

for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical Cross section of road and V-drain with a cut embankment

CONTRACTOR DRAWING NO:

CoT DRAWING NO:

WI09-01

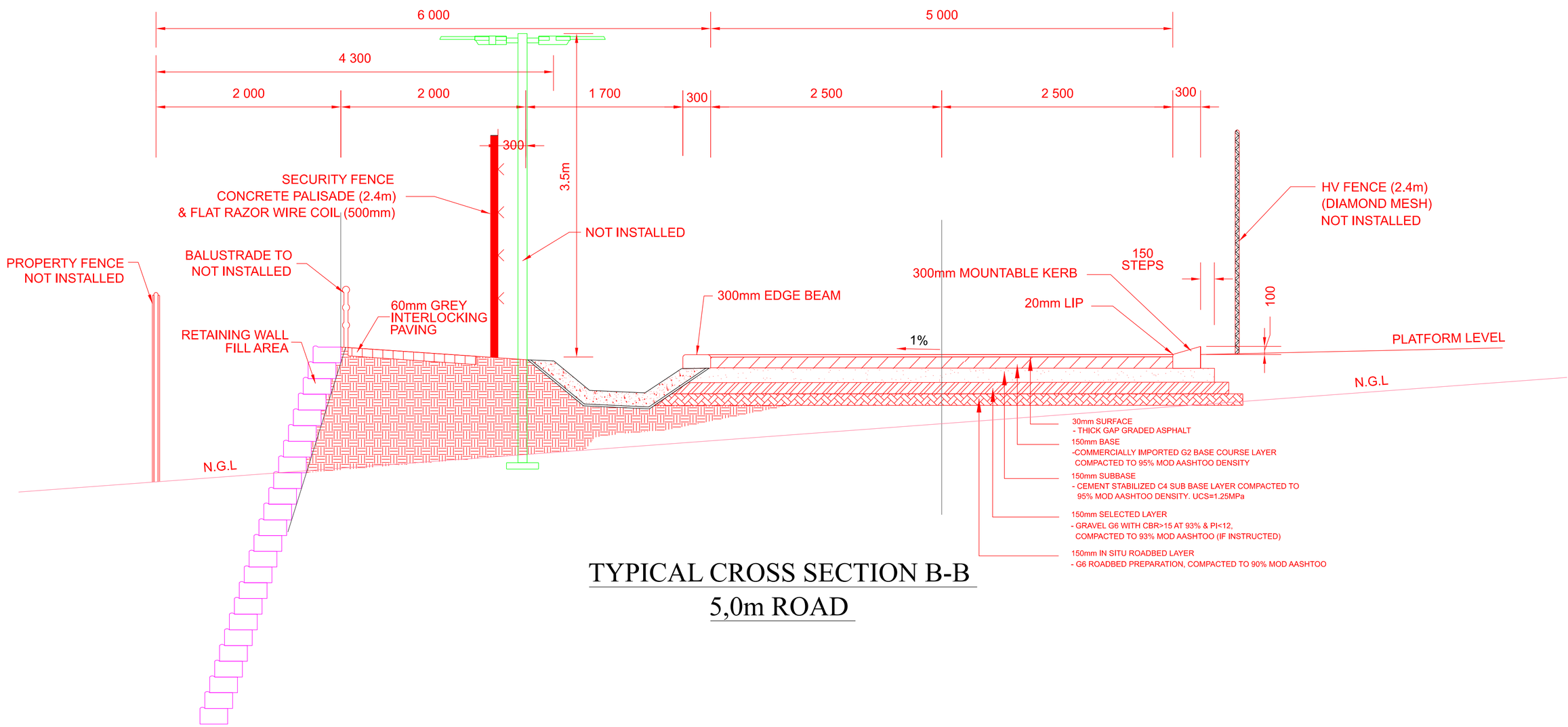
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: ____



TYPICAL CROSS SECTION B-B
5,0m ROAD

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					
5					

ELECTRICITY DEPARTMENT
ELECTRICITY

CITY OF TSHWANE
IGNITING EXCELLENCE

PO BOX 423
PRETORIA
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TEL NO: +27 12 358 4368 FAX NO: +27 12 358 4397

APPROVED BY
Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical Cross section of road and V-drain with a fill embankment

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI09-02

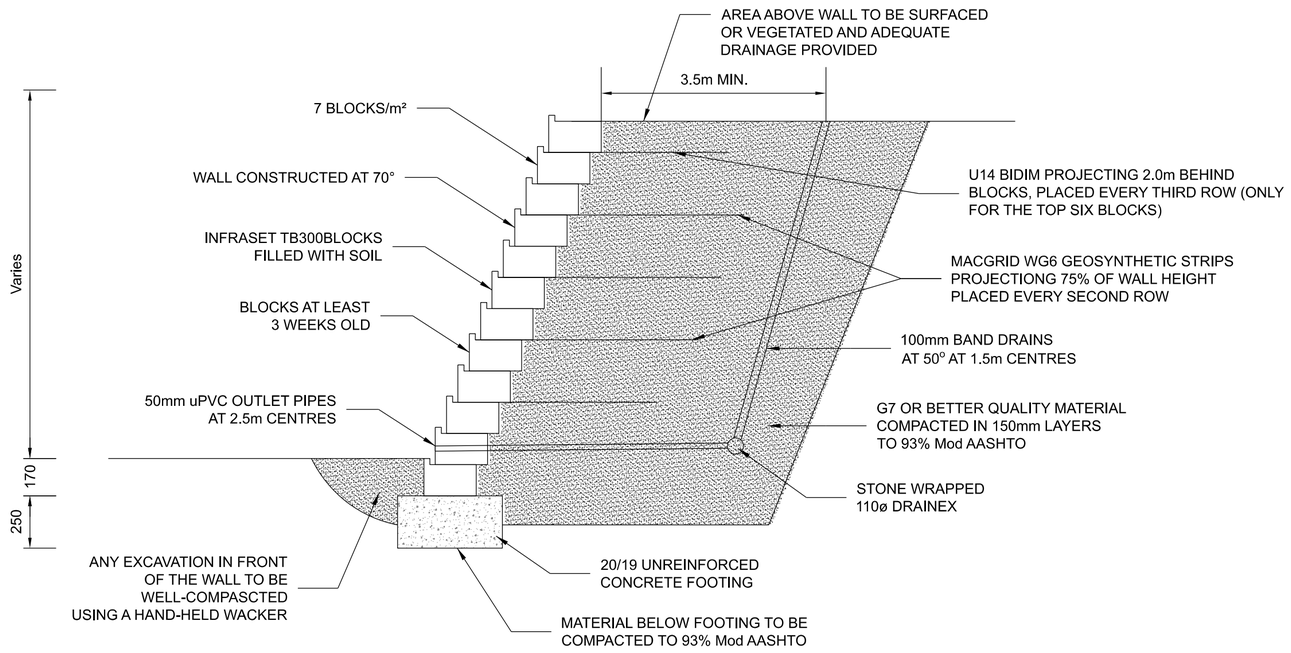
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: ____



LOFFELSTEIN RETAINER

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
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PO BOX 423
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APPROVED BY

Jan Mboyane

for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical Cross section of loffelstein retaining wall.

CONTRACTOR DRAWING NO:

CoT DRAWING NO:

WI09-03

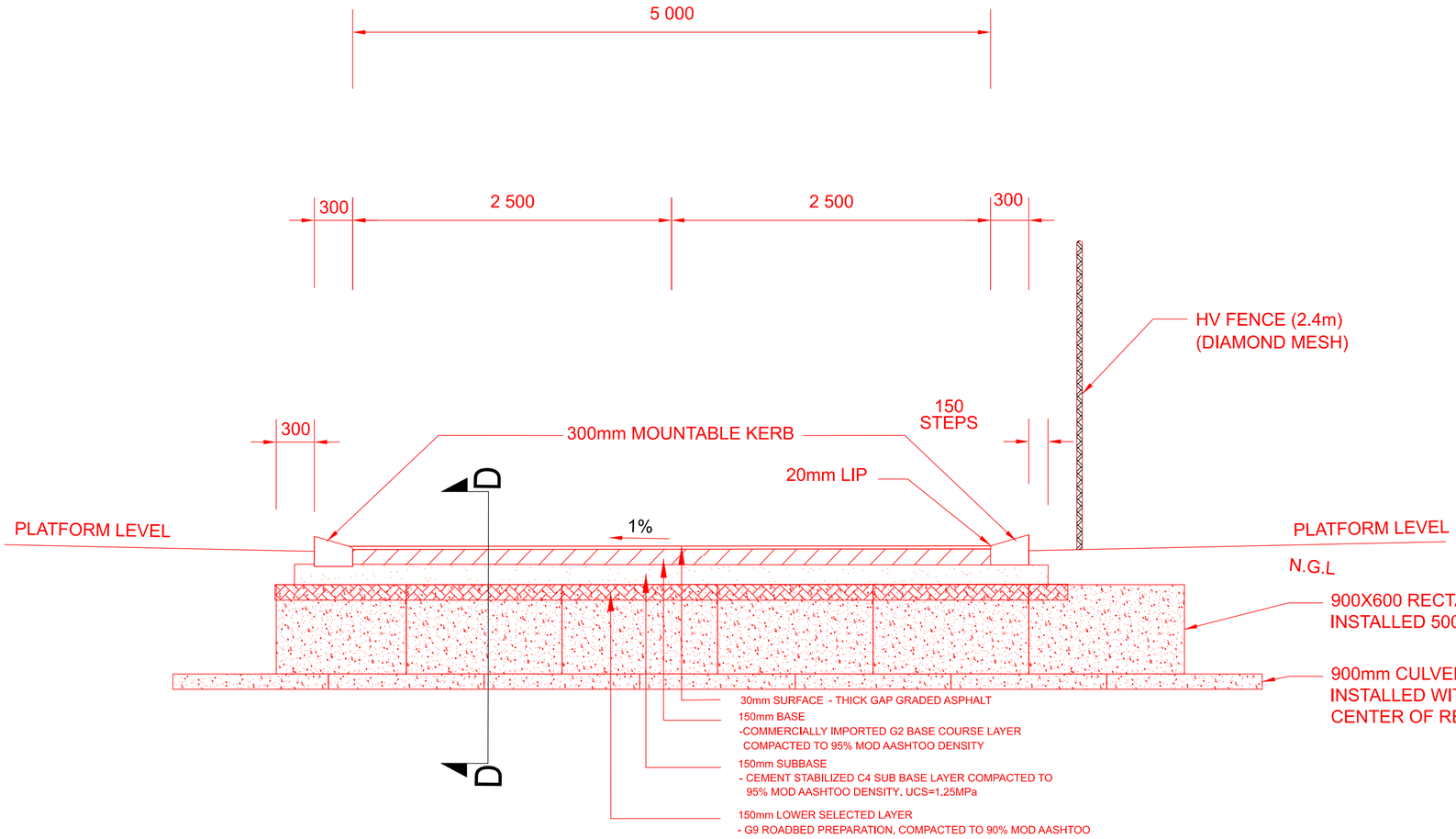
Design: Koos Jooste

Drawn: Jannie Gous

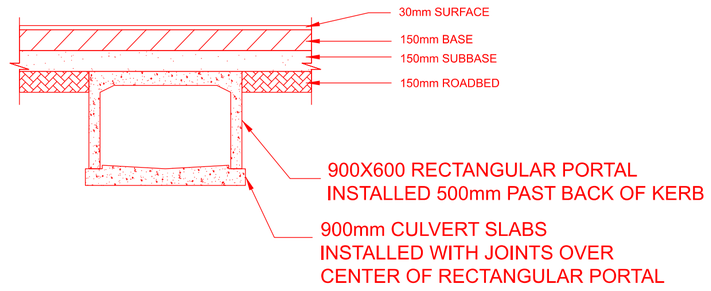
Checked: Jones Rustoff

Date: 25-06-2021

Sheet: ____



LINK ROAD CROSS SECTION C-C
5,0m ROAD



SECTION D-D

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
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4					
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ELECTRICITY

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APPROVED BY
Jan Mboyane
for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical Cross section of link road.

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI09-02

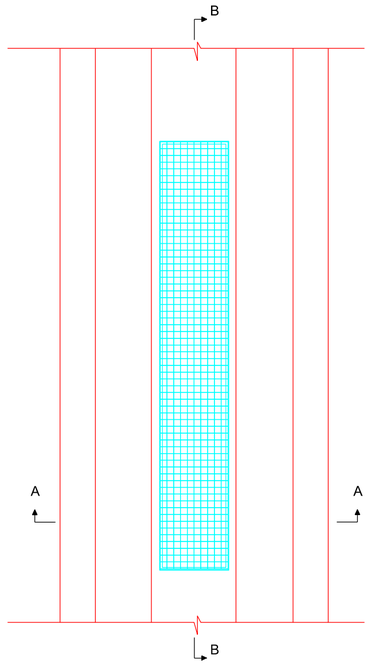
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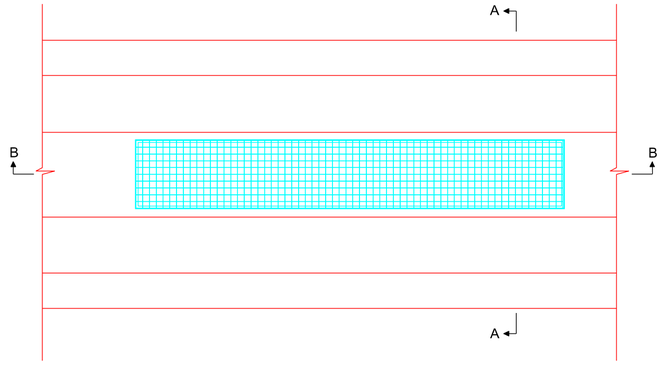
Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: _____





SECTION A-A

SECTION B-B

DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
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APPROVED BY

Jan Mboyane

for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV Infeed station

Typical road cross section with stromwater side drain

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI09-05

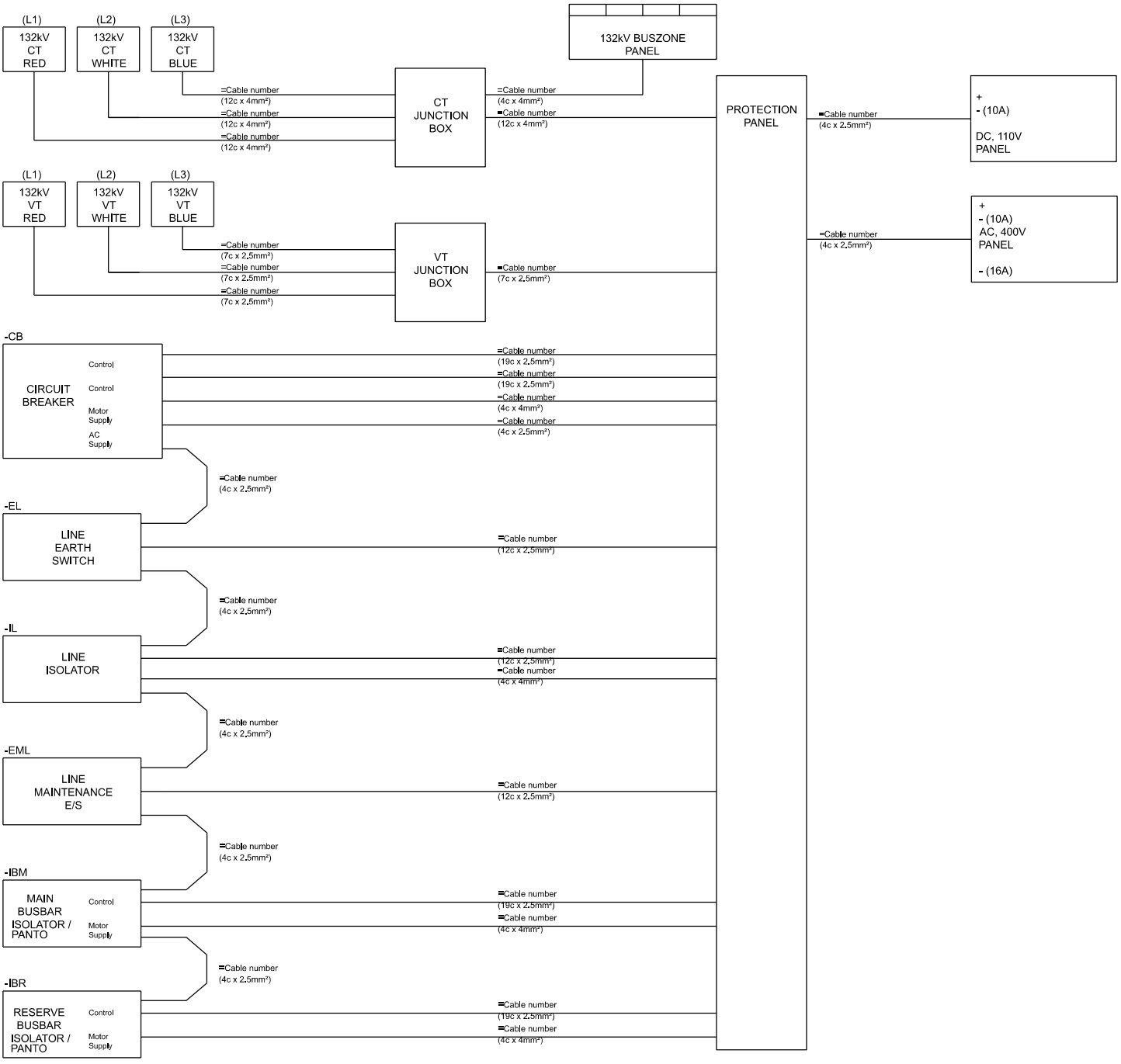
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

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Jan Mboyane
for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical 132kV Feeder bay

Cable block diagram

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI11-01

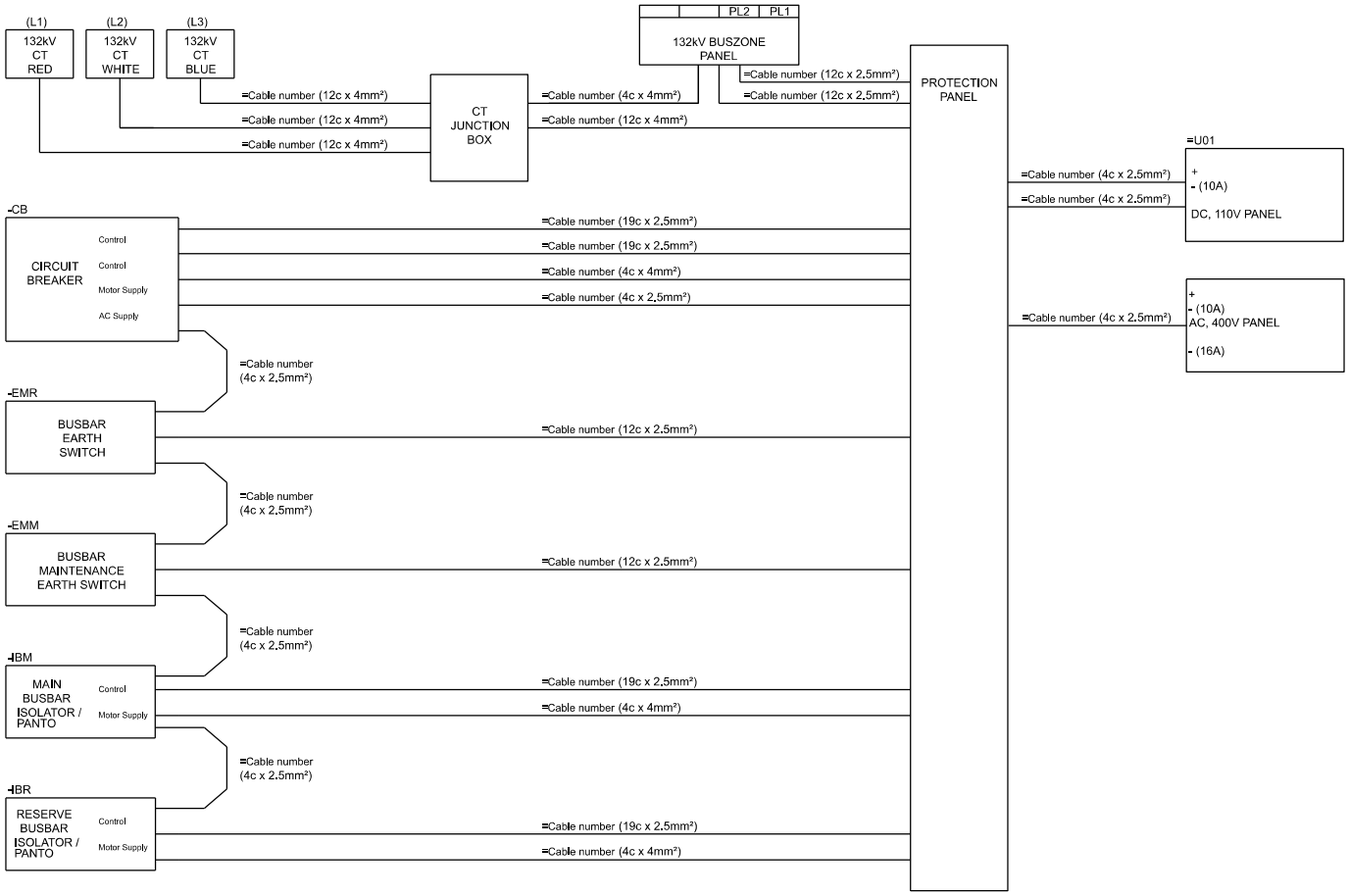
Design: Koos Jooste

Drawn: Janrie Gous

Checked: Jones Rustoff

Date: 25-08-2021

Sheet: ____



DESIGN DRAWING

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for: Electricity Department

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SCALE: N.T.S.

Wildebees 400/132kV Infeed station

Typical 132kV Bus Coupler bay

Cable block diagram

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI11-02

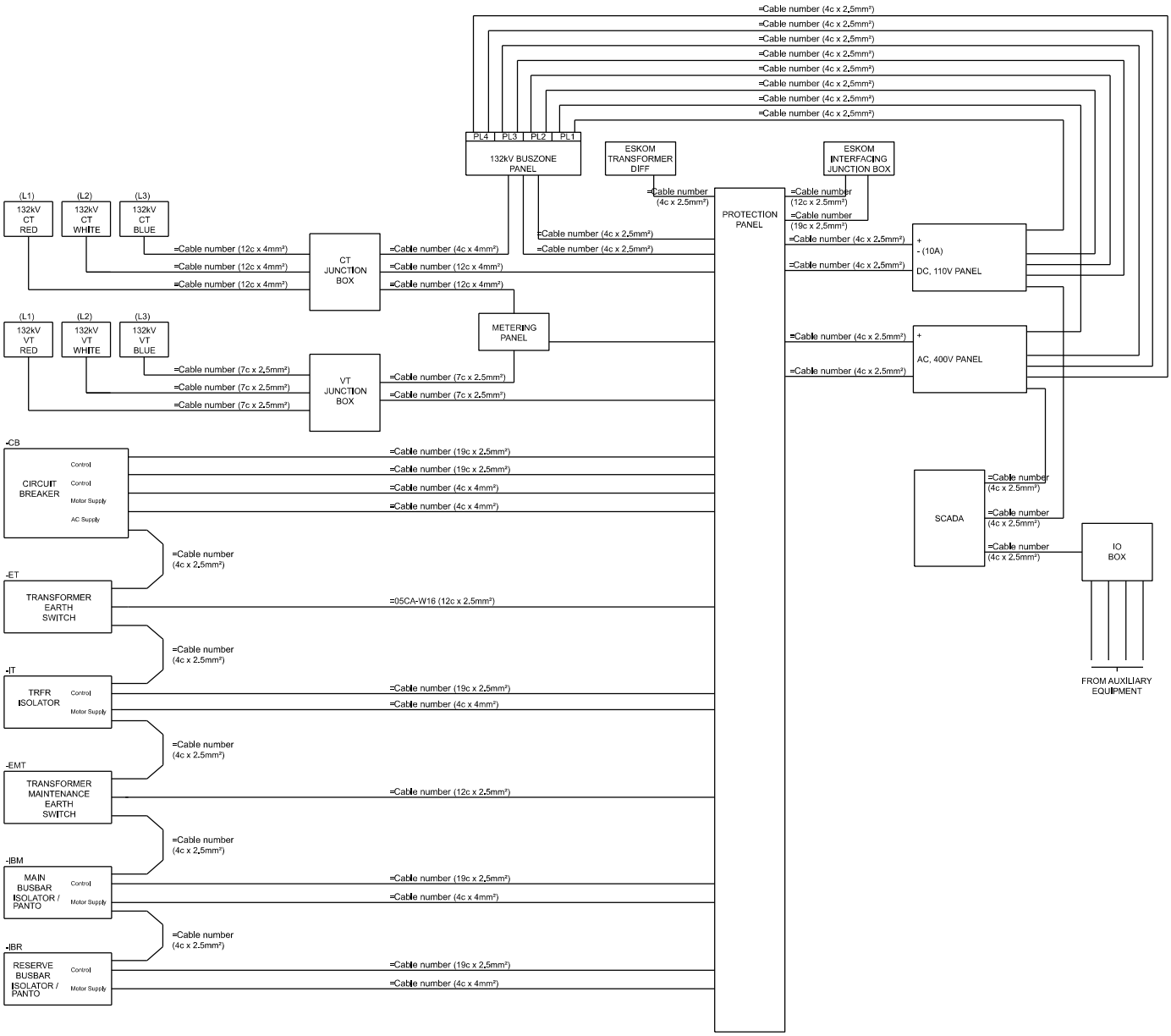
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: ____



DESIGN DRAWING

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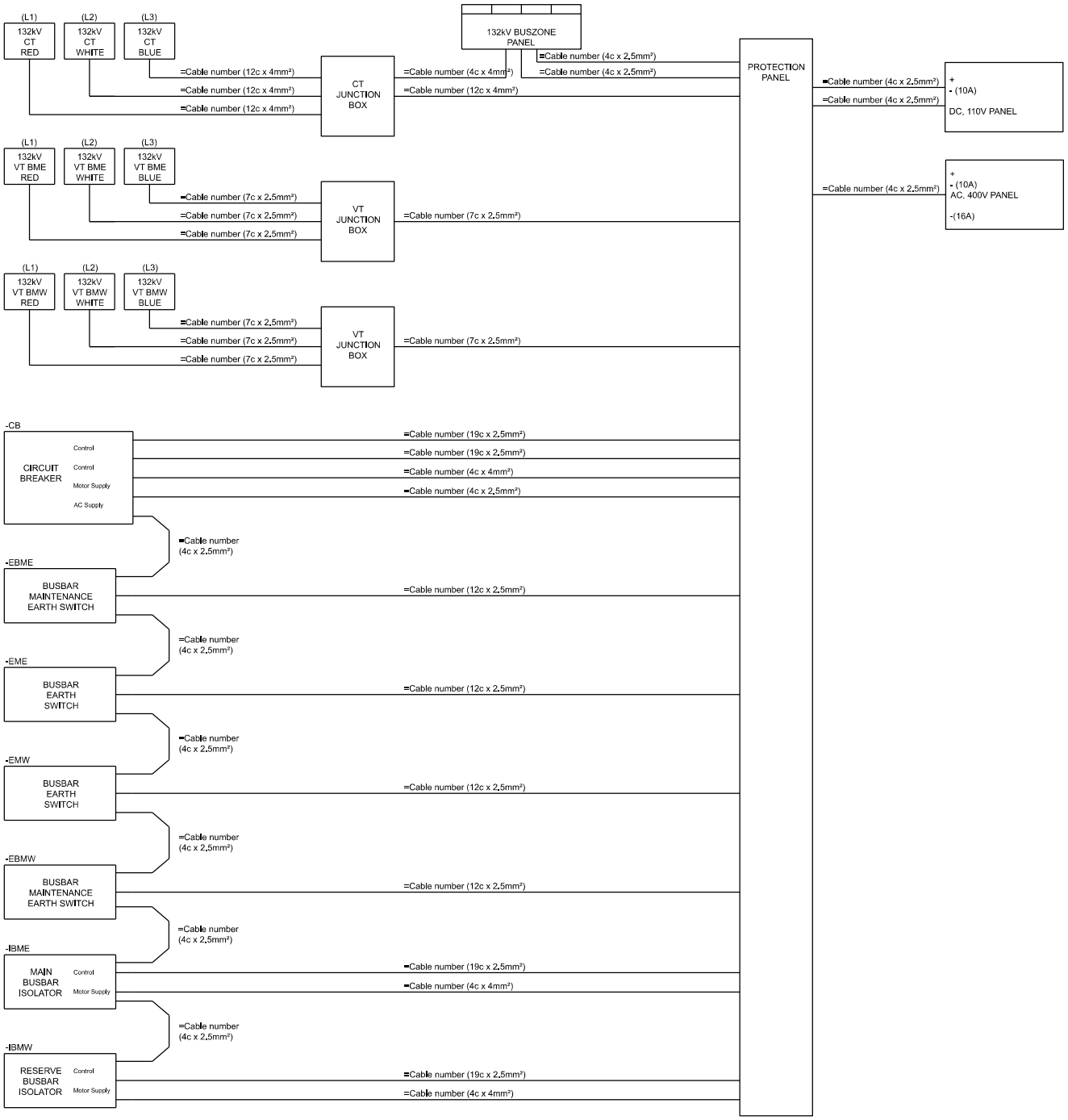
SCALE: N.T.S.

Wildebees 400/132kV Infeed station
Typical 132kV Transformer bay
Cable block diagram

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI11-03

Design: Koos Jooste
Drawn: Jannie Gous
Checked: Jones Rustoff
Date: 25-06-2021
Sheet:



DESIGN DRAWING

No.	Date	Drawn	Amendment	Requested	Checked
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Jan Mboyane
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SCALE: N.T.S.

Wildebees 400/132kV Infeed station

Typical 132kV Bus Section bay

Cable schedule

CONTRACTOR DRAWING NO:

CoT DRAWING NO: WI11-04

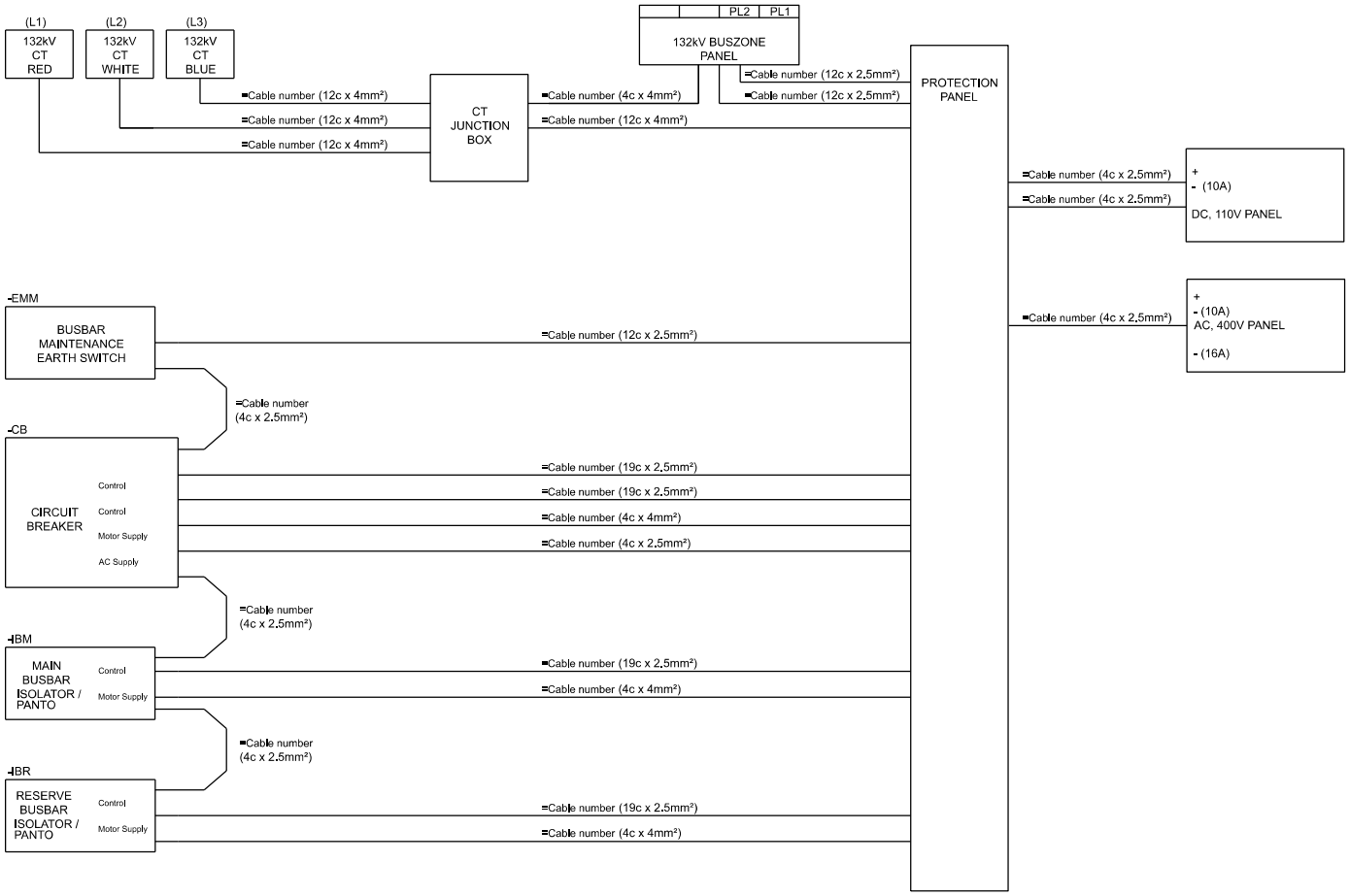
Design: Kobs Jooste

Drawn: Jarrole Gous

Checked: Jones Rustoff

Date: 25-06-2021

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Wildebees 400/132kV Infeed station

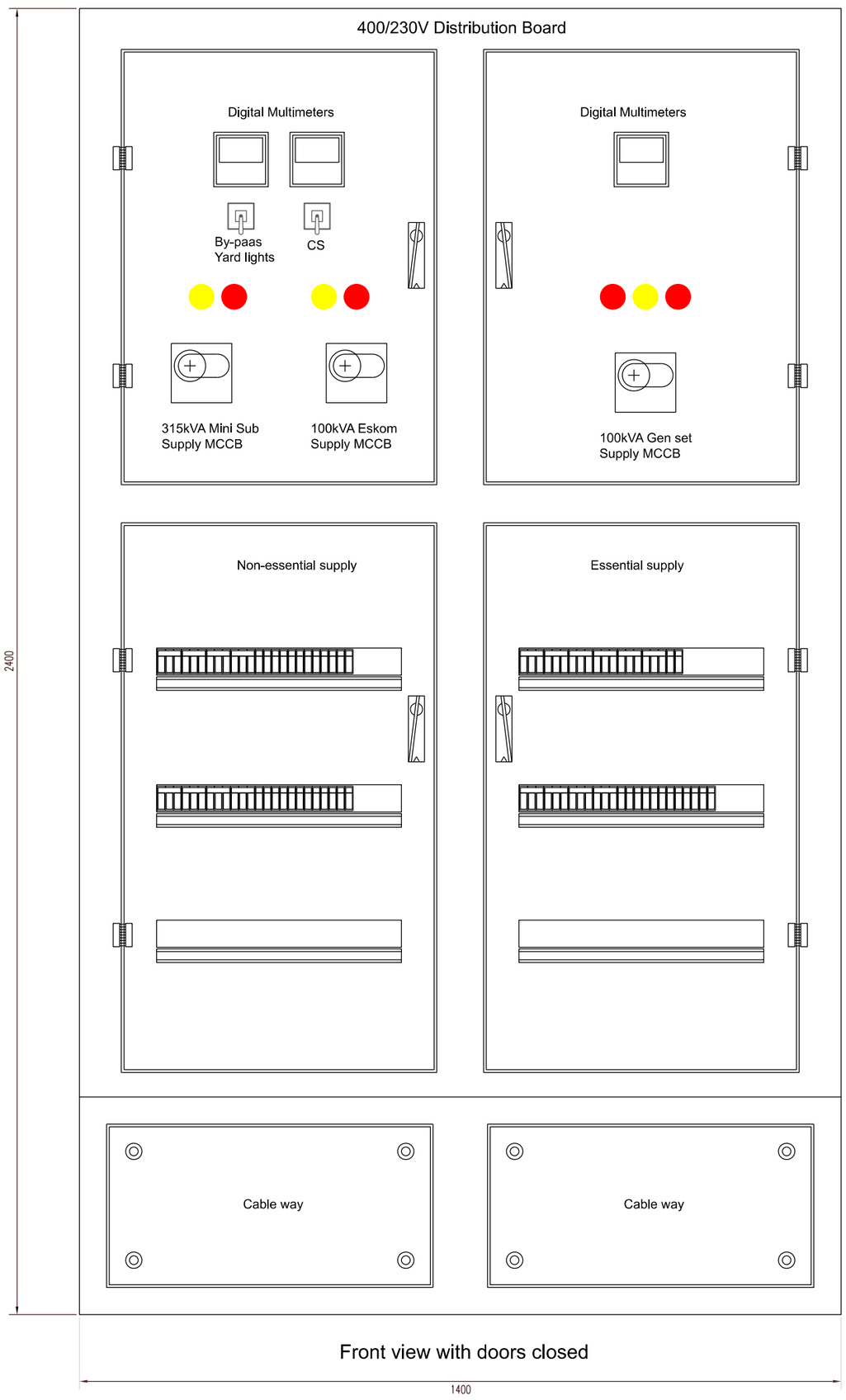
Typical 132kV Power Factor Correction

Cable block diagram

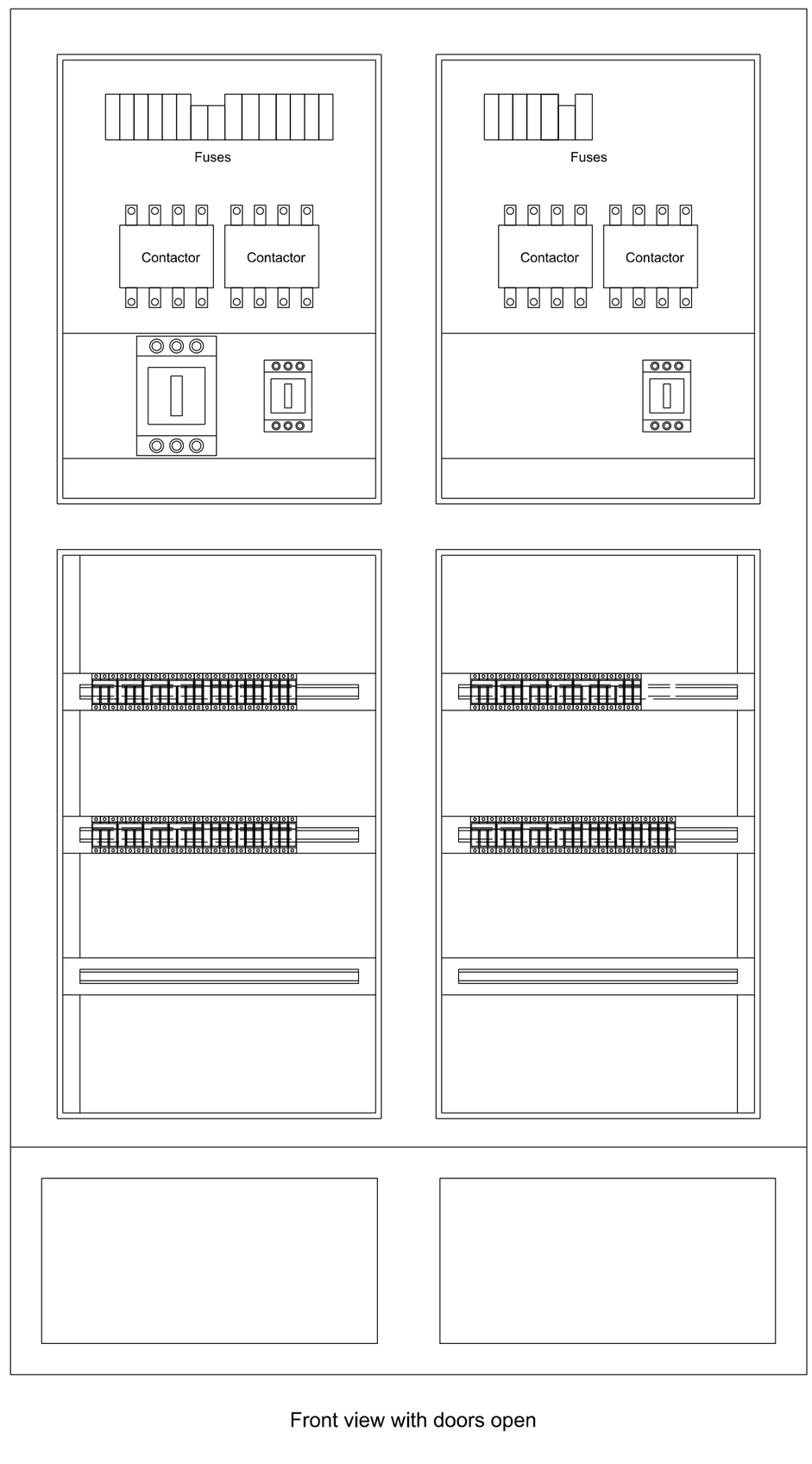
CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI11-05

Design: Kobus Jacobs
Drawn: Jannie Gous
Checked: Jones Rustoff
Date: 25-06-2021
Sheet:



Front view with doors closed



Front view with doors open

Note:
Dimentions ond component positions shown may vary to suite construction details.

Panel colour: Cloud grey F48
Texture: Poweder coated

Essential supply doors: Signal red
Texture: Poweder coated

Chassis plates: White
Texture: Poweder coated

Plinth: Black

DESIGN DRAWING

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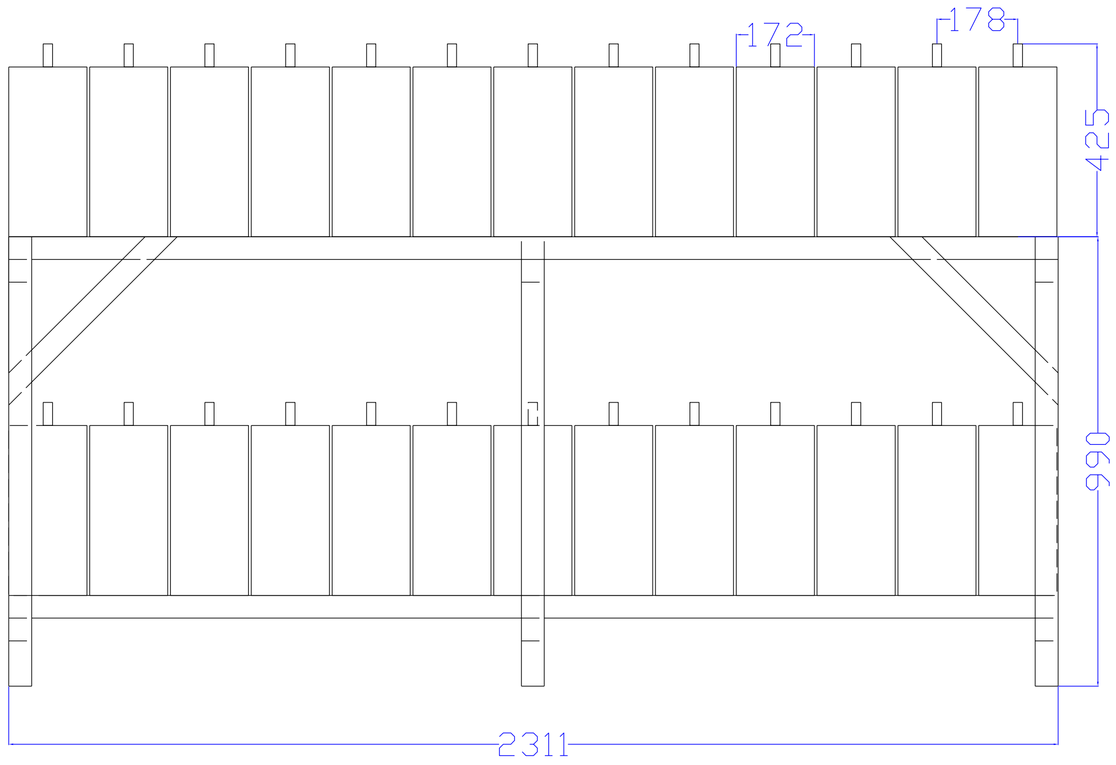
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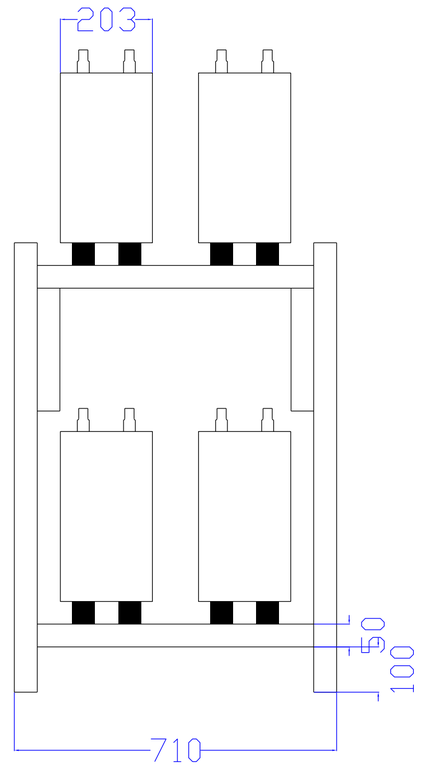
Wildebees 400/132kV
Infeed station
Typical LVAC Board
400VAC 500Amp

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI11-06

Design: Koos Jooste
Drawn: Jannie Gous
Checked: Jones Rustoff
Date: 25-06-2021
Sheet:





To suit a 52 x YCP13 Cell lead acid face to face

DESIGN DRAWING

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SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Typical 110V Battery stand

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI11-07

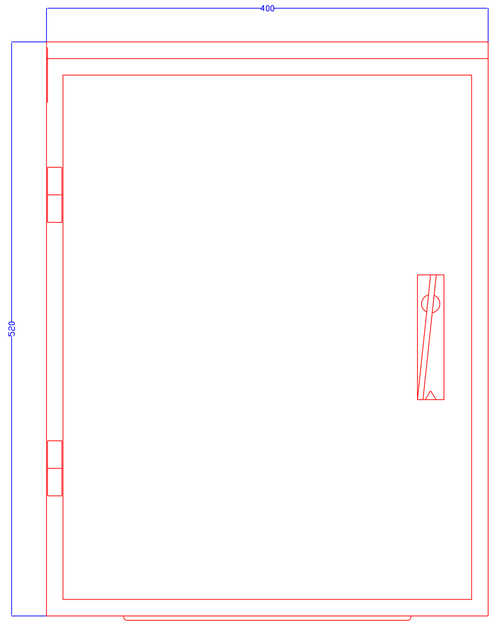
Design: Koos Jooste

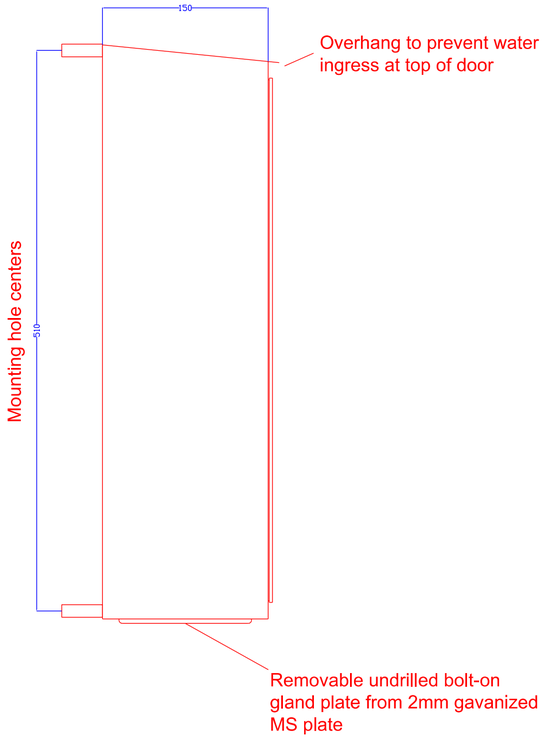
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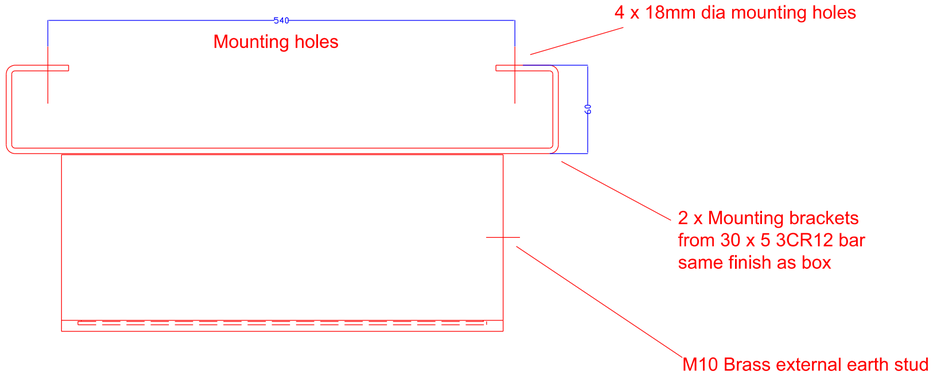
Checked: Jones Rustoff

Date: 25-06-2021

Sheet: _____







Notes:
1. Box to be fabricated from 1.6mm 3CR12 plate.
2. Dimentions shown are indicative only (except for mounting brackets) and may be varied to suit construction details.
3. All metalwork to be suitably prepares for specified paint finishes.
4. Box assembly with mounting brackets to be Texture powerder coated; Dark Admiral Grey G12.
5. Box to be weatherproof suitable for outdoor service with effective dust sealing to doors; IP54.
6. Door to be hung on 2x lift-off hinges on LH side and with lever type padlockablehandle on RH side/
7. Mounting brackets to be welded to box prior to poweder coating.

DESIGN DRAWING

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Jan Mboyane
for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Junction box VT

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI11-08

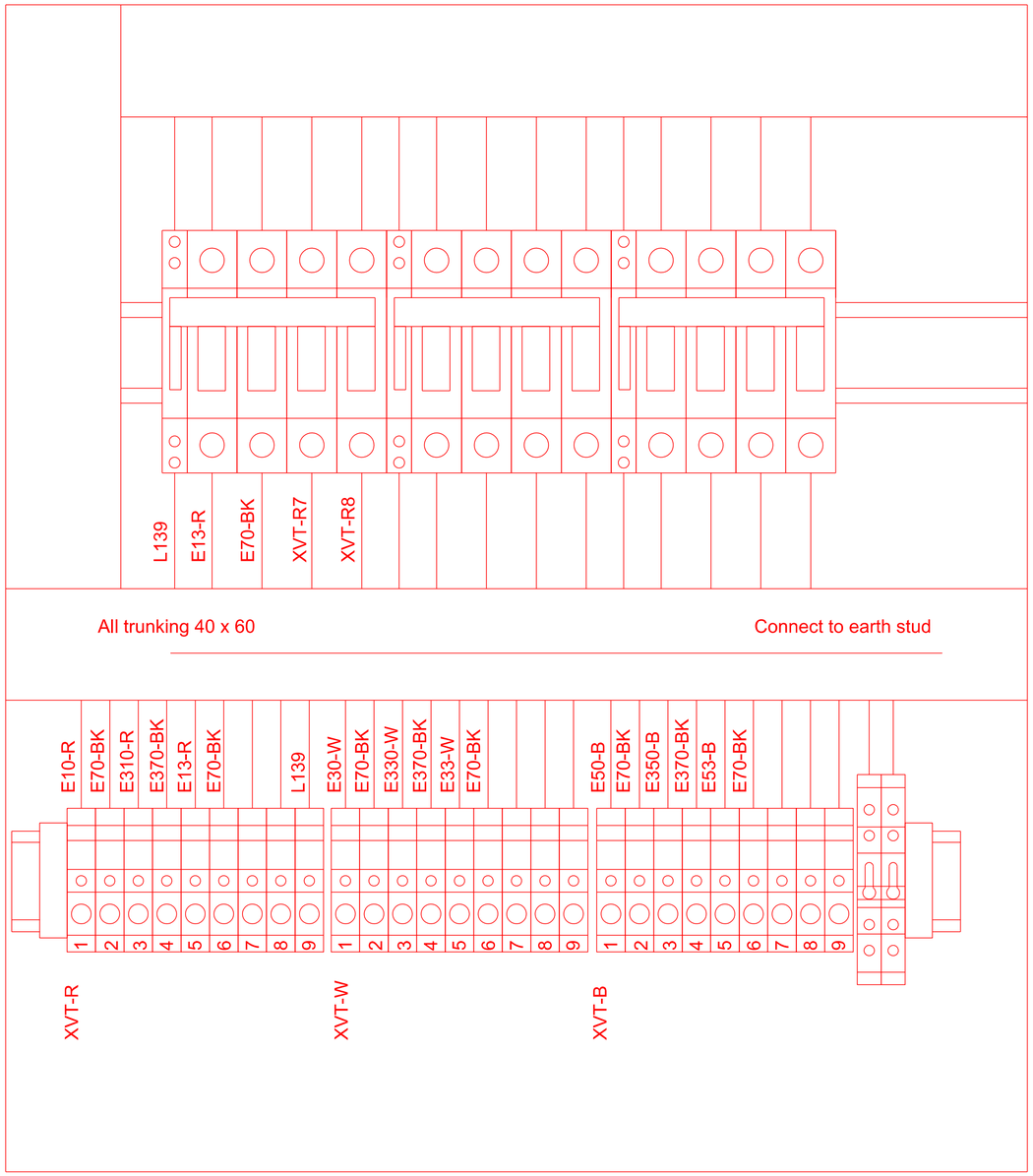
Design: Koos Jooste

Drawn: Jannie Gous

Checked: Jones Rustoff

Date: 25-06-2021

Sheet: 1 of 2



MCB 4P 6A 6kA + Aux. Contact

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Jan Mboyane

for: Electricity Department

Date: _____

SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Junction box VT

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI11-08

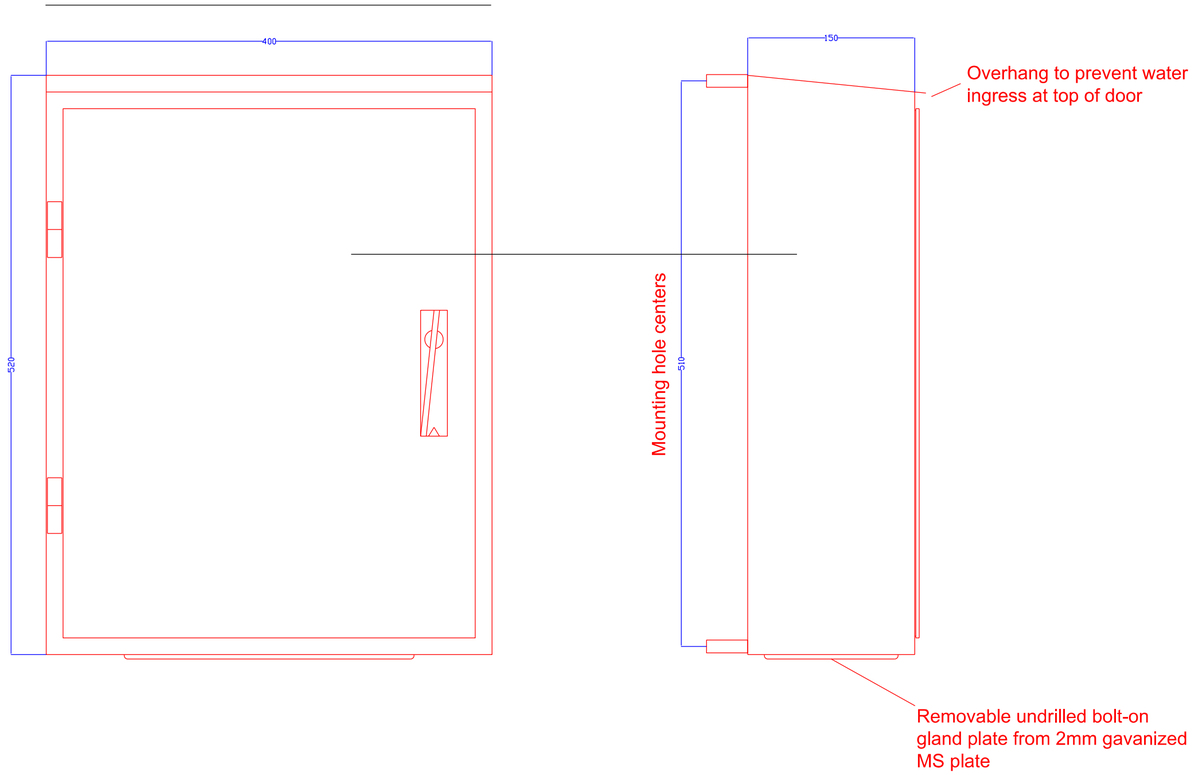
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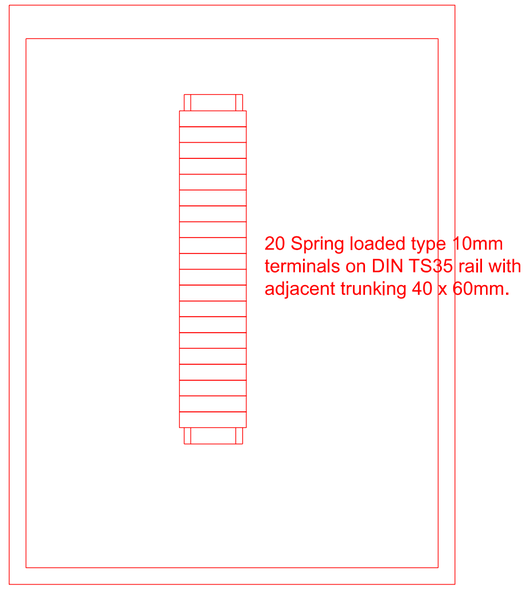
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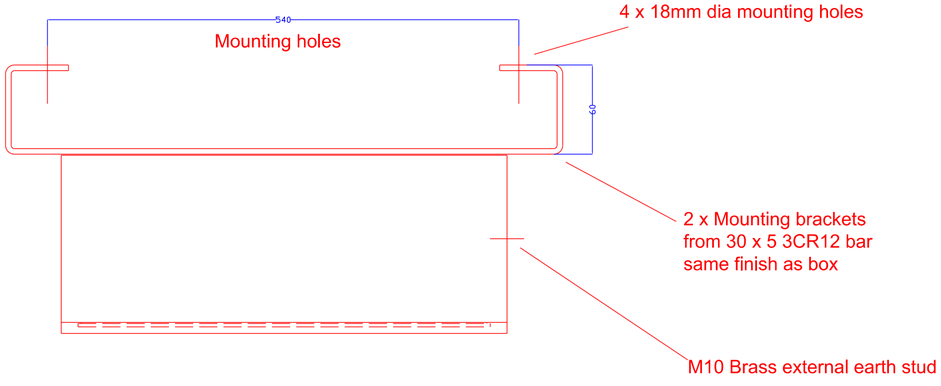
Date: 25-06-2021

Sheet: 2 of 2



Notes:
1. Box to be fabricated from 1.6mm 3CR12 plate.
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for: Electricity Department

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SCALE: N.T.S.

Wildebees 400/132kV
Infeed station

Junction box CT

CONTRACTOR DRAWING NO: _____

CoT DRAWING NO: WI11-09

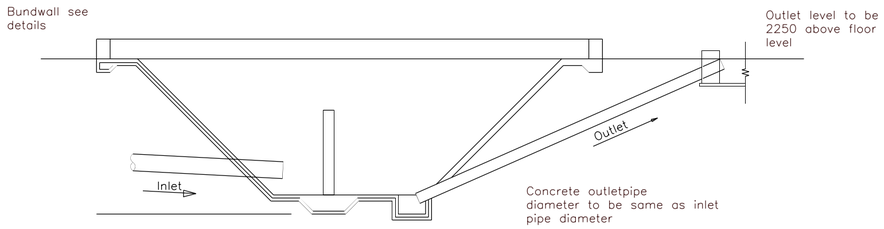
Design: Koos Jooste

Drawn: Jannie Gous

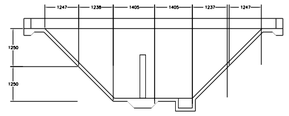
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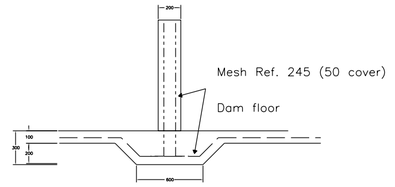
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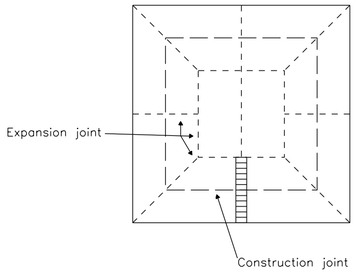
Typical section



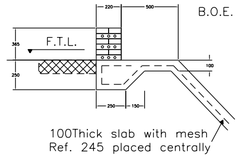
Typical section



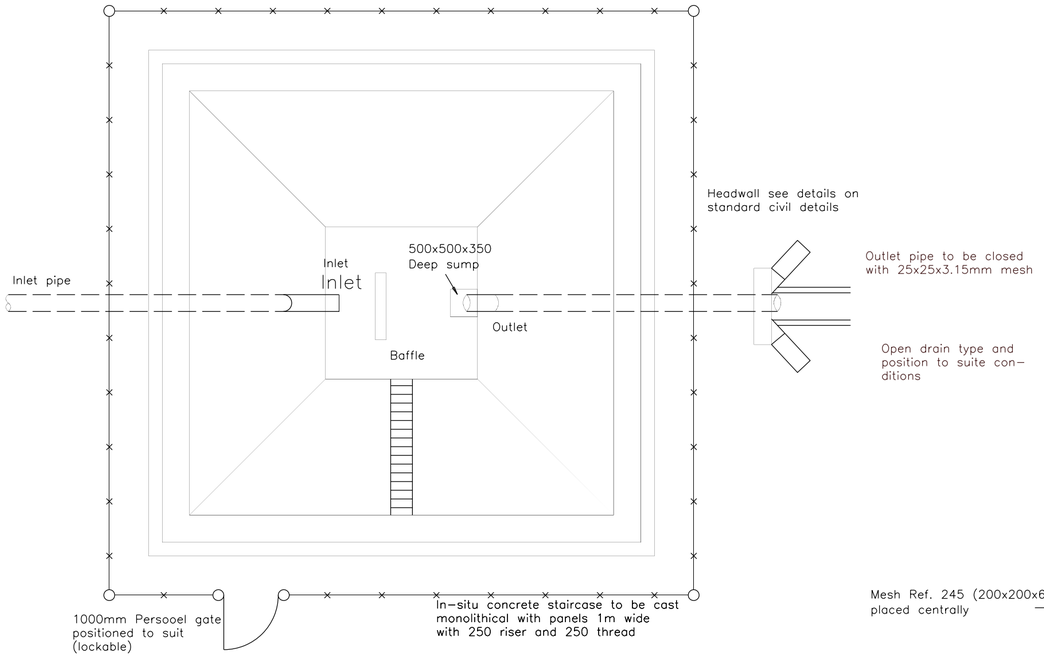
1.5m Long baffle wall details



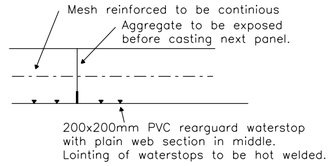
Joint positions



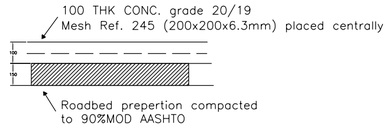
Bundwall details



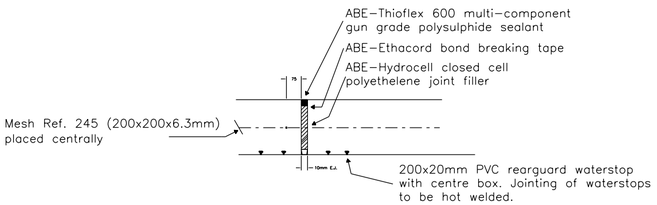
Plan on TX oil dam



Construction joint deatail



Section through floor and embankment wall



Expantion joint detail

Notes:
1. 100mm Thick concrete with mesh Ref. 245 (200x200x6.3mm) placed centrally.
2. Concrete strength at 28 days/stone size: Blinding = 20/19
3. Concreteto have wood float finish
4. All building and civil works to comply with SABS 1200 specification
5. The dam must be completely waterproof
6. For I.L's see drainage layout drawing
7. All steelwork to be grade 300W
8. All steelwork to be hot dipped galvanized to SABS 1461
9. Welding symbols in accordance with SABS 0.44
10. All wlds to be seal welded
11. All holes to be dia. 14mm unless othewise shown (M6 gutter bolt)
12. All exposed corners to be chamfered 20x20mm

DESIGN DRAWING

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Jan Mboyane

for: Electricity Department

Date:

SCALE: N.T.S.

Wildebees 400/132kV Infeed station

Oil dam

CONTRACTOR DRAWING NO:

CoT DRAWING NO:

WI15-01

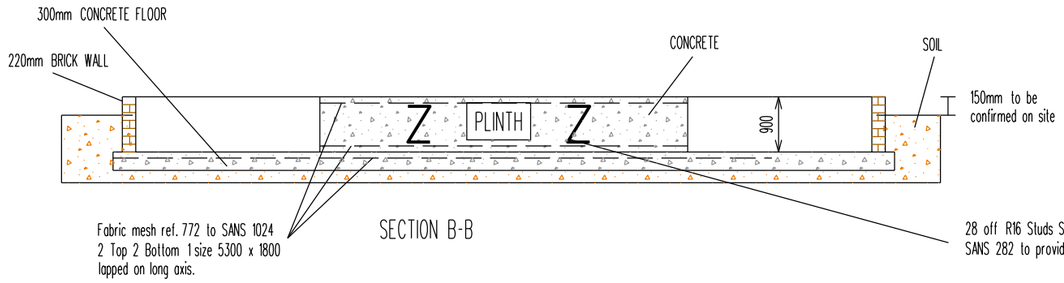
Design: Koos Jooste

Drawn: Jannie Gous

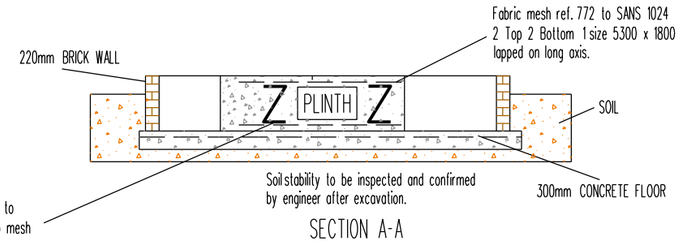
Checked: Jones Rustoff

Date: 25-06-2021

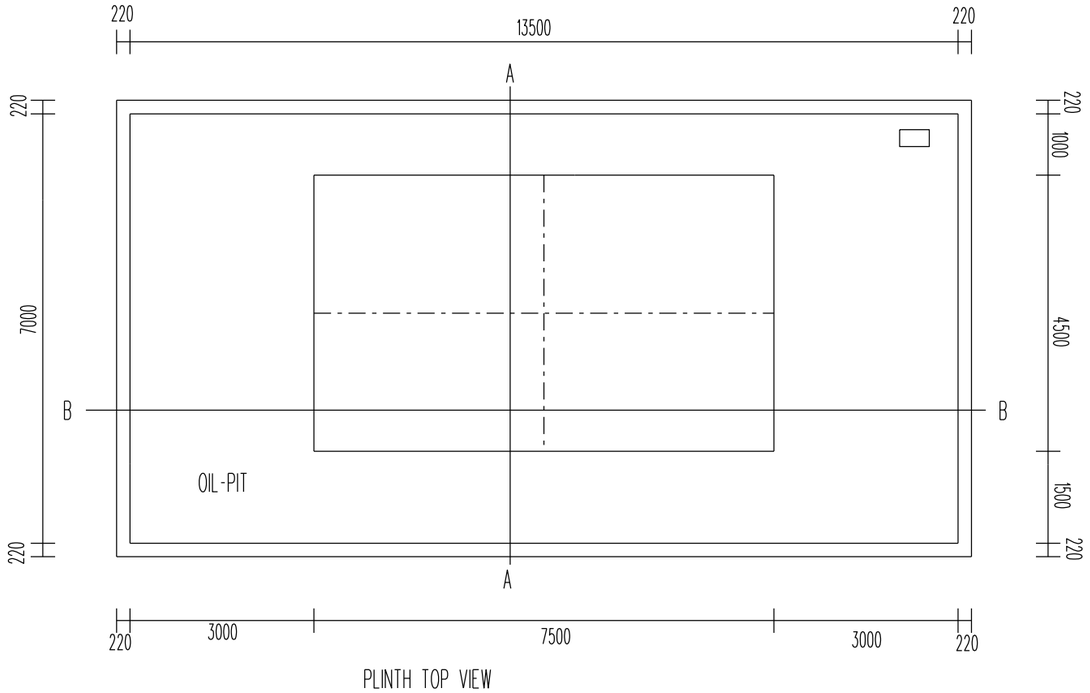
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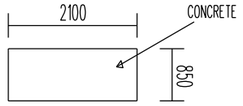
SECTION B-B



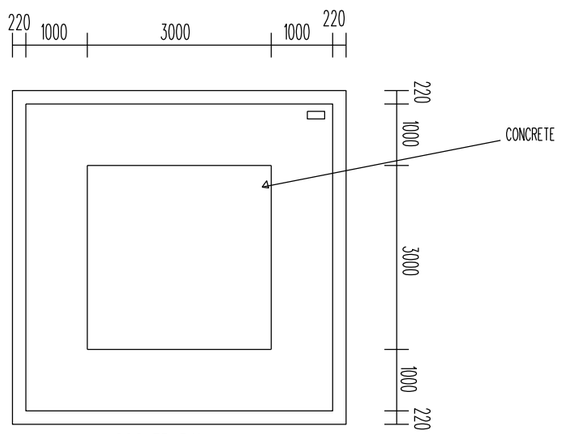
SECTION A-A



PLINTH TOP VIEW



TMK



COOLER BANK

ABBREVIATIONS/SYMBOLS

TRF: Transformer

TMK: Transformer Marshalling Kiosk

NOTES:

SOIL:
Excavation as per the standard specifications for Municipal Civil Engineering Works.
Allow for intermediate material.

RAIN WATER:
Drain valve to be fitted in sloped drainage pipe.

CONCRETE:
Plinth: 20MPa
Floor: 20MPa
Wall: 20MPa

TRF & NER SIZES:
TRF, Cooler bank and TMK plinth designs done for 315MVA TRF

MEASURMENTS:
All measurments are shown in mm.

PLINTH SIZE & POSITION:
The exact plinth size & position of the TRF plinth with regard to the oil pit to be determined once the TRF outline diagram is obtained.

Foundation Plinth Approval by Registered Civil Structural Engineer

1. Foundations approved subject to introduction of mesh reference 772 and R16 studs shape code 83 as detailed above
2. Intermediate layers compacted to sustain an imposed pressure of 50kpa

No.	Date	Drawn	Amendment	Requested	Checked
1					
2					
3					
4					

CITY OF TSHWANE
IGNITING EXCELLENCE

Energy and Electricity Department
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001
TEL NO: +27 12 358 0423

APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.
Date:
SCALE: N.T.S.

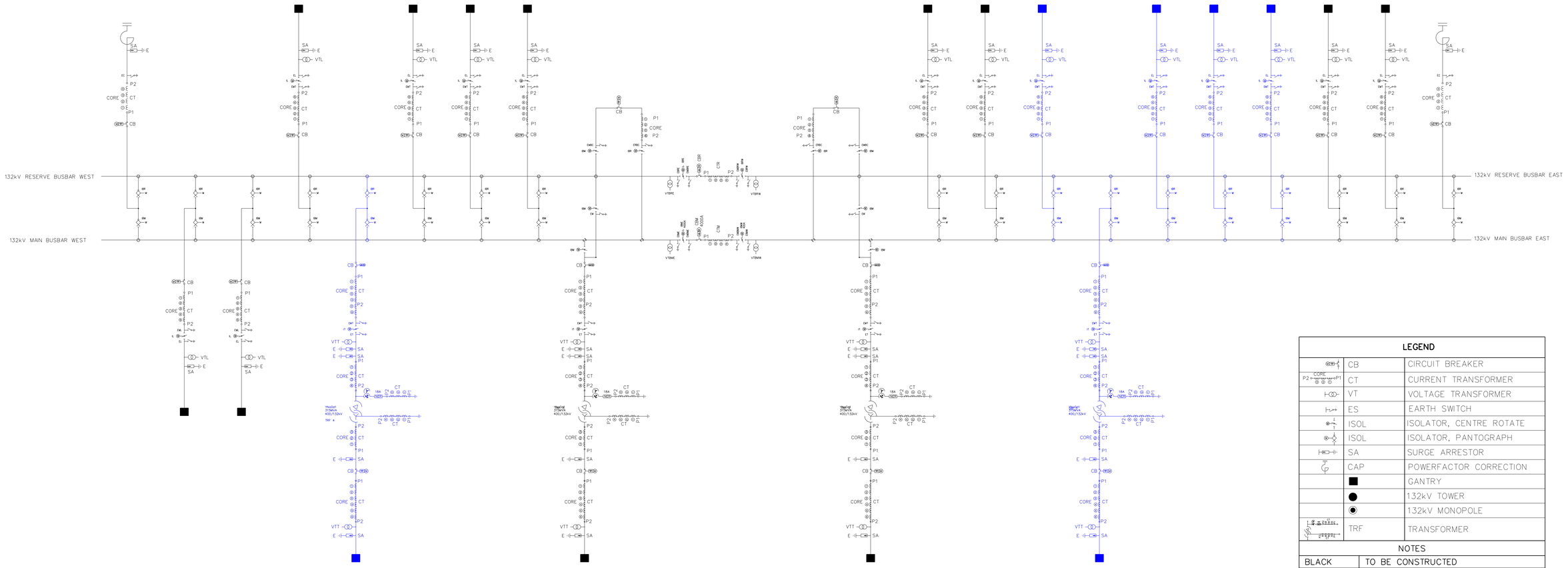
Plinth Transformer; MK, Coolers 315MVA

CONTRACTOR DRAWING NO:

CoT DRAWING NO: WI15-02

Design: J.M. Bosman
Drawn: J.A. Gous
Checked: J. Rustoff
Drawn Date: 2023-03-15
Sheet: 1 of 1

Bay Number	1	2	3	4	5	6	7	8	9	10	11	12A	12B	13	14	15	16	17	18	19	20	21	22	23
Feeder Name	Capacitor Bank 1	Mooiplaas Line 1	Mooiplaas Line 2	Eland 2, Line 1	Transformer 4	Eland 2, Line 2	Eland 1, Line 1	Eland 1, Line 2	Transformer 3 & BCW	Bus Coupler West	Bus Section West	Bus Section East	Bus Coupler East	Transformer 2 & BCE	Hatherley Line 1	Hatherley Line 2	Roodeplaat Line 1	Transformer 1	Roodeplaat Line 2	Cullinan Line2	Cullinan Line 2	Boschkop Line 1	Boschkop Line 2	Capacitor Bank 2
Rating	78 MVAr	132kV 300MVA	132kV 300MVA	132kV 300MVA	315MVA 400/132kV	132kV 300MVA	132kV 300MVA	132kV 300MVA	315MVA 400/132kV	132kV 1000MVA	132kV 1000MVA	132kV 1000MVA	132kV 1000MVA	315MVA 400/132kV	132kV 300MVA	132kV 300MVA	132kV 300MVA	315MVA 400/132kV	132kV 300MVA	132kV 300MVA	132kV 300MVA	132kV 300MVA	132kV 300MVA	78 MVAr



Bay Number	4			3			2			1
Feeder Name	Transformer 4			Transformer 3			Transformer 2			Transformer 1
Rating	315MVA 400/132kV			315MVA 400/132kV			315MVA 400/132kV			315MVA 400/132kV

LEGEND		
	CB	CIRCUIT BREAKER
CORE P2 P1	CT	CURRENT TRANSFORMER
	VT	VOLTAGE TRANSFORMER
	ES	EARTH SWITCH
	ISOL	ISOLATOR, CENTRE ROTATE
	ISOL	ISOLATOR, PANTOGRAPH
	SA	SURGE ARRESTOR
	CAP	POWERFACTOR CORRECTION
	■	GANTRY
	●	132kV TOWER
	◉	132kV MONOPOLE
	TRF	TRANSFORMER

NOTES	
BLACK	TO BE CONSTRUCTED
BLUE	FUTURE
LIGHT GRAY	EXISTING

(1) 400kV CT TRANSFORMER INCOMER						
CORE	1	2	3	4	5	6
CLASS	X	X	X	X	0.2	0.2
RATIO	2400/1600/800/400/1	1600/800/400/1	1600/800/400/1	1600/800/400/1	1600/800/400/1	1600/800/400/1
VA / KpV	2400V	-	-	-	-	-
Rct (Ohm) <	9.6Ω	-	-	-	-	-
Ie (mA)<	42mA	-	-	-	-	-

(2) 132kV CT TRANSFORMER INCOMER						
CORE	1	2	3	4	5	6
CLASS	X	X	5P15	0.2	5P15	X
RATIO	2400/1600/1200/1200/1	2400/1600/1200/1	2400/1600/1200/1	2400/1600/1200/1	2400/1600/1200/1	2400/1600/1200/1
VA / KpV	-	-	10VA	-	10VA	-
Rct (Ohm) <	-	-	-	-	-	-
Ie (mA)<	-	-	-	-	-	-

(3) 132kV CT TRANSFORMER LV NEUTRAL		
CORE	1	2
CLASS	x	x
RATIO: Standby EF	1200/1	-
RATIO: Restricted EF	-	1600/1
VA / KpV	-	-
Rct (Ohm) <	-	-
Ie (mA)<	-	-

(4) 132kV CT Bus Section/Bus Coupler				
CORE	1	2	3	4
CLASS	X	5P15	X	5P15
RATIO	2400/1600/1200/800/1	2400/1600/1200/800/1	2400/1600/1200/800/1	2400/1600/1200/800/1
VA / KpV	-	10VA	-	-
Rct (Ohm) <	-	-	-	-
Ie (mA)<	-	-	-	-

(5) 132kV CT POWER LINE 300MVA					
CORE	1	2	3	4	5
CLASS	X	0.2	5P15	5P15	X
RATIO	2400/1600/1200/800/1	2400/1600/1200/800/1	2400/1600/1200/800/1	2400/1600/1200/800/1	2400/1600/1200/800/1
VA / KpV	-	-	10VA	10VA	-
Rct (Ohm) <	-	-	-	-	-
Ie (mA)<	-	-	-	-	-

No.	Date	Drawn	Amendment	Requested	Checked
21	2023-03-15	J.A. Gous	Relocate CAP bank and Hatherley lines, add CT info table. Update CT cores.	A. Choma	J.M. Bosman
22					
23					
24					

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APPROVED BY
M.J. Mboyane
for Energy and Electricity Dept.

Date:

SCALE: N.T.S.

Wildebees 400/132kV
Infeed Station
Single Line Diagram

CONTRACTOR DRAWING NO:

CoT DRAWING NO:
WI01-01

Design: J.M. Bosman
Drawn: J.A. Gous
Checked: J. Rustoff
Drawn Date: 2023-03-15
Sheet: 1 of 2

X3

X3

X2

X2

Y

Borehole/CoT water

Standby Generator

Septic tank

1						
2						
3						
4						
5						
No.	Date	Drawn	Amendment	Requested	Checked	

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IGNITING EXCELLENCE

Energy and Electricity Division
Primary Planning, Design and Construction
PO Box 423
Pretoria
0001

TEL NO: +27 12 358 4368

APPROVED BY

M.J. Mboyane
for Energy and Electricity

Date:

SCALE: N.T.S.

Wildebees 400/132kV Yard Layout

CONTRACTOR DRAWING NO:

CoT DRAWING NO:

WI 02-1

Design: K. Jooste

Drawn: J.A. Gous

Checked: J Rustoff

Date: 2024-10-29

Sheet: 1:1