METSIMAHOLO LOCAL MUNICIPALITY

BID NO: MLM 12/2021/22

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

EMPLOYER:
METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG
1947

CONSULTING ENGINEERS:
LYON AND PARTNERS (PTY) LTD
P O Box 3925
VANDERBIJLPARK, 1900

TO BE COMPLETED BY TENDERER

NAME OF COMPANY: .....

CONTACT NAME: .....

CONTACT NUMBER: .....

E-MAIL: .....

ESKOM VENDOR NO.: .....

CIDB/CRS NUMBER: …….....

CSD NO: …….

TENDER AMOUNT (INCL VAT): **R**.....

SUB-CONTRACTOR COMPANY: …….

SUB-CONTRACT AMOUNT (INCL VAT): **R**…….
(30% OF Tender Amount)

SIGNED BY TENDERER …….

CLOSING DATE: Thursday, 04 November 2021 at 11:00,
Tender Box, Ground Floor, Metsimaholo Local Municipality, Sasolburg

Supply Chain Management Unit hereby invites bids for the following requirements:

Bid No. MLM	Bid Description	Evaluation Criteria	Bid Fee	Compulsory Briefing Meeting	CIDB Grading	Pre-Qualifying Criteria	Closing Date	Technical Contact Person
12/2021/22	CONSTRUCTION OF THEMBA KUBHEKA BULK ELECTRICAL SUPPLY FULL PHASE (VAALDAM SUBSTATION UPGRADE & RETICULATION)	90/10 Price	R 1000.00	N/A	8 EP OR HIGHER	A tenderer subcontracting a minimum of 30% to an EME or QSE which is at least 51% owned by black people.	04 NOVEMBER 2021 @ 11h00 FINANCE BUILDING 2ND FLOOR FOYER	Mr S. Bila 016 973 8487

Bids terms and conditions:

Bids terms and conditions:

1. Bids shall be evaluated and adjudicated in accordance with the Supply Chain Management Policy of Metsimaholo Local Municipality.
2. **WHERE A COMPULSORY BRIEFING SESSION IS REQUIRED, IT IS THE ONUS OF THE BIDDER TO ATTEND AND ARRIVE IN TIME. LATE ARRIVALS WILL NOT BE ALLOWED IN THE VENUE AND TO SIGN THE ATTENDANCE REGISTER AND WILL BE DEEMED TO BE ABSENT. NO BIDS WILL BE CONSIDERED FROM BIDDERS WHO DID NOT ATTEND THE BRIEFING SESSION.**
3. Tender **Sasolburg.**
4. **TENDER DOCUMENTS CAN ALSO BE DOWNLOADED ON E-TENDER @www.etenders.gov.za**
5. The municipality reserves the right to accept the tender in part.
6. **Tenders endorsed with their specific Tender Numbers must be placed in the tender box located at Metsimaholo Local Municipality, Ground floor, Finance Building, 10 Fichardt Street, Sasolburg.**
7. Late tenders will not be accepted.
8. Incomplete tenders may be disqualified.
9. No faxed or e-mailed tenders shall be accepted.
10. The municipality reserves the right to accept any tender price and not necessarily the lowest, and to withdraw any bid before the award.
11. Bidders must comply with the requirements as specified in a tender document; failure to comply may lead to non-consideration (disqualification).
12. No bids from the persons in the service of the state such as Councillors, and other elected representative (MPs, MPLs), public servants, national and provincial, municipal officials, directors of public and municipal entities are barred from engaging in business with the municipality. The documents will be available at the **SCM Office, Metsimaholo Local Municipality, Civic Centre, 10 Fichardt Street, Sasolburg, finance building, 1st floor.**
13. Non-refundable tender document fee is payable in cash between 07:30am and 15:30pm at the **cashiers in the Rates Hall, Metsimaholo Local Municipality, Civic Centre, 10 Fichardt Street.**

DOCUMENT CONTROL: LYON FILEPATH F:_Metsimaholo\VE 9335-6 Vaaldam Substation\T - TENDER\MLM 12_2021_22 Vaaldam SS & Themba Khubeka Retic\0-COVER & INDEX\0 - COVER AND CONTENT - Vaaldam SS 2021-10-06.docx

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NOTE:
All writing to be done in this document must be in black to facilitate clear photocopying.

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SECTION 1 -
T1: TENDER CONDITIONS

METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG
1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 1:
T1 - TENDER CONDITIONS

LYON AND PARTNERS (Pty) Ltd
Electrical Consulting Engineers
P O Box 3925
VANDERBIJLPARK
1900

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T1.1 – TENDER NOTICE AND INVITATION TO TENDER

T1.1. TENDER NOTICE AND INVITATION TO TENDER

Contractors are invited to tender for the extension of the existing Vaaldam substation by adding a 10 MVA, 88 kV/22kV transformer bay and 2 x 22kV feeder bays to supply the Themba Khubeka switching station, and used to electrify the Themba Khubeka Township (Refengkotso Ext. 5) comprising of 2361 stands. This includes the supply, delivery, installation, testing, commissioning and hand over of all equipment, as specified.

Tender documents can be downloaded from the e-tender portal (https://etenders.treasury.gov.za). Tender with Bid No. MLM 12/2021/22 was publicly advertised.
The Employer is not obliged to accept the lowest or any tender and reserves the right to re-negotiate tender rates.

T1.1.1. MBD 1 - INVITATION TO BID – PART A

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE METSIMAHOLO LOCAL MUNICIPALITY					
BID NUMBER:	**MLM 12/2021/22**	CLOSING DATE:	**04 November 2021**	CLOSING TIME:	**11h00**
DESCRIPTION	Vaaldam Substation Extension and Themba Khubeka Electrification				
THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT.					

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN
THE BID BOX SITUATED AT:

Metsimaholo Local Municipality				
Finance Building, First Floor				
10 Fichardt Street				
Sasolburg				
1947				
SUPPLIER INFORMATION				
NAME OF BIDDER				
POSTAL ADDRESS				
STREET ADDRESS				
TELEPHONE NUMBER	CODE		NUMBER	
CELLPHONE NUMBER				
FACSIMILE NUMBER	CODE		NUMBER	
E-MAIL ADDRESS				
VAT REGISTRATION NUMBER				
CSD NUMBER				
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX]	☐ Yes ☐ No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT	☐ Yes ☐ No

T1.1 TENDER NOTICE

[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES & QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]			
***ARE YOU THE ACCREDITED REPRESENTATIVE** IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?*	☐Yes ☐No [IF YES ENCLOSE PROOF]	***ARE YOU A FOREIGN BASED SUPPLIER FOR** THE GOODS /SERVICES /WORKS OFFERED?*	☐Yes ☐No [IF YES, ANSWER PART B:3]
TOTAL NUMBER OF ITEMS OFFERED		*N/A*	*N/A*
SIGNATURE OF BIDDER	……	*DATE*	
CAPACITY UNDER WHICH THIS BID IS SIGNED			

BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		**TECHNICAL INFORMATION MAY BE DIRECTED TO:**	
DEPARTMENT	**SUPPLY CHAIN MANAGEMENT**	**TECHNICAL**	
CONTACT PERSON	**Ms S. Motsei**	CONTACT PERSON	**Mr. S. Bila**
TELEPHONE NUMBER	**016 973 8743**	TELEPHONE NUMBER	**016 973 8487**
FACSIMILE NUMBER	**016 973 2191**	FACSIMILE NUMBER	**016 973 2191**
E-MAIL ADDRESS	**sylvia.motsei@metsimaholo.gov.za**	E-MAIL ADDRESS	**sibusiso.bila@metsimaholo.gov.za**

T1.1.1.1 MBD 1 – TERMS & CONDITIONS FOR BIDDING – PART B

1. BID SUBMISSION:

1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.

1.2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE**

1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.

2. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS	
3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?	☐ YES ☐NO
3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA?	☐ YES ☐ NO
3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?	☐ YES ☐ NO
3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?	☐ YES ☐ NO
3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?	☐ YES ☐ NO

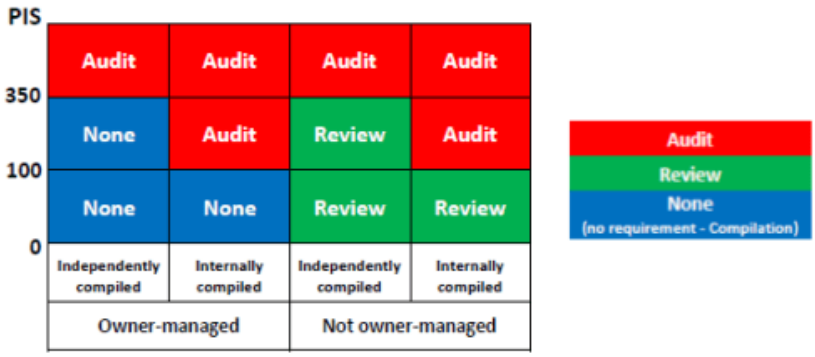
TO BE COMPLETED BY: BIDDERS NOT REQUIRED TO SUBMIT AUDITED FINANCIAL STATEMENT

DETERMINATION OF WHETHER THE FINANCIAL STATEMENTS NEEDS TO BE AUDITED

QUESTIONER	YES	NO
IS COMPANY OWNER-MANAGED		
ARE THE COMPANY FINANCIAL STATEMENT INDEPENDENTLY COMPILED		

QUESTIONER	PI SCORE	REQUIRED ATTACHMENT
WHAT IS THE BIDDER'S LATEST PUBLIC INTEREST SCORE		ATTACH PROOF OF CALCULATION

(ii) What type of engagement is required?



NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.

SIGNATURE OF BIDDER: ……

CAPACITY UNDER WHICH THIS BID IS SIGNED: ……

DATE: ……..

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T1.1.2. REFERENCE NUMBER AND TITLE

The contract number and title shall be:

MLM 12/2021/22: VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

T1.1.3. BRIEF DESCRIPTION OF THE WORKS

The Contractor to be appointed by Metsimaholo Local Municipality will undertake the full scope of work which, at high level, comprises of the supply, delivery, installation, testing, commissioning, and handing over, complete with auxiliary equipment, of:

a) The extension of the existing Eskom Vaaldam substation yard by extending the substation platform, earth grid and construction of a new fence to accommodate the following additions:
   - 1 x 88kV bus-section with two 132kV isolators.
   - 1 x Complete 88/22 kV 10 MVA transformer bay.
   - 1 x 22kV road crossing structure.
   - 1 x 22kV transformer breaker.
   - 1 x 22kV bus-section isolator.
   - Extension of the existing 22kV busbar by installing a new 22kV bus-section.
   - 1 x 22kV busbar VT.
   - 2 x 22kV feeder bays with composite unit circuit breakers and current transformers
   - 3 x swing frame panels to house protection schemes and metering.

b) Medium voltage reticulation, low voltage reticulation, and house connections within Themba Khubeka, comprising of
   - 38.2 km of 22kV medium voltage overhead lines (Fox ACSR), with 53 transformer areas.
   - 24.25 km of low voltage aerial bundled conductor overhead lines
   - 2361 overhead house connections.

c) Re-commissioning of Leitrim 88/11kV substation.

d) Corrective actions, commissioning, and energising of the Zamdela to Leitrim 88kV overhead power line.

T1.1.4. SUBMISSION AND VALIDITY OF TENDERS

Tenders are to be delivered to:

THE TENDER BOX, FIRST FLOOR
FINANCE BUILDING
METSIMAHOLO LOCAL MUNICPALITY
10 FICHARDT STREET
SASOLBURG

Tenders are to be submitted in a robust sealed parcel clearly marked as follows:

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

BID NO : MLM 12/2021/22

CLOSING DATE : Thursday, 04 November 2021 at 11h00

NAME OF TENDERER : ……...

The name of the Tenderer shall appear prominently on the cover of the parcel.

Tenders will not be considered unless all relevant schedules and Form of Tender contained herein have been completed.

Any alternative offers by the Tenderer must be presented on the Tenderer's official stationary as part of the Cover Letter. Alternatively, offers shall be subject to all the conditions set out in this document.

Tenderer's "Condition of Sale" or "Contract" printed on their own stationary will be disregarded. The only applicable Conditions shall be those contained in these documents, unless the Tenderer specifically absolves himself from any such conditions on the form "Alterations by Tenderer" provided herein (under Tender Data).

On no account shall any alterations be made to the text of these documents or any pages removed from the binding

Tenders received after the closing date and time shall not be considered.

Faxed, e-mailed or telephonic tenders will NOT be accepted.

Tenders are to be valid for the period as indicated in C1.1: "Form of Offer", within the "Letter of Tender".

Tender prices shall remain fixed and firm for the entire validity period.

The Tenderer shall submit one completed original tender document, one copy of the original tender document and two electronic version of the completed tender document.

T1.1.5. NON-COMPULSORY SITE BRIEFING

There will be no site briefing.

T1.2: TENDER DATA

T1.2 – TENDER DATA

T1.2. TENDER DATA

The Contractor shall supply, install and commission all material for this project and deliver the project up to the final handing over stage, including the Defects Notification Period.

The tenderer shall allow for construction over multiple financial years as funding is made available. As provided in the Bill of Quantities, the tender shall allow for de-establishment and re-establishment costs, and renewal or extension of contractual obligations for an extended construction period.

The Contract shall include all costs for the design and preparation of detail manufacturing drawings, all supply and delivery costs, all costs for commissioning the Works, costs for handing over of the Works to the relevant authority, all supervision costs, labour costs and tools and materials cost necessary for constructing and testing of the works.

The Contract shall also include a warranty/defects notification period, as indicated in the Contract Data under the Conditions of Contract (Defects Notification Period), all in accordance with the Conditions of Contract and Schedule of Requirements. The Contractor shall supply, install and commission all material for this project and deliver the project up to the final handing over stage, including the Defects Notification Period.

Prequalification criteria is as follows (failure to submit will lead to automatic disqualification):

A tenderer subcontracting a minimum of 30% to an EME of QSE which is at least 51% black owned

Subcontracted company must submit the following documents: -

1. **Sub-contracting form – fully completed and signed from Section T2.1.**
2. **The subcontracting company registration Documents**
3. **B-BBEE sworn affidavit or certified copy of SANAS accredited B-BBEE certificate. The affidavit / certificate must indicate an EME or QSE which is at least 51% owned by black people.**

Failure to comply with the above-mentioned terms and conditions will deem your bid to be disqualified

The tender document shall be accompanied with all the specified tender returnables.

The following conditions shall apply to this project:

a) The contract shall be executed by means of labour intensive construction methods for the purpose of including local labour.
b) The tenders will be adjudicated according to Metsimaholo Local Municipality's SCM Policy.
c) Payment shall be according to the construction progress, and only **material installed** and certified by the Engineer shall be paid.

T1.2.1. TENDER VALIDITY

The tender offer validity shall be 90 calendar days from the tender closing date, as indicated in the Letter of Tender under C1.1 Form of Offer and Form of Acceptance. The tender offer validity period shall not exceed 12 weeks without approval granted by the Accounting Officer.

T1.2.2. DOCUMENTS

The Tender Documents comprise of a complete set which includes one (1) bound volume: (Ref. No. MLM 12/2021/22) containing consecutively numbered pages per section scheduled in the List(s) of Contents, and drawings which are listed in the "Drawings Section" of the document and included as an annexure.

Tenderers are advised to check the number of pages in the Tender Document and verify the inclusion of all drawings listed. If any pages or drawings are missing or duplicated, or if there are any discrepencies or obvious errors noticed, the Tenderer is liable for any errors and ambiguities in the tender submitted. The Tenderer shall immediately request clarification.

T1.2.3. CONSULTING ENGINEERS

The Employer has appointed Lyon and Partners (Pty) Ltd as Consulting Engineers and Project Managers.

TECHNICAL ENQUIRIES MAY BE DIRECTED TO:

Consulting Engineers (Lyon and Partners):
Name : Mr. M. Lyon
Telephone : 016 981 6270
Email : lyon@lyon.co.za / marnus@lyon.co.za

Copy to Metsimaholo LM Contact:
Name : Mr. S. Bila
Telephone : 016 973 8487
Email : sibusiso.bila@metsimaholo.gov.za

Name : Mr. K. Mvulane
Telephone : 016 973 8487
Email : khubekile.mvulane@metsimaholo.gov.za

SUPPLY CHAIN ENQUIRIES MAY BE DIRECTED TO:

Name : Ms. S. Motsei
Telephone : 016 973 8743
E-Mail : sylvia.motsei@metsimaholo.gov.za

Queries shall be in writing and no queries will be entertained within seven (7) calendar days of the tender closing date.

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T1.2.4. PROGRAMME & CASH FLOW

Tenderers are required to submit programmes for the main activities of each section of work as well as a proposed cash flow.

The program shall indicate the following items as a minimum:

1. Time for site establishment.
2. Time for obtaining H & S permit (if required)
3. Factory Acceptance Testing.
4. Site Acceptance Testing.
5. Handover.
6. "Float" for unforeseen delays
7. Any items in the Conditions of Contract, i.e.:
   a) Commencement date, time for completion
   b) Date for right of access to, and possession of, the site
   c) Order in which the Works are to be executed, including:
      i) preparation and submission of the Contractor documents
      ii) procurement
      iii) manufacture of equipment
      iv) inspection
      v) delivery to site
      vi) construction
      vii) erection
      viii) installation
      ix) work by sub-contractor
      x) testing and commissioning
   d) Revision periods
   e) Sequence and timing of inspections and tests
   f) Holidays, weekends, etc.
   g) Key delivery dates
   h) Progress reports, etc.

T1.2.5. COMPLIANCE WITH SPECIFICATIONS AND STANDARDS

The Tenderer is responsible for the aptitude and efficiency of the proposal submitted, which is offered as a complete working unit, it follows that the tenderer is entirely responsible for the inclusion in the tender offer for every item of plant and every accessory which may be necessary including the means of fixture into its required position, and also including all measures required by any Act or Regulation in force governing the operations of electrical equipment, wiring and installations. It is also incumbent on the Tenderer to make provision in the tender offer for the highest quality of workmanship, in both the manufacture of the equipment and its accessories, and in the erection thereof.

If it is found, whilst the plant is being erected or when it is about to be commissioned or during its test period or period of warranty, that any item necessary for the continuous and efficient operations of the Works to the full capacity required was omitted from the tender or was included, but has since been found not to be entirely satisfactory, or that the workmanship during manufacture or erection was not of the best standard, it shall be the responsibility of the Tenderer to supply such an item, replace it with a satisfactory one, or re-erect any portion of the Works, as the case may be, at his/her own expense.

Under the provisions above, it follows that there shall be no extras of any kind except such extras as may be ordered in writings by the Engineer to be supplied or erected by way of additional plant or accessories, or such extras which may arise as a result of the building work not having been carried out in conformity with the working drawings supplied by the Contractor.

T1.2.6. WITHDRAWAL OF TENDER

If the tenderer withdraws his/her tender before the validity period expires, fails to sign the Contract or fails to provide security, to the satisfaction of the Employer and the Engineer after his/her tender has been accepted, the tenderer shall pay any additional expenses incurred by the Employer, to call for new tenders, or to pay the difference between his/her tender price and the next suitable tender price.

T1.2.7. COPYRIGHT

Copyright is reserved for all designs, specifications and information contained as part of this document. No part of this document in full or in part may be reproduced or used in any form without written consent by the Engineer.

T1.2.8. ASSESSMENT OF TENDERS

Tenders will be adjudicated solely on the information submitted with the tender before tender closure. No alteration shall be considered after tender closure. The Engineer / Adjudicator reserves the right to adjust obvious arithmetic errors in the Bill of Quantities and subsequent calculation of the total tender amount. Tenders shall firstly be evaluated for responsiveness which requires full compliance to compulsory returnables, to be deemed responsive. Responsive tenders shall be evaluated for functionality.

Responsive tenders scoring above the minimum functionality threshold shall be evaluated in accordance with the Preferential Procurement Policy Framework Act (2000), to determine the preferred bidder.

T1.2.9. ACCEPTANCE OF TENDERS

The successful tenderer shall enter into a Contract with the Employer, in accordance with the Conditions of Contract, for the execution of the specified works.

The Employer does not bind himself to accept the lowest or any tender or to give any explanation for decisions made in connection with the tenders, further, the Employer reserves the right not to award the contract.

The Employer reserves the right to accept any one or more or all of the sections of the Works as specified in this document, and that no liability is accepted for any expenses incurred by a tenderer in submitting a tender offer. The Employer therefore reserves the right to scale down the project to fall within the values of the available funds even if the reduced Scope of Works exceeds 20 % of the tender amount. No alteration of unit prices will be allowed for scaling down on the project.

Limited, non-guaranteed funds are available for this project.

The tender shall be disqualified if the materials offered by the tenderer do not comply with the relevant specifications.

T1.2.10. SUB-CONTRACTING

The Tenderer should take cognizance of the requirement for sub-contracting as stipulated in the Preferential Procurement Policy Framework Act, Act No 5 of 2000, Preferential Procurement Regulations, 2017 as Government Gazette No. 10681 dated 20 January 2017.
In terms of the Preferential Procurement Regulation 2017, an Organ of State must apply subcontracting for a contract above R 30 million with the prescribe percentage being a minimum of 30 % of the value of the contract to advance the following designated groups:

a) an Exempted Micro Enterprise (EME) or Qualifying Small Enterprise (QSE),
b) an EME or QSE which are at least 51% owned by black people,
c) an EME or QSE which are at least 51% owned by black people who are youth,
d) an EME or QSE which are at least 51% owned by black people who are women,
e) an EME or QSE which are at least 51% owned by black people with disabilities,
f) an EME or QSE which are at least 51% owned by black people living in rural areas or underdeveloped area or townships,
g) a cooperative which is at least 51% owned by black people,
h) an EME or QSE which are at least 51% owned by black people who are military veterans,
i) an EME or QSE which are at least 51% owned by black people

Based on the cost estimate, the sub-contracting clause <u>will</u> be triggered with this bid.

The tenderer shall provide a detailed list of all works where local sub-contractors can be utilized. Potential sub-contracting opportunities identified are:

a) Security Services
b) Procurement of PPE
c) Supply and installation of security fence.
d) Civil Works.
e) House connections
f) Wiring of pole-top distribution boxes
g) The scope for the subcontracting within the substation scope of works is limited due to the specialized nature of the work.

It shall be noted that the main contractor shall remain responsible for all work completed by sub-contractors. It is a requirement that the tenderer select a suitable sub-contractor and perform a complete due diligence on the subcontractor.

T1.2.11. CURRENCY AND FOREIGN TENDERS

All prices quoted and all transactions are to be in the currency of the Republic of South Africa (South African Rand).

Tenders not domiciled in the Republic of South Africa (R.S.A.) shall state the name and address of their accredited or intended agents within the R.S.A, failure to do so will invalidate the tender.

T1.2.12. HEALTH AND SAFETY

The Tenderer shall comply with the provisions of the Occupational Health and Safety Act no 85 of 1993, as amended, and shall undertake to acquaint his/her employees with the provisions, regulations, duties, obligations and prohibitions, and shall accept sole liability for due compliance with the duties, obligations and prohibitions and absolve the Employer from being obliged to comply with the aforesaid duties, obligations and prohibitions.

T1.2.13. TECHNICAL FUNCTIONALITY

After evaluating tenders for responsiveness, the functionality of the tenderer will be evaluated and to qualify for the next round of evaluation, the tenderer must score a minimum threshold percentage. Only tenders scoring above the minimum threshold score will advance to the preferential procurement evaluation.

The responsiveness check determines if all information and documents required are submitted with the tender, non-responsive tenders shall not be considered for functionality evaluation. The functionality evaluation involves detailed adjudication of all forms, technical schedules, returnables etc. to be populated or included by the tenderer.
The tenderers shall take note that Metsimaholo Local Municipality shall audit the technical evaluation done by the appointed Consulting Engineer.

For the point allocations, refer to Section 2: T2 – Tender Form, under Returnables: Claim for Functionality Points.

T1.2.14. PREFERENTIAL PROCUREMENT

The following preference point systems are applicable to all bids in terms of the
"PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT, 2000:
PREFERENTIAL PROCUREMENT REGULATIONS, 2017":

- the 80/20 system for requirements with a Rand value equal to or above R 30 000.00 and up to R 50 000 000.00 (all applicable taxes included); and
- the 90/10 system for requirements with A Rand value above R 50 000 000.00 (all applicable taxes included)

The value of this bid is estimated not to exceed R 50 000 000 (all applicable taxes included) therefore the 90/10 system shall be applicable.
Preference points for this bid shall be awarded for:

- Price; and
- B-BBEE Status Level of Contribution.

The maximum points for this bid are allocated as follows:

	POINTS
PRICE	90
B-BBEE STATUS LEVEL OF CONTRIBUTION	10
Total points for price and B-BBEE must not exceed	**100**

Failure on the part of a bidder to fill in and/or to sign this form and submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or a sworn affidavit together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed. It shall further be noted that the sworn affidavit be provided by the authorised representative of the company. Affidavits from accounting firms will not be accepted.

Original or Certified copy of SANAS only accredited BBBEE certificate OR copy of BBBEE Sworn Affidavit must be attached. (Failure to submit Valid Certificate will result in your bid not being allocated Points for BBBEE).

The Employer reserves the right to request the bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the Employer

T1.2.15. ELIGIBILITY TO TENDER

Only those tenderers who satisfy the following eligibility criteria shall be eligible to submit tenders:

a) The Tenderer or any of its directors/ shareholders is not listed on the Register of Tenderer 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.

b) Has the legal capacity to enter into the contract,

c) 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.

d) The Tenderer is registered with the CIDB with an appropriate category of registration.

e) The Tenderer has not:
- Abused the Employer's Supply Chain Management System; or
- Failed to perform on any previous contract and has been given a written notice to the effect.
- Failed to pay municipal rates ad taxes or service charges and such rates, taxes and charges are in arrears for more than three months.

f) Latest Municipal rates & taxes account which is not in arrears for more than 3 months (In a case of Rates & Taxes Account being in a family member's name, **ONLY A MUNICIPAL** account where the address of the account matches the address on the CK document will be accepted) for the **COMPANY AND DIRECTORS / TRUSTEES / MEMBERS / SHAREHOLDERS.**

In the event of a tenant (renting) a copy of a valid and signed (both Lessor and lessee) Lease Agreement (the lease agreement must indicate dates of commencement and expiry, in the occasion where the lease has expired the original lease **AND** extension must be attached with commencement and expiry dates) for the **COMPANY AND DIRECTORS / TRUSTEES / MEMBERS / SHAREHOLDERS.**

NOTE - The following documents will not be accepted:

- Affidavits;
- Address confirmation letter;
- Invoices from the body corporates or agents,
- Rates and taxes of the lessor and;
- Municipal tender/rates clearance letter.

As per the Local Government: Municipal Finance Management Act 56 of 2003 updated in 20 January 2017 on Section 28 (1) (c) and Section 38 (1) (d) (i):

28 (1) (c) check in respect of the recommended bidder whether municipal rates and taxes and municipal service charges are not in arrears;
38 (1) (d) to reject any bid from a bidder;
(i) if any municipal rates and taxes or municipal service charges owed by that bidder or any of its directors to the municipality or municipal entity, or to any other municipality or municipal entity, are in arrears for more than three months.

h) There is no conflict 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.

i) Competency of management and supervisory staff:
- Only tenderers with staff satisfying the requirements of the Scope of Works, are eligible to submit tender.

j) Joint ventures are eligible provide that:
- Every member of the joint venture is registered with the CIDB.
- The lead partner has a grading equal to or higher than the gradering specified.
- The combined contractor grading designation calculated in accordance with the CIDB Regulations is 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

T1.2.16. ALTERATIONS BY TENDERER

Tenderer’s Condition of Sale or Contract printed on their own stationary will be disregarded, the Conditions which shall apply shall be those contained in these documents unless the Tenderer specifically absolves himself from any such conditions on the form "Alterations by Tenderer" contained in the “Alterations to Tender” table.

On no account shall any alterations be made to the text of these documents or any pages removed from the binding.

Should the Tenderer desire to make any departures or modifications to the General Conditions of Contract, Specifications, Bill of Quantities or Drawings, or to qualify his/her tender in any way, he shall set out his/her proposals clearly in the table hereunder.

If no departures or modifications are desired, the Schedule hereunder is to be marked NIL and signed by the Tenderer.

FAILURE TO POPULATE AND SIGN *"Table 1: Alterations by tenderer"* SHALL RESULT IN THE TENDER OFFER BEING NON-RESPONSIVE.

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T1.2 TENDER DATA

Table 1: Alterations by tenderer

PAGE	CLAUSE OR ITEM

NAME & SIGNATURE OF TENDERER : .....

DATE : .....

NAME & SIGNATURE OF WITNESS : .....

SECTION 2 -
T2: TENDER FORM

METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG
1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 2:
T2 - TENDER FORM

LYON AND PARTNERS (Pty) Ltd
Electrical Consulting Engineers
P O Box 3925
VANDERBIJLPARK
1900

CONTENTS: TENDER FORM

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T2.1: LIST OF RETURNABLE DOCUMENTS

T2.1 – LIST OF RETURNABLE DOCUMENTS

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T2. TENDER FORM

T2.1. LIST OF RETURNABLE DOCUMENTS

It is a condition of tender that the tender offer must be accompanied with the following documentation. Failure to submit the following documentation will result in the tender offer being non-responsive:

T2.1.1. COMPULSORY RETURNABLES

NO	RETURNABLES	NOTES
1	Form of Offer	• Fully completed and signed in black ink pen.
2	A copy of a CSD summary report **OR** CSD number.	• CSD full report or summary report OR CSD number. • Municipality may not make any award to a person whose tax matters are not complaint with SARS, please note that tax compliance will be verified before any award.
3	Proof of company registration documents with the Director's details must be attached.	• The company registration documents must indicate the company and Director's details.
4	Fully completed MBD forms	• **Fully Completed** and **signed**, handwritten and in black ink pen.
5	Audited Financial Statements signed by the **CA or Auditor & Director of the company** (MBD 5 form)	• If required by law submit audited financial statements for the past 3 years or since the date of establishment if established during the past 3 years. • If not required by law to submit Audited Financial Statement, complete a Public Interest Score form (T1.1.1.1 page no 3) (p.12/567) and a proof of PI Score calculations.
6	Joint Venture Agreement	• If applicable submit a complete and signed JV agreement. • JV agreement stating who the lead partner is with the shared percentages. • Note: JV agreement must be as per CIDB regulation of 2008 regulation 25 (5)(a), (b) and (6)
7	Latest Municipal rates and taxes account for the **COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/SHAREHOLDERS.**	• End of September / October 2021 municipal rates & taxes statement must be attached • The submitted account must not be in arrears for more than 3 months. • In a case of Rates & Taxes Account being in a family member's name, **ONLY MUNICIPAL** Account where the address of the Account matches the address on the company registration documents will be accepted) if not in arrears for more than 3 months.

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T2.1 RETURNABLE DOCUMENTS

8	In the event of a tenant renting a lease agreement **MUST** be attached for the **COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/SHAREHOLDERS.**	The lease agreement must include the following: • A valid copy of the lease agreement must be signed by (both Lessor and lessee). • The lease agreement must indicate dates of commencement and expiry or duration. • **NOTE:** The lease agreement for the company must indicate that the premises are for business purpose. • In a case where the lease agreement has expired and there is a clause indicating an automatic renewal the original lease agreement and a confirmation letter signed by Lessor must be attached. • In the occasion where the lease agreement has expired the original lease agreement **AND** extension must be attached with commencement and expiry dates or duration.
Note: If the company registration document's physical address on lease agreement or the municipal rates and taxes statement is the same as the Director's physical address we will accept for both Company & Director.		
NB! The following documents will not be accepted: **Affidavits; Address confirmation letter; invoices from the body corporates or agents, rates and taxes of the lessor (without a lease agreement) and municipal tender / rates clearance letter.**		
9	Municipal rates and taxes for bidders who are from the rural areas for the **COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/SHAREHOLDERS.**	• In the event that the bidder is from the rural area a letter from the municipality that the area is not liable to pay municipal rates and taxes **OR** a signed letter from the chief indicating that the bidder is from that particular rural/tribal area.
10	BBBEE Certificate or Affidavit	• Valid Certified copy of SANAS only accredited BBBEE certificate **OR** valid copy of BBBEE Sworn Affidavit must be attached**. (Failure to submit Valid Certificate will result in your bid not being allocated Points for BBBEE).**
11	CIDB Grading	• Copy of Company CIDB Grading designation 8 EP or Higher
12	Eskom Vendor Number (The company with Vendor Registration must submit documents listed on 12.1 & 12.2)	• **Complete bid document front page.** If the main bidder does not have an Eskom vendor number. Complete an appointment sheet on T2.2.1 page 1 (p.39/567) to include the recommended Eskom vendor registered company.
12.1	ORHVS Qualification/ Authorization	• Attach certified personnel proof of ORHVS registration. SAIEE and private organisations qualifications will be verified. Ensure all necessary information is included in order for verification to be confirmed.

T2.1 RETURNABLE DOCUMENTS

12.2	ECSA/ SACPCMP registration	• Attach Valid **ECSA/ SACPCMP** personnel registration. Ensure all necessary information is included in order for verification to be confirmed.
12.3	Fully Completed BOQ	• BOQ completed in handwriting and black ink pen

T2.2: RETURNABLE SCHEDULES

T2.2 – RETURNABLE SCHEDULES

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T2.2. RETURNABLE SCHEDULES

T2.2.1. ESKOM VENDOR NUMBER

It is confirmed that …… (*company name*) is registered on the Eskom Supplier Database with vendor number ……., proof of which is included in the returnables.

OR

(the following subcontractor appointment must be populated if the main contractor/tenderer is not registered with Eskom as a vendor) – refer to T2.2.10 for subcontracting by designated group

ESKOM SUBCONTRACTOR APPOINTMENT

_____

("the Contractor")

_____

("the Subcontractor")

The Contractor hereby conditionally appoints the Subcontractor for:

THE EXTENSION OF ESKOM'S VAALDAM 88/22 kV SUBSTATION, BY EXTENDING THE SUBSTATION YARD, ESTABLISHING A NEW 10 MVA TRANSFORMER BAY AND TWO 22 kV FEEDER BAYS.

The provisions for the conditional appointment includes that:

- The Contractor and Subcontractor shall enter into a supplemental agreement based on the Main Contract if the Contractor's bid is successful.
- There shall be no claim by the Subcontractor if the Contractor's bid is unsuccessful.
- The Subcontractor shall be authorized to execute self-build work on Eskom infrastructures.
- The supplemental agreement shall be subject to approval by the Main Contract's Engineer.
- The Subcontractor shall comply and be subjected to all the conditions of the Main Contract.

Subcontractor details

Company Registration Number : _____

herein represented by : _____

in the capacity of : _____

It is confirmed that …… (subcontractor name) is registered on the Eskom Supplier Database with vendor number ……., proof of which is included in the returnables.

Signed at _____ on _____ 20__.

Witnesses:

1. _____

2. _____

For: **THE CONTRACTOR**

_____

Name :

Designation : _____

Signed at _____ on _____ 20__.

Witnesses:

1. _____

2. _____

For: **THE SUBCONTRACTOR**

_____

Name :

Designation :

T2.2.2. CIDB REQUIREMENTS

In terms of Clause 3 of the Notes on the use of Standardized Procurement Documents for Engineering and Construction Works, October 2005, all Prime or Main Contractors must register with the Construction Industry Development Board (CIDB) according to Act 38 of 2000.

After receipt of an application the CIDB will grade the applicant according to experience in the various sections of works and financial capability.

The CIDB requirements for all contractors tendering on this project are as follows:

1. Tenderers and his subcontractor must be registered with the CIDB in an EP a class of construction works.

2. Tenderers must have a CIBD Contractor Grading Designation of 8 EP or higher. Please note that this tender will not be split and that no portion of the contract may be outsourced unless specified.

3. The tenderer shall submit the company profile and CIDB registration of the proposed sub-contractor for this project.

NAME & SIGNATURE OF TENDERER : .....

DATE : .....

NAME & SIGNATURE OF WITNESS : .....

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T2.2.3. 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, shareholder[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:..……..

……...……..

Full details of directors / trustees / members / shareholders.

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Table 1: Details – Directors/Trustees/Members & Shareholders

Full Name	Identity Number	State Employee Number

CERTIFICATION

I, THE UNDERSIGNED ……..……..……*(Full Name)*

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

……... Signature

…… Date

……. Position

……. Name of Bidder

T2.2.4. MBD 5 – DECLARATION FOR PROCUREMENT ABOVE R 10 MILLION (ALL APPLICABLE TAXES INCLUDED)

For all procurement expected to exceed R10 million (all applicable taxes included), bidders must complete the following questionnaire *(Delete if not applicable)*:

T2.2.4.1. Are you by law required to prepare annual financial statements for auditing? **(YES/NO)**

……..

……..

T2.2.4.2. If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.

……..

……..

T2.2.4.3. Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days? **(YES/NO)**

……..

T2.2.4.4. If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days.

...…….....

……..

T2.2.4.5. If yes, provide particulars.

……..

…….....

T2.2.4.6. Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract? **(YES/NO)**

……..

……..

T2.2.4.7. If yes, furnish particulars

…….

…….

T2.2.4.8. Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic?
(YES/NO)

……

……

T2.2.4.9. If yes, furnish particulars

…….

…….

CERTIFICATION

I, THE UNDERSIGNED (NAME) ……...

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

……... Signature

…… Date

……. Position

……. Name of Bidder

MBD FORMS

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T2.2.5. MBD 6.1 - PREFERENTIAL PROCUREMENT CLAIM FORM

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

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

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

T2.2.5.1. GENERAL CONDITIONS

a) The following preference point systems are applicable to all bids:
- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

b) The value of this bid is estimated to exceed R50 000 000 (all applicable taxes included) and therefore the 90/10 preference point system shall be applicable; or

c) Points for this bid shall be awarded for:
(i) Price; and
(ii) B-BBEE Status Level of Contributor.

d) The maximum points for this bid are allocated as follows:

	POINTS
PRICE	**90**
B-BBEE STATUS LEVEL OF CONTRIBUTOR	**10**
Total points for Price and B-BBEE must not exceed	**100**

e) Failure on the part of a bidder to submit proof of B-BBEE Status level of contributor together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

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

T2.2.5.2. DEFINITIONS

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

(b) **"B-BBEE status level of contributor"** means the B-BBEE status of an entity in terms of a code of good practice on black economic empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

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

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

(e) **"EME"** means an Exempted Micro Enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;

(f) **"functionality"** means the ability of a tenderer to provide goods or services in accordance with specifications as set out in the tender documents.

(g) **"prices"** includes all applicable taxes less all unconditional discounts;

(h) **"proof of B-BBEE status level of contributor"** means:
1) B-BBEE Status level certificate issued by an authorized body or person;
2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;
3) Any other requirement prescribed in terms of the B-BBEE Act;

(i) **"QSE"** means a qualifying small business enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;

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

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

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

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

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

(o) **"firm price"** means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs

or excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;

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

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

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

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

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

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

T2.2.6. ADJUDICATION USING A POINT SYSTEM

- The bidder obtaining the highest number of total points will be awarded the contract.
- Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts;.
- Points scored must be rounded off to the nearest 2 decimal places.
- In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of preference points for B-BBEE.
- However, when functionality is part of the evaluation process and two or more bids have scored equal points including equal preference points for B-BBEE, the successful bid must be the one scoring the highest score for functionality.
- Should two or more bids be equal in all respects, the award shall be decided by the drawing of lots.

T2.2.7. POINTS AWARDED FOR PRICE

T2.2.7.1. THE 90/10 PREFERENCE POINT SYSTEMS

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

90/10

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

Where

Ps = Points scored for price of bid under consideration

Pt = Price of bid under consideration

Pmin = Price of lowest acceptable bid

T2.2.7.2. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

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

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

Bidders who qualify as EMEs in terms of the B-BBEE Act must submit a certificate issued by an Accounting Officer as contemplated in the CCA or a Verification Agency accredited by SANAS or a Registered Auditor. Registered auditors do not need to meet the prerequisite for IRBA's approval for the purpose of conducting verification and issuing EMEs with B-BBEE Status Level Certificates.

Bidders other than EMEs must submit their original and valid B-BBEE status level verification certificate or a certified copy thereof, substantiating their B-BBEE rating issued by a Registered Auditor approved by IRBA or a Verification Agency accredited by SANAS.

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

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

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

A person will not be awarded points for B-BBEE status level if it is indicated in the bid documents that such a bidder intends sub-contracting more than 25% of the value of the contract to any other enterprise that does not qualify for at least the points that such a bidder qualifies for, unless the intended sub-contractor is an EME that has the capability and ability to execute the sub-contract.

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

T2.2.8. BID DECLARATION

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

T2.2.9. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED

B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED
B-BBEE Status Level of Contributor: = …… (maximum of 10 or 20 points)

T2.2.10. SUB-CONTRACTING

It is a pre-qualifying condition that at least 30% of the contract be subcontracted to a EME(s) or QSE(s) which is/are at least 51% black owned. Documents of the subcontractor which include share certificates, ID documents, shareholder certificates should the CK not indicate shareholder ownership.

I/We hereby notify you that it is my/our intention to employ the following subcontractor for work in this contract.

If I/we am/are awarded a contract I/we agree that this notification does not change the requirement for me/us to submit the names of proposed subcontractors in accordance with requirements of the contract for such appointments. **Subcontracting shall be in accordance with the Preferential procurement regulations, 2017 pertaining to the Preferential Procurement Policy Framework Act, Act No. 5 of 2000.**

T2.2 RETURNABLE SCHEDULES

NAMES OF PROPOSED SUBCONTRACTOR	NATURE AND EXTENT OF WORK TO BE SUBCONTRACTED	TOTAL AMOUNT (30% of all inclusive Total Bid Value)

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

If yes, indicate:

a) what percentage of the contract will be subcontracted? ……..…%

b) the name of the sub-contractor? ……...…….

c) the CIDB grading of the sub-contractor?.....……

d) the B-BBEE status level of the sub-contractor?.....……

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

f) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations, 2017:

Table 2: Sub-contracting by designated group

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

SIGNATURE
(Subcontractor): …….

SIGNATURE
(Main Contractor): …….

***Attach pre-tender agreements and other mandatory documents**

T2.2.11. DECLARATION WITH REGARD TO COMPANY/FIRM

a) Name of company/firm: …….

b) VAT registration number: ……..

c) Company registration number:……

d) TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

e) DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

……

……

……

f) COMPANY CLASSIFICATION

- Manufacturer
- Supplier
- Professional service provider
- Other service providers, e.g. transporter, etc.

[TICK APPLICABLE BOX]

g) MUNICIPAL INFORMATION

Municipality where business is situated ……..…….

Registered Account Number ……..…….

Stand Number ……..…….

h) TOTAL NUMBER OF YEARS THE COMPANY/FIRM HAS BEEN IN BUSINESS? ……

i) I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contributor indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:
   i) The information furnished is true and correct;
   ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;

iv) If the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –

- disqualify the person from the bidding process;
- recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
- 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;
- recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury 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
- forward the matter for criminal prosecution.

WITNESSES:

1. …….

2. …….

……..
SIGNATURE(S) OF BIDDER(S)

DATE: ……

ADDRESS: …….....

……..

T2.2.12. MBD 8 – DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

a) This Municipal Bidding Document must form part of all bids invited.
b) It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
c) The bid of any bidder may be rejected if that bidder, or any of its directors have:

   i. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;

   ii. been convicted for fraud or corruption during the past five years;

   iii. wilfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or

   iv. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).

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

Item	Question	Yes	No
T2.2.12.d)1	Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the *audi alteram partem* rule was applied). **The Database of Restricted Suppliers now resides on the National Treasury's website(www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.**	Yes ☐	No ☐
	If so, furnish particulars:		
T2.2.12.d)2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? **The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.**	Yes ☐	No ☐

T2.2 RETURNABLE SCHEDULES

Item	Question	Yes	No
T2.2.12.d)2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? **The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.**	Yes ☐	No ☐
	If so, furnish particulars:		
T2.2.12.d)3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐
	If so, furnish particulars:		
T2.2.12.d)4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes ☐	No ☐
	If so, furnish particulars:		
T2.2.12.d)5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
	If so, furnish particulars:		

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CERTIFICATION

I, THE UNDERSIGNED ……..……..…… *(Full Name)*

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN addition TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

……...	……
Signature	Date
…….	…….
Position	Name of Bidder

T2.2.13. MBD 9 - CERTIFICATE OF INDEPENDENT BID DETERMINATION

a) This Municipal Bidding Document (MBD) must form part of all bids[1] invited.

b) 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 *per se* prohibition meaning that it cannot be justified under any grounds.

c) 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:

   i. take all reasonable steps to prevent such abuse;

   ii. 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

   iii. 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.

d) 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.

e) 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 bids and proposals.

[2] Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or 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.

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CERTIFICATE OF INDEPENDENT BID DETERMINATION (MBD 9)

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

in response to the invitation for the bid made by:

_____

(Name of Municipality / Municipal Entity)

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

I certify, on behalf of: _____ that:

(Name of Bidder)

1. I have read and I 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 complete in every respect;

3. I am authorized 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 authorized 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 than the bidder, whether or not affiliated with the bidder, who:
   (a) has been requested to submit a bid in response to this bid invitation;
   (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
   (c) 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 from, 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 or arrangement with any competitor regarding:
   (a) prices;
   (b) geographical area where product or service will be rendered (market allocation)
   (c) methods, factors or formulas used to calculate prices;

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(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 arrangements 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 of the awarding of the contract.

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

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

…… ……
Signature Date

……. ...……
Position Name of Bidder

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T2.2.14. FINANCIAL STATEMENTS

I / We agree, if required, to furnish audited copies of the required financial statements, together with my / our Director's and Auditor's report, for the current, unaudited financial year, including management statements for each month, for consideration by the Employer.

T2.2.14.1. FINANCIAL INFORMATION

a) Turnover in the last three (3) financial years:

2020 / 2021: …….....

2019 / 2020: ……..

2018 / 2019: ……..

b) Financial Year starts on ……..…… and ends on ……

c) Average monthly **income** over the last three financial years: ……...

d) Average monthly **expenses** over the last three financial years: ……..….

e) Average monthly **profit** over the last three financial years: ……...….

f) Average monthly **cash funds** over the last three financial years: …….

g) Value of the **largest** <u>completed</u> project in the last three years (excluding VAT):

R……

h) **Average** value of projects completed in the last five years (excluding VAT):

R……

i) Highest (combined) total value of debtors at any given period during the last three financial years: R……..

j) Lowest (combined) total value of debtors at any given period during the last three financial years: R……..

k) Debtors at tender closing:

> Current (excl. VAT): …….

> 30 days (excl. VAT): …….

> 60 days (excl. VAT): …….

> 90 days (excl. VAT): …….

In excess of 120 days : …….
(excl. VAT)

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l) Creditors at tender closing:

> Current (excl. VAT): …….

> 30 days (excl. VAT): …….

> 60 days (excl. VAT): …….

> 90 days (excl. VAT): …….

In excess of 120 days : …….
(excl. VAT)

m) Management statements for all months in the current financial year included: Yes / No
(delete which is not applicable)

n) Name of accountant : ……

Qualifications : ……

Signature : ……

Date : ……

SIGNED AT ……...

ON THIS……DAY OF …….....2021.

ON BEHALF OF ……...

…….

SIGNATURE: …….

AS WITNESSES:

1. ……

2. ……

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T2.2.15. PROGRAMME

1.	Has the site been inspected by the Tenderer?	YES / NO
2.	Date of inspection	_____
3.	Has a thorough method study been made of the proposed execution of the project?	YES / NO
4.	Has a preliminary construction programme been prepared of the project and accompanying the tender?	YES / NO

(ALL PERIODS TO BE CALCULATED FROM DATE OF RECEIVING AN APPOINTMENT LETTER)

5.	Period required to commence work:	_____ days
6.	Period required to establish site:	_____ days
7.	Period required for material delivery:	_____ days
8.	Period to first delivery of material:	_____ days
9.	Period to last delivery of material:	_____ days
10.	Period required to complete the project:	_____ weeks *(should be the same as the Letter of Tender AND the project programme)*

I / We accept responsibility for late delivery of material and will enter into agreements with our suppliers of material to forward penalties accruing from claims due to late delivery of materials.

…… ……
Signature Date

……. ...……
Position Name of Bidder

T2.2.16. DAYWORK SCHEDULE

No daywork will apply to this Contract. The provision of the rates below is for information purposes only.

T2.2.16.1. LABOUR

The daywork rate for labour shall be the total hourly rate for the use of the labour inclusive of overhead and supervision costs. The time of Gangers or Charge Hands actually working with the gangs may be included in the daywork claim but the time of Foremen and Gangers is not to be included but is to be covered in the tendered rates.

Table 3: Hourly Rates

CLASS OF LABOUR	HOURLY RATE FOR		
	NORMAL HOURS	OVERTIME	SUNDAYS
Supervisor			
Artisan			
Semi-skilled			
Labour or unskilled			

T2.2.16.2. TRANSPORT

Transport cost per km for:

Vehicles less than 1 ton : .....

Vehicles above 1 ton : …….....

T2.2.17. LIST OF CONSTRUCTION EQUIPMENT

The Tenderer is requested to indicate what equipment and plant is immediately available, what equipment is ordered but not yet delivered and what equipment will be purchased in the event of this Contract being awarded to the Tenderer.

EQUIPMENT IMMEDIATELY (WITH HOURLY RATES) AVAILABLE FOR THIS CONTRACT

Table 4: Equipment Available

TYPE OF EQUIPMENT	CONDITION	RATE (R/h)

EQUIPMENT (WITH HOURLY RATES) ON ORDER WHICH ON DELIVERY WILL BE USED FOR THIS CONTRACT

Table 5: Equipment on order

TYPE OF EQUIPMENT	SUPPLIER	DELIVERY PERIOD	RATE (R/h)

EQUIPMENT (WITH HOURLY RATES) TO BE PURCHASED IF THIS TENDER IS ACCEPTED

Table 6: Equipment to be ordered

TYPE OF EQUIPMENT	SUPPLIER	DELIVERY PERIOD	RATE (R/h)

After the Contract has been awarded the Contractor will have to satisfy the Engineer that the above-mentioned equipment, or equivalent, will be on site when required. The Contractor will maintain the equipment in good working order for the full duration of the Contract. The Contractor also undertakes to bring any additional equipment, without additional cost to the Employer, onto the Site when it is in the opinion of the Employer necessary to complete the Contract within the Contract period.

NOTE:

The hourly rates for equipment, must include diesel, operator / driver and all maintenance and transport cost to and from the site.

T2.2.18. PREVIOUS EXPERIENCE – PROJECT REFERENCES

Particulars of projects of similar nature to that contained in this contract to which the Tenderer is at present committed and / or involved during the last 3 years to be submitted hereunder.

Table 7: Previous Experience

	PROJECT	PLACE	ENGINEER & TEL NO	CONTRACT AMOUNT	CONTRACT PERIOD	DATE COMPLETED	COMPLETION IN TIME (YES / NO)
1.							
2.							
3.							
4.							
5.							

Is the information provided in compliance with the POPI (Protection of Personal Information) Act? Yes ☐ No ☐

…… Signature

…… Date

…… Position

…… Name of Bidder

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T2.2.19. ESTIMATED MONTHLY EXPENDITURE (CASH FLOW)

The Tenderer shall, in the table below, state the estimated value of work to be completed every month, based on his preliminary program and his tendered unit rates. Amounts for contingencies and contract price adjustment shall not be included.

Table 8: Cash Flow

MONTH	VALUE
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	

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T2.2 RETURNABLE SCHEDULES

MONTH	VALUE
25.	
26.	
27.	
28.	
29.	
30.	
31.	
32.	
33.	
34.	
35.	
36.	
SUBTOTAL Plus: 5 % Retention	R R
TOTAL	**R**

Note: Preference will be given to tenderers that can provide bridging financing.

T2.2.20. MATERIAL INFORMATION

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

Where certain products of a specified manufacturer are unobtainable, substitutes may be offered, but shall only be supplied after written consent has been given by the Engineer.

All apparatus, components, fittings and material supplied and / or installed, whether expressly specified herein or not, shall confirm in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards and / or the appropriate current "British Standard Specifications and Addenda thereto", except where otherwise specified or permitted by the Engineer in writing.

The Engineer may order the elected contractor to supply and / or deliver and / or install any other make or manufacture of article(s) than that / those for which the contractor tendered. The unit total cost of such item(s) taken out, shall then be subtracted from the tender sum of the contractor and the unit total of such other apparatus, component parts, fittings and / or materials, with which these are replaced, if any, shall be added to the tender price.

The price of such items added or omitted shall be calculated by using the current general wholesale prices at which the Electrical Contractor can buy such equipment. The Engineer's decision for the determination of such prices shall be final.

Installation work which has been started with certain materials and / or equipment shall be completed by using the same manufacture of articles or equipment throughout the whole project, for that specific application, unless specified otherwise.

……	……
Signature	Date
…….	...……
Position	Name of Bidder

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T2.2 RETURNABLE SCHEDULES

NO CHANGE OF SUPPLIER OF MATERIALS AS QUOTED WILL BE CONSIDERED

Table 9: Equipment Delivery & Manufacturers

	DELIVERY PERIOD	TYPE	MANUFACTURER
Isolator 132 kV 2500 A 25 kA CRDB			
CT 132 kV 2500 A 25 kA 2P2M			
Breaker 132 kV 3150 A 40 kA 3P			
VT 88 kV / 110V Class 3P/0.2			
10 MVA, 88 / 11 kV Transformer			
Isolator 22 kV 2500 A 25 kA CRDB			
NEC/NER/AUX Trfr 11 kV, 300 A,			
88 kV Surge Arrestor			
66 kV Surge Arrestor			
11 kV Surge Arrestor			
Post Insulator 132 kV			
Post Insulator 66 kV			
Long Rod Insulator 132 kV			
Medium Voltage Outdoor Switchgear			
Control Panels			
Battery charger			
SCADA			
Telemetry			
Long Rod Insulator 132 kV			
Fox ACSR			
100kVA & 200kVA transformers			
$35mm^2$ and $70mm^2$ ABC			
Pole boxes			
Ready boards			
Wood poles			
MV assemblies			
LV assemblies			

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T2.2.21. IMPORTED EQUIPMENT

The tenderer shall, in the table below, state the value of equipment to be imported every month, based on his preliminary program and his tendered unit rates. Amounts for contingencies and contract price adjustment shall not be included.

Table 10: Imported Equipment

EQUIPMENT	MONTH	VALUE
	1	R
	2	R
	3	R
	4	R
	5	R
	6	R
	7	R
	8	R
	9	R
	10	R
	11	R
	12	R
	13	R
	14	R
	15	R
	16	R
	17	R
	18	R
	19	R
	20	R
	21	R
	22	R
	23	R
	24	R
	25	R
	26	R
	27	R
	28	R

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EQUIPMENT	MONTH	VALUE
	29	R
	30	R
	31	R
	32	R
	33	R
	34	R
	35	R
	36	R
SUBTOTAL		R
TOTAL		**R**

T2.2.22. COMPOSITION OF TENDERER'S COMPANY

T2.2.22.1. GENERAL

State whether the Tenderer is a company, a partnership, a person or a closed corporation.

Company		Partnership		Person		Closed Corporation	

T2.2.23. INFORMATION TO BE PROVIDED

T2.2.23.1. IF THE TENDERER IS A COMPANY:

a) Affix a certified copy of the Certificate of Incorporation to this page.

b) List the Directors and each Director's date of appointment:

Table 11: Directors' appointment dates

DIRECTORS	DATE OF APPOINTMENT
1.	
2.	
3.	
4.	
5.	
6.	

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T2.2 RETURNABLE SCHEDULES

1) List the Shareholders and percentage of shareholding:

Table 12: Shareholders' percentages

SHAREHOLDERS	PERCENTAGE OF SHARE HOLDING
1.	
2.	
3.	
4.	
5.	
6.	

2) List all companies of which your Company is a shareholder and percentage shares:

Table 13: Company shareholding

COMPANIES	PERCENTAGE SHARES
1.	
2.	
3.	
4.	
5.	
6.	

T2.2.23.2. IF THE TENDERER IS A PARTNERSHIP:

a) List the partners and state each partner's share in the partnership:

Table 14: Partnership shares

PARTNER	PARTNER'S SHARE
1.	
2.	
3.	
4.	
5.	
6.	

T2.2.23.3. IF THE TENDERER IS A PERSON:

a) Provide the full name and qualifications of the person:

Table 15: Tenderer qualification

FULL NAME OF PERSON	QUALIFICATIONS
1.	
2.	
3.	
4.	
5.	
6.	

T2.2.23.4. IF THE TENDERER IS A CLOSED CORPORATION:

a) State each member's share in the closed corporation:

Table 16: Member shares in Close Corporation

MEMBER	MEMBER'S SHARE
1.	
2.	
3.	
4.	
5.	
6.	

b) It shall be expected from the above members of the closed corporation to be responsible in their personal capacity for any transaction relating to this project.

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T2.2.23.5. SCHEDULE OF SUBCONTRACTORS:

Table 17: Complete Schedule of Sub-contractors

Name of Sub-contractor	Proposed Duties	% of Overall Scope	Experience (Years)
1.			
2.			
3.			
4.			
5.			
6.			
7.			

TOTAL PERCENTAGE SUB-CONTRACTING: ……..%

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T2.2.24. POWER OF ATTORNEY

RESOLUTION PASSED BY THE BOARD OF DIRECTORS OF:

.....

.....

AT ..... ON THE ..... DAY OF ..... 20.....

RESOLVED

THAT .....

IN THE CAPACITY OF .....

is hereby authorised and empowered to sign the Tender and Contract Documents on behalf

of the Company ..... for the supply, delivery, erection and testing of all Works covered in the attached document.

SIGNATURE: 1. .....

2. .....

CERTIFIED A TRUE COPY: .....

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T2.2.25. CERTIFICATE OF CONVERSANCE WITH THE TENDER DOCUMENTS

I / We, the undersigned ..... hereby certify that I / We am / are fully conversant with the General and Special Conditions of Contract, Conditions of Tender, Specifications, Schedules of Quantities and Drawings. I / We declare that I / We am / are satisfied with the description of the work and the explanations furnished by the Engineer, and that I / We fully understand the nature and extent of the work required to be executed, as specified and according to the intent of the Contract. I / We declare that all the equipment offered in my / our tender comply to the Specifications of these Tender Documents and that the relevant Data Sheets have been completed correctly and in full. I / We have ascertained all factors which may have a bearing on the execution of the works and the costs thereof.

SIGNED AT ..... ON BEHALF OF THE FIRM .....

ON THIS ..... DAY OF ..... 20.....

SIGNATURE .....

CAPACITY .....

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T2.2.26. CERTIFICATE OF CONVERSANCE WITH THE PROJECT PHASING

I / We, the undersigned ……. hereby acknowledge that the project will be phased over multiple years as from the date of tender award up to June 2024.

I / We, the undersigned …… hereby further acknowledge that I / We am / are fully conversant that the funding is not guaranteed and the construction works will be subject to the availability of funds.

I / We declare that I / We has / have adequately allowed for all costs associated with site de-establishing and site re-establishment over multiple years as from the date of tender award up to June 2024.

I / We declare that I / We am / are fully conversant with the envisaged Scope of Works for phases.

I / We, the undersigned …… hereby acknowledge that the Scope of Works for phases might be adjusted in excess of 20 % as dictated by the funds allocations and that our unit rates will remain fixed.

SIGNED AT ……

ON BEHALF OF THE FIRM ……..

ON THIS ……. DAY OF……. 20……

SIGNATURE ……..

CAPACITY ……..

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T2.2.27. CLAIM FOR FUNCTIONALITY POINTS

For the technical functionality a minimum score of 70 points must be obtained to qualify for the next round of the evaluation. The weighting per section is indicated in the table below:

Table 18: Technical Functionality Summary

Functionality	Maximum Points
a) Experience on similar projects	40
b) Interpretation of Scope of Works	10
c) Resources relevant to Scope of Works	15
d) Capacity relevant to Scope of Works	15
e) Financial viability	20
Total	**100**

Table 19: Technical Functionality Point Allocation

a) EXPERIENCE ON SIMILAR PROJECTS		
Client signed Letters of Appointment and Completion Letter/Certificate which must indicate project value and scope of work completed within the last 10 years.	4 x Appointment & completion confirmations (substation) **&** 2 x Appointment confirmations (reticulation) **TOTAL: 40 points**	**Max. 40 points**
	3 x Appointment & completion confirmations (substation) **&** 2 x Appointment confirmations (reticulation) **TOTAL 30 points**	
	2 x Appointment & completion confirmations (substation) **&** 2 x Appointment confirmations (reticulation) **TOTAL: 20 points**	

1) SIGNED LETTERS OF APPOINTMENT & COMPLETION LETTERS WHICH MUST INDICATE THE FOLLOWING:

1.1) Substation/ Electrical reticulation project or combined scope

2) MINIMUM PROJECT VALUE PER LETTER MUST BE AS FOLLOWS TO BE CONSIDERED FOR POINTS:

2.1) Min Project Value of R 15m for Substation

2.2) Min Project Value of R5m for Electrical Reticulation

2.3) Min Project Value of R 20m for combined scope of Substation and Electrical reticulation

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T2.2 RETURNABLE SCHEDULES

3) CONDITIONS

3.1) A minimum of 2 Electrical reticulation projects must be attached or no points will be issued further for substation projects

3.2) A minimum of one project with the state/ SOE/ parastatal must be attached or no points will be issued further for the remaining project letters

3.3) Non-attachment of Appointment and completion letter/ certificate of the same project will result in zero points

3.4) For appointment/ completion letters that do not include the required info, please attach a client signed confirmation letter that confirms the Scope and project Value that was implemented.

b) INTERPRETATION OF SCOPE OF WORKS		
Submission of a proposed project programme in a Gantt format.	Attached: 5 points Not Attached: 0 points	Max. 5 Points
Submission of Method Statement of Contract Works based on Scope of Works and contractual requirements (max. 5 pages).	Attached: 5 points Not Attached: 0 points	Max. 5 Points
c) RESOURCES		
5-ton crane truck Company/Director Vehicle Registration Certificates/ Letter from Rental Company/ Plant confirmation letter	1 x 5t crane truck: 5 points 0 x 5t crane truck: 0 points	Max. 5 points
LDV's Company/Director Vehicle Registration Certificates/ Letter from Rental Company/ Plant confirmation letter	2 x LDV: 3 points 1 x LDV: 2 points 0 x LDV: 0 points	Max. 3 points
1 x 100 A (min.) Substation injection test set. (Photo of equipment with proof of the serial number and calibration certificate indicating company name).	Own test equipment: 2 points Rental agreement: 1 point Non submission: 0 points	Max. 2 points

d) CAPACITY **Complete Company Personnel Sheet on Pages 50, 51 & 52**		
Qualified Electrician with minimum N4 or higher qualification **Attach**: **Qualification**	5 projects: 5 points	Max. 5 points
	4 projects: 4 points	
	3 projects: 3 points	
	2 projects: 2 points	
	1 project: 1 point	
	None or No submission: 0 points	
SHEQ representative **Attach**: **Relevant safety qualification**	3 projects: 3 points	Max. 3 points
	None or No submission: 0 points	
Commissioning Engineer with minimum N; Diploma or higher qualification **Attach: Qualification & Commissioning Report.**	5 projects: 7 points	Max. 7 points
	4 projects: 5 points	
	3 projects: 3 points	
	2 projects: 2 points	
	1 project: 1 point	
	None or No submission: 0 points	
e) FINANCIAL VIABILITY Minimum points required for this sub-category are 20 points **The required ratios will be deduced from the attached AFS. Please attach a summary of the required ratios for evaluation purposes as per the CA or RA approval of the AFS. For Non- Audited FS, please attach an affidavit confirming correctness of the FS.**		
1.	**Current Ratio of between:** 1.5 or greater = 10 points 1 to less than 1.5 = 5 points	10 points
2.	**Debt Ratio of between:** 0.4 or greater = 5 points	5 points
3.	**Cash Ratio between:** 0.5 or greater = 5 points	5 points

T2.2 RETURNABLE SCHEDULES

NOTE - THE MUNICIPALITY RESERVES THE RIGHT TO VERIFY THE SUBMITTED FUNCTIONALITY DOCUMENTS

I HEREBY CONFIRM THAT THE INCLUDED COMPANY FINANCIAL RATIOS ARE TRUE AND CORRECT AND THAT MISREPRESENTATION OF THE FINANCIALS WILL LEAD TO DISQUALIFICATION OF THE BID SUBMISSION

NAME OF PR ACCOUNTANT / RA / CA : ...…….

QUALIFICATION : ……..

SIGNATURE : …….....

DATE : ……..…….

As part of the responsiveness evaluation for functionality, the tenderer shall populate all forms included under this section (next page).

T2.2 RETURNABLE SCHEDULES

T2.2.27.1. QUALIFIED ELECTRICIAN

NB: Attach: Copy of qualification *(Failure to fully complete will lead to no point scoring for functionality)*

Name & Surname	
ID/Passport Number	
Highest Qualification	

Employer & Contact reference No.	**Project**	**Project Duration (Year)**

T2.2.27.2. SHEQ REPRESENTATIVE

NB: Attach: Qualification *(Failure to fully complete will lead to no point scoring for functionality)*

Name & Surname	
ID/Passport Number	
Highest Qualification	

Employer & Contact reference No.	**Project**	**Project Duration (Year)**

T2.2 RETURNABLE SCHEDULES

T2.2.27.3. COMMISIONING ENGINEER

NB: Attach: Copy of qualification & Commissioning report *(Failure to fully complete will lead to no point scoring for functionality)*

Name & Surname	
ID/Passport Number	
Highest Qualification	

Employer & Contact reference No.	Project	Project Duration (Year)

T2.2.28. TECHNICAL SCHEDULES (THEMBA KHUBEKA RETIC)

The Technical Schedules shall be populated by the contractor / OEM. Failure to complete any schedule may result in the bid submitted being disqualified.

At no stage during the delivery of the works may the contractor change supplier / manufacturer without the written consent from the Engineer.

TECHNICAL A-B SCHEDULES:
Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

SIGNED ON BEHALF OF TENDERER: : _____

COMPANY NAME : _____

NAME IN BLOCK LETTERS : _____

DATE : _____

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T2.2.28.1. DISTRIBUTION TRANSFORMERS

The general requirements Distribution Transformers are covered by SANS780 respectively. The detail project requirements shall be covered in the Project Specification, Drawings and Bill of Quantities.

Table 20: Technical Schedules A and B – 100 kVA

Sub-clause of SANS 780	Description		Schedule A	Schedule B
Part 1	**Preferred Fittings**			
	Number of units required			
	a) firm		45	xxxxxxxxxxx
	b) optional		0	xxxxxxxxxxx
4	Nominal rating		100 kVA	
	Rating of low-voltage neutral terminal, if other than as specified	kVA	xxxxxxxxxx	……...
4.5	Primary voltage	V	22 000	xxxxxxxxxx
	Secondary voltage	V	420	
	Number of phases		~~Single-phase~~ Three-phase	
4.6	Insulation level			
	c) medium-voltage	kV	xxxxxxxxxx	.....
	d) low-voltage	kV	xxxxxxxxxx	.....
5.2	Tapping's		YES/~~NO~~	
5.6	Losses, if other than as specified			
	e) no-load losses	W	xxxxxxxxxx	.....
6.1.3	f) load losses	W	xxxxxxxxxx	.....
	Vector symbol, if other than as specified		Dyn11	.....
8.4	Dimensions			
	a) overall height	mm	xxxxxxxxxx	.....
	b) overall length	mm	xxxxxxxxxx	.....

T2.2 RETURNABLE SCHEDULES

Sub-clause of SANS 780	Description		Schedule A	Schedule B
	c) overall	mm	xxxxxxxxxx	.....
	d) width Total mass	kg	xxxxxxxxxx	.....
8.5	Constructional details and fittings (see table 3)		xxxxxxxxx	……..
8.9	Tank type		Sealed/ ~~free-breathing~~	
8.9.4	Expansion space	%	xxxxxxxxxx	.....
8.9.6	Tank cover of sealed transformer to be bolted, if so agreed		~~YES~~/NO	.....
8.9.11	Pressure-relief device		~~YES~~/NO	……
8.10	Conservator		~~YES~~/NO	
8.13.1	The type of arrangement required in an air- filled arrangement		xxxxxxxxx	.....
8.13.2	Number and type of connection required		Cable Box N/A	xxxxxxxxxxx
8.14	Terminations		Outdoor	
	Medium-voltage bushings			
	a) material		xxxxxxxxxx	.....
	b) creepage distance	mm	xxxxxxxxxx	.....
	BIL	kV		
	Low-voltage bushings			
	a) material		xxxxxxxxxx	.....
	b) creepage distance	mm	xxxxxxxxxx	.....
	BIL	kV		
	Number of conductors per terminal		xxxxxxxxxx	.....
	Position of bushings		xxxxxxxxxx	.....
8.14.2	The form of protection against accidental contact with an MV overhead line connection		xxxxxxxxxx	.....

T2.2 RETURNABLE SCHEDULES

Sub-clause of SANS 780	Description		Schedule A	Schedule B
8.14.3	The mounting position of bushings		xxxxxxxxxx	……
8.15	Mounting of an MV surge arrester on a transformer with outdoor bushings		xxxxxxxxxx	……
8.16	Breather type		xxxxxxxxxx	.....
8.17	Oil-level gauge (> 400 kVA sealed)		~~YES~~/NO	
8.20	Under base		Flat/~~skid~~	
8.20.4	Fixing hole spacing details		xxxxxxxxxx	.....
8.20.5	Ground-mounted transformers		xxxxxxxxxx	.....
8.21	Details of jacking pads for transformers smaller than 630 kVA		xxxxxxxxxx	.....
8.23	Corrosive environment		~~High~~/low	
	Colours of finishing coats, if different from standard		Avo Green	.....
8.24.1	Insulating material, if other than as specified		xxxxxxxxxx	.....
8.24.2	Cooling method		ONAN/~~LNAN~~	
8.25.1	Overload protection	%	YES/NO	xxxxxxxxxx
	Open/close convention, if other than as specified		.....	.....
8.25.2	MV fuses		YES/~~NO~~	
8.26	Number of phases, rated primary and secondary no-load voltages		xxxxxxxxxx	.....
8.27	Impedance voltage, if other than as specified		.....	.....
10	Tests			
10.2	Number of copies of routine test results to be provided		1	
10.3	Details of previous type-test results		xxxxxxxxxx	.....
			xxxxxxxxxx	.....
			xxxxxxxxxx	.....
	Type-test certificate serial numbers and dates		xxxxxxxxxx	.....

T2.2 RETURNABLE SCHEDULES

Sub-clause of SANS 780	Description		Schedule A	Schedule B
10.3.3	The sequence of panels of depth exceeding 260 mm in the corrugated tank fatigue test		xxxxxxxxxx	.....
10.4.1	Short-circuit withstand test require		~~YES~~/NO	
10.4.2	Sound level determination required		~~YES~~/NO	
Part 2	**Optional Fittings** (Complete only if such fittings are required)			
C.1	Current transformers		~~YES~~/NO	
	type required (mounting details)		N/A	
	Ratio		N/A	
C.2	Gas-actuated and oil-actuated relay		~~YES~~/NO	
	Type		N/A.	.....
C.3	Thermometer pockets		~~YES~~/NO	
C.4	Indicating thermometer		~~YES~~/NO	
C.4.2	Type of indicating thermometer		N/A	.....
C.4.4	Alarm contacts details		N/A	.....
C.6	Wheels and axles, if required		~~YES~~/NO	
Part 3	**Particulars of transformer for parallel operation** (complete only if such fittings are required)			
	Turns ratio of windings at rated voltage		N/A	
	Turns ratio corresponding to tapping's		N/A	
	Tapped winding		N/A	
	Load loss at rated current corrected to a reference temperature of 75 °C	W	N/A	xxxxxxxxxx
	Impedance voltage related to the principal tapping	%	N/A	xxxxxxxxxx
	Internal winding connection symbol		N/A	
	Winding material		Copper	

T2.2 RETURNABLE SCHEDULES

Table 21:Technical Schedules A and B – 200 kVA

Sub-clause of SANS 780	Description		Schedule A	Schedule B
Part 1	**Preferred Fittings**			
	Number of units required			
	g) firm		8	xxxxxxxxxxx
	h) optional		0	xxxxxxxxxxx
4	Nominal rating		200 kVA	
	Rating of low-voltage neutral terminal, if other than as specified	kVA	xxxxxxxxxx	……..
4.5	Primary voltage	V	22 000	xxxxxxxxxx
	Secondary voltage	V	420	
	Number of phases		~~Single-phase~~ Three-phase	
4.6	Insulation level			
	i) medium-voltage	kV	xxxxxxxxxx	.....
	j) low-voltage	kV	xxxxxxxxxx	.....
5.2	Tapping's		YES/~~NO~~	
5.6	Losses, if other than as specified			
	k) no-load losses	W	xxxxxxxxxx	.....
6.1.3	l) load losses	W	xxxxxxxxxx	.....
	Vector symbol, if other than as specified		Dyn11	.....
8.4	Dimensions			
	e) overall height	mm	xxxxxxxxxx	.....
	f) overall length	mm	xxxxxxxxxx	.....
	g) overall	mm	xxxxxxxxxx	.....
	h) width Total mass	kg	xxxxxxxxxx	.....

T2.2 RETURNABLE SCHEDULES

Sub-clause of SANS 780	Description		Schedule A	Schedule B
8.5	Constructional details and fittings (see table 3)		xxxxxxxxx	……..
8.9	Tank type		Sealed/ ~~free-breathing~~	
8.9.4	Expansion space	%	xxxxxxxxxx	.....
8.9.6	Tank cover of sealed transformer to be bolted, if so agreed		~~YES~~/NO	.....
8.9.11	Pressure-relief device		~~YES~~/NO	……
8.10	Conservator		~~YES~~/NO	
8.13.1	The type of arrangement required in an air- filled arrangement		xxxxxxxxx	.....
8.13.2	Number and type of connection required		Cable Box N/A	xxxxxxxxxxx
8.14	Terminations		Outdoor	
	Medium-voltage bushings			
	c) material		xxxxxxxxxx	.....
	d) creepage distance	mm	xxxxxxxxxx	.....
	BIL	kV		
	Low-voltage bushings			
	c) material		xxxxxxxxxx	.....
	d) creepage distance	mm	xxxxxxxxxx	.....
	BIL	kV		
	Number of conductors per terminal		xxxxxxxxxx	.....
	Position of bushings		xxxxxxxxxx	.....
8.14.2	The form of protection against accidental contact with an MV overhead line connection		xxxxxxxxxx	.....
8.14.3	The mounting position of bushings		xxxxxxxxxx	……
8.15	Mounting of an MV surge arrester on a transformer with outdoor bushings		xxxxxxxxxx	……

T2.2 RETURNABLE SCHEDULES

Sub-clause of SANS 780	Description		Schedule A	Schedule B
8.16	Breather type		xxxxxxxxxx	.....
8.17	Oil-level gauge (> 400 kVA sealed)		~~YES~~/NO	
8.20	Under base		Flat/~~skid~~	
8.20.4	Fixing hole spacing details		xxxxxxxxxx	.....
8.20.5	Ground-mounted transformers		xxxxxxxxxx	.....
8.21	Details of jacking pads for transformers smaller than 630 kVA		xxxxxxxxxx	.....
8.23	Corrosive environment		~~High~~/low	
	Colours of finishing coats, if different from standard		Avo Green	.....
8.24.1	Insulating material, if other than as specified		xxxxxxxxxx	.....
8.24.2	Cooling method		ONAN/~~LNAN~~	
8.25.1	Overload protection	%	YES/NO	xxxxxxxxxx
	Open/close convention, if other than as specified		.....	.....
8.25.2	MV fuses		YES/~~NO~~	
8.26	Number of phases, rated primary and secondary no-load voltages		xxxxxxxxxx	.....
8.27	Impedance voltage, if other than as specified		.....	.....
10	Tests			
10.2	Number of copies of routine test results to be provided		1	
10.3	Details of previous type-test results		xxxxxxxxxx	.....
			xxxxxxxxxx	.....
			xxxxxxxxxx	.....
	Type-test certificate serial numbers and dates		xxxxxxxxxx	.....
10.3.3	The sequence of panels of depth exceeding 260 mm in the corrugated tank fatigue test		xxxxxxxxxx	.....
10.4.1	Short-circuit withstand test require		~~YES~~/NO	

Sub-clause of SANS 780	Description		Schedule A	Schedule B
10.4.2	Sound level determination required		~~YES~~/NO	
Part 2	**Optional Fittings** (Complete only if such fittings are required)			
C.1	Current transformers		~~YES~~/NO	
	type required (mounting details)		N/A	
	Ratio		N/A	
C.2	Gas-actuated and oil-actuated relay		~~YES~~/NO	
	Type		N/A.	.....
C.3	Thermometer pockets		~~YES~~/NO	
C.4	Indicating thermometer		~~YES~~/NO	
C.4.2	Type of indicating thermometer		N/A	.....
C.4.4	Alarm contacts details		N/A	.....
C.6	Wheels and axles, if required		~~YES~~/NO	
Part 3	**Particulars of transformer for parallel operation** (complete only if such fittings are required)			
	Turns ratio of windings at rated voltage		N/A	
	Turns ratio corresponding to tapping's		N/A	
	Tapped winding		N/A	
	Load loss at rated current corrected to a reference temperature of 75 °C	W	N/A	xxxxxxxxxxx
	Impedance voltage related to the principal tapping	%	N/A	xxxxxxxxxxx
	Internal winding connection symbol		N/A	
	Winding material		Copper	

T2.2.28.2. MV SWITCHGEAR

The general requirements for Medium Voltage Indoor Switchgear is covered by SANS1885:2004. The detail project requirements shall be covered in the Project Specification, Drawings and Bill of Quantities.

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T2.2 RETURNABLE SCHEDULES

Table 22: Switchgear Technical Schedule

Item	Clause	Description	Schedule A	Schedule B
1	4.1.1.1	Rated voltage s kV	22	
	4.1.1.3	Rated current of Feeders A	800	
	4.1.1.3	Rated current of Busbar A	1250	
		Busbar Configuration	Single	
	4.1.1.4.2	Is 75 kV impulse required for 12 kV switchgear? kV	125	
	4.1.1.5.2	Rated short time withstand current for 12 kV switchgear kA	25 / 3 sec	
	4.1.2	Auxiliary supply voltage of other than d.c. 110 V? V	110 V_{DC}	
2	4.2.1.3	Switchgear information: a) manufacturer b) country of origin c) catalogue/type designation d) total switchgear mass kg	 xxxxxxxxx xxxxxxxxx xxxxxxxxx xxxxxxxxx	
	4.2.4.1	Is installation and on-site operational testing to be carried out by the supplier?	Yes	
	4.2.5.1	Is the switchgear to be joined to an existing switchboard?	Yes	
	4.2.5.2	Details of existing switchboard (if applicable)	Refer to project drawings	xxxxxxxxx
	4.2.6.1	Are heaters to be installed in the switchgear?	Yes	
	4.2.6.2	Type of heater offered	xxxxxxxxx	
	4.2.7.1	Are surge arresters to be installed in feeder panels?	No	
	4.2.7.2	If yes, state type and position of arrester	N/A	
	4.2.8.1	What is the earth fault current? A	360 A	
		System earthing type?	Resistive	
	4.2.8.2	Clearance hole or stud size of earthing bar offered	xxxxxxxxx	
	4.2.9.1	Is SF_6 used for insulation?	No	
		If yes, in which compartments?	N/A	
	4.2.9.4	Is a device for monitoring the SF_6 pressure required?	No	
	4.2.9.6	Quantity of SF_6 to be used in each separately filled compartment?	N/A	xxxxxxxxx
3.1	4.3.1.1.3	Circuit-breaker interrupting medium?	Vacuum	
	4.3.1.4.1	Are earthing facilities required for all main circuits?	Yes	
	4.3.1.4.2	Is a busbar earthing facility required?	No	
	4.3.1.4.3	Is a bus-section earthing facility required?	No	
	4.3.1.4.4	Details of earthing facilities offered	xxxxxxxxx	
	4.3.1.4.5	Diameter of earth switch clamping screw	xxxxxxxxx	
	4.3.1.4.7	Details of the use of bus-section or bus-coupler panels for integral busbar earthing	xxxxxxxxx	
	4.3.1.6.1	Are open/close switches for local electrical operation required?	Yes, Remote Stand-Off T/C Only	
	4.3.1.7.3	Are pins 5 and 6 required for charging?	Yes	
	4.3.1.8.2	Is mechanical close required?	Yes	

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T2.2 RETURNABLE SCHEDULES

Item	Clause	Description	Schedule A	Schedule B
	4.3.1.9.1	Circuit-breaker closing mechanism if other than manually charged, stored energy with mechanical close?	Motor Charge Spring Release & Manual Charge	
	4.3.1.9.3	A.C. supply voltage of spring charge motor V A.C. ratings of spring charge motor	xxxxxxxxx xxxxxxxxx	
	4.3.1.9.4	D.C. supply voltage of spring charge motor V Peak power kW kW Steady power	110 V_{DC} xxxxxxxxx xxxxxxxxx	
	4.3.1.9.6	Type of circuit-breaker closing mechanism offered	xxxxxxxxx	
	4.3.1.9.7	Ratings of each circuit-breaker closing device: a) voltage V b) current A c) power k W	 xxxxxxxxx xxxxxxxxx xxxxxxxxx	
	4.3.1.9.9	If applicable, state alternative circuit-breaker tripping mechanism required	Manual	
	4.3.1.10.4	Ratings of circuit-breaker coils: a) voltage V b) peak power kW	 xxxxxxxxx xxxxxxxxx xxxxxxxxx	
	4.3.1.11.3	Number of spare contacts required for: a) SF_6 alarm b) lock-out SF_6 c) circuit-breaker auxiliary 'a' d) circuit-breaker auxiliary 'b' e) spring limit f) circuit-breaker earthed	 N/A N/A xxxxxxxxx xxxxxxxxx xxxxxxxxx xxxxxxxxx xxxxxxxxx	
	4.3.1.11.6	Should <u>all</u> the circuit-breaker auxiliary contacts be wired to the compartment behind the relay chamber doors	Yes	
3.2	4.3.2.1.5	Circuit-breaker details: a) manufacturer b) country of origin c) model/type designation d) total mass (cart included) kg e) rating nameplate position	 Actom xxxxxxxxx SBV24L xxxxxxxxx xxxxxxxxx	
	4.3.2.1.7	Isolation displacement of circuit-breaker	Vertical/ horizontal	
	4.3.2.4.2	Type of earthing switch offered	Integral (cable)	
	4.3.2.7.2	Type of circuit-breaker transporting device	integral	
3.3	4.3.3.1.2	Circuit-breaker details: a) manufacturer b) country of origin c) model/type designation d) total mass kg e) rating nameplate position	 xxxxxxxxx xxxxxxxxx xxxxxxxxx xxxxxxxxx xxxxxxxxx	
	4.3.3.1.3	Number of in-line disconnectors?	N/A	
	4.3.3.1.4	Are two or three position disconnectors offered?	N/A	
	4.3.3.6.1	Is an integral type circuit test facility required?	Yes	
	4.3.3.6.4	Type of test facility offered?	xxxxxxxxx	
	4.3.3.6.5	Description of test plugs	xxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

Item	Clause	Description	Schedule A	Schedule B
4	4.4.1.4	Is an integral three-pole earthing switch required?	Yes	
	4.4.1.5	Type of switch disconnector offered	xxxxxxxxx	
	4.4.3.1	Is an integral type circuit test facility required?	Yes	
	4.4.3.4	Type of test facility offered	xxxxxxxxx	
	4.4.3.5	Description of test plugs	xxxxxxxxx	
5	4.5.1.4	Is an integral earthing facility in the circuit side required?	Yes	
	4.5.1.5	Type of switch-fuse combination offered	xxxxxxxxx	
	4.5.1.6	Operating temperatures if higher than 40 °C	xxxxxxxxx	
	4.5.1.7	Type of fuse links required a) length mm b) diameter	 N/A N/A	 xxxxxxxxx xxxxxxxxx
	4.5.4.1	Is an integral type circuit test facility required?	Yes	
	4.5.4.4	Type of circuit test facility offered	xxxxxxxxx	
	4.5.4.5	Description of test plugs	xxxxxxxxx	
6	4.6.2	Type of cable termination offered	xxxxxxxxx	
7	4.7.1	Is a substation battery required?	No	
	4.7.3	Type of battery offered	N/A	xxxxxxxx
	4.7.4	Is a substation battery charger required?	No	
	4.7.6	Type of battery charger offered	N/A	xxxxxxxx
	4.7.7	Voltages and types of auxiliary power supply available Maximum current that can be drawn from power supply A	230 V 23	
	4.7.8	Peak and standby power requirements of the switchgear VA	……	
8	4.8.1	Number of current transformers & cores required per Feeder: a) protection b) metering c) instrumentation	SEE SWITCHGEAR SCHEDULE	
	4.8.2	State the following requirements for each current application a) class b) burden c) tap ratios d) tap points e) knee-point voltage V f) secondary resistance Ω g) excitation current at knee-point voltage mA	SEE SWITCHGEAR SCHEDULE	
	4.8.3	Is permission required for metering current transformers to be used for other instruments?	Yes	
	4.8.4	Details of terminal block/rail mounted terminals offered for current transformers	xxxxxxxxx	
10	4.10.2	Requirements for protection equipment	SEE SWITCHGEAR SCHEDULE	
	4.10.4	Details of protection equipment offered a) manufacturer	 xxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

Item	Clause	Description	Schedule A	Schedule B
		b) type c) rating	xxxxxxxxx xxxxxxxxx	
11	4.11.1.1	Details of instruments required	Indications	
		Details of transducers required	N/A	xxxxxxxxx
		Details of metering equipment required	Enerdis	
		Details of instruments offered	xxxxxxxxx	
		Details of transducers offered	xxxxxxxxx	
		Details of metering equipment offered	xxxxxxxxx	
	4.11.1.2	Scale length of indicating instruments if there is preference mm	xxxxxxxxx	
	4.11.2.4	Are ammeters with a thermal maximum demand indicator required?	No	
	4.11.2.7	Accuracy of ammeters offered %	xxxxxxxxx	
	4.11.2.8	Scale plate required on ammeter	xxxxxxxxx	
	4.11.3.2	Are voltmeters with a range of 0 % to 120 % required?	No	
	4.12.1.2	Details of indicators offered	xxxxxxxxx	
12	4.12.2.1	What live circuit indication of the circuit side is required? On which panels?	VDS All	
	4.12.2.3	Details of bushing and voltage dividers	xxxxxxxxx	
	4.12.3.1	What signal indicators are required?	Open/Close/Trip	
		On which panels?	All	
	4.12.3.2	What trip indicators are required? On which panels?	Fault All	
13	4.13	Details of alarm circuits required	DC Voltage	
14	4.14.2.2	Are there alternative wiring requirements? If yes, state details Is approval required for any alternative wiring offered?	No xxxxxxxxx Yes	
	4.14.3.1	D.C. circuit protection	Fuses/MCCBs	
	4.14.4.2	Where are ammeter selector switches required?	N/A	
	4.14.4.3	Details of ammeter selector switches offered	xxxxxxxxx	
	4.14.4.5	Where are voltmeter selector switches required?	N/A	xxxxxxxx
	4.14.4.6	Details of voltmeter selector switches offered	N/A	xxxxxxxx
	4.14.6.5	Where should the external termination box be positioned?	Back	
	4.14.7.1	If relevant, state alternative termination of auxiliary wiring required	N/A	xxxxxxxx
	4.14.8.1	Details of terminal blocks offered	xxxxxxxxx	
	4.14.9.1	Markings of current and voltage transformers terminals if other than as specified	xxxxxxxxx	
	4.14.9.4	State alternative circuit designations required	xxxxxxxxx	
15	4.15.7	Details of test pack required	As per Annex D of SANS 1885:2004	
	4.15.9	Quantities of each type of pack to be supplied	xxxxxxxxx	
	4.15.11	Mounting of accessories cabinet required?	No	

Item	Clause	Description	Schedule A	Schedule B
	4.15.12	Is a circuit-breaker maintenance trolley required?	xxxxxxxxx	
16	4.16.1.1	State method used to attach rating plates	xxxxxxxxx	
17	4.17.1.1	State method used to attach labels	xxxxxxxxx	
	14.17.2.4	State requirements for main circuit designation labels	As per Dwg.	
		State details of labels	xxxxxxxxx	
18	4.18.2	State special coating requirements	SANS 1091	
	4.18.3	State other colours required	As per Dwg.	
19	5.1.3	Number of South African manufactured overseas products produced and installed in South Africa	xxxxxxxxx	
	5.3.8	Details of points, test burden and current for routine accuracy tests on current and voltage transformers	xxxxxxxxx	
20	6	Spares readily available in South Africa with short lead time.	xxxxxxxxx	

T2.2.28.3. RETIC OHL TECHNICAL SCHEDULE

The general requirements for Overhead Power Lines (22kV and below) are covered by NRS 092: 2010. If any wooden poles or cross-arms are required, only eucalyptus poles (63 MPa) in accordance with SANS 754 shall be accepted. The detailed project requirements shall be covered in the Project Specifications, Drawings and Bill of Quantities.

T2.2.28.3.1. CONDUCTORS

- Supplier : .....
- Code name : .....
- Material of conductor : .....
- Number and diameter of wires : .....
- Delivery period : ……..……weeks
- In accordance with the specification:….……Yes/ No

T2.2.28.3.2. INSULATORS (22 KV)

LONG ROD INSULATORS

- Material : .....
- Insulator type number : .....
- Maximum working load : .....
- Minimum failing load : .....
- Outside diameter : .....

- Distance between centre of unit : ..... mm
- Mass of unit : ..... kg
- Minimum dry flashover : ..... kV
- Minimum wet flashover : ..... kV
- Minimum puncture voltage : ..... kV
- In accordance with the specification:……Yes / No

POST INSULATORS (22 KV)

- Material : .....
- Insulator type number : .....
- Maximum working load : .....
- Minimum failing load : .....
- Outside diameter : .....
- Distance between centre of unit : ..... mm
- Mass of unit : ..... kg
- Minimum dry flashover : ..... kV
- Minimum wet flashover : ..... kV
- Minimum puncture voltage : ..... kV
- In accordance with the specification:.....Yes / No

T2.2.28.3.3. POLES

- Supplier : .....
- Delivery Period : .....
- Type(wood, concrete, steel, etc.) : .....
- If wood – please specify : .....
- MPa : .....

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T2.2.28.3.4. POLE STAYS

- Stay wire number and diameter of wires .....

T2.2.28.3.5. STAY ROD

- Type : .....
- Size : .....
- Stay plate - size : .....
- In accordance with the specification:……...Yes / No

T2.2.28.3.6. SURGE ARRESTORS (22 KV)

- Manufacturer : .....
- Type : .....
- Nominal rating : ..... kA
- In accordance with the specification:..... Yes / No

T2.2.28.3.7. ON-LOAD LINKS

- Manufacturer : .....
- Type : .....
- Current rating : ..... Ampere
- In accordance with the specification:.....Yes / No

T2.2.28.3.8. OFF-LOAD LINKS

- Manufacturer : .....
- Type : .....
- Current rating : ..... Ampere
- In accordance with the specification:.....Yes / No

T2.2.28.3.9. PREFORM DEAD-END TERMINATIONS

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

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T2.2.28.3.10. CLEVIS THIMBLE CLAMPS

- Manufacturer : .....
- Type : .....
- In accordance with the specification:……..…….Yes / No

T2.2.28.3.11. PARALLEL GROOVE CLAMPS

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

T2.2.28.3.12. PREFORM TOP TIES

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

T2.2.28.3.13. PREFORM SIDE TIES (DOUBLE-WRAP)

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

T2.2.28.3.14. PREFORM ARCING HORNS

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

T2.2.28.3.15. PREFORM WRAPLOCK TIES

- Manufacturer : .....
- Type : .....
- In accordance with the specification:.....Yes / No

T2.2.28.3.16. PREFORM FULL TENSION SPLICES

- Manufacturer : .....
- Type : .....
- In accordance with the specification:……..Yes / No

T2.2.28.3.17. PORCELAIN POST INSULATOR CAPLESS

- Supplier : .....
- Type : .....
- Complies with specification : .....Yes / No

T2.2.28.3.18. MV STAY INSULATOR

- Supplier : .....
- Type : .....
- Complies with specification : .....Yes / No

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T2.2.28.4. MV CABLES: 95 MM² AL.

In accordance with NRS 013:2007.

Table 23: 95mm² PILC A-B Schedule (Table 20)

Item	Subclause	Description		Schedule A	Schedule B
1	4.1.3 (a)	Type of insulation (paper or XLPE)		Paper	
	4.1.3 (b)	Number of cores (one or three)		Three	
	4.1.3 (c)	Cable operating voltage	kV	22	
	4.1.3 (d)	Conductor material (copper or aluminium)		Aluminium	
	4.1.3 (e)	Conductor size	mm^2	95	
	4.1.3 (f)	Symmetrical fault level (1 s)	kA	xxxxxxxxxx	
	4.1.3 (g)	Earth fault level (1 s)	kA	xxxxxxxxxx	
	4.1.5 (a)	Manufacturer's name		xxxxxxxxxx	
	4.1.5 (b)	Country of origin		xxxxxxxxxx	
	4.1.5 (c)	Minimum bending radius during pulling	mm	xxxxxxxxxx	
	4.1.5 (d)	Minimum bending radius at termination	mm	xxxxxxxxxx	
	4.1.5 (e)	Maximum pulling tension	N	xxxxxxxxxx	
	4.1.5 (f)	Drum diameter over lagging	mm	xxxxxxxxxx	
	4.1.5 (g)	Overall width of drum	mm	xxxxxxxxxx	
	4.1.5 (h)	Diameter of spindle hole	mm	xxxxxxxxxx	
	4.1.5 (i)	Gross mass of cable and drum	kg	xxxxxxxxxx	
	4.1.5 (j)	Mass of cable only	kg/m	xxxxxxxxxx	
	4.1.6	Details of any deviations from specification		xxxxxxxxxx	
	4.2.1	Are screened or belted cables required?		Screened	
	4.2.4.1 / 4.2.42	Wire armouring required?		Yes	
	4.3.1.2	Type B cable required		No	
	4.3.4.1	Type of wire armouring required?		Steel / Aluminium	
	4.2.5(PILC) 4.3.5(XLPE)	Type of outer sheath required?		Black PVC – S2	
Item	**Subclause**	**Description**		**Schedule A**	**Schedule B**
2	5.2	Are routine test certificates required?	Yes/No	Yes	

3	6.1.1.1 (e)	Details of any unique sequence of alphanumeric characters required			
	6.2.2	Is a treated drum required?	Yes/No	No	
	6.2.3	Length of cable on drum if not 300 m for three-core or 500 m for single-core	m	xxxxxxxxxx	
4	7	Is documentation required? With tender: - Type test certificate - Cable composition table (material & dimensions) and cross-sectional dwg. Prior to delivery: - Factory test certificate per cable drum	Yes/No	Yes	

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T2.2.28.5. TECHNICAL SCHEDULES (VAALDAM SUBSTATION)

The Technical Schedules shall be populated by the contractor / OEM. Failure to complete any schedule may result in the bid submitted being disqualified.

At no stage during the delivery of the works may the contractor change supplier / manufacturer without the written consent from the Engineer.

TECHNICAL A-B SCHEDULES:
Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

SIGNED ON BEHALF OF TENDERER: : _____

COMPANY NAME : _____

NAME IN BLOCK LETTERS : _____

DATE : _____

T2.2.28.5.1. TSE18 - POWER TRANSFORMERS

- 10 MVA, 88/22 kV Power Transformer in accordance with Eskom 240-68973110

The general requirements for power transformers rated for 1.25 MVA and above and with highest voltage of 2.2 kV or above are covered by Eskom specification 240-68973110.

Table 24: Technical Schedule (10MVA 88/22kV)

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
1.	**Purchasing Details**			
1.1	SAP No		0185721	
1.2	Class		Class 1	
2	**Delivery and off-loading**			
2.1	Transformer delivered to:		Vaaldam S/S	
2.2	Off-loaded from transport vehicle and transferred to intended operating position by supplier.		Yes	
2.3	Distance from off-loading position	m	± 10	
2.4	Rise or fall to off-loading position	mm	± 500	
2.5	Acceleration limit in any direction	g	10	

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B
3	**Erection**		
3.1	Erected ready for service	Yes	
3.2	Place 3 ply Malthoid on plinth	Yes	
4	**Tests (Type Tests are for first of design units only, although Customer has right to request this for any transformer)**		
4.1	Temperature rise tests	Yes	
4.2	Lightning Impulse Withstand Test	Yes	
4.3	Chopped Impulse Test	Yes	
4.4	Acoustic noise level measurements	Yes	
4.5	Determination of capacitances, windings to earth & between windings as well as bushing dielectric loss (tan delta)	Yes	
4.6	Zero sequence impedance measurement for three winding transformers	Yes	
4.7	Short-circuit withstand tests	Provide design details	
4.8	Insulation resistance to earth	Yes	
4.9	Short duration AC tests (partial discharge)	Yes	
4.10	Frequency Response Analysis Test (Factory & Site)	Yes	
4.11	Impact Recorders (Active part & Tank)	Yes	
4.12	Voltage Ratio and Phase Displacement	Yes	
4.13	Winding DC Resistance	Yes	
4.14	Separate Source Voltage Withstand	Yes	
4.15	Over Voltage Withstand	Yes	
4.16	Short Circuit Impedence and Load Loss	Yes	
4.17	No Load Loss and Magnetizing Current	Yes	
4.18	On Load Tap Changing	Yes	
4.19	Oil DGA	Yes	
4.20	Paint Thickness and Quality	Yes	
4.21	Auxiliary Wiring Functionality and Pressure Test	Yes	
5.	**Continuous rated power for all tapping's**		
5.1	ONAN MVA	10	
5.2	ONAF MVA	N/A	
6	**Rated voltage (Un) on principal tapping**		
6.1	Primary kV r.m.s	88	

T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
6.2	Secondary	kV r.m.s	22	
7.	**Voltage tapping range of Primary/Secondary ratio (% of the ratio on the principal tapping):**			
7.1	Max	%	5	
7.2	Min	%	-15	
7.3	Size of steps	%	1.25	
7.4	Number of positions (including transition positions)		17	
8.	**Resulting no-load voltage appearing having MV constant**			
8.1	On principal tapping	kV	xxxxxxxxx	
8.2	On extreme plus tapping	kV	xxxxxxxxx	
8.3	On extreme minus tapping	kV	xxxxxxxxx	
9.	**Transformer Type**			
9.1	Vector Group		YNd1	
9.2	Type of transformer		Core	
9.3	Number of limbs		3	
9.4	Winding Arrangement (Core/Secondary/Primary/Regulating)		As Specified	
9.5	Type of cooling		ONAN	
10	**Operating environment**			
10.1	Corrosion protection		Yes	
10.2	Pollution level		Moderate	
11	**Maximum current density in windings**			
11.1	Primary (outer winding)	A/mm^2	≤ 3.0	
11.2	Secondary (inner winding)	A/mm^2	≤ 3.2	
12	**Transformer losses**			
12.1	**No load losses (Maximum rated power)**			
12.1.1	@ 90%	kW	xxxxxxxxx	
12.1.2	@ 100% (This value will be used in fin evaluation)	kW	xxxxxxxxx	
12.1.3	@ 110%	kW	xxxxxxxxx	
12.2	**Load losses**			
12.2.1	Extreme Plus tap position	kW	xxxxxxxxx	
12.2.2	Nominal tap position	kW	xxxxxxxxx	
12.2.3	Extreme Minus tap position	kW	xxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
	(Note: Loss evaluation will be performed using the average of the above three values)			
13.	**Core Design**			
13.1	Maximum flux density @ Un	T	< 1.75	
14	**Losses for cooling equipment (Fans)**			
14.1	Power	kW	N/A	
14.2	Current	A	N/A	
15	**Primary / Secondary impedance at 75 °C at rated MVA (Refer 7.1 of Design Parameter Schedule)**			
15.1	On principal tapping	%	10	
15.2	On extreme plus tapping (maximum impedance)	%	xxxxxxxxxxx	
15.3	On extreme minus tapping (minimum impedance)	%	9	
16	**Primary / Secondary tolerances applicable to guaranteed impedances**			
16.1	On principal tapping		IEC	
16.2	On extreme plus tapping		IEC	
16.3	On extreme minus tapping (minimum impedance)	%	+10 / -0	
17.	**Temperature rises at altitude of 1 800 m**			
17.1	Top oil	°C	55	
17.2	Windings (by resistance)	°C	60	
17.3	Hotspot of winding	°C	< 68	
17.4	Hotspot of metal parts in contact with oil	°C	< 75	
18.	**Maximum acoustic noise**	dB(A)	73	
19.	**Heavy Duty Type**		Yes	
20.	**Minimum insulation for windings (Note: Provide detailed test plan for evaluation)**			
20.1	**Impulse withstand test voltage for line terminal:**			
20.1.1	Primary	kV peak	380	
20.1.2	Secondary	kV peak	95	
20.2	**Sixty-second, separate source**			
20.2.1	Primary	kV r.m.s	150	
20.2.2	Secondary	kV r.m.s	28	
20.3	**Sixty-second, induced-overvoltage withstand test voltages**			
20.3.1	Primary to earth	kV r.m.s	150	

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
20.3.2	Secondary	kV r.m.s	22	
21	**Main terminals & Bushing**			
21.1	**Type**		Outdoor	
21.2	**Details of Primary bushing / terminal (composite)**			
21.2.1	Make & Model		xxxxxxxxxx	
21.2.2	Stem size (dia x length)	mm	26 x 125	
21.2.3	Current Rating (incl 20% overcurrent)	A	> 78	
21.2.4	Impulse withstand voltage at sea level	kV peak	550	
21.2.5	Power frequency withstand voltage	kV r.m.s	230	
21.2.6	Total Creepage	mm	> 3100	
21.2.7	Protected Creepage (<50% of Total Creepage)	mm	xxxxxxxxxx	
21.3	**Details of Secondary bushing / terminal (composite)**			
21.3.1	Make & Model		xxxxxxxxxx	
21.3.2	Stem size (dia x length)	mm	38 x 125	
21.3.3	Current Rating (incl 20% overcurrent)	A	> 314	
21.3.4	Impulse withstand voltage at sea level	kV peak	200	
21.3.5	Power frequency withstand voltage	kV r.m.s	70	
21.3.6	Total Creepage	mm	> 375	
21.3.7	Protected Creepage (<50% of Total Creepage)	mm	xxxxxxxxxx	
21.4	**Details of Neutral bushing / terminal (composite)**			
21.4.1	Make & Model		xxxxxxxxxx	
21.4.2	Stem size (dia x length)	mm	26 x 125	
21.4.3	Current Rating (incl. 20% overcurrent)	A	> 314	
21.4.4	Impulse withstand voltage at sea level	kV peak	350	
21.4.5	Power frequency withstand voltage	kV r.m.s	140	
21.4.6	Total Creepage	mm	> 1500	
21.4.7	Protected Creepage (<50% of Total Creepage)	mm	xxxxxxxxxx	
22	**Physical arrangement**			
22.1	**Compliance with Figure 2 & 3**		Yes	
22.2	**Overall dimensions of complete unit**			
22.2.1	Height	mm	< 5500	
22.2.2	Length	mm	< 6400	

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
22.2.3	Width	mm	< 5000	
22.3	**Overall dimensions of tank only**		xxxxxxxxxx	
22.3.1	Base plate type (flat / prefabricated)	mm	Flat	
22.3.2	Length	mm	± 3200 (< 4400)	
22.3.3	Width	mm	≤ 1500	
22.3.4	Base plate thickness	mm	± 20	
23	**Cooling equipment**			
23.1	**Radiators**			
23.1.1	Material Type (Cooler tubes / press sheet radiators)		xxxxxxxxxx	
23.1.2	Material Thickness	mm	xxxxxxxxxx	
23.2	**Motors (Forced cooling)**			
23.2.1	Make		N/A	
23.2.2	Type		N/A	
24	**Safe withstand vacuum at sea level**	kPA	1.5	
25	**Transformer oil type**		240-75661431 ESKOM 32-406	
26	**Tap-changers**			
26.1	Type		OLTC	
26.2	Tap-changer		xxxxxxxxxx	
26.2.1	Manufacturer		xxxxxxxxxx	
26.2.2	Model Number		xxxxxxxxxx	
26.2.3	Precise electrical location of tappings.		Y-neutral end	
26.2.4	Diagrammatic arrangement shown on Drawing No.		xxxxxxxxxx	
26.2.5	Number of maintenance free operations		300,000	
26.3	Nominal **50 Hz ratings of tap-changer:**			
26.3.1	Voltage	kV	> 51	
26.3.2	Current (non-vacuum type)	A	> 78	
26.3.3	Current (vacuum type)	A	> 78	
26.4	Insulation **levels of tap-changer**			
26.4.1	phase-to-phase peak	kV peak	380	
26.5	**Tap-changer 50 Hz withstand**			
26.5.1	phase-to-phase	kV r.m.s	125	
26.6	**Tap-changer contacts**			

T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
26.6.1	Selector	kV/A	xxxxxxxxxx	
26.6.2	Selector switch	kV/A	xxxxxxxxxx	
26.6.3	Diverter switch	kV/A	xxxxxxxxxx	
26.6.4	Tie-in Resistor used?		~~Yes/~~No	
26.6.5	Value of tie-in resistor	Ω	xxxxxxxxxx	
26.7	Tap-**changer transition resistor**	kV/A	xxxxxxxxxx	
26.8	Tap-**changer driving motor**			
26.8.1	Type of driving motor		3 phase	
26.8.2	Supply voltage to motor	V_{ac}	420V	
26.8.3	Power	kW	xxxxxxxxxx	
26.8.4	Current	A	xxxxxxxxxx	
27	**Drawings & Manuals**			
27.1	Quantity of drawings as per 3.2.2		1	
27.2	Quantity of Manuals (hard copy + electronic)		5 + 1	
28	**Indicating and protective devices**			
28.1	Tap-changer protective device (detail)		Specify Type	
28.2	Pressure relief device		Specify Type	
28.3	Oil- and gas-actuated relay		Specify Type	
28.4	Conservator bag required		No	
28.5	Conservator bag type		N/A	
28.6	Dehydrating breathers		Specify Type	
28.7	Oil level indicators		Specify Type	
28.8	Oil temperature thermometer		Specify Type	
28.9	Winding temperature thermometer(s)		Specify Type	
29	**Schedule of type test & routine test certificates submitted**		Yes - compulsory	
30	**Spares recommended by manufacturer (Provide detailed list)**			

T2.2 RETURNABLE SCHEDULES

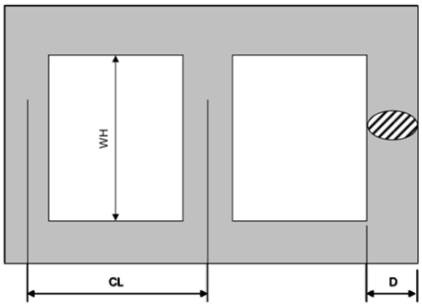
Table 25: Deviations schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	**Sub-clause**	**Proposed deviation**

Table 26: Design Parameter Schedules and B for a YNd1 Power trfr

Item	**Description**	**Schedule A**	**Schedule B**
1.	**Core Steel**		
1.1	Manufacturer of core steel	xxxxxxxxxx	
1.2	Grade of core steel	xxxxxxxxxx	
1.3	Thickness of core steel mm	xxxxxxxxxx	
2	**Core Dimensions**		
2.1	Window height (WH) mm	xxxxxxxxxx	
2.2	Distance between core limb centres (CL) mm	xxxxxxxxxx	
2.3	Core Diameter (D) mm	xxxxxxxxxx	
2.4	Filling Factor	xxxxxxxxxx	
3	**Cross sectional areas**		

T2.2 RETURNABLE SCHEDULES

Item	Description		Schedule A	Schedule B
3.1	Wound limbs	mm^2		
3.2	Yoke	mm^2		
4	**Total Core mass**	Kg		
5	**The design flux density at U_n for:**			
5.1	Wound limbs	T	xxxxxxxxxx	
5.2	Yoke	T	xxxxxxxxxx	
6	**Volts/turn at the above flux**	V/turn		
7. Winding Design 				
7.1	**Winding arrangement (CORE / LV / HV / TAP)**		xxxxxxxxxx	
7.2	**Conductor Yield strength**	N/mm^2	xxxxxxxxxx	
7.3	**Winding 1**		LV	
7.3.1	Type (i.e. multilayer helix)		xxxxxxxxxx	
7.3.2	Lead type (End Fed / Centre Fed)		xxxxxxxxxx	
7.3.3	Number of turns		xxxxxxxxxx	
7.3.4	Inner Diameter	mm	xxxxxxxxxx	
7.3.5	Outer Diameter	mm	xxxxxxxxxx	
7.3.6	Radial build	mm	xxxxxxxxxx	
7.3.7	Magnetic height	mm	xxxxxxxxxx	
7.3.8	Conductor configuration		xxxxxxxxxx	
7.3.9	- Size		xxxxxxxxxx	
7.3.10	- Number		xxxxxxxxxx	
7.3.11	Conductor insulation	mm	xxxxxxxxxx	
7.3.12	Current density	A/mm^2	xxxxxxxxxx	
7.3.13	Temperature gradient winding – oil	°C (K)	xxxxxxxxxx	
7.3.14	Total conductor mass	kg	xxxxxxxxxx	
7.4	**Winding 2**		**HV**	

T2.2 RETURNABLE SCHEDULES

Item	Description		Schedule A	Schedule B
7.4.1	Type (i.e. multilayer helix)		xxxxxxxxxx	
7.4.2	Lead type (End Fed / Centre Fed)		xxxxxxxxxx	
7.4.3	Number of turns		xxxxxxxxxx	
7.4.4	Inner Diameter	mm	xxxxxxxxxx	
7.4.5	Outer Diameter	mm	xxxxxxxxxx	
7.4.6	Radial build	mm	xxxxxxxxxx	
7.4.7	Magnetic height	mm	xxxxxxxxxx	
7.4.8	Conductor configuration		xxxxxxxxxx	
7.4.9	- Size		xxxxxxxxxx	
7.4.10	- Number		xxxxxxxxxx	
7.4.11	Conductor insulation	mm	xxxxxxxxxx	
7.4.12	Current density rated	A/mm^2	xxxxxxxxxx	
7.4.13	Temperature gradient winding – oil	°C (K)	xxxxxxxxxx	
7.4.14	Total conductor mass	kg	xxxxxxxxxx	
7.5	**Winding 3**		**TAP**	
7.5.1	Type (i.e. multilayer helix)		xxxxxxxxxx	
7.5.2	Lead type (End Fed / Centre Fed)		xxxxxxxxxx	
7.5.3	Number of turns		xxxxxxxxxx	
7.5.4	Inner Diameter	mm	xxxxxxxxxx	
7.5.5	Outer Diameter	mm	xxxxxxxxxx	
7.5.6	Radial build	mm	xxxxxxxxxx	
7.5.7	Magnetic height	mm	xxxxxxxxxx	
7.5.8	Conductor configuration		xxxxxxxxxx	
7.5.9	- Size		xxxxxxxxxx	
7.5.10	- Number		xxxxxxxxxx	
7.5.11	Conductor insulation	mm	xxxxxxxxxx	
7.5.12	Current density	A/mm^2	xxxxxxxxxx	
7.5.13	Temperature gradient winding – oil	°C (K)	xxxxxxxxxx	
7.5.14	Total conductor mass	kg	xxxxxxxxxx	
8.	**Inter-winding Insulation**		xxxxxxxxxx	
8.1	**CORE - LV winding**		xxxxxxxxxx	
8.1.1	Number of barriers		xxxxxxxxxx	
8.1.2	Barrier thickness	mm	xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

Item	Description		Schedule A	Schedule B
8.1.3	Distance from windings	mm	xxxxxxxxxx	
8.1.4	Distance between barriers	mm	xxxxxxxxxx	
8.2	**LV winding to HV winding**		xxxxxxxxxx	
8.2.1	Number of barriers		xxxxxxxxxx	
8.2.2	Barrier thickness	mm	xxxxxxxxxx	
8.2.3	Distance from windings	mm	xxxxxxxxxx	
8.2.4	Distance between barriers	mm	xxxxxxxxxx	
8.3	**HV winding to TAP winding**		xxxxxxxxxx	
8.3.1	Number of barriers		xxxxxxxxxx	
8.3.2	Barrier thickness	mm	xxxxxxxxxx	
8.3.3	Distance from windings	mm	xxxxxxxxxx	
8.3.4	Distance between barriers	mm	xxxxxxxxxx	

Table 27: Design Parameter Schedules and B for a YNd1 Power trfr

Item	Description		Schedule A	Schedule B
1	**Transformer general information**			
1.1	Manufacturer		xxxxxxxxxx	
1.2	Place of manufacture		xxxxxxxxxx	
2	**Oil quantities:**			
2.1	Transformer tank	l	xxxxxxxxxx	
2.2	Tap-changer	l	xxxxxxxxxx	
2.3	Radiators	l	xxxxxxxxxx	
2.4	Conservator (Main & tap-changer)	l	xxxxxxxxxx	
3	**Masses**			
3.1	Mass of core steel	kg	xxxxxxxxxx	
3.2	Total dry insulation mass	kg	xxxxxxxxxx	
3.3	Total mass of active part	kg	xxxxxxxxxx	
3.4	Mass of tank and fittings	kg	xxxxxxxxxx	
3.5	Mass of coolers (dry)	kg	xxxxxxxxxx	

Item	Description		Schedule A	Schedule B
3.6	Mass of oil	kg	xxxxxxxxxx	
3.7	Greatest transportation mass	kg	xxxxxxxxxx	
4	**Primary / Secondary zero sequence impedances**	%	xxxxxxxxxx	
4.1	On principal tapping			
4.2	On extreme plus tapping	%	xxxxxxxxxx	
4.3	On extreme minus tapping	%	xxxxxxxxxx	
5	**Filling medium for transport**		xxxxxxxxxx	
6.	**Training of purchaser's staff**			
6.1	Training provided on components		Yes	
6.2	Details provided of how training is going to be conducted on purchaser's staff?		Yes	

T2.2.28.5.2. TSE20 – NECRT'S

- 22 kV / 300-360 A: Neutral electromagnetic coupler with neutral earthing resistor and auxiliary transformer (NECRT) in accordance with Eskom specification 240-576488480.

The general requirements for three phase neutral electro-magnetic couplers with neutral earthing resistors and auxiliary transformers (NECRT'S) are covered by Eskom specification 240-57648848.

Eskom standard number: 34-1690 (240-57648848) 2015/03-30

Table 28: Technical Schedule

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
1	**Identification**			
	a) Supplier's name		xxxxxxxxxx	
	b) Manufacturer's name		xxxxxxxxxx	
	c) Type designation		xxxxxxxxxx	
2	**Site conditions**			
	a) Altitude	m	1800	
	b) Maximum ambient temperature	°C	45	
	c) Minimum ambient temperature	°C	-10	

T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
	d) Maximum diurnal variation	°C	35	
	e) Seismic Shocks	g	0.3	
	f) Relative humidity	%	≤ 100	
	g) Life expectancy	y	40	
3	**Electrical conditions**			
	a) Nominal system voltage	(Um) kV	22	
	b) Maximum system voltage	(Um) kV	24	
	c) Nominal frequency	Hz	50	
4	**Rated requirements**			
	General			
	a) Nominal short time (10 s) current of NEC and NER	(r.m.s.)A	360	
	b) Nominal continuous current of NEC and NER	(r.m.s.)A	10	
	c) Zero sequence reactance (X_o)	Ω/ph	47,3 to 56,8	
	d) Zero sequence resistance (R_o) at 100°C	Ω/ph	94,7 to 113,6	
	e) Zero sequence impedance (Z_0) at 100°C	Ω/ph	xxxxxxxxxx	
	NEC			
	a) Zero sequence reactance (X_c)	Ω	xxxxxxxxxx	
	b) Zero sequence resistance (R_c) at 100°C	Ω	xxxxxxxxxx	
	c) No load loss of NEC at U_n	kW	xxxxxxxxxx	
	d) Flux density of NEC core	T	xxxxxxxxxx	
	e) Magnetization current	(r.m.s.)A	xxxxxxxxxx	
	f) Current density at nominal short time current	A/mm^2	xxxxxxxxxx	
	NER			
	a) Zero sequence reactance (Xr)	Ω	xxxxxxxxxx	
	b) Zero sequence resistance (Rr) at 100 °C	Ω	xxxxxxxxxx	
	c) Nominal voltage ($U_n/\sqrt{3}$)	kV	12.7	
	d) Temperature coefficient at 100 °C	Ω/°C	xxxxxxxxxx	
	e) Specific heat capacity	kJ/kg °C	xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION		SCHEDULE A	SCHEDULE B
	f) Temperature range in which (d) and (e) apply	°C	xxxxxxxxxx	
4.1	**Auxiliary transformer**			
	a) Nominal rating	kVA	100	
	b) Primary nominal voltage	kV	22	
	c) No load secondary voltage	V	420	
	d) Vector group Dyn11 or Yzn11		xxxxxxxxxx	
	e) Flux density of aux core	T	xxxxxxxxxx	
	f) Magnetizing current	A	xxxxxxxxxx	
	g) Load loss	kW	xxxxxxxxxx	
	h) No-load loss	kW	xxxxxxxxxx	
	i) Percentage impedance	%	As SANS 780	
5	**Temperature rise** (at site altitude)			
	Conditions:			
	I Passage of maximum continuous neutral	A	xxxxxxxxxx	
	II Passage of rated current of auxiliary transformer	A	xxxxxxxxxx	
	III Passage of nominal short time current for	A	xxxxxxxxxx	
	Top oil temperature for condition:			
	a) I	°C	xxxxxxxxxx	
	b) II	°C	xxxxxxxxxx	
	c) III	°C	xxxxxxxxxx	
	d) I and II	°C	xxxxxxxxxx	
	e) I and II and III	°C	xxxxxxxxxx	
	NEC winding temperature (calculated) for condition			
	a) I	°C	xxxxxxxxxx	
	b) II	°C	xxxxxxxxxx	
	c) III	°C	xxxxxxxxxx	
	d) I and II	°C	xxxxxxxxxx	
	e) I and II and III	°C	xxxxxxxxxx	
	Metallic NER temperature (measured) for condition:			

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION			SCHEDULE A	SCHEDULE B
	a) I		°C	xxxxxxxxxx	
	b) II		°C	xxxxxxxxxx	
	c) III		°C	xxxxxxxxxx	
6	**Material**				
	a) NEC winding			xxxxxxxxxx	
	b) AUX HV winding			xxxxxxxxxx	
	c) AUX LV winding			xxxxxxxxxx	
	d) Grade of NER elements			xxxxxxxxxx	
7	**Material thickness**				
	a) Tank top		mm	xxxxxxxxxx	
	b) Tank bottom		mm	xxxxxxxxxx	
	c) Tank sides		mm	xxxxxxxxxx	
	d) Conservator		mm	xxxxxxxxxx	
	e) Radiator tubes (if any)		mm	xxxxxxxxxx	
8*	**Housing and corrosion protection**				
	a) Material	- Inland		xxxxxxxxxx	
		- Coastal		xxxxxxxxxx	
	b) Corrosion protection	- Inland		As SCSSCAAP9	
		- Coastal		As SCSSCAAP9	
	c) Tank colour			Admiralty Grey	
	d) Conservator colour			White	
9*	**HV Bushings**				
	a) Profile characteristics	- Inland		As IEC 60815	
		- Coastal		As IEC 60815	
	b) Minimum creepage	- Inland	mm/kV	25	
	~~———————————~~	~~- Coastal~~	~~mm/kV~~	~~31~~	
	c) Material	- Inland		xxxxxxxxxx	
		- Coastal		xxxxxxxxxx	
	d) Manufacturer and type	- Inland		xxxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B
	- Coastal	xxxxxxxxxx	
10	**Current transformers**		
	REF and differential		
	a) Manufacturer	xxxxxxxxxx	
	b) Ratio	2400/1	
	c) Accuracy class (on 600/1 ratio)	TPS	
	d) Max excitation current at 300 V mA	100	
	e) Max internal resistance on 600/1 ratio Ω	2,4	
	f) Secondary voltage/turn V/turn	0,5	
	g) Secondary internal resistance/turn mΩ/turn	4	
	h) Location: (earthed end of NER nearer to earthed terminal)	xxxxxxxxxx	
	i) Reference number of mag. curve	xxxxxxxxxx	
	IDMTEF		
	a) Manufacturer	xxxxxxxxxx	
	b) Ratio	100/1	
	c) Accuracy class	10P10	
	d) Location: (earthed end of NER near resistor)	xxxxxxxxxx	
	e) Reference number of mag. curve	xxxxxxxxxx	
11	**NER elements**		
	a) Manufacturer	xxxxxxxxxx	
	b) Type designation	xxxxxxxxxx	
	c) Number of elements	xxxxxxxxxx	
12	**Buchholz relay**		
	a) Manufacturer	xxxxxxxxxx	
	b) Type designation	xxxxxxxxxx	
	c) Minimum size mm	50	
13	**Dial type thermometer**	xxxxxxxxxx	
	a) Manufacturer		

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T2.2 RETURNABLE SCHEDULES

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B
	b) Type designation	xxxxxxxxxx	
14	**Overall dimensions**		
	a) Height mm	xxxxxxxxxx	
	b) Length mm	xxxxxxxxxx	
	c) Width mm	xxxxxxxxxx	
	Mass		
15	a) NEC core and winding kg	xxxxxxxxxx	
	b) NER kg	xxxxxxxxxx	
	c) AUX core and winding kg	xxxxxxxxxx	
	d) Tank and fittings kg	xxxxxxxxxx	
	e) Oil kg	xxxxxxxxxx	
	f) Total kg	xxxxxxxxxx	
16	**Documentation** Provide reference number for:		
	a) Outline drawings	xxxxxxxxxx	
	b) Rating and diagram plate	xxxxxxxxxx	
	c) Internal general assembly drawing	xxxxxxxxxx	
	d) AUX transformer wiring diagram	xxxxxxxxxx	
17	**Type and special test** Provide test report for:		
	a) Power-frequency voltage withstand test.	xxxxxxxxxx	
	b) Impulse test.	xxxxxxxxxx	
	c) Separate source voltage withstand test.	xxxxxxxxxx	
	d) Induced over voltage test.	xxxxxxxxxx	
	e) Measurement of zero sequence	xxxxxxxxxx	
	f) Temperature rise test.	xxxxxxxxxx	
	g) Short-circuit test on AUX	xxxxxxxxxx	
	h) Short-time current test on NEC/NER	xxxxxxxxxx	
	i) Vacuum test	xxxxxxxxxx	
	j) Accelerated ageing test for composite bushings.	xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

NOTE:
*The schedule makes provision for both coastal/high-corrosive environments and inland/low-corrosive applications.

*Insulation shall be based on coastal/high-corrosive environments, even if installed inland.

Table 29: Deviations Schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	**Sub-clause**	**Proposed deviation**

Show formulae according to which the zero-sequence inductance and resistance will be designed to limit the fault to 300 A.

T2.2.28.5.3. TSE25 - OUTDOOR HV SWITCHGEAR (ISOLATOR)

- 132 kV Disconnector (hand-operated) and 132 kV separate earthing switch for use in very heavily polluted conditions (31 mm / kV) in accordance with Eskom specification 240-56063815.

- 22 kV Disconnector (hand-operated) and 22 kV separate earthing switch for use in very heavily polluted conditions (31 mm / kV) in accordance with Eskom specification 240-56063815.

Table 30: Technical Schedule – HV Outdoor disconnectors 132 kV 2500A hand operated disconnectors

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
1		Purchasing details			
1,1		· Quantity of units required		As per BoQ	
1,2		· SAP No		0642558	
1,3		· Region		N/A	
1,4		· Site Name		Vaaldam SS	
1,5		· Nearest Town		Deneysville	
1,6		· Province		Free State	
1,7		· Distance from nearest town	km	1.7	
1,8		· Access to site		tar/gravel road	
2		Delivery and off-loading			
2,1		· Disconnector delivered to:		Vaaldam SS	
2,2		· Delivery effected not before	Date	TBA	
2,3		· Erection completed not later than	Date	TBA	
2,4		· Off-loaded from transport vehicle and transferred to intended operating position by supplier.		Yes	
2,5		· Construction supply available		Yes	
3	1,3	Site conditions of service			
3,1		· Altitude	m	1 800	
3,2		· Ambient air temperature range			
3,3		· Maximum (Peak)	°C	+45	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
3,4		· Highest average daily	°C	+35	
3,5		· Lowest average daily maximum	°C	+5	
3,6		· Minimum	°C	-10	
3,7		· Maximum average daily variation	°C	25	
3,8		· Design level	°C	50	
3,9		· Icing conditions		None	
3,10		· Humidity			
3.11		Relative humidity conditions			
3,12		Minimum	%	5	
3,13		Maximum	%	99	
3,14		Average	%	50	
3,15		· Solar radiation	W/m²	1 100	
3,16		· Wind loadings			
3,17		· Basic design velocity	km/hr	115	
3,18		· Maximum wind speed	km/hr	144	
3,19		· Wind loadings	Pascals	1 000	
3,20		· Lightning flash density	flashes /km²/yr	8	
4	4.2.1.1	System conditions of service			
4,1		· Maximum system voltage	kV	145	
4,2		· Number of phases		3	
4,3		· Nominal system frequency	Hz	50	
4,4		· System earthing		Effectively earthed	
5	4.2.1.1	Type of Disconnector			
5,1		· Type of disconnector required		CRPDB	
6	4.2.1.2	Detail of disconnector			

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
6,1		· Manufacturer		xxxxxxxxxx	
6,2		· Type designation		xxxxxxxxxx	
6,3		· Number of breaks		2	
6,4		· Main contacts		xxxxxxxxxx	
6,5		Type		xxxxxxxxxx	
6,6		Entry		Free/Friction	
6,7		Contact force	N	xxxxxxxxxx	
6,8		Materials		xxxxxxxxxx	
6,9		Wear allowance		xxxxxxxxxx	
7	4.2.2	· Disconnector ratings (IEC 62271-102)			
7,1		· Rated nominal voltage	kV	132	
7,2		· Rated normal current	A	2 500	
7,3		· Rated short-time withstand current	kA	25	
7,4		· Rated duration of short circuit	s	3	
7,5		· Rated peak withstand current	kA	100	
7,6		· Rated short-duration power frequency withstand voltage	kV	275	
7,7		· Rated lightning impulse withstand voltage	kV	550	
8	4.3	· Mounting of disconnector			
8,1		· Upright, horizontal or vertical		Upright horizontal	
8,2		· Phase spacing	mm	2 400	
8,3		· Mounting height (lowest part of insulation above ground level)	mm	2 500	
8,4		· Arrangement of phases, in-line or transverse		In-line and transverse	
8,5		· Is mounting structure for the isolator to be provided by the supplier		Yes	
8,6		· Is mounting structure for the separate earth switch to be provided by the supplier		Yes	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
9	4.4.1	· Type of operation			
9,1		· Isolator		Hand	
9,2		· Earth switch		Hand	
10	4.4.2	· Operating movement (for hand driven mechanism)			
10,1		· Isolators		Horizontal	
10,2		· Earth switch		Horizontal	
11	4.4.3	· Motor driven mechanism			
11,1		· Motor voltage	V	N/A	
11,2		· Rated torque of drive	Nm	N/A	
11,3		· Maximum starting current	A	N/A	
11,4		· Operating times			
11,5		Opening	s	N/A	
11,6		Closing	s	N/A	
12	4,9	· Auxiliary switches			
12,1		· Number of contacts for disconnectors		DX TX	
12,2		Type G		8 7	
12,3		Type M		5 4	
12,4		Type F		1 N/A	
12,5		Type N		2 5	
12,6		· Number of contacts for earthing switches			
12,7		Type M		4	
12,8		Type N		4	
13	4,9	· Ratings for auxiliary switches			
13,1		· Breaking current	A	10	
13,2		· AC - 110 Volts (power factor 0,5)	A	10	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
13,3		· DC - 229 Volts (t=60 ms)	A	2	
13,4		· Continuous current	A	10	
13,5		· Short-time current for 1 second	(t= 60 ms)	100	
13,6		· Volt drop across contacts for a current of 10A DC	mV	xxxxxxxxxx	
14	4,13	Main terminals			
14,1		· Type		38mm Stem	
14,2		· Material		Aluminium	
14,3		· Orientation: vertical or horizontal		Vertical	
14,4		· Dimension of pads:			
14,5		Number of holes		N/A	
14,6		Diameter of holes	mm	N/A	
14,7		Pitch of holes	mm	N/A	
14,8		Thickness of pad	mm	xxxxxxxxxx	
15		Insulation and clearances			
15,1	4,18	· Details of insulators offered			
15,2		· Manufacturer		xxxxxxxxxx	
15,3		· Type designation		xxxxxxxxxx	
15,4		· Number of units in stack		xxxxxxxxxx	
15,5		· Cantilever strength class	N	xxxxxxxxxx	
15,6		· Torsion strength	Nm	xxxxxxxxxx	
15,7		· Creepage distance (minimum)	mm	4092	
15,8		· Insulator material		Porcelain or silicon rubber	
16	4.18.1	· Insulator test voltage			
16,1		· Lightning impulse withstand voltage (1,2/50 µs) referred to sea level			
16,2		· To earth and between phases in the open position	kV	550	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
16,3		· Across the isolating distance	kV	630	
17		. Power frequency wet withstand voltage (60 second) referred to sea level			
17,1		. To earth and between phases in the open position	kV	230	
17,2		Across the isolating distance	kV	265	
18		· Voltage test across isolating distance (bias test)			
18,1		· Value of power frequency voltage	kV	N/A	
18,2		· Crest value of lightning impulse wave		N/A	
18,3		· Crest value of switching impulse wave	kV	N/A	
19		· Radio influence voltage test			
19,1		. Single phase test voltage applied to disconnector in open and closed position	kV	104	
19,2		· Radio influence voltage at 1 MHz	µV	2 500 max	
20		· Electrical clearances			
20,1		· Between live portions of phases	mm	xxxxxxxxxx	
20,2		. Between live portions at system voltage and earth	mm	>3 700	
20,3		. Lowest point of insulation above ground level not to be less than	mm	2 500	
21		Miscellaneous			
21,1	4.2.1	Mass details			
21,2		. Complete disconnector without earthing switch		kg	
21,3		. Complete disconnector with single earthing switch		kg	
21,4		. Complete disconnector with double earthing switch		kg	
21,5		· Separate earthing switch		kg	
22		· Protection of housing and mechanism boxes			
22,1		· International Protection rating		IP55	
22,2		· Material type		316 stainless steel	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
23		· Cubicle heating and ventilation			
23,1		· Electrical heating			
23,2		Supply voltage, 50 Hz	V	230	
23,3		Power rating	W	xxxxxxxxxx	
24		. Secondary terminals, gland plate and cable connections			
24,1		· Terminal type		Spring loaded	
24,2		· Manufacturer			
24,3		. Undrilled gland plate of minimum usable area	mm	100 x 50	
24,4		· Control cable type used by Eskom		PVC SWA	
24,5		. Minimum distance between terminal board and gland plate	mm	150	
25		· Supporting structures to be provided		No, unless part of construction	
26		. Testing authority certificates held to prove all ratings		Yes and must be less than 7 years old	
27		· Number of complete sets of instruction manuals and routine test results to be supplied with each equipment		One per equipment supplied in weather protective envelop inside mechanism door	
28		Number of complete sets of instruction manuals to be supplied on award of contract		5	
29		· Terminal mechanical loading			
29,1		· Maximum continuous loading:			
29,2		Horizontal	kN	xxxxxxxxxx	
29,3		30° to horizontal	kN	xxxxxxxxxx	
29,4		60° to horizontal	kN	xxxxxxxxxx	
30		Documentation (to be submitted with tender)			
		Note: All documentation to be provided in electronic format.			

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
30,1		· Type test certificates	Sets	1	
30,2		· Outline drawings of disconnectors	Sets	1	
30,3		· Wiring diagrams	Sets	1	
30,4		· Operation and maintenance manuals	Sets	1	

Table 31: Deviation Schedule – HV Outdoor disconnectors 132 kV 2500A hand operated disconnectors

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	Sub-clause	Proposed deviation

T2.2 RETURNABLE SCHEDULES

Table 32: Technical Schedule – HV Outdoor disconnectors 22 kV 2500A hand operated disconnectors

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
1		Purchasing details			
1,1		· Quantity of units required		As per BoQ	
1,2		· SAP No		N/A	
1,3		· Region		N/A	
1,4		· Site Name		Vaaldam SS	
1,5		· Nearest Town		Deneysville	
1,6		· Province		Free State	
1,7		· Distance from nearest town	km	1.7	
1,8		· Access to site		tar/gravel road	
2		Delivery and off-loading			
2,1		· Disconnector delivered to:		Vaaldam SS	
2,2		· Delivery effected not before	Date	TBA	
2,3		· Erection completed not later than	Date	TBA	
2,4		· Off-loaded from transport vehicle and transferred to intended operating position by supplier.		Yes	
2,5		· Construction supply available		Yes	
3	1,3	Site conditions of service			
3,1		· Altitude	m	1 800	
3,2		· Ambient air temperature range			
3,3		· Maximum (Peak)	°C	+45	
3,4		· Highest average daily	°C	+35	
3,5		· Lowest average daily maximum	°C	+5	
3,6		· Minimum	°C	-10	
3,7		· Maximum average daily variation	°C	25	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
3,8		· Design level	°C	50	
3,9		· Icing conditions		None	
3,10		· Humidity			
3.11		Relative humidity conditions			
3,12		Minimum	%	5	
3,13		Maximum	%	99	
3,14		Average	%	50	
3,15		· Solar radiation	W/m²	1 100	
3,16		· Wind loadings			
3,17		· Basic design velocity	km/hr	115	
3,18		· Maximum wind speed	km/hr	144	
3,19		· Wind loadings	Pascals	1 000	
3,20		· Lightning flash density	flashes/ km²/yr	8	
4	4.2.1.1	System conditions of service			
4,1		· Maximum system voltage	kV	24	
4,2		· Number of phases		3	
4,3		· Nominal system frequency	Hz	50	
4,4		· System earthing		Effectively earthed	
5	4.2.1.1	Type of Disconnector			
5,1		· Type of disconnector required		CRPDB	
6	4.2.1.2	Detail of disconnector			
6,1		· Manufacturer		xxxxxxxxxx	
6,2		· Type designation		xxxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
6,3		· Number of breaks		2	
6,4		· Main contacts		xxxxxxxxxx	
6,5		Type		xxxxxxxxxx	
6,6		Entry		Free/Friction	
6,7		Contact force	N	xxxxxxxxxx	
6,8		Materials		xxxxxxxxxx	
6,9		Wear allowance		xxxxxxxxxx	
7	4.2.2	· Disconnector ratings (IEC 62271-102)			
7,1		· Rated nominal voltage	kV	22	
7,2		· Rated normal current	A	2 500	
7,3		· Rated short-time withstand current	kA	25	
7,4		· Rated duration of short circuit	s	3	
7,5		· Rated peak withstand current	kA	63	
7,6		· Rated short-duration power frequency withstand voltage	kV	50	
7,7		· Rated lightning impulse withstand voltage	kV	150	
8	4,3	· Mounting of disconnector			
8,1		· Upright, horizontal or vertical		Upright horizontal	
8,2		· Phase spacing	mm	1 000	
8,3		· Mounting height (lowest part of insulation above ground level)	mm	2 500	
8,4		· Arrangement of phases, in-line or transverse		Transverse	
8,5		· Is mounting structure for the isolator to be provided by the supplier		Yes	
8,6		· Is mounting structure for the separate earth switch to be provided by the supplier		N.A.	
9	4.4.1	· Type of operation			
9,1		· Isolator		Hand	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
9,2		· Earth switch		Hand	
10	4.4.2	. Operating movement (for hand driven mechanism)			
10,1		· Isolators		Horizontal	
10,2		· Earth switch		Horizontal	
11	4.4.3	· Motor driven mechanism			
11,1		· Motor voltage	V	N/A	
11,2		· Rated torque of drive	Nm	N/A	
11,3		· Maximum starting current	A	N/A	
11,4		· Operating times			
11,5		Opening	s	N/A	
11,6		Closing	s	N/A	
12	4,9	· Auxiliary switches			
12,1		· Number of contacts for disconnectors		DX TX	
12,2		Type G		8 7	
12,3		Type M		5 4	
12,4		Type F		1 N/A	
12,5		Type N		2 5	
12,6		· Number of contacts for earthing switches			
12,7		Type M		4	
12,8		Type N		4	
13	4,9	· Ratings for auxiliary switches			
13,1		· Breaking current	A	10	
13,2		· AC - 110 Volts (power factor 0,5)	A	10	
13,3		· DC - 229 Volts (t=60 ms)	A	2	
13,4		· Continuous current	A	10	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
13,5		· Short-time current for 1 second (t= 60 ms)		100	
13,6		· Volt drop across contacts for a current of 10A DC	mV	xxxxxxxxxx	
14	4,13	Main terminals			
14,1		· Type		38mm Stem	
14,2		· Material		Aluminium	
14,3		· Orientation: vertical or horizontal		Vertical	
14,4		· Dimension of pads:			
14,5		Number of holes		N/A	
14,6		Diameter of holes	mm	N/A	
14,7		Pitch of holes	mm	N/A	
14,8		Thickness of pad	mm	xxxxxxxxxx	
15		Insulation and clearances			
15,1	4,18	· Details of insulators offered			
15,2		· Manufacturer		xxxxxxxxxx	
15,3		· Type designation		xxxxxxxxxx	
15,4		· Number of units in stack		xxxxxxxxxx	
15,5		· Cantilever strength class	N	xxxxxxxxxx	
15,6		· Torsion strength	Nm	xxxxxxxxxx	
15,7		· Creepage distance (minimum)	mm	744	
15,8		· Insulator material		Porcelain or silicon rubber	
16	4.18.1	· Insulator test voltage			
16,1		· Lightning impulse withstand voltage (1,2/50 µs) referred to sea level			
16,2		· To earth and between phases in the open position	kV	150	
16,3		· Across the isolating distance	kV	172	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
17		. Power frequency wet withstand voltage (60 second) referred to sea level			
17,1		. To earth and between phases in the open position	kV	50	
17,2		Across the isolating distance	kV	55	
18		· Voltage test across isolating distance (bias test)			
18,1		· Value of power frequency voltage	kV	N/A	
18,2		· Crest value of lightning impulse wave		N/A	
18,3		· Crest value of switching impulse wave	kV	N/A	
19		· Radio influence voltage test			
19,1		. Single phase test voltage applied to disconnector in open and closed position	kV	N/A	
19,2		· Radio influence voltage at 1 MHz	µV	N/A	
20		· Electrical clearances			
20,1		· Between live portions of phases	mm	xxxxxxxxxx	
20,2		. Between live portions at system voltage and earth	mm	>2 700	
20,3		. Lowest point of insulation above ground level not to be less than	mm	2 500	
21		Miscellaneous			
21,1	4.2.1	Mass details			
21,2		. Complete disconnector without earthing switch		kg	
21,3		. Complete disconnector with single earthing switch		kg	
21,4		. Complete disconnector with double earthing switch		kg	
21,5		· Separate earthing switch		kg	
22		· Protection of housing and mechanism boxes			
22,1		· International Protection rating		IP55	
22,2		· Material type		316 stainless steel	
23		· Cubicle heating and ventilation			

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
23,1		· Electrical heating			
23,2		Supply voltage, 50 Hz	V	230	
23,3		Power rating	W	xxxxxxxxxx	
24		. Secondary terminals, gland plate and cable connections			
24,1		· Terminal type		Spring loaded	
24,2		· Manufacturer			
24,3		. Undrilled gland plate of minimum usable area	mm	100 x 50	
24,4		· Control cable type used by Eskom		PVC SWA	
24,5		. Minimum distance between terminal board and gland plate	mm	150	
25		· Supporting structures to be provided		No, unless part of construction	
26		. Testing authority certificates held to prove all ratings		Yes and must be less than 7 years old	
27		· Number of complete sets of instruction manuals and routine test results to be supplied with each equipment		One per equipment supplied in weather protective envelop inside mechanism door	
28		Number of complete sets of instruction manuals to be supplied on award of contract		5	
29		· Terminal mechanical loading			
29,1		· Maximum continuous loading:			
29,2		Horizontal	kN	xxxxxxxxxx	
29,3		30° to horizontal	kN	xxxxxxxxxx	
29,4		60° to horizontal	kN	xxxxxxxxxx	
30		Documentation (to be submitted with tender)			
		Note: All documentation to be provided in electronic format.			
30,1		· Type test certificates	Sets	1	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF NRS 003	DESCRIPTION		SCHEDULE A	SCHEDULE B
30,2		· Outline drawings of disconnectors	Sets	1	
30,3		· Wiring diagrams	Sets	1	
30,4		· Operation and maintenance manuals	Sets	1	

Table 33: Deviations Schedule – MV Outdoor disconnectors 22 kV 2500A hand operated disconnectors

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	Sub-clause	Proposed deviation

T2.2.28.5.4. TSE25 - OUTDOOR HV SWITCHGEAR (CIRCUIT BREAKER)

- 132 kV circuit breaker for use in very heavily polluted conditions (31 mm / kV) in accordance with Eskom 240-56063756.
- 22 kV outdoor kiosk for use in very heavily polluted conditions (31 mm / kV) in accordance with Eskom 240-66581487 (Combi-unit, not “dog-box”).

Table 34: SAP: 0218735 BKR 132kV 3150A 40kA 3P 110VDC 31

ITEM	CLAUSE OF 240-56063756	DESCRIPTION			SCHEDULE A	SCHEDULE B
1		**Item and system description**				
			BKR 132kV 3150A 40kA 3P 110VDC 31			
1.1		·	SAP No		0218735	xxxxxxxxxx
1.2		·	Buyers Guide Drawing		D-DT-6250	xxxxxxxxxx
1.3	5.3	·	Circuit-breaker application		General-purpose	xxxxxxxxxx
1.4	4.1	·	Nominal system voltage (U_n)	kV	88&132	xxxxxxxxxx
1.5		·	System voltage range	pu	0,9 to 1,1	xxxxxxxxxx
1.6	5.1.2	·	System earthing (effective/non effective)		Non-effective	xxxxxxxxxx
2		**Ratings**				
2.1	4.1	·	Rated voltage (U_r)	kV	145	
2.2	4.1	·	Number of phases		3	
2.3	4.2	·	Rated short-duration power-frequency withstand voltage (U_d)	kV	275	
2.4	4.2	·	Rated peak lightning impulse withstand voltage (U_p)	kV	650	
2.5	4.3	·	Rated frequency (f_r)	Hz	50	
2.6	4.4	·	Rated normal current (I_r) - main circuit	A	3150	
2.7	4.4	·	Calculated maximum continuous current - main circuit @ 40 ^{0}C ambient	A	xxxxxxxxxx	
2.8	4.4	·	Calculated maximum continuous current - main circuit @ 45 ^{0}C ambient	A	xxxxxxxxxx	
2.9	4.4	·	Maximum allowable temperature of main contacts (refer to Table 3 of SANS 62271-1)	^{O}C	xxxxxxxxxx	
2.10	4.4	·	Measured temperature rise (highest) of main contacts @ rated current (type test)	K	xxxxxxxxxx	
2.11	4.4	·	Maximum allowable temperature of bolted or equiv connections (refer to Table 3 of SANS 62271-1)	^{O}C	xxxxxxxxxx	
2.12	4.4	·	Measured temperature rise (highest) of bolted or equiv connections @ rated current (type test)	K	xxxxxxxxxx	
2.13	4.4	·	Maximum allowable temperature of terminals for the connection to external conductors (refer to Table 3 of SANS 62271-1)	^{O}C	xxxxxxxxxx	
2.14	4.4	·	Measured temperature rise (highest) of terminals for the connection to external conductors @ rated current (type test)	K	xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
2.15	4.5	·	Rated short-time withstand current (I_k and I_{ke})	kA	40	
2.16	4.6	·	Rated peak withstand current (I_p and I_{pe})	kA	100	
2.17	4.7	·	Rated duration of short circuit (t_k)	s	3	
2.18	4.8	·	Rated d.c. supply voltage of closing and opening devices and of auxiliary and control circuits (U_a)	V	110	
2.19	4.8	·	Rated a.c. supply voltage of heaters and other a.c. auxiliary circuits (U_a)	V	230	
2.20	4.9	·	Rated supply frequency of closing and opening devices and of auxiliary and control circuits	Hz	d.c.	
2.21	4.9	·	Rated supply frequency of heaters and other a.c. auxiliary circuits	Hz	50	
2.22	4.101.1	·	Rated short-circuit breaking current (I_{SC}) of circuit-breaker	kA	40	
2.23	4.101.2	·	Factor by which the 100 % symmetrical and asymmetrical single-phase rated short-circuit breaking current exceeds the three-phase rating	kA	xxxxxxxxxx	
2.24	4.102	·	Circuit-breaker class		N/A	
2.25	4.102	·	First-pole-to-clear factor (k_{pp}) for circuit-breaker		1,5	
2.26	4.102	·	Standard values of TRV related to the rated short-circuit breaking current (SANS 62271-100)		SANS 62271-100 Table 4	
2.27	4.103	·	Rated short-circuit making current of circuit-breaker	kA	100	
2.28	4.104	·	Rated operating sequence for circuit-breaker		O-0,3s-CO-3m-CO (all poles)	
2.29	4.104	·	Minimum resting time following rated operating sequence	min	xxxxxxxxxx	
2.30	4.105	·	Characteristics for short-line faults		SANS 62271-100 4.105 for Class S2 circuit-breakers only	
2.31	4.106	·	Rated out-of-phase making and breaking current for circuit-breakers	kA	xxxxxxxxxx	
2.32	4.107	·	Classification of circuit-breaker according to its restrike performance (line- and cable-charging breaking current)		Class C2	
2.33	4.107	·	Rated capacitive switching currents for circuit-breaker - line-charging breaking current	A	50	
2.34	4.107	·	Rated capacitive switching currents for circuit-breaker - cable-charging breaking current	A	160	
2.35	4.107	·	Classification of circuit-breaker according to its restrike performance (capacitor bank switching)		xxxxxxxxxx	
2.36	4.107	·	Rated capacitive switching currents for circuit-breaker - single capacitor bank breaking current	A	xxxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
2.37	4.107	·	Rated capacitive switching currents for circuit-breaker - back-to-back capacitor bank breaking current	A	xxxxxxxxxx	
2.38	4.107	·	Rated capacitive switching currents for circuit-breaker - back-to-back capacitor bank inrush making current	kA	xxxxxxxxxx	
2.39	4.108	·	Chopping number of the circuit-breaker	λ	xxxxxxxxxx	
2.40	4.109	·	Rated opening time for circuit-breaker	ms	xxxxxxxxxx	
2.41	4.109	·	Rated break-time for circuit-breaker	ms	xxxxxxxxxx	
2.42	4.109	·	Rated closing time for circuit-breaker	ms	xxxxxxxxxx	
2.43	4.109	·	Rated open-close time for circuit-breaker	ms	xxxxxxxxxx	
2.44	4.109	·	Rated reclosing time for circuit-breaker	ms	xxxxxxxxxx	
2.45	4.109	·	Rated close-open time for circuit-breaker	ms	xxxxxxxxxx	
2.46	4.109	·	Rated pre-insertion time for circuit-breaker	ms	xxxxxxxxxx	
2.47	4.110	·	Circuit-breaker mechanical endurance class		Class M2	
2.48	4.110	·	Number of mechanical operations for circuit-breaker		10000	
2.49	4.111	·	Classification of circuit-breakers as a function of electrical endurance		N/A	
3	5.1	**Service conditions**				
3.1	5.1.1	·	Location (indoors/outdoors)		Outdoors	
3.2	5.1.1	·	Ambient air temperature range	°C	-10 to +40	
3.3	5.1.1	·	Solar radiation	W/m^2	up to 1100	
3.4	5.1.1	·	Altitude (amsl)	m	up to 1800	
3.5	5.1.1	·	Class of pollution (SANS 60815-1:2009)		Very heavy ('e')	
3.6	5.1.1	·	Average humidity	%	up to 95	
3.7	5.1.1	·	Wind speed	m/s	up to 34	
3.8	5.1.1	·	Condensation and precipitations		Yes	
3.9	5.1.1	·	Seismic activity	g	0,3	
4	5.2	**General**				
4.1	5.2.1	·	Circuit-breaker compliant to SANS 62271-100		Yes	
4.2	5.2.2	·	Circuit-breaker design (live-tank / dead-tank)		Live-tank	
4.3		·	Circuit-breaker manufacturer		xxxxxxxxxx	
4.4		·	Circuit-breaker country of origin		xxxxxxxxxx	
4.5		·	Circuit-breaker model/type designation		xxxxxxxxxx	
4.6		·	Circuit-breaker total mass	kg	xxxxxxxxxx	
4.7	5.2.3	·	CTs required		No	
4.8			- CT manufacturer		N/A	
4.9			- CT country of origin		N/A	
4.10	5.2.4	·	Support structure design		2 column support with common base frame	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756	DESCRIPTION		SCHEDULE A	SCHEDULE B
4.11	5.2.4	- Steel support structure to be supplied with circuit-breaker	Y/N	No	
4.12	5.2.5.1	- Circuit-breaker pole operation		3-pole operated (3P)	
4.13	5.2.5.2	- Stored energy operation for circuit-breaker mechanism		Yes	
4.14	5.2.5.2	- Energy storage device		Spring	
	5.2.5.2	**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 recharged			
4.15	5.2.5.2	- Manual and motorised spring charging		Yes	
4.16	5.2.5.2	- Manual and electric energy release		Yes	
4.17	5.2.5.2	- Mechanical energy stored in charged spring	kJ	xxxxxxxxxx	
4.18	5.2.5.2	- Mechanical device provided to prevent over-charging of the closing spring for manual charging		Yes	
4.19	5.2.5.3	- Safe conditions produced in the case of failure to latch		Yes	
4.20	5.2.6	- Circuit-breaker interrupting technology (Vacuum/SF_6)		Vacuum/SF6	
4.21	5.2.6	- Type of interrupter design (puffer, self-blast, etc.)		xxxxxxxxxx	
4.22	5.2.6	- Configuration of moving contacts (single, double or triple motion)		xxxxxxxxxx	
4.23	5.2.7	- Minimim expected life-span of circuit-breaker	years	> 30	
5	5.3	**Construction requirements**			
	5.3.1	. Design and layout of the circuit-breaker :			
5.1		- standardised circuit-breaker elements to maximise interchageability	Y/N	Yes	
5.2		- modular, pre-assembled elements shall be designed to facilitate handling and installation	Y/N	Yes	
5.3		- designed to facilitate ease of construction and maintenance	Y/N	Yes	
5.4		- SF6 filter material housing located to provide easy access during maintenance	Y/N	Yes	
6	5.4	**Circuit-breaker operating mechanism enclosure requirements**			
6.1	5.4.1	. Operating mechanisms, local control facilities and all parts requiring lubrication protected by weatherproof enclosures	Y/N	Yes	
6.2	5.4.1	- degree of protection for enclosures containing exposed bearings, auxiliary switches, motors and other electrical devices	IP	IP 55	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
6.3	5.4.1		- degree of protection for all open areas in the circuit-breaker common base frame as well as externally mounted indicating devices (where applicable)	IP	IP 2X	
6.4	5.4.1		- degree of protection for all other enclosures	IP	IP 54	
6.5	5.4.2	·	Operating mechanism enclosure material		3CR12 / Stainless steel	
6.6	5.4.2	·	Operating mechanism enclosure corrosion protection in accordance with 5.6 of DSP 32-1166	Y/N	Yes	
6.7	5.4.3	·	Operating mechanism enclosures arranged to facilitate easy access from all sides	Y/N	Yes	
6.8	5.4.3		- all fastenings compliant with ESP 32-1166	Y/N	Yes	
6.9	5.4.4	·	Circuit-breaker designed for operation from the font of the operating mechanism enclosure	Y/N	Yes	
6.10	5.4.5	·	Access to the operating mechanism controls, LV terminals strips etc. provided through hinged front access door	Y/N	Yes	
6.11	5.4.6	·	Maximum height to top of mechanism enclosure equipment requiring access	mm	2000	
6.12	5.4.7	·	Front access door secured with a heavy-duty locking mechanism	Y/N	Yes	
6.13	5.4.8	·	Padlocking facility shackle diameter	Y/N	6	
6.14	5.4.9	·	Front access door equipped with travel stop	Y/N	Yes	
6.15	5.4.10	·	Steel documentation pocket provided on inside of front access door	Y/N	Yes	
6.16	5.4.11	·	Facilites provided for securing operating tools on inside of front access door	Y/N	Yes	
6.17	5.4.12	·	Earthing of operating mechanism enclosure in accordance with ESP 32-1166	mm	Yes	
6.18	5.4.13	·	Provision for bottom entry of all control cabling into operating mechanism enclosure	Y/N	Yes	
6.19	5.4.14	·	Metallic cable racking provided for inter-pole cabling?	Y/N	No	
6.20	5.4.15	·	Upper surfaces of enclosure shaped/sloped to prevent the accumulation of water	Y/N	Yes	
6.21	5.4.16	·	Gasket material offered		Neoprene / Heavy-duty foam-plastic	
6.22	5.4.17	·	Gauze-covered drain hole provided (> 25 mm)	Y/N	Yes	
6.23	5.4.18	·	Enclosure lifting eyes provided		Top	
6.24	5.4.19	·	Enclosure colour		Light grey (G29)	
7	5.5	**Circuit-breaker supporting structure**				
	5.5.1	·	Mechanical loads and parameters relating to the design of the circuit-			

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
			breaker support structure and foundation			
7.1	5.5.1		- “static” dead weight of the circuit-breaker	N	xxxxxxxxxx	
7.2	5.5.1		- rated “static” terminal force F_{shA} of the circuit-breaker due to connected conductors	N	xxxxxxxxxx	
7.3	5.5.1		- rated “static” terminal force F_{shB} of the circuit-breaker due to connected conductors	N	xxxxxxxxxx	
7.4	5.5.1		- rated “static” terminal force F_{sv} of the circuit-breaker due to connected conductors	N	xxxxxxxxxx	
7.5	5.5.1		- “dynamic” horizontal force exerted during operation on the foundation	N	xxxxxxxxxx	
7.6	5.5.1		- “dynamic” vertical force exerted during operation on the foundation	N	xxxxxxxxxx	
7.7	5.5.1		- “dynamic” moment (torque) exerted during operation about the foundation	Nm	xxxxxxxxxx	
7.8	5.5.1		- “dynamic” horizontal force exerted between circuit-breaker poles (centre phase interrupter chamber) during a rated (terminal fault) short-circuit	N	xxxxxxxxxx	
7.9	5.5.1		- wind force (load) exerted on the circuit-breaker	N	xxxxxxxxxx	
7.10	5.5.1		- maximum torque required for the foundation holding down bolt nuts	Nm	xxxxxxxxxx	
7.11	5.5.2	·	Circuit-breaker steel support structure to be designed by manufacturer	Y/N	No	
7.12	5.5.2	·	Circuit-breaker concrete foundation to be designed by manufacturer	Y/N	No	
7.13	5.5.3	·	Common base frame supplied with circuit-breaker ($U_n \leq 132$ kV)	Y / N / N/A	Yes	
7.14	5.5.3 / 5.5.4	·	Circuit-breaker designed to interface with the standard Eskom steel support structure	Y/N	Yes	
7.15	5.5.3 / 5.5.4	·	Circuit-breaker support structure designed to interface with the standard Eskom concrete foundation	Y/N	Yes	
7.16	5.5.3 / 5.5.4	·	Circuit-breaker steel support structure drawing		D-DT-5200 Sh 2	
7.17	5.5.3 / 5.5.4	·	Circuit-breaker concrete foundation drawing		D-DT-5200 Sh 1	
7.18	5.5.5	·	Surge arrester mounting brackets supplied and fitted	Y/N	No	
8	5.6	**Corrosion protection and lubrication**				
8.1	5.6.1	·	Corrosion specification		DSP 34-1658	
8.2	5.6.1	·	Corrosivity rating of environment		"high" to "very high"	xxxxxxxxxx
8.3	5.6.2	·	Minimum detailed specification number for exposed metal	DS	DS-11	xxxxxxxxxx
8.4	5.6.3		- Equivalent detailed specification number offered for operating mechanism enclosures	DS	xxxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
8.5	5.6.3		- Equivalent detailed specification number offered for all bolts, nuts and washers	DS	xxxxxxxxxx	
8.6	5.6.3		- Equivalent detailed specification number offered for all structural steel	DS	xxxxxxxxxx	
8.7	5.6.3		- Equivalent detailed specification number offered for all other exposed metal (excluding main terminals)	DS	xxxxxxxxxx	
8.8	5.6.4	·	Details of lubricants provided with tender documentation	Y/N	Yes	
8.9	5.6.5	·	Details of flange arrangements, treatments to prevent flange corrosion provided with tender		Yes	
9	5.7	**Circuit-breaker operating mechanism enclosure heaters**				
9.1	5.7.1	·	Heater size offered	Watt	xxxxxxxxxx	
9.2	5.7.4	·	Heater control circuit specification		DST 34-1692	
10	5.8	**Terminal requirements**				
10.1	5.8.1.1	·	HV main terminal type: "Flat pad" / "Stem"		Flat pad	
10.2	5.8.1.1.1	·	Flat pad details:			
10.3	5.8.1.1.1		- Number of holes and pitch	mm	8 x 50	
10.4	5.8.1.1.1		- Thickness (min)	mm	20	
10.5	5.8.1.1.1		- Material		Aluminium	
10.6	5.8.1.1.2	·	Stem details:			
10.7	5.8.1.1.2		- Diameter	mm	N/A	
10.7	5.8.1.1.2		- Length (min)	mm	N/A	
10.9	5.8.1.1.2		- Material		N/A	
10.10	5.8.1.4	·	HV main terminals removable without interfering with operation of circuit-breaker	Y/N	Yes	
	5.8.2	·	Earthing terminals			
10.11	5.8.2.1		- Earthing of circuit-breaker via steel support structure and foundation holding down bolts	Y/N	Yes	
10.12	5.8.2.1		- Additional conductor provided between the circuit-breaker and the support structure	Y/N	xxxxxxxxxx	
10.13	5.8.2.1		- Material		xxxxxxxxxx	
10.14	5.8.2.2		- Additional Ø18 mm hole provided at bottom of steel support structure		N/A	
11	5.9	**Safety clearances and personnel safety**				
11.1	5.9.1	·	Live parts isolated by means of elavation	Y/N	Yes	
11.2	5.9.2	·	Electrical working clearance (min)	mm	3950	
11.3	5.9.3	·	Distance from lowest part of any high-voltage insulation above ground	mm	2500	
11.4	5.9.4/5.9.5	·	Type of pressure relief devices provided		xxxxxxxxxx	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
12	5.10	**Insulation requirements**				
	5.10.1	·	Hollow insulators			
12.1	5.10.1.1		- Insulator material		Silicone rubber composite	
12.2	5.10.1.1		- Insulator manufacturer		xxxxxxxxxx	
12.3	5.10.1.2		- Ceramic type insulators in accordance with SANS 62155 and SANS 60815-2	Y/N	N/A	
12.4	5.10.1.3		- Silicone rubber composite type insulators in accordance with SANS 61462 and SANS 60815-3	Y/N	Yes	
12.5	5.10.1.4		- Circuit-breaker tested at KIPTS	Y/N	Yes	
	5.10.2	·	Minimum insulation creepage distances (SANS 60815-1)			
12.6	5.10.2.1/2		- Minimum external unified specific creepage distance	mm/kV	53,7	
	5.10.3	·	Clearances in air			
12.7	5.10.3.1		- Phase to phase clearance in air	mm	xxxxxxxxxx	
12.8	5.10.3.1		- Phase to earth clearance in air	mm	xxxxxxxxxx	
13	5.11	**Position / status indication**				
		·	Circuit-breaker position indication			
13.1	5.11.1		- Position indication to SANS 62271-1		Yes	
13.2	5.11.1		- Position indication visible with operating mechanism enclosure front access door closed		Yes	
13.3	5.11.2		- Closed position: “I” in white lettering on a red background		Yes	
13.4	5.11.2		- Open position: “O” in white lettering on a green background		Yes	
13.5	5.11.3		- Lettering (symbol) size (min)	mm	30	
		·	Closing spring status indication			
13.6	5.11.4		- Status indicated by "SPRING CHARGED" and "SPRING DISCHARGED"		Yes	
13.7	5.11.4		- Lettering size (min)	mm	15	
13.8	5.11.5	·	Type of non-resettable circuit-breaker operation counter offered		Mechanical / electrical	
13.9	5.11.6	·	SF_6 pressure gauge provided (compensated for temperature and responding to SF6 gas density) - where applicable		Yes	
13.10	5.11.6	·	SF_6 pressure gauge sheltered from the elements - where applicable		Yes	
14	5.12	**Labels**				
	5.12.1	·	Operating labels			
14.1			- Instructions for tripping and closing the circuit-breaker		N/A	
14.2			- Instructions for charging closing springs		N/A	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
14.3	5.12.2	·	Actuator(s) for local opening and closing of the circuit-breaker labelled in accordance with ESP 32-1166		Yes	
14.4	5.12.3 / 5.12.4	·	Warning labels for manual operation		Yes	
	5.12.5	·	Function labels			
14.5			- Function labels provided to identify all LV equipment		Yes	
14.6			- Function label text height (min)	mm	5	
14.7	5.12.6	·	Labels manufactured to DSP 34-1513		Yes	
15	5.13		**Requirements for sulphur hexafluoride (SF_6) gas (where applicable)**			
15.1	5.13.1	·	SF_6 in accordance with IEC 60376		Yes	
15.2	5.13.3	·	The maximum SF_6 gas leakage rate	%	0,5 / year	
	5.13.4	·	SF_6 gas purity			
15.3			- SF_6 content	%	>98	
15.4			- Dew point at rated filling pressure	^{0}C	>-30	
	5.13.5	·	SF_6 gas-filled circuit-breaker filling and pressure monitoring			
15.5			- central gas/filling evacuation point connection provided		DILO DN8	
15.6			- height of gas filling/evacuation point above ground (max)	mm	2250	
15.7			- gas filling point and the gas pressure gauge separated	Y/N	Yes	
15.8			- dial type gauge responding to SF_6 density and indicating pressure compensated for temperature provided	Y/N	Yes	
15.9			- SF_6 density monitoring device (density switch) contact requirements		D-DT-5407	
15.10			- SF_6 density monitoring device suitable for outdoor operation	Y/N	Yes	
15.11			- method/system used to prevent corrosion of moving parts and contacts		xxxxxxxxxx	
15.12			- SF_6 density monitoring device shielded against direct sunshine	Y/N	Yes	
15.13			- non-return valves fitted on all DN8/DN20 fittings and pipe work to allow removal of poles and/or density monitoring device while maintaining system pressure	Y/N	Yes	
15.14			- details of arrangement offered supplied with tender documentation	Y/N	Yes	
15.15			- pipe work material		S/Steel / Cu	
15.16			- separate/common SF_6 filling/evacuating and SF_6 density monitoring point per pole provided		Common	
15.17			- type of electrical connections to the density-monitoring device		xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
15.18			- cabling protected using compression glands/grommets	Y/N	Yes	
15.19			- details of all pressure devices provided with tender documentation	Y/N	Yes	
15.20			- gas density monitoring device electrical interlocks and alarm requirements		DST 34-1692	
15.21	5.13.8	·	Management of SF_6 gas in accordance with NRS 087	Y/N	Yes	
16	5.14	**Current Transformers**				
16.1	5.14.1	·	Type of CT design		N/A	
16.2	5.14.1	·	CT specification		N/A	
16.3	5.14.2	·	Number of cores		N/A	
16.4	5.14.2	·	CT specification (drawing number)		N/A	
16.5	4.7	·	Rated short-time withstand current - magnitude	kA	N/A	
			Rated short-time withstand current - duration	s	N/A	
16.6	5.14.2	·	Position relative to the circuit-breaker		N/A	
16.7	5.14.3	·	Terminal numbering and wiring interface (drawing number)		N/A	
		·	Protection current transformers:			
16.8	5.14.2		a) cores		N/A	
16.9	5.14.2		b) class		N/A	
16.10	5.14.2		c) ratios	A	N/A	
		·	Bus-zone current transformers:			
16.11	5.14.2		a) cores		N/A	
16.12	5.14.2		b) class		N/A	
16.13	5.14.2		c) ratios	A	N/A	
		·	Measurement current transformers:			
16.14	5.14.2		a) cores		N/A	
16.15	5.14.2		b) class		N/A	
16.16	5.14.2		c) burden	VA	N/A	
16.17	5.14.2		d) ratios	A	N/A	
16.18	5.14.5	·	Cross-section of Cu conductors between post-type CT and circuit-breaker (where applicable)	mm^2	N/A	
16.19	5.14.5	·	Post-type CT main terminals in accordance with 5.8.1 provided (where applicable)		N/A	
16.20	5.14.7	·	Ring-type CTs interchangeable without dismantling the bushing (where applicable)		N/A	
17	5.15	**Switching surge control (where applicable)**				
17.1	5.15.1	·	Pre-insertion closing resistor offered	Y/N	xxxxxxxxxx	
17.1	5.15.1	·	Pre-insertion closing resistor resistance	Ω	xxxxxxxxxx	
17.2	5.15.2	·	Controller offered for switching of capacitor banks, reactor banks and transformers	Y/N	xxxxxxxxxx	
17.3	5.15.2	·	Metal oxide surge arresters offered	Y/N	xxxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
18	5.16	**Grading capacitors (where applicable)**				
18.1	5.16.1	·	Grading capacitors required	Y/N	xxxxxxxxxx	
18.2	5.16.1	·	Grading capacitor capacitance	pF	xxxxxxxxxx	
18.3	5.16.2	·	Details of how to verify condition of grading capacitors during the life of the circuit-breaker provided with the tender documentation	Y/N	Yes (where applicable)	
19	5.17	**Extreme asymmetrical short-circuit interrupting capability (where applicable)**				
19.1	5.17	·	Circuit-breaker required to interrupt short-circuit currents with a higher degree of asymmetry than required by SANS 62271-100	Y/N	No	
19.2	5.17	·	Proof of higher asymmetrical interrupting capability provided with tender documentation	Y/N	Yes (where applicable)	
20	5.18	**Requirements for simultaneity of poles during single closing and single opening operations**				
20.1	5.18	·	Contact synchronism retained within rated values during the expected maintenance interval of circuit-breaker	Y/N	Yes	
20.2	5.18		- time interval between contact touch for all poles of the circuit-breaker	ms	< 5	
20.3	5.18		- time interval between contact touch for interrupters in the same pole	ms	< 1	
20.4	5.18		- time interval between contact touch for individual closing resistors - where applicable	ms	< 10	
20.5	5.18		- time interval between contact touch for individual closing resistors in the same pole (series connected) - where applicable	ms	< 6,6	
20.6	5.18		- time interval between contact separation for all poles of the circuit-breaker	ms	< 3,3	
20.7	5.18		- time interval between contact separation for interrupters in the same pole	ms	< 1	
21	5.19	**Controlled switching**				
21.1	5.19	·	All information and details provided with the tender documentation	Y/N	Yes	
22	5.20	**Pole discordance (PD) or phase discrepancy**				
22.1	5.20	·	All information and details provided with the tender documentation	Y/N	Yes	
23	5.21	**Auxiliary and control circuits**				
23.1	5.21.1	·	Auxiliary and control circuit requirements		DST 34-1692	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756	DESCRIPTION			SCHEDULE A	SCHEDULE B
		·	Auxiliary power supplies:			
23.2			- Provision		On site by Eskom	
23.3			- Peak power requirement (max)	VA	xxxxxxxxxx	
23.4			- Standby power requirements	VA	xxxxxxxxxx	
		·	Circuit-breaker spring-charging motor control circuit (per mechanism):			
23.5			- d.c. supply voltage range of operation	%	85 to 110	
23.6			- d.c. current (peak starting)	A	< 30	
23.7			- d.c. current (max continuous)	A	< 10	
23.8			- total time taken to charge spring	s	< 10	
23.9			- method offered for protection against continual motor running (over-run)		xxxxxxxxxx	
23.1			- automatic charging of closing spring		Yes	
23.11			- number of spare contacts of SLS provided		D-DT-5407	
		·	Circuit-breaker closing control circuit (per mechanism):			
23.12			- d.c. supply voltage range of operation	%	85 to 110	
23.13			- d.c. power (peak)	W	≤ 500	
23.14			- number of close coils required		1	
23.15			- close coil current	A	xxxxxxxxxx	
23.16			- close coil resitance @ 20^0C	Ω	xxxxxxxxxx	
		·	Circuit-breaker tripping control circuit (per mechanism):			
23.17			- d.c. supply voltage range of operation	%	70 to 110	
23.18			- d.c. power (peak)	W	≤ 500	
23.19			- number of trip coils required		2	
23.2			- physically and electrically separate trip control circuits		Yes	
23.21			- trip circuit supervision		Yes	
23.22			- trip coils rated to carry 20mA d.c. continuously		Yes	
23.23			- trip coil current	A	xxxxxxxxxx	
23.24			- trip coil resitance @ 20^0C	Ω	xxxxxxxxxx	
23.25		·	Circuit-breaker equipped with anti-pumping circuitry		Yes	
23.26		·	d.c. isolation switch provided		Yes	
23.27		·	Circuit-breaker control circuit interlocks specification		DST 34-1692	
23.28		·	Circuit-breaker alarm circuits wiring specification		DST 34-1692	
		·	Auxiliary contacts provided (spare for Eskom use):			
			Duty rating			
23.29			- a.c. and d.c. supply current	A	10	
23.30			- N/O and N/C contact reference positions		Circuit-breaker opened, spring discharged, gas low, relay coils de-energised	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
			Low gas alarm			
23.31			- N/O		0	
23.32			- N/C		2	
			Low gas block contacts			
23.33			- N/O		0	
23.34			- N/C		2	
			Spare circuit-breaker auxiliary switch contacts (per mechanism)			
23.35			- N/O		4	
23.36			- N/C		4	
			Spare circuit-breaker spring limit switch contacts (per mechanism)			
23.37			- N/O		3	
23.38			- N/C		3	
		·	Terminal blocks and terminal strips:			
23.39			- Number of spare terminals provided		≥ 6	
23.4			- Terminal blocks to DSP 34-253, screw clamp, spring-loaded insertion type		Yes	
23.41			- Terminal block width offered	mm	≥ 8	
23.42			- Make of terminal block offered		xxxxxxxxxx	
23.43		·	Lugs (insulated hook blade type)		Crimped	
23.44		·	Earth sliding link types/equivalents		Weidmuller TVP SAKA 10	
23.45		·	Trunking provided on both sides of each terminal strip		Yes	
23.46		·	'Fine-tooth' trunking tooth width	mm	6,1	
23.47		·	Trunking size	mm	60 x 60	
		·	Wiring size:			
23.48			- CT and motor control circuit wires	mm^2	2,5	
23.49			- Control and other auxiliary wires	mm^2	1,5	
23.5			- Minimum number of strands		7	
		·	Wiring colour:			
23.51			- CT wires		red/white/blue/black	
23.52			- Earth wires		green/yellow	
23.53			- All other wires		grey	
23.54		·	Wiring identification		Ferruling	
23.55		·	Terminal strips numbered and designated as per drawing		D-DT-5407	
		·	LV MCBs:			
23.56			- MCBs to SANS 60947-2 and IEC 60898		Yes	
23.57			- Make and type offered		xxxxxxxxxx	
23.58			- I_{CU}	kA	xxxxxxxxxx	
23.59			- I_{CS}	kA	xxxxxxxxxx	
23.6			- Utilisation category (SANS 60947-2)		'A'	
23.61			- Max service voltage	VA	xxxxxxxxxx	
23.62			- d.c. MCB rated voltage	V	≥ 250	
23.63			- Pollution degree (SANS 60947-2)		≥ 3	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
23.64			- Suitable for isolation (SANS 60947-2)		Yes	
23.65			- Protection curve (SANS 60947-2 / IEC 60898)		'C'	
23.66			- Location		Mechanism enclosure	
23.67	5.21.2	·	Circuit-breaker auxiliary and control circuit wiring interface (drawing number)		D-DT-5407	
23.68	5.21.3	·	Bottom entry removable brass/aluminium LV gland plates provided		Yes	
23.69	5.21.4	·	Terminal strips shall be arranged in a vertical orientation		Yes	
23.70	5.21.5	·	Earthing stud / terminals provided		Yes	
24	5.22	**Nameplates**				
		·	Nameplates provided for the following:			
24.1	5.22.1		- circuit-breaker (SANS 62271-100)	Y/N	Yes	
24.2	5.22.2		- circuit-breaker operating mechanism (SANS 62271-100)	Y/N	Yes	
24.2			- CT (SANS 60044-1 / NRS 029)	Y/N	N/A	
24.3	5.22.4	·	Method used to attach nameplates		xxxxxxxxxx	
24.4	5.22.4	·	Nameplate material offered		xxxxxxxxxx	
24.5	5.22.5	·	Duplicate nameplates provided for CTs on inside of operating mechanism enclosure front access door	Y/N	N/A	
25	5.23 / 8.3	**Tools and spares**				
		.	Tools to be supplied with circuit-breaker (minimum requirements):			
25.1	5.23.1		- full set of operating tools (provide list on separate sheet provided)	Sets	1 set per circuit-breaker	
25.2	5.23.2		- tools fitted on inside of the front access door	Y/N	Yes	
25.3	5.23.3	·	Standard tools available for minor maintenance (provide list on separate sheet provided)	Y/N	Yes	
25.4	5.23.4	·	Specialised tools available for major maintenance purposes (provide list on separate sheet provided)	Y/N	Yes	
25.5	5.23.5 / 8.3	·	Spares available for maintenance (provide list on separate sheet provided)	Y/N	Yes	
26	5.24	**Documentation**				
		Note: All tender documentation to be provided in electronic format.				
	5.24.1	·	Documentation to be supplied with tender:			
26.1			- GA drawing (provide drawing number on separate sheet provided)	Sets	1	
26.2			- Drawing of all insulators used in the circuit-breaker (provide drawing number on separate sheet provided)	Sets	1	

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
26.3			- Generic layout of nameplates (provide drawing number on separate sheet provided)	Sets	1	
26.4			- Generic auxiliary and control circuit schematic wiring diagram (provide drawing number on separate sheet provided)	Sets	1	
26.5			- GA drawing of the operating mechanism enclosure	Sets	1	
26.6			- list of spare parts with prices for each circuit-breaker offered (provide list on separate sheet provided)	Sets	1	
26.7			- list of all operating tools for each circuit-breaker offered (provide list on separate sheet provided)	Sets	1	
26.8			- list of all standard minor maintenance tools for each circuit-breaker offered (provide list on separate sheet provided)	Sets	1	
26.9			- list of all specialised major maintenance tools for each circuit-breaker offered (provide list on separate sheet provided)	Sets	1	
26.1			- full list as well as copies of type test certificates and reports (provide report numbers on separate sheet provided)	Sets	1	
26.11			- generic routine test certificates for each circuit-breaker	Sets	1	
26.12			- transport, storage, installation, operating and maintenance manuals	Sets	1	
26.13			- training material	Sets	1	
26.14			- all other relevant additional information requested	Sets	1	
	5.24.2	·	Documentation to be supplied with each circuit-breaker:			
26.15			- Schematic wiring diagram for circuit-breaker	Sets	1	
26.16			- Complete set of routine test certificates for circuit-breaker	Sets	1	
26.17			- Commissioning and hand-over test sheet	Sets	1	
26.18			- Transport, storage, installation, operating and maintenance manuals	Sets	1	
26.19	5.24.4	·	Submission of documentation requested upon awarding of contract	Y/N	Yes	
26.19		·	Units used in Republic of South Africa		In tender/offer	
26.20		·	Project reference list, service to Eskom		In tender/offer	
27	5.25	**Packaging requirements**				
27.1	5.25.1	·	Each individual circuit-breaker unit packed	Y/N	Yes	
27.2	5.25.2	·	Containers (e.g. wooden crates) suitable for transport and storage over long periods (for up to 18 months)	Y/N	Yes	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE OF 240-56063756		DESCRIPTION		SCHEDULE A	SCHEDULE B
27.3	5.25.3	·	Packaging designed prevent damage to components during transportation and storage on site	Y/N	Yes	
27.4	5.25.3	·	Suitable ventilation provided to minimise condensation	Y/N	Yes	
27.5	5.25.4	·	Packaging able to withstand impact loadings of at least 18 kN	Y/N	Yes	
27.6	5.25.5	·	Each crate clearly and sequentially marked	Y/N	Yes	
27.7	5.25.6	·	Each container/crate clearly marked with a durable label using an indelible font with all specified information in ESP 32-1166	Y/N	Yes	
27.8	5.25.7	·	Exposed shafts, bearings and machined surfaces treated with a temporary anti-corrosive coating	Y/N	Yes	
27.9	5.25.8	·	Loose components or components that are subject to damage from exposure to dust or water packed in hermetically sealed plastic bags	Y/N	Yes	
27.10	5.25.9	·	All components clearly marked	Y/N	Yes	
27.11	5.25.10	·	Fork-lift lifting points provided on the packaging - where applicable	Y/N	Yes	
27.12	5.25.11	·	External temporary 230 V a.c. connection point for the heater circuit provided	Y/N	Yes	
27.13	5.25.12	·	Non-resettable impact recorder/detector provided	Y/N	Yes	
27.14	5.25.13	·	Circuit-breaker transported with a positive gas pressure of maximum 150 kPa - where applicable	Y/N	Yes	
27.15	5.25.14	·	Copy of the BOM shall be provided with the delivery note	Y/N	Yes	
28		**Miscellaneous**				
		·	General			
28.1			Guarantee period	Years	xxxxxxxxxx	
28.2	8.3.2		Required period for spares availability	Years	25 years after discontinuation of switchgear	
29		**Training Requirements**				
29.1		·	Training offered in accordance with DSP 34-2207	Y/N	Yes	

T2.2.28.5.5. TSE53 - VOLTAGE AND POWER VOLTAGE TRANSFORMERS

- 88 kV Voltage Transformer for use in very heavily polluted conditions (31 mm / kV) in accordance with Eskom specification 240-56062765.
- 22kV Voltage Transformer for use in very heavily polluted conditions (31mm/kV) in accordance with Eskom specification 240-56062765.

Table 35: 22kV VT Technical Schedule

ITEM	CLAUSE	DESCRIPTION	SCHEDULE A	SCHEDULE B
1	**4.1**	**General requirements**		
	4.1a)	**Service conditions**		
		a) Altitude m	1800	
		b) Climate conditions	Humid and salt air	
		c) Lightning area	Yes	
		d) Level of pollution that the equipment will be subjected to	Very heavy	
		When erection is not required:		
		a) Access to stores by	Road	
		b) To be off-loaded from transport by supplier?	No	
		When erection is required		
		a) Access to site by	Tar/Gravel road	
		b) To be off-loaded from transport by supplier?	Yes	
		c) Crane available for off-loading?	No	
		d) Distance from off-loading point to operation position m	100	
		e) Nature of ground to be traversed	Soft earth	
		f) Rise to fall m	3	
		g) Erection on prepared steel support structures	Yes	
		h) Construction power supply available	Yes	
		i) Is mounting structure to be provided by the supplier	No	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
2	**4.1b)**	**System details** a) Outdoor use			
		b) Measuring or protection application **Measuring / Protection**			
		1) Rated burden per phase	VA	50	
		2) Accuracy class		3P/0.2	
		Voltage transformer ratio: primary voltage secondary voltage	kV V	22 / $\sqrt{3}$	
		c) Nominal system r.m.s. phase-to-phase voltage (Un)	kV	22	
		d) Higher r.m.s. voltage phase-to-phase voltage of equipment (Um)	kV	24	
		e) Number of phases		3	
		f) Rated frequency	Hz	50	
		g) Method of earthing: effective or non-effective		Effective	
		h) 3 off single-phase voltage transformers		Yes	
		i) Power frequency short-duration withstand voltage	kV (r.m.s.)	50 (min)	
		j) Lightning impulse withstand voltage	kV (peak)	150 (min)	
	4.1	**Is a power winding required?**		No	
3	**4.1c)**	**Type of voltage transformer offered** a) Manufacturer of voltage transformer		xxxxxxxxx	
		b) Manufacturer type designation		xxxxxxxxx	
		Creepage distance Minimum creepage distance for other than medium pollution (IEC 60815)	mm/kV	31	
4	**4.1.3**	**Insulation materials**		xxxxxxxxx	
		a) Outdoor type voltage transformers			
		1) Primary insulation medium			
		2) Secondary insulation medium		xxxxxxxxx	
		3) Core insulation medium		xxxxxxxxx	
		4) Main insulation (oil, gas or resin)		Oil	
5	**4.1.4**	**Oil-insulated voltage transformers**			

T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
		Details to be supplied for approval			
		a) Sealing arrangement		xxxxxxxxx	
		b) Oil-level indicators		xxxxxxxxx	
	4.1.5	**Dry-type insulation**		N/A	
		Is the core included in the encapsulation?		N/A	
	4.1.6	**Gas insulated voltage transformers**		N/A	
		Method of sealing		N/A	
	4.2.1.2/3/4	**Voltage factor**		2.1	
		Time for voltage factor		Continuous	
	4.2.3.1/2	**Are primary fuses required?**		No	
	4.2.3.1/3	**Is secondary protection required?**		Yes	
		a) By means of fuses or MCCBs?		Fuses	
		b) Current rating	A	32	
		c) Make and type of protection		xxxxxxxxx	
	4.2.3.4	**Short-circuit currents**			
		d) Calculated secondary short-circuits current	A	xxxxxxxxx	
		e) Maximum permissible duration of secondary short-circuits current	s	1	
		f) Operating time for secondary short-circuit	s	xxxxxxxxx	
		g) Calculated primary current for a secondary short-circuit assuming zero source impedance	A	xxxxxxxxx	
		h) Drawing showing method of mounting secondary fuses		xxxxxxxxx	
	4.3.1	**Windings and connections**			
		Is a residual voltage winding required?		No	
		If yes,		N/A	
		a) Rated burden	VA	N/A	
		b) Rated secondary voltage		N/A	

ITEM	CLAUSE	DESCRIPTION	SCHEDULE A	SCHEDULE B
		c) Are tapped windings for providing both rated secondary residual voltages required?	N/A	
	4.3.1.6	**Details of primary winding neutral (earth) terminal**	xxxxxxxxx	
		a) Drawing number of magnetisation curve showing voltage/magnetising current for built up core	xxxxxxxxx	
		b) Core steel details required 1) B/H curve	xxxxxxxxx	
		2) Core steel thickness mm	xxxxxxxxx	
8	**4.3.4**	**Secondary terminal box**		
	4.3.4.1	Number of fuses	xxxxxxxxx	
		Manufacturer of fuses	xxxxxxxxx	
		Type of fuses	xxxxxxxxx	
		Current rating of fuses A	xxxxxxxxx	
		Diameter of secondary earthing terminal mm	xxxxxxxxx	
	4.3.4.2	HV winding earth end to be brought out, with link to earth terminal	Yes	
	4.3.4.4	Dimension of terminal box		
		Length mm	xxxxxxxxx	
		Height mm	xxxxxxxxx	
		Depth mm	xxxxxxxxx	
9	**4.3.5**	**Mounting arrangement**		
		Holding down bolts to be arranged to fall within a square of maximum dimensions. mm mm	706 × 706	
		Diameter of the hole to be mm	18	
10	**4.3.6**	**Finish**	No	
		Finish offered on ferrous parts	xxxxxxxxx	
		Finish offered on non-ferrous parts	xxxxxxxxx	
11	**4.4**	**Primary terminals (Post-type voltage transformer)**		
		Type of primary terminal	Stem	
		Material of primary terminal	xxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION		SCHEDULE A	SCHEDULE B
		Overall dimensions of primary terminal			
		Length	mm	125	
		Diameter	mm	26	
		Orientation		Vertical	
		Diameter of tank earthing terminal	mm	xxxxxxxxx	
13	**4.3.2**	**Core material details and B/ H curve required with tender?**		Yes	
14	**4.7**	**Drawing numbers for post type voltage transformers** Outline dimension		xxxxxxxxx	
		Assembly		xxxxxxxxx	
		Terminal box		xxxxxxxxx	
		Terminal marking		xxxxxxxxx	
		Rating plate		xxxxxxxxx	
		Diagram plate		xxxxxxxxx	
		Miscellaneous Oil quantity	l	xxxxxxxxx	
		a) Overall dimensions of voltage transformer			
		Height	mm	xxxxxxxxx	
		Length	mm	xxxxxxxxx	
		Width	mm	xxxxxxxxx	
		Total mass of voltage transformer	kg	xxxxxxxxx	
		Number of instruction books if other than three		6	
		Number of copies of routine test certificates		6	
		Storage for outdoor-type voltage transformers Guides on		xxxxxxxxx	
		Storage		xxxxxxxxx	
		Transportation		xxxxxxxxx	
		Handling and slinging		xxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

ITEM	CLAUSE	DESCRIPTION	SCHEDULE A	SCHEDULE B
17	**4.8**	**Spare fuses**	N/A	
18	**5.1.1.1**	**Type tests** Are type test results available?	xxxxxxxxx	
		If No, are type tests to be performed?	Yes	
		If required where are type tests to be carried out?	xxxxxxxxx	
19	**5.2**	**Routine tests** Is a tangent delta test required?	No	
	5.2.7.5	**Test procedure for cast resin encapsulated voltage transformers**	N/A	
		Marking/labelling/documentation Materials used for rating plates	xxxxxxxxx	
		Material used for diagram plates	xxxxxxxxx	
		Method of fixing diagram and rating plates	xxxxxxxxx	

Table 36: Deviation Schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.

Item	Sub-clause	Proposed deviation

T2.2.28.5.6. TSE56 - SURGE ARRESTORS

The general requirements for station class surge arresters are covered by Eskom specification 240-75540566.

- Station class surge arresters for a 22 kV system in accordance with Eskom specification DSP_34-419.
- Station class surge arresters for a 66 kV system in accordance with Eskom specification DSP_34-419.
- Station class surge arresters for an 88 kV system in accordance with Eskom specification DSP_34-419.

Table 37: Technical Schedule – 22 kV Surge Arrester

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	1. SURGE ARRESTER IDENTIFICATION			
	a) Supplier		xxxxxxxxxx	
	b) Manufacturer		xxxxxxxxxx	
	c) MOV block manufacturer		xxxxxxxxxx	
	d) Product code: Item 3 (Coastal)		xxxxxxxxxx	
	• Item 4 (Inland)		xxxxxxxxxx	
4.1	**2. OPERATING CONDITIONS**			
	a) Altitude	m	up to 1800	xxxxxxxxxx
	b) Average humidity	%	30 to 90	xxxxxxxxxx
	c) Minimum ambient temperature	°C	−10	xxxxxxxxxx
	• Maximum ambient temperature	°C	40	xxxxxxxxxx
	• Maximum diurnal variation	°C	30	xxxxxxxxxx
	d) Intensity of solar radiation	kW/m^2	1,1	xxxxxxxxxx
	e) IEC pollution level: Item 3 (Coastal)		HVH	xxxxxxxxxx
	• Item 4 (Inland)		LM	xxxxxxxxxx
	f) Lightning activity		High	xxxxxxxxxx
	g) System earthing		Non-effective	xxxxxxxxxx

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	h) System configuration		3-phase, 3-wire	xxxxxxxxxx
	i) Nominal system voltage (Un)	kV	22	xxxxxxxxxx
	j) Maximum system voltage (Um)	kV	24	xxxxxxxxxx
	k) Supply frequency	Hz	50	xxxxxxxxxx
	l) BIL of equipment to be protected	kV peak	150	xxxxxxxxxx
4.3	**3. ELECTRICAL CHARACTERISTICS OF ARRESTER**			
	a) Arrester classification		Station class	
	b) IEC line discharge class		2	
	c) Nominal lightning discharge current (8/20µs)	kA	10	
	d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	kJ/kV	xxxxxxxxxx	
	e) Arrester rated voltage (Ur)	kV	xxxxxxxxxx	
	f) MCOV (Uc)	kV	24	
	g) Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	85	
4.4	**4. ARRESTER HOUSING**			
	a) Housing material			
	• Item 3 (Coastal)		xxxxxxxxxx	
	~~• Item 4 (Inland)~~		~~xxxxxxxxx~~	
	b) Minimum external creepage distance:			
	• Item 3 (Coastal) [Um x 31 mm/kV]	mm	372	
	~~• Item 4 (Inland) [Um x 20 mm/kV]~~	~~mm~~	~~240~~	
4.4.3	**5. ARRESTER HOUSING PROFILE DESIGN**			
	IEC 60815 annex D parameters:			
	a) c		≥ 20	
	b) s/p		≥ 0,65	

SUB CLAUSE OF 34-419	DESCRIPTION	SCHEDULE A	SCHEDULE B
	c) Ld/d	≤ 5	
	d) P1 – P2	≥ 15	
	e) CF	≤ 3,5	
	f) PF	≥ 0,7	
4.5	**6. ARRESTER MOUNTING DETAILS**		
	a) Orientation	Vertical	xxxxxxxxxx
	b) Method of mounting	Base	xxxxxxxxxx
	c) Reference number of drawing showing mounting details	xxxxxxxxxx	
4.6.1	**7. ARRESTER LINE TERMINAL**		
	a) Type	Threaded	
	b) Diameter	M12	
	c) Minimum length mm	50	
	d) Orientation	Vertical	
	e) Supplied with: M12 nut, two flat washers and spring washer	Yes	
	f) Material	xxxxxxxxxx	
	g) Reference number of drawing showing details of line terminal	xxxxxxxxxx	
4.6.2	**8. ARRESTER EARTH TERMINAL**		
	a) Type	Threaded	
	b) Diameter	M12	
	c) Minimum length mm	50	
	d) Orientation	Vertical	
	e) Supplied with nut, two flat washers and spring washer	Yes	
	f) Material	xxxxxxxxxx	
	g) Reference number of drawing showing details of line terminal	xxxxxxxxxx	
4.7.1	**9. DRAWINGS TO BE SUBMITTED WITH TENDER**		

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	Single copies of drawings shall be submitted as part of the original tender showing the following detail:			
	a) Outline dimensions of arrester, fit as for service		Reference number	
	b) Mounting details		Reference number	
	c) Line and earth terminal, conductor clamping arrangement		Reference number	
	d) Details of grading rings		Reference number	
4.7.2	**10. ARRESTER CHARACTERISTIC DATA REQUIRED**			
	a) V-I characteristic curve, AC		Reference Number:	
	b) V-I characteristic curve, DC		Reference Number:	
	c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.		Reference Number:	
	11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY. (prior duty as defined in annex D, IEC 60099-4)			
	a) Overvoltage applied for 1 s	pu of MCOV	xxxxxxxxx	
	b) Overvoltage applied for 5 s	pu of MCOV	xxxxxxxxx	
	c) Overvoltage applied for 10 s	pu of MCOV	xxxxxxxxx	
	12. PHYSICAL DIMENSIONS OF ARRESTERS			
	d) Overall height of arrester	mm	xxxxxxxxx	
	e) Minimum external flashover distance	mm	320	
	f) External diameter of arrester housing	mm	xxxxxxxxx	
	g) Diameter of voltage grading rings	mm	xxxxxxxxx	
	h) Distance of grading ring from top of arrester	mm	xxxxxxxxx	
	13. MOV ELEMENTS			
	a) Diameter of elements	mm	xxxxxxxxx	
	b) Thickness of elements	mm	xxxxxxxxx	
	c) Number of elements per arrester		xxxxxxxxx	
4.2.2	d) Number of stacks in parallel		0	

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	14. MISCELLANEOUS			
4.2.1	a) Live spray washing (Yes/No)		No	xxxxxxxxxx
	b) Total mass of assembled unit	kg	xxxxxxxxxx	
	c) Minimum expected life of arrester at 40 °C and MCOV	yrs	30	
4.2.7	d) Sample available for inspection		Yes	
5.2.10	e) Declared specified long-term load	kN	xxxxxxxxxx	
5.2.1	**15. INSULATION WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Lightning impulse (1,2/50µs) withstand level [(1,3/0,82) × Ures]	kV	150	
	c) 60 s wet power frequency withstand	r.m.s kV	50	
5.2.2	**16. RESIDUAL VOLTAGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs)	kV	85	
	c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			
	• 5 kA	kV	xxxxxxxxxx	
	• 10 kA	kV	85	
	• 20 kA	kV	xxxxxxxxxx	
	d) Maximum residual voltage for a 500 A switching current impulse	kV	xxxxxxxxxx	
5.2.3	**17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Charging voltage	pu of U_r	3,2	
	or			
	• charging current	A	xxxxxxxxxx	
	c) Virtual duration of peak	µs	2000	

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	d) Number of discharge operations		18	
	e) Number of grouped operations		6	
	f) Operations per group		3	
	g) Maximum interval between operations	s	60	
	h) Interval between groups		Cool to ambient	
	i) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.4	**18. OPERATING DUTY TESTS**			
	a) Reference number of test report		xxxxxxxxxx	
	Conditioning part 1:			
	b) 10 kA current impulse (8/20µs), energized at 1,2 x MCOV	kV	14.5	
	c) Number of discharge operations		20	
	d) Number of grouped operations		4	
	e) Operations per group		5	
	f) Interval between operations	s	60	
	g) Intervals between groups	min	30	
	Conditioning part 2:			
	h) High current impulse (4/10µs)	kA	100	
	i) Number of applications		2	
	Conditions for switching surge test:			
	j) Charging voltage	pu of U_r	3.2	
	or			
	• charging current	A	xxxxxxxxxx	
	k) Virtual duration of peak	µs	2000	
	l) Number of discharge operations		2	
	m) Interval between operations	s	60	

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	n) Starting temperature for first impulse	°C	60	
	o) Energy dissipated during second impulse	kJ	xxxxxxxxxx	
	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:			
	p) Interval between last long duration current impulse and power frequency test	ms	100	
	q) Elevated rated voltage (Ur*) applied for 10 s	kV	xxxxxxxxxx	
	r) Elevated continuous operating voltage (Uc*) applied for 30 min	kV	xxxxxxxxxx	
	s) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.5	**19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.6	**20. SHORT-CIRCUIT TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) High current	kA r.m.s.	40	
	c) Low current	kA r.m.s.	0,6 ± 0,2	
5.2.7	**21. NATURAL AGEING AND POLLUTION PERFORMANCE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.8	**22. INTERNAL PARTIAL DISCHARGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Power frequency voltage applied [1,05 x MCOV]	kV	xxxxxxxx	
	c) Maximum partial discharge	pC	10	
5.2.9	**23. MOISTURE INGRESS TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.10	**24. BENDING MOMENT TEST**			
	a) Reference number of test report		xxxxxxxxxx	

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Table 38: Deviation Schedule – 22 kV Surge Arrester

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	**Sub-clause**	**Proposed deviation**

Table 39: Technical Schedule - 66 kV Surge Arrester

SUB CLAUSE OF 34-419	**DESCRIPTION**	**SCHEDULE A**	**SCHEDULE B**
	1. SURGE ARRESTER IDENTIFICATION		
	a) Supplier	xxxxxxxxxx	
	b) Manufacturer	xxxxxxxxxx	
	c) MOV block manufacturer	xxxxxxxxxx	
	d) Product code: Item 9 (Coastal)	xxxxxxxxxx	
	• Item 10 (Inland)	xxxxxxxxxx	
4.1	**2. OPERATING CONDITIONS**		

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	a) Altitude	m	up to 1800	xxxxxxxxxx
	b) Average humidity	%	30 to 90	xxxxxxxxxx
	c) Minimum ambient temperature	°C	−10	xxxxxxxxxx
	• Maximum ambient temperature	°C	40	xxxxxxxxxx
	• Maximum diurnal variation	°C	30	xxxxxxxxxx
	d) Intensity of solar radiation	kW/m^2	1,1	xxxxxxxxxx
	e) IEC pollution level: Item 9 (Coastal)		HVH	xxxxxxxxxx
	• Item 10 (Inland)		LM	xxxxxxxxxx
	f) Lightning activity		High	xxxxxxxxxx
	g) System earthing		Effective	xxxxxxxxxx
	h) System configuration		3-phase, 3-wire	xxxxxxxxxx
	i) Nominal system voltage (Un)	kV	66	xxxxxxxxxx
	j) Maximum system voltage (Um)	kV	73	xxxxxxxxxx
	k) Supply frequency	Hz	50	xxxxxxxxxx
4.3	**3. ELECTRICAL CHARACTERISTICS OF ARRESTER**			
	a) Arrester classification		Station class	
	b) IEC line discharge class		2	
	c) Nominal lightning discharge current (8/20µs)	kA	10	
	d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	kJ/kV	3,4	
	e) Arrester rated voltage (Ur)	kV	xxxxxxxxxx	
	f) MCOV (Uc)	kV	48	
	g) Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	165	
4.4	**4. ARRESTER HOUSING**			
	a) Housing material			

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	• Item 9 (Coastal)		xxxxxxxxxx	
	~~• Item 10 (Inland)~~		~~xxxxxxxxx~~	
	b) Minimum external creepage distance:			
	• Item 9 (Coastal) [Um x 31 mm/kV]	mm	2263	
	~~• Item 10 (Inland) [Um x 20 mm/kV]~~	~~mm~~	~~1460~~	
4.4.3	**5. ARRESTER HOUSING PROFILE DESIGN**			
	IEC 60815 annex D parameters:			
	a) c		≥ 20	
	b) s/p		≥ 0,65	
	c) Ld/d		≤ 5	
	d) P1 – P2		≥ 15	
	e) CF		≤ 3,5	
	f) PF		≥ 0,7	
4.5	**6. ARRESTER MOUNTING DETAILS**			
	a) Orientation		Vertical	xxxxxxxxxx
	b) Method of mounting		Tripod base	xxxxxxxxxx
	c) Diameter of mounting holes in base	mm	xxxxxxxxxx	
	d) PCD (see Figure 1 of SCSSCAAO0)	mm	110 - 255	
	e) Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers.		Yes	
	f) Reference number of drawing showing mounting details		xxxxxxxxxx	
4.6.1	**7. ARRESTER LINE TERMINAL**			
	a) Type		Stem	
	b) Diameter		26	
	c) Minimum length	mm	100	
	d) Orientation		Vertical	

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SUB CLAUSE OF 34-419	DESCRIPTION	SCHEDULE A	SCHEDULE B
	e) Material	xxxxxxxxxx	
	f) Reference number of drawing showing details of line terminal	xxxxxxxxxx	
4.6.2	**8. ARRESTER EARTH TERMINAL**		
	Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor:		
	a) Conductor material	Copper	
	b) Conductor type	Strap	
	c) Conductor dimensions mm	50 x 3	
	d) Material used for clamping arrangement	xxxxxxxxxx	
	e) If dissimilar metals are used for clamping arrangement, state types	xxxxxxxxxx	
	f) Reference number of drawing showing details of earth terminal	xxxxxxxxxx	
4.7.1	**9. DRAWINGS TO BE SUBMITTED WITH TENDER**		
	Single copies of drawings shall be submitted as part of the original tender showing the following detail:		
	a) Outline dimensions of arrester, fit as for service	Reference number	
	b) Mounting details	Reference number	
	c) Line and earth terminal, conductor clamping arrangement	Reference number	
	d) Details of grading rings	Reference number	
4.7.2	**10. ARRESTER CHARACTERISTIC DATA REQUIRED**		
	a) V-I characteristic curve, AC	Reference Number:	
	b) V-I characteristic curve, DC	Reference Number:	
	c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.	Reference Number:	
	11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY. (prior duty as defined in annex D, IEC 60099-4)		
	a) Overvoltage applied for 1 s pu of MCOV	xxxxxxxxx	
	b) Overvoltage applied for 5 s pu of MCOV	xxxxxxxxx	
	c) Overvoltage applied for 10 s pu of MCOV	xxxxxxxxx	

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	12. PHYSICAL DIMENSIONS OF ARRESTERS			
	a) Overall height of arrester	mm	xxxxxxxxx	
	b) Minimum external flashover distance	mm	450	
	c) External diameter of arrester housing	mm	xxxxxxxxx	
	d) Diameter of voltage grading rings	mm	xxxxxxxxx	
	e) Distance of grading ring from top of arrester	mm	xxxxxxxxx	
	13. MOV ELEMENTS			
	a) Diameter of elements	mm	xxxxxxxxx	
	b) Thickness of elements	mm	xxxxxxxxx	
	c) Number of elements per arrester		xxxxxxxxx	
4.2.2	d) Number of stacks in parallel		0	
	14. MISCELLANEOUS			
4.2.1	a) Live spray washing (Yes/No)		No	xxxxxxxxxx
	b) Total mass of assembled unit	kg	xxxxxxxxxx	
	c) Minimum expected life of arrester at 40 °C and MCOV	yrs	25	
4.2.7	d) Sample available for inspection		Yes	
5.2.10	e) Declared specified long-term load	kN	xxxxxxxxxx	
5.2.1	**15. INSULATION WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Lightning impulse (1,2/50µs) withstand level [(1,3/0,82) × Ures]	kV	262	
	c) 60 s wet power frequency withstand	r.m.s kV	90	
5.2.2	**16. RESIDUAL VOLTAGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs)	kV	183	
	c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	• 5 kA	kV	xxxxxxxxxx	
	• 10 kA	kV	165	
	• 20 kA	kV	xxxxxxxxxx	
	d) Maximum residual voltage for a 500 A switching current impulse	kV	xxxxxxxxxx	
5.2.3	**17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Charging voltage	pu of U_r	3,2	
	or			
	• charging current	A	xxxxxxxxxx	
	c) Virtual duration of peak	µs	2000	
	d) Number of discharge operations		18	
	e) Number of grouped operations		6	
	f) Operations per group		3	
	g) Maximum interval between operations	s	60	
	h) Interval between groups		Cool to ambient	
	i) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.4	**18. OPERATING DUTY TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	Conditioning part 1:			
	b) 10 kA current impulse (8/20µs), energized at 1,2 x MCOV	kV	58	
	c) Number of discharge operations		20	
	d) Number of grouped operations		4	
	e) Operations per group		5	
	f) Interval between operations	s	60	

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	g) Intervals between groups	min	30	
	Conditioning part 2:			
	h) High current impulse (4/10µs)	kA	100	
	i) Number of applications		2	
	Conditions for switching surge test:			
	j) Charging voltage	pu of U_r	3.2	
	or			
	• charging current	A	xxxxxxxxxx	
	k) Virtual duration of peak	µs	2000	
	l) Number of discharge operations		2	
	m) Interval between operations	s	60	
	n) Starting temperature for first impulse	°C	60	
	o) Energy dissipated during second impulse	kJ	xxxxxxxxxx	
	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:			
	p) Interval between last long duration current impulse and power frequency test	ms	100	
	q) Elevated rated voltage (Ur*) applied for 10 s	kV	xxxxxxxxxx	
	r) Elevated continuous operating voltage (Uc*) applied for 30 min	kV	xxxxxxxxxx	
	s) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.5	**19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.6	**20. SHORT-CIRCUIT TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) High current	kA r.m.s.	40	
	c) Low current	kA r.m.s.	0,6 ± 0,2	

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
5.2.7	**21. NATURAL AGEING AND POLLUTION PERFORMANCE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.8	**22. INTERNAL PARTIAL DISCHARGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Power frequency voltage applied [1,05 x MCOV]	kV	50.5	
	c) Maximum partial discharge	pC	10	
5.2.9	**23. MOISTURE INGRESS TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.10	**24. BENDING MOMENT TEST**			
	a) Reference number of test report		xxxxxxxxxx	

Table 40: Deviation Schedule - 66 kV Surge Arrester

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	**Sub-clause**	**Proposed deviation**

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Table 41: Technical Schedule – 88 kV Surge Arresters

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	1. SURGE ARRESTER IDENTIFICATION			
	a) Supplier		xxxxxxxxxx	
	b) Manufacturer		xxxxxxxxxx	
	c) MOV block manufacturer		xxxxxxxxxx	
	d) Product code: Item 11(Coastal)		xxxxxxxxxx	
	• Item 12 (Inland)		xxxxxxxxxx	
4.1	**2. OPERATING CONDITIONS**			
	a) Altitude	m	up to 1800	xxxxxxxxxx
	b) Average humidity	%	30 to 90	xxxxxxxxxx
	c) Minimum ambient temperature	°C	−10	xxxxxxxxxx
	• Maximum ambient temperature	°C	40	xxxxxxxxxx
	• Maximum diurnal variation	°C	30	xxxxxxxxxx
	d) Intensity of solar radiation	kW/m^2	1,1	xxxxxxxxxx
	e) IEC pollution level: Item 11 (Coastal)		HVH	xxxxxxxxxx
	• Item 12 (Inland)		LM	xxxxxxxxxx
	f) Lightning activity		High	xxxxxxxxxx
	g) System earthing		Effective	xxxxxxxxxx
	h) System configuration		3-phase, 3-wire	xxxxxxxxxx
	i) Nominal system voltage (Un)	kV	88	xxxxxxxxxx
	j) Maximum system voltage (Um)	kV	97	xxxxxxxxxx
	k) Supply frequency	Hz	50	xxxxxxxxxx
	l) BIL of equipment to be protected	kV peak	380	xxxxxxxxxx
4.3	**3. ELECTRICAL CHARACTERISTICS OF ARRESTER**			
	a) Arrester classification		Station class	

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	b) IEC line discharge class		2	
	c) Nominal lightning discharge current (8/20µs)	kA	10	
	d) Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	kJ/kV	3,4	
	e) Arrester rated voltage (Ur)	kV	xxxxxxxxxx	
	f) MCOV (Uc)	kV	56	
	g) Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	210	
4.4	**4. ARRESTER HOUSING**			
	a) Housing material Item 11 (Coastal)		xxxxxxxxxx	
	• Item 12 (Inland)		xxxxxxxxx	
	b) Minimum external creepage distance:			
	• Item 11 (Coastal) [Um x 31 mm/kV]	mm	3007	
	• Item 12 (Inland) [Um x 20 mm/kV]	mm	1940	
4.4.3	**5. ARRESTER HOUSING PROFILE DESIGN**			
	IEC 60815 annex D parameters:			
	a) c		≥ 20	
	b) s/p		≥ 0,65	
	c) Ld/d		≤ 5	
	d) P1 – P2		≥ 15	
	e) CF		≤ 3,5	
	f) PF		≥ 0,7	
4.5	**6. ARRESTER MOUNTING DETAILS**			
	a) Orientation		Vertical	xxxxxxxxxx
	b) Method of mounting		Tripod base	xxxxxxxxxx
	c) Diameter of mounting holes in base	mm	xxxxxxxxxx	

SUB CLAUSE OF 34-419	DESCRIPTION	SCHEDULE A	SCHEDULE B
	d) PCD (see Figure 1 of SCSSCAAO0) mm	110 - 255	
	e) Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers.	Yes	
	f) Reference number of drawing showing mounting details	xxxxxxxxxx	
4.6.1	**7. ARRESTER LINE TERMINAL**		
	g) Type	Stem	
	h) Diameter	26	
	i) Minimum length mm	100	
	j) Orientation	Vertical	
	k) Material	xxxxxxxxxx	
	l) Reference number of drawing showing details of line terminal	xxxxxxxxxx	
4.6.2	**8. ARRESTER EARTH TERMINAL**		
	Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor:		
	a) Conductor material	Copper	
	b) Conductor type	Strap	
	c) Conductor dimensions mm	50 x 3	
	d) Material used for clamping arrangement	xxxxxxxxxx	
	e) If dissimilar metals are used for clamping arrangement, state types	xxxxxxxxxx	
	f) Reference number of drawing showing details of earth terminal	xxxxxxxxxx	
4.7.1	**9. DRAWINGS TO BE SUBMITTED WITH TENDER**		
	Single copies of drawings shall be submitted as part of the original tender showing the following detail:		
	a) Outline dimensions of arrester, fit as for service	Reference number	
	b) Mounting details	Reference number	
	c) Line and earth terminal, conductor clamping arrangement	Reference number	

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SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	d) Details of grading rings		Reference number	
4.7.2	**10. ARRESTER CHARACTERISTIC DATA REQUIRED**			
	a) V-I characteristic curve, AC		Reference Number:	
	b) V-I characteristic curve, DC		Reference Number:	
	c) Temporary overvoltage withstands capability curve in per unit of MCOV, with and with-out prior duty.		Reference Number:	
	11. ARRESTER TEMPORARY OVERVOLTAGE CAPABILITY, WITH PRIOR DUTY. (prior duty as defined in annex D, IEC 60099-4)			
	a) Overvoltage applied for 1 s	pu of MCOV	xxxxxxxxx	
	b) Overvoltage applied for 5 s	pu of MCOV	xxxxxxxxx	
	c) Overvoltage applied for 10 s	pu of MCOV	xxxxxxxxx	
	12. PHYSICAL DIMENSIONS OF ARRESTERS			
	a) Overall height of arrester	mm	xxxxxxxxx	
	b) Minimum external flashover distance	mm	900	
	c) External diameter of arrester housing	mm	xxxxxxxxx	
	d) Diameter of voltage grading rings	mm	xxxxxxxxx	
	e) Distance of grading ring from top of arrester	mm	xxxxxxxxx	
	13. MOV ELEMENTS			
	a) Diameter of elements	mm	xxxxxxxxx	
	b) Thickness of elements	mm	xxxxxxxxx	
	c) Number of elements per arrester		xxxxxxxxx	
4.2.2	d) Number of stacks in parallel		0	
	14. MISCELLANEOUS			
4.2.1	a) Live spray washing (Yes/No)		No	xxxxxxxxxx

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T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	b) Total mass of assembled unit	kg	xxxxxxxxxx	
	c) Minimum expected life of arrester at 40 °C and MCOV	yrs	25	
4.2.7	d) Sample available for inspection		Yes	
5.2.10	e) Declared specified long-term load	kN	xxxxxxxxxx	
5.2.1	**15. INSULATION WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Lightning impulse (1,2/50µs) withstand level [(1,3/0,82) × Ures]	kV	333	
	c) 60 s wet power frequency withstand	r.m.s kV	150	
5.2.2	**16. RESIDUAL VOLTAGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Maximum residual voltage for a 10 kA steep current impulse (1/20µs)	kV	227	
	c) Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			
	• 5 kA	kV	xxxxxxxxxx	
	• 10 kA	kV	210	
	• 20 kA	kV	xxxxxxxxxx	
	d) Maximum residual voltage for a 500 A switching current impulse	kV	xxxxxxxxxx	
5.2.3	**17. LONG DURATION CURRENT IMPULSE WITHSTAND TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Charging voltage	pu of U_r	3,2	
	or			
	• charging current	A	xxxxxxxxxx	
	c) Virtual duration of peak	µs	2000	
	d) Number of discharge operations		18	
	e) Number of grouped operations		6	

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	f) Operations per group		3	
	g) Maximum interval between operations	s	60	
	h) Interval between groups		Cool to ambient	
	i) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.4	**18. OPERATING DUTY TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	Conditioning part 1:			
	b) 10 kA current impulse (8/20µs), energized at 1,2 x MCOV	kV	67	
	c) Number of discharge operations		20	
	d) Number of grouped operations		4	
	e) Operations per group		5	
	f) Interval between operations	s	60	
	g) Intervals between groups	min	30	
	Conditioning part 2:			
	h) High current impulse (4/10µs)	kA	100	
	i) Number of applications		2	
	Conditions for switching surge test:			
	j) Charging voltage	pu of U_r	3.2	
	or			
	• charging current	A	xxxxxxxxxx	
	k) Virtual duration of peak	µs	2000	
	l) Number of discharge operations		2	
	m) Interval between operations	s	60	
	n) Starting temperature for first impulse	°C	60	

T2.2 RETURNABLE SCHEDULES

SUB CLAUSE OF 34-419	DESCRIPTION		SCHEDULE A	SCHEDULE B
	o) Energy dissipated during second impulse	kJ	xxxxxxxxxx	
	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:			
	p) Interval between last long duration current impulse and power frequency test	ms	100	
	q) Elevated rated voltage (Ur*) applied for 10 s	kV	xxxxxxxxxx	
	r) Elevated continuous operating voltage (Uc*) applied for 30 min	kV	xxxxxxxxxx	
	s) Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
5.2.5	**19. POWER FREQUENCY VOLTAGE VERSUS TIME CHARACTERISTIC**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.6	**20 Short-circuit test**			
	a) Reference number of test report		xxxxxxxxxx	
	b) High current	kA r.m.s.	40	
	c) Low current	kA r.m.s.	0,6 ± 0,2	
5.2.7	**20. NATURAL AGEING AND POLLUTION PERFORMANCE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.8	**21. INTERNAL PARTIAL DISCHARGE TEST**			
	a) Reference number of test report		xxxxxxxxxx	
	b) Power frequency voltage applied [1,05 x MCOV]	kV	59	
	c) Maximum partial discharge	pC	10	
5.2.9	**22. MOISTURE INGRESS TEST**			
	a) Reference number of test report		xxxxxxxxxx	
5.2.10	**23. BENDING MOMENT TEST**			
	a) Reference number of test report		xxxxxxxxxx	

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Table 42: Deviation Schedule - 88 kV Surge Arrester

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than the specification.		
Item	**Sub-clause**	**Proposed deviation**

T2.2.28.5.7. TSE57 - CURRENT TRANSFORMERS

- 132 kV Distribution Current Transformers for use in very heavily polluted conditions (31mm / kV) in accordance with Eskom specification 34-1689.
- 22 kV Combined Current Transformers for outdoor air insulated MV circuit-breaker in accordance with Eskom specification 240-66581487.

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SECTION 3 -
C1: CONDITIONS OF CONTRACT

METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG
1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 3:
C1 – CONDITIONS OF CONTRACT

LYON AND PARTNERS (Pty) Ltd
Electrical Consulting Engineers
P O Box 3925
VANDERBIJLPARK
1900

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C1.1: FORM OF OFFER AND ACCEPTANCE

C1.1 – FORM OF OFFER AND ACCEPTANCE

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C1. CONDITIONS OF CONTRACT
C1.1. FORM OF OFFER AND ACCEPTANCE

Tenderers are required to fill up all the blank spaces in this Tender Form and Appendices.

C1.1.1. LETTER OF TENDER (MBD 3.1)

Metsimaholo Local Municipality
P O Box 60
SASOLBURG
1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

We have examined the Conditions of Contract, Specifications, Drawings, Bill of Quantities, Schedules, the attached Appendix and Addenda for the execution of the above-named Works. We offer to execute and complete the Works and remedy any defects therein in conformity with this Tender which includes all these documents, for the sum of:

TOTAL TENDER AMOUNT (VAT is included) *(carried over from summary of Bill of Quantities)*	**TIME FOR COMPLETION**
R	.....weeks

TENDER AMOUNT IN WORDS.....

.....

We accept your suggestions for the appointment of the Dispute Avoidance and Adjudication Board, as set out in the Schedule.

We agree to abide by this Tender until …….., which is a period of **ninety (90)** days, from the date of submission and it shall remain binding upon us and may be accepted at any time before that date. We acknowledge that the Appendix forms part of this Letter of Tender. We further agree to carry all costs incurred by the Employer in the securing of a suitable alternative Tender, if we should withdraw this Tender before the expiry of the tender validity period, which may include the difference between our tender price and the tender price of the next suitable tender.

We undertake, if our tender is accepted, to commence with the Works on receipt of your order and to complete and deliver the Works comprised in the Contract in accordance with the programme set out in the Conditions of Contract, or as mutually agreed between ourselves, the Engineer and the Employer, before acceptance of tender.

We undertake to provide all necessary information, descriptive material, operational procedures, drawings, special circuits where necessary, attend all meetings as required to permit the Engineer to prepare further documents for the Works and to administer the contract to its completion. We further undertake to provide the above data when required by the Employer and the Engineer to ensure that the proposed programme is adhered to.

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C1.1 FORM OF OFFER AND ACCEPTANCE

If this offer is accepted, we will provide the specified Performance Security from an accredited FICA/approved NCR Institution, to be jointly and severally bound in the percentage amount of the tender sum, as set out in the Appendix to tender, for the due performance of the Contract, to commence the Works as soon as is reasonably practicable after the Commencement Date, and to complete the Works in accordance with the tender and contract documents within the Time for Completion.

Unless and until a formal Agreement is prepared and executed this Letter of Tender, together with your written acceptance thereof, shall constitute a binding contract between us.

We confirm that we have satisfied ourselves as to the correctness and validity of our bid; that the price(s) and rate(s) quoted cover all the goods and/or works specified in the bidding documents; that the price(s) and rate(s) cover all our obligations and we accept that any mistakes regarding price(s) and rate(s) and calculations will be at our own risk.

We understand that you are not bound to accept the lowest or any tender you may receive and that the tender may be accepted as a whole or partially and that certain items, which may not be required, may be omitted from the Bill of Quantities.

Signature…….. in the capacity of ……

Duly authorised to sign tenders for and on behalf of ……...

……...

Address: …….

……..…

Date : …….

C1.1 FORM OF OFFER AND ACCEPTANCE

C1.1.2. FORM OF AGREEMENT

This Agreement made the ..... day of ..... 20.....

between

METSIMAHOLO LOCAL MUNICIPALITY

herein represented by

.....
(here after called "the Employer") of the one part and

(COMPANY) .....

herein represented by

(NAME) .....
(here after called "the Contractor") of the other part

WHEREAS the Employer is desirous that certain Works, hereafter called the Contract Works, should be provided and executed, by the Contractor

viz.

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

and has appointed **M LYON Pr Eng** of the firm **LYON AND PARTNERS (Pty) Ltd** as the Engineer for the purposes thereof (here after called the “Engineer”) and has accepted a Tender by the Contractor for the provision, execution and maintenance of such Works under the direction and to the reasonable satisfaction of the Engineer in the sum of

.....

…….

.....
(Here after called "the Contract Sum").

C1.1 FORM OF OFFER AND ACCEPTANCE

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract here after referred to.

2. The Conditions of Contract applicable to this agreement is the FIDIC Conditions of Contract for Building and Engineering Works designed by the Employer, Second Edition 2017.

3. The following documents shall be deemed to form and be read and construed as part of this Agreement viz:

   a) The Letter of Acceptance dated ……
   b) The Letter of Tender dated ……
   c) The Conditions of Contract – Part 1: General Conditions of Contract
   d) The Conditions of Contract – Part 2: Contract Data
   e) The Specifications / Scope of Work
   f) The Drawings, and
   g) The Completed Schedules

4. The Contractor hereby undertakes to execute and complete the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

5. The Employer hereby covenants to pay the Contractor in consideration of the provision, execution and completion of the Works and the remedying of defects therein the Contract sum or such other sum as may become payable under the provisions of the Contract at the time and in the manner prescribed by the Contract.

In Witness whereof the parties hereto have caused this Agreement to be executed the day and year first before written in accordance with their respective laws.

SIGNATURE: …….	SIGNATURE: ……
SIGNED BY: ……..	SIGNED BY: ……..
*for and on behalf of the **EMPLOYER***	*for and on behalf of the **CONTRACTOR***
in the presence of	*in the presence of*
Witness *(sign)*:……	Witness *(sign)*:..……....
Name : ……	Name: ……
Address: ……	Address: ……
Date: …….	Date: ……..

C1.1.3. PRO-FORMA LETTER OF ACCEPTANCE

Our ref.: MLM 12/2021/22 *(Date)*

.....
P O Box .....
.....
.....

For the attention of: Mr .....

Sir,

LETTER OF ACCEPTANCE:
VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

1. I have pleasure in informing you that *the Employer* has decided to accept your tender, dated *day-month-year* for the above contract.

2. Your contract amount can be composed as follows:

Nett amount of tender *Min/Plus: Correction of calculation errors (Refer to item .....)*	R *R*
Nett amended tender amount Plus: Amount allowed for contingencies Plus: Amount allowed for escalation	R R R
SUBTOTAL Plus: 15 % VAT	R R
TOTAL ACCEPTED CONTRACT AMOUNT	**R**

3. Your attention is drawn to the fact that the above PROVISIONAL AMOUNTS for escalation in costs and for contingencies shall only be spent at the discretion of the Engineer and will fall away in part or in whole if not required.
Prior to any variation, official approval must be given.

4. The date of commencement of the contract is *day-month-year*, on which day you were informed that your tender was accepted. Furthermore, in terms of the ..... months completion period, the completion date of the entire Works will be day-month-year (after allowing for 3 weeks builders holiday).

5. The site will be handed over to you on day-month-year at ..... It is requested that your authorized representative attend this meeting for the signing of the document.

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6. The Conditions of Contract applicable for administering the project shall be the FIDIC "Red Book" 2017 (ISBN 978-2-88432-084-9), with the General Conditions of Contract (Part 1) and Contract Data (Part 2) as included in the tender documentation.

7. You must furnish us with the following documents or information within the time periods given:

7.1. The Performance Security, correctly completed in duplicate, by a Bank, Insurance or other FICA approved / NCR institution, in the amount set out in the Appendix to Tender, which must remain valid until the date of issue of the Performance Certificate with Final Completion of the project. The provision in respect of the surety amount, as contained in the Contract Data is 10% of the total contract amount i.e. R……., which can be reduced by 50% with issuing of the Taking Over Certificate. The Contractor shall produce a draft Performance Security within 14 days of the commencement date and the Final Performance Security within 28 days of the commencement date.

8. Proof that you have provided, as prescribed by Clause 19 of the Conditions of Contract, adequate insurance in the joint names of the Employer and Contractor as summarised below:

8.1. Insurance cover against loss or damage for the replacement value plus 15% of the works (Contract sum plus 15 % = R.....) valid until the date of the Taking-Over Certificate plus 28 days – Sub-clause 19.2.1.

8.2. Insurance cover to the full replacement value of the Goods and other things brought to site by the Contractor, valid until they are no longer required for the Works – Sub-clause 19.2.2.

8.3. Insurance cover against liability for breach of professional duty for any designs by the Contractor for the permanent Works – Sub-clause 19.2.3.

8.4. Insurance against liability for claims, damages, losses and expenses resulting in injury, sickness, disease, or death of any person employed by the Contractor or any of the Contractor's other personnel – Sub-clause 19.2.4 and 19.2.5.

8.5. In accordance with South African practice, third party liability insurance against any claims, damages, losses and expenses during the execution of the Works – Sub-clause 19.2.6.

9. You are hereby informed that no payments will be made to you before the completed Performance Security has been returned to us.

10. We confirm that the Employer will not accept any responsibility or liability for making good on any claims or losses resulting from your failure to adequately insure as required in par 8 and 9 above.

11. The following general conditions are applicable to this contract:

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C1.1 FORM OF OFFER AND ACCEPTANCE

11.1. The defects liability period or period of maintenance of the Works, as described in Clause 11 of the Conditions of Contract is twelve months from the issuing of the Taking-Over Certificate for the Works, and another twelve months for the Goods taken from the issuing of the Performance Security.

11.2. The liquidated damages payable in respect of late completion of the Works as described in Clause 8.8 of the Conditions of Contract, is R..... per working day, to a maximum of R.....

12. In terms of the Occupational Health and Safety Act, 85/1993, it is required that you appoint a Safety Officer who must sign the "Written Agreement on Occupational Health and Safety" as well as Safety on Construction Site forms, taking full responsibility of the work carried out on site. He must also compile and submit a Health and Safety Plan and Risk Assessment forming part of the Safety, Health, Environmental and Quality (SHEQ) file. The SHEQ file must contain all appointments of the workforce, duly signed by your company MD or delegated person, and complete list of equipment required to execute the project scope with valid roadworthiness and calibration certificates. No work will be permitted on site until approval of the Health & Safety part of the SHEQ file by the Employer or his Safety Representative.

13. Your attention is finally drawn to the fact that our firm, being the Employer's Consulting Engineers, will administer this project. Consequently, any negotiations that may become necessary during the execution of the work regarding rates, additions, omissions, escalation in costs, etc. will only be carried on with our firm.

14. We respectfully point out that time is of the essence in the completion of this contract. You are earnestly requested to take every effort to ensure the timeous completion of the work or, if in any way possible, to improve thereon.

15. As stated in the Tender Form, this Letter of Acceptance will form part of the FORM OF AGREEMENT between the *Employer* and *Contractor*.

16. We trust that you will carry out the work with earnestness and to the best of your ability. You are assured of our complete co-operation in all aspects of this contract.

Yours faithfully

LYON AND PARTNERS (PTY) LTD

M. LYON (PR.ENG)

C1.2: PART 1: GENERAL CONDITIONS OF CONTRACT

C1.2 – PART 1: GENERAL CONDITIONS OF CONTRACT

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C1.2. GENERAL CONDITIONS OF CONTRACT (PART 1)

CONDITIONS OF CONTRACT IN ACCORDANCE WITH THE FIDIC CONDITIONS OF CONTRACT FOR CONSTRUCTION FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER

FIDIC ® SECOND EDITION 2017

The Conditions of Contract comprises of two parts of which Part 1 is the General Conditions of Contract and Part 2 the Particular Conditions of Contract. Furthermore, the Particular Conditions comprise of the Particular Conditions Part A – Contract Data and the Particular Conditions Part B – Special Provisions.

Under the usual arrangement of this Contract, the Contractor is responsible for the construction, in accordance with the design of the Employer, of building and/or engineering Works. These Conditions allow that the Contractor may be required to design a proportion or element of the Permanent Works.

GENERAL CONDITIONS OF CONTRACT: PART 1

The Conditions of Contract comprise of:

"GENERAL CONDITIONS"

Which form part of the:

"CONDITIONS OF CONTRACT FOR CONSTRUCTION FOR BUILDING AND ENGINEERING WORKS DESIGNED BY THE EMPLOYER"

[Second Edition 2017, as published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC)(ISBN 978-2-88432-084-9)]

(Copy obtainable at cost from CESA)

SIGNATURE: …….

SIGNED BY: ……. DATE: …….
(for and on behalf of the Contractor)

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PARTICULAR CONDITIONS OF CONTRACT: PART 2

The Conditions of Contract further comprise of the following "Particular Conditions of Contract" (PCC), the General Conditions of Contract shall be amended by the Particular Conditions of Contract as detailed herein.

These "Particular Conditions of Contract" forms an integral part of the Contract and they supersede conditions contained elsewhere in the documents.

The Particular Conditions of Contract comprise of two sub-parts viz:

PART 2 A: CONTRACT DATA
PART 2 B: SPECIAL PROVISIONS

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C1.3: PART 2A: CONTRACT DATA

C1.3 - PART 2A: CONTRACT DATA

C1.3. GENERAL CONDITIONS OF CONTRACT (PART 2A)

PART 2A: PARTICULAR CONDITIONS – CONTRACT DATA

The following Contract Data lays down specific information required by certain Sub-Clauses in the General Condition of Contract. Tenderers shall not amend the Contract data as provided unless instruction is given to populate data i.e. *"Tenderer to complete"*.

SUB-CLAUSE	DATA TO BE GIVEN	DATA
1.1.19	Where the Contract allows for Cost Plus Profit, percentage profit to be added to the Cost:	5 %
1.1.27	Defects Notification Period (DNP)	365 days *(From the date of issuing the Taking-Over Certificate)*
1.1.31	Employer's name and address	**METSIMAHOLO LOCAL MUNICIPALITY** 10 Fichardt Street SASOLBURG 1947
1.1.35	Engineer's name and address	**LYON AND PARTNERS (PTY) LTD.** 24 Hertz Boulevard, Proliba Building, Suite 2, VANDERBIJLPARK 1911
1.1.85	Time for Completion *(Tenderer to Complete)*	_____ *(period to correspond with the letter of tender and programme submitted with the tender)*
1.3(a)(ii)	Agreed methods of electronic transmission	e-mail
1.3(d)	Address of Employer for communications	Mr. Sibusiso Bila sibusiso.bila@metsimaholo.gov.za 10 Fichardt Street SASOLBURG 1947
1.3(d)	Address of Engineer for communications	Mr. Marnus Lyon marnus@lyon.co.za 24 Hertz Boulevard, Proliba Building, Suite 2, VANDERBIJLPARK 1911
1.3(d)	Address of Contractor for communications *(Tenderer to Complete)*	_____ _____ _____
1.4	Contract shall be governed by the law of:	The contract shall be governed, construed and interpreted in accordance with the Laws of the Republic of South Africa.
1.4	Ruling language	English

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
1.4	Language for communications	English
1.8	Number of document copies to the Contractor	- One electronic copy to the Contractor
	Number of <u>additional</u> paper copies of Contractor's Documents	- One paper original to the Employer. - One paper copy to the Employer.
	Documents to be kept on site by the Contractor	At least one copy of: (a) the Contract; (b) Contractor's records as per Sub-Clause 6.10 [*Contractor's Records*] and Sub-Clause 20.2.3 [*Contemporary Records*]; (c) publications named in the Specification / Scope of Works, such as Eskom's standards and D-DT drawings; (d) the Contractor's documents, such as ordering and delivering schedules; (e) the Drawings; (f) all Variations, Indices, Instructions, Minutes and other communication given under the Contract; (g) the Project Programme; (h) Wayleaves and Approvals; and (i) Safety, Health, Environmental and Quality documents.
2.1	After receiving the Letter of Acceptance, the Contractor shall be given right of access to all or part of the Site within	14 days, the Contractor shall receive a Site Handover Certificate.
2.4	Employer's financial arrangements	Department of Mineral Energy (DMRE) grant funding: Integrated National Electrification Programme 2021/2022: approx. R 30 400 000.00 2022/2023: approx. R 20 000 000.00 <u>2023/2024: approx. R 19 580 000.00</u> ***TOTAL : approx. R 69 980 000.00*** Phased over multiple financial years.
2.5	Site data and items of reference	Included under "C4 – Site Information"
2.6	List of Employer-Supplied Material and / or Employer's Equipment	Not Applicable
4.1	Contractor's general obligations	Sub-Clause 4.1 (a) to (h) applies – The Contract requires the Contractor to provide detail designs, according to specifications, for all equipment, whether the detail design is executed by the Contractor or an OEM. The Contractor is responsible for any deficiencies in manufacturing designs or drawings.
4.2	Performance Security (as percentages of the Accepted Contract Amount in Currencies):	
	- Percent	10 % - reduced to 5% following the issuing of the Taking-Over Certificate
	- Currency	ZAR

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
4.3	Name of the Contractor's Representative during performance of the Contract *(Tenderer to Complete)*	_____
4.6	Co-operation	The Contractor shall provide training for the operation and maintenance of the Works to the Employer's personnel.
4.7.2	Period for notification by the Contractor of errors in the items of reference	28 days
4.8	Time for submission of the Health and Safety Manual	Within 21 days of the commencement date
4.9	Time for submission of the Quality Management System documents	Within 28 days of the commencement date
4.16	Transport of Goods notice	The Contractor shall give no less than 21 days' notice to the Engineer before the delivery date of any Goods to site
4.19	Period of payment by the Contractor for temporary utilities	Monthly *(the Contractor is to provide for all utilities required, i.e. water, electricity, toilets, wireless communication, etc.)*
4.20	Contractor shall submit progress reports to the Engineer	Monthly
5.1(a)	Maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	20 %
5.1(b)	Parts of the Works for which subcontracting is not permitted	• Erection of primary plant equipment • Installation of control cabling into the control room • Stringing of overhead conductor
6.5	Normal working hours on the Site	- Monday to Friday from 07:00 to 17:00 - Saturday from 07h00 to 13h00 - No Sundays - No public holidays (Note: work outside normal working hours required for power outages)
6.6	Facilities to be provided for Staff and Labour	Contractor to provide for accommodation and welfare facilities for the Contractor's personnel.

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C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
6.12	List of the Contractor's key personnel	Project / Contracts Manager: _____ Health and Safety Officer: _____ ORHVS Qualified Site Supervisor: _____ Qualified Electrician: _____ SHEQ Representative: _____ Commissioning Engineer: _____ Company Accountant: _____
7.2	Period for the Contractor to submit samples to the Engineer	Within 28 days of the commencement date
7.3	Period for notification by the Contractor to the Engineer whenever any Plant, Materials or Work is ready for inspection	14 days
7.4	Period for notification by the Contractor to the Engineer whenever any Plant, Materials or Work is ready for testing	14 days
7.7	Payment shall be certified as a percentage of the material rate for material delivered to site.	Payment shall only be certified for equipment installed (80% to be considered subject to prior approval).
8.1	Commencement Date	Date of the Letter of Acceptance, as stated in the Letter of Acceptance, or 14 days from the date of the Letter of Acceptance. The Engineer shall give at least 14 days' notice to the Contractor stating the commencement date. The commencement date shall be no more than 42 days after the Contractor receives the Letter of Acceptance. The Contractor shall commence the execution of the Works on, or as soon as is reasonably practicable, after the commencement date and shall then proceed with the Works with due expedition and without delay.
8.3	Period for submission of the Programme by the Contractor to the Engineer	Within 28 days of the commencement date
8.8	Delay Damages payable for each day of delay	0.5% of the Contract amount per calendar day.

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
8.8	Maximum amount of Delay Damages	10% of final contract sum.
9.1	Completion test rectification Period by Contractor to Engineer	Test programme no less than 42 days before commencing with completion tests and 21 days' notice before starting completion tests
11.1	Defects Notification Period	For the Works, 365 days from the issuing of the Taking-Over Certificate for the Works, and for the Goods another 365 days after the issuing of the Performance Certificate.
11.11	Period for clearance of the site	Within 28 days of issuing the Performance Certificate
12.2	Method of measurement	Nett actual quantities measured by means of the Bill of Quantities according to progress.
12.3	Percentage profit	As stated under 1.1.19 above
13.4(b)(ii)	Percentage rate to be applied to Provisional Sums for overhead charges and profit	0 % if the Employer enters into a direct payment agreement with a subcontractor or nominated subcontractor, otherwise 5 %.
13.7	Adjustments for Changes in Cost: *(Tenderer to Complete)*	This clause is not applicable to fixed amount contracts. **Contract Price Adjustment (CPA) will not be applicable to this contract as whole, but will be partially apply to items allowed in the CPA Items Table.** The contract prices are fixed and firm for the duration of the contract. The Contractor must therefore allow for escalation in cost in his unit prices. Provision will however only be made for escalation on only the long lead items listed in the table below.

Table 1: CPA Items

EQUIPMENT	FOREIGN CURRENCY	COUNTRY OF ORIGIN
Power Transformer		
NECRT		
Cables		
88 kV Isolators		
88 kV CT's		
22 kV Switchgear		
Labour (after 12 months)		
Electrical material		

The above list of material and/or equipment will be subject to the formulae and conditions contained in the special provisions of the particular conditions of contract.

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
14.2	Total amount of Advance Payment (as a percentage of Accepted Contract Amount)	Not applicable
14.2	Currency or currencies of Advance Payment	Not applicable
14.2.3	Percentage deductions for the repayment of the advance Payment	Not applicable
14.3	Period of payment	Monthly
14.3	Application for Interim Payment	The Contractor shall submit a Statement and Progress report to the Engineer on the 15th of each month.
14.3(iii)	Percentage of retention	Retention shall be withheld for payments due by the Employer to the Contractor: - 10% of each Statement value certified for interim payment, until 5% of the Contract value is accumulated as retention, for the duration of the executions of the Works; - 50% of the 5% accumulated retention amount is released on issuing of the Taking-Over Certificate; - The remaining 50% of the 5% previously accumulated retention is released on issue of the Final Completion Certificate (Performance Certificate as per sub-clause 11.9); Or In lieu of the above the Contractor may submit a retention guarantee for the duration of the defects notification period if approved by the Employer.
14.3(iii)	Limit of Retention Money (as a percentage of Accepted Contract Amount)	5% of the Contract amount
14.5(b)(i)	Plant and Materials for payment when shipped	Not applicable
14.5(c)(i)	Plant and Materials for payment when delivered to the site	Not applicable
14.6.2	Minimum amount of Interim Payment Certificate (IPC)	R 200 000.00
14.6.1	Period within which the Engineer shall issue the Employer with an Interim Certificate (IPC) under sub-clause 14.6.1	As per the General Conditions: 28 days after the Engineer receives the statement and supporting documents.
14.7(a)	Period for payment of Advance Payment to the Contractor	Not applicable
14.7(b)(i)	Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 *(Interim Payment)*	As per the General Conditions: 56 days after the Engineer receives the Contractor's statement
14.7(b)(ii)	Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.13 *(Final Interim Payment)*	As per the General Conditions: 28 days after the Employer receives the FPC

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
14.7(c)	Period for the Employer to make final payment to the Contractor *(Final Payment)*	As per the General Conditions: 56 days after the Employer receives the FPC
14.8	Financing charges for delayed payment *(percentage points above the average bank short-term lending rate as referred to under sub-paragraph "a")*	As per the General Conditions: ABSA Prime Rate plus 3%
14.13	Period within which the Engineer shall issue the Employer with a Final Payment Certificate (FPC) under Sub-Clause 14.13 *(Final Payment)*	As per the General Conditions: 28 days after the Engineer receives the Final Statement.
14.15	Currencies for payment of Contract Price	ZAR
14.15(a)(i)	Proportions or amounts of Local and Foreign Currencies are: - Local *(Contractor to complete)*	 _____
	- Foreign *(Contractor to complete)*	_____
14.15(c)	Currencies and proportions for payment of Delay Damages	ZAR
14.15(f)	Rates of exchange *(Tenderer to complete and list applicable items)*	This clause is not applicable to fixed rate contracts The Rates of Exchange in Foreign Currency (at date of tender submission) for the purpose of this contract: i. 1 US Dollar: R_____ ii. 1 Euro: R_____ iii. 1 British Pound: R_____ iv. 1 Chinese RMB (Yuan): R_____ v. 1 Japanese Yen: R_____ The Tenderer must allow for changes in the Rate of Exchange in his unit prices. Provision will however be made for Rate of Exchange changes on only long lead items listed in the table below. Rate of exchange will apply to imported material to cater for upward and downward fluctuations in cost.

Table 2: RoE equipment table

EQUIPMENT	FOREIGN CURRENCY	COUNTRY OF ORIGIN
88 kV Circuit Breakers		
Surge Arrestor		
Protection IED's		

Note - The country of manufacturing origin's exchange rate shall be used i.e. a USD – ZAR exchange rate will not be accepted for equipment not manufactured in the USA.

C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
17.2(d)	Forces of nature, the risks of which are allocated to the Contractor	Abnormal weather. Refer to the Annexure to PCC - Rainfall
19.1	Permitted deductible limits:	
	- Insurance required for the Works and Goods	R 20 000.00
	- Insurance required for liability for breach of professional duty	R 20 000.00
	- Insurance required against liability for fitness for purpose (if any is required)	R 20 000.00
	- Insurance required for injury to persons and damage to property	R 20 000.00
	- Insurance required for injury to employees	R 20 000.00
	- Other insurances required by Laws and by Local Practice	_____ _____
19.2(1)(b)	Additional amount to be insured in the joint name of the Contractor and the Employer	As per the General Conditions: 15%
19.2(1)(iv)	List of Exceptional Risks which shall not be excluded from the insurance cover for the Works	Force majeure, community unrest, riot, political
19.2.2	Extent of insurance required for Goods	Full replacement value plus delivery to site
19.2.3(a)	Amount of insurance required for liability for breach of professional duty	R 5 000 000.00
19.2.3(b)	Insurance required against liability for fitness for purpose	Yes
19.2.3	Period of insurance required for liability for breach of professional duty	From the commencement date to the date of the Performance Certificate
19.2.4	Amount of insurance required for injury to persons and damage to property	Minimum amount of R 5 000 000,00 insurance for third party liability
19.2.6	Other insurances required by Laws and by local practice *(Tenderer to complete)*	_____
21.1	Time for appointment of DAAB	28 Days after dispute is declared
21.1	The DAAB shall comprise	One (1) Member
21.1	List of proposed members of DAAB	
	- Proposed by Employer	Dennis Lourens LSO Consulting Engineers (Pty) Ltd.
	- Proposed by Contractor	1. _____

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C1.3 - PART 2A: CONTRACT DATA

SUB-CLAUSE	DATA TO BE GIVEN	DATA
21.2	Appointing entity (official) for DAAB members	The President of FIDIC or a person appointed by the President

Definition of sections (if any):

Table 3: Designated section of the Works

Description of parts of the Works that shall be designated a Section for the purposes of the Contract *(FIDIC Sub-Clause 1.1.73)*	**Value: Percentage* of Accepted Contract Amount** *(FIDIC Sub-Clause 14.9)*	**Time for Completion** *(FIDIC Sub-Clause 1.1.84)*	**Delay Damages** *(FIDIC Sub-Clause 8.8)*
Extension of Vaaldam Substation			
Themba Khubeka Electrification (DMRE 2021/2022 financial year).			
Themba Khubeka Electrification (DMRE 2022/2023 financial year).			
Themba Khubeka Electrification (DMRE 2023/2024 financial year).			
*(*These percentages shall also be applied to each half of the Retention Money under Sub-Clause 14.9)*			

I, ……..., on behalf of the Company,

……., hereby

acknowledge and accept the Conditions of Contract as set out in the table above.

SIGNATURE: …….

SIGNED BY: ……... DATE: ……

(for and on behalf of the Contractor)

C1.4: PART 2B: SPECIAL PROVISIONS

C1.4 - PART 2B: SPECIAL PROVISIONS

C1.4. GENERAL CONDITIONS OF CONTRACT (PART 2B)

PART 2B: PARTICULAR CONDITIONS – SPECIAL PROVISIONS

The Conditions of Contract further comprise of the following Special Provisions as part of the Particular Conditions of Contract, the General Conditions of Contract shall be amended by the Special Provisions as detailed herein.

These Special Provisions forms an integral part of the Particular Conditions of Contract and the Contract, and supersedes overrides any other provisions contained elsewhere in the documents.

The following clauses of the "Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer" Second Edition 2017, published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC) (ISBN 978-2-88432-084-9) shall be amended as follows:

Clause Description	Clause No	Amendment
1. GENERAL PROVISIONS		
DEFINITIONS	1.1.31	"Employer" also means the Company, Subsidiary or Succession in Title or stated in the Contract Data.
	1.1.35	"Engineer" means an Engineer duly authorised by the Company, Subsidiary or Succession in Title stated in the Contract Data.
	1.1.7	Add to this sub-clause: The **Commencement Date** shall be notified in the Contract Data or the Letter of Acceptance. Access to the site shall be granted on the Commencement Date.
LIMITATION OF LIABILITY	1.15	Notwithstanding the provisions of this Clause, the Contractors Limit of Liability in terms of defects shall be 5 years.
2. THE EMPLOYER		
EMPLOYER'S FINANCIAL ARRANGEMENTS	2.4	The Employer shall only be obliged to provide reasonable evidence that financial arrangements have been made and are being made, if there is a dispute arising from non-payment of a certificate or of any amounts payable to the Contractor or if the Employer intends to make material changes notwithstanding the provisions of this sub-clause. In all other cases, the Employer shall not be bound to provide the requested information.
EMPLOYER-SUPPLIED MATERIALS AND EMPLOYER'S EQUIPMENT	2.6	Add to this sub-clause: After this visual inspection, the Employer-Supplied / free-issue materials shall come under the care, custody and control of the Contractor at which point, except where otherwise stated in the Contract, all risk in such free-issue materials shall also pass to the Contractor and shall remain with the Contractor unless and until the said free-issue materials are returned to the custody and control of the Employer.

Clause Description	Clause No	Amendment
3. THE ENGINEER		
ENGINEER'S DUTIES AND AUTHORITY	3.2	Add to this sub-clause: The Engineer shall require approval from the Employer on any matter which affects extension of time or variation to the Contract Price. Variations of the project scope that is covered by contingency amounts requires only the Engineer's approval. If the Contractor receives any instructions from the Engineer not complying with these conditions, he shall obtain written confirmation from the Employer before proceeding.
DELEGATION BY THE ENGINEER	3.4	Add to the end of this sub-clause: No oral representation shall be made by the Contractor to the Engineer through the Engineers Representative. The authority to delegate expressly excludes the delegation of powers to vary the Works in terms of Sub-Clause 13.1 [Right to Vary].
ENGINEERS INSTRUCTIONS	3.5	Add to this sub-clause: No oral instructions may be accepted from the Engineer unless these are recorded in writing by the Contractor who then obtains confirmation from the Engineer by means of a signature or confirmation in minutes within 7 days of the instruction being issued, or prior to commencing work on the item in question.
REPLACEMENT OF THE ENGINEER	3.6	Add to this sub-clause: In the unforeseen situation where the Engineer or Engineers representative is not available to complete the Works, the Employer will advise the Contractor immediately upon knowledge of such an event and will give notice to the Contractor within 7 days of the details of the proposed replacement.
4. THE CONTRACTOR		
PERFORMANCE SECURITY	4.2	Add to this sub-clause: With the Employers consent, the Engineer will hold the original Performance Security for safekeeping. The following stipulations shall be included in the performance security: (i) A statement that the performance security may be called on by means of written instruction by the Engineer; (ii) The person's name, contact details and address to which the Engineer's instruction to call on the performance security must be addressed; (iii) A statement confirming the period from the date of the Engineer's instruction to call on the performance security, until the security amount is paid to the Employer (period to be less than 56 days); (iv) Cancellation of the performance security shall be subject to approval by the Engineer; and (v) Specific inclusion of the 12 month defect notification period. The following is added at the end of this Sub-Clause: Should the Contractor fail to provide the said security within the specified time the Employer, in his sole discretion, may either: - (a) Withhold payment from the Contractor until the amount withheld is equal the Performance Security Amount

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C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
		stipulated in the Contract Data (as percentages of the Accepted Contract Amount) over and above the normal retention, or (b) Proceed to issue notice in terms of Clause 15 [Termination by Employer] and recover costs from the Contractor.
CONTRACTORS REPRESENTATIVE	4.3	Add to this sub-clause: Without derogating from the generality of the foregoing, the Contractor's Representative shall, at the Contractor's cost, implement forthwith any additional safety precautions which the Engineer may consider necessary for the proper protection of the Contractor's employees engaged in the Works. Work to which such additional precautions will apply shall be suspended pending the implementation of such precautions.
QUALITY ASSURANCE	4.9	Add to this sub-clause under 4.9.3 General provisions: Testing frequency of all materials shall be in accordance with the relevant clause of the Specifications or as specified on the construction drawings. The Engineer will have the right to visit the manufacturing location for the purpose of audit, surveillance or inspection during the manufacturing of the Materials/Plant to verify the Contractor's quality management. In the event of the Material/Plant being rejected due to non-compliance with the specification, workmanship and/or other valid reasons, then the cost of rectification as well as the Engineer's time based cost and re-inspection cost shall be for the account of the Contractor.

Clause Description	Clause No	Amendment
SUFFICIENCY OF THE ACCEPTED CONTRACT AMOUNT	4.11	The following is added at the end of this Sub-Clause: Without derogating from the generality of the foregoing, no claim by the Contractor for additional payment will be entertained which is consequent upon any misunderstanding or the allegation, or fact that it was supplied with incorrect information by any person, or its failure to obtain correct information as to any matter affecting its accepted tender or the execution of the Works to be provided, nor will any such misunderstanding, or the obtaining of incorrect information, or the failure to obtain correct information, relieve it from any risk or responsibility for the due fulfilment of its obligations in terms of the Contract.
PROGRESS REPORTS	4.20	Add to this sub-clause: Progress reports shall include updating of drawings issued by the Engineer to as-built drawings as the work progresses
WAIVER OF CONTRACTOR'S LIEN	4.24	The following additional Sub-Clause 4.24 is added to the end of Clause 4: The Contractor waives, in favour of the Employer, any lien or right of retention that is or may be held in respect of the Works to be executed on the Site. The Contractor shall ensure that it procures similar waivers from its subcontractors.

Clause Description	Clause No	Amendment

5. SUBCONTRACTING

NOMINATED SUBCONTRACTORS	5.2	The following additional Sub-Clause 5.2.5 is added to the end of Clause 5.2: 5.2.5 Direct Payment with nominated sub-contractors The Employer may enter into a direct payment agreement with a nominated sub-contractor. The Contractors profit shall not be paid to the Contractor if: i) The Contractor does not pay the subcontractor's invoice after receiving payment for work certified by the Engineer. ii) The Employer and nominated sub-contractor enters into a direct payment agreement and the Contractor performs no managerial function related to the Works by the nominated sub-contractor.

6. STAFF AND LABOUR

WORKING HOURS	6.5	Add to this sub-clause: As stipulated in sub-clause 6.5 (c) execution of work on any day including holidays at any time will be required, without additional remuneration to the Contractor, for power outages and other unavoidable circumstances.
HEALTH AND SAFETY	6.7	Add to this sub-clause: A Health and Safety plan shall be furnished by the Contractor within 14 days after Letter of Acceptance

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Clause Description	Clause No	Amendment
CONTRACTOR'S PERSONNEL	6.9	In addition to the items listed under headings (a) to (f), The Engineer may require the Contractor to remove any person who is in contravention of the provisions of the: • Environmental Management Plan • Client Safety Specification • The provisions of any statutory Act, i.e. OHS. Within seven (7) working days of signature of Letter Acceptance, the Contractor is required to furnish the Employer with a safety plan, risk assessment report and safe work procedures. Prior to commencement of site activities, the entire workforce to be located on site may be required to attend a Health and Safety Induction at the premises of the Employer. The Contractor shall ensure that all requirements set aside by the Occupational Health and Safety Act, and Construction Regulation are fulfilled.

7. PLANT, MATERIALS AND WORKMANSHIP

MANNER OF EXECUTION	7.1	Add the following to Clause (d): All work shall be completed in accordance with the Specifications and drawings to be read in conjunction with all appropriate SANS or SABS, NRS, IEC, BC, IEEE and ANSI codes or guidelines prepared by authorities representing specialised industries.
OWNERSHIP OF PLANT AND MATERIALS	7.7	Add to this sub-clause: Before making any payment for Plant and Materials defined in this Clause, the Contractor is to provide the Employer with a Cession of ownership in a format to be agreed 14 days prior to the payment certificate. Payment thereof will be limited to materials stored where the following conditions are met: • Materials have not been prematurely delivered. • Materials are stored and protected adequately on site or an approved location. • Proof of payment for such materials is made available by the Contractor. After payment of the rate stipulated in the Contract Data, the ownership of material shall be ceded to the Employer.

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Clause Description	Clause No	Amendment

8. COMMENCEMENT, DELAYS AND SUSPENSION

COMMENCEMENT OF THE WORKS	8.1	Further to the provisions of this Clause, notwithstanding the agreed date for the commencement of the Works, none of the activities related to project execution may begin until such time as the required proofs are received in respect of: • Insurances • Performance Securities • Approved SHEQ file The notice by the Engineer of the Commencement Date is recorded in the Contract Data. Access to the site shall be granted on the Commencement Date.
PROGRAMME	8.3	The first paragraph of this Clause is amended to read 14 days in place of 28 days. Add to this sub-clause: The programme shall provide for a minimum of two weeks “slack” in order to cater for unforeseen delays. The programme shall be submitted in the form of a Microsoft Projects Gantt Chart (version 2007 or newer)
EXTENSION OF TIME FOR COMPLETION	8.5	Add to this sub-clause: No extension of time for completion will be granted on account of normal inclement weather, but extension of time shall be determined for abnormal rainfall or wet conditions separately for each calendar month or part thereof in accordance with the Annexure to the Conditions of Contract applicable to Rainfall. The Contractor shall not be entitled to an extension of the Time for Completion to the extent that completion would, in the circumstances, in any event have been delayed by a cause not listed in sub-clause 8.5.
DELAY DAMAGES (PENALTIES)	8.8	Add to this sub-clause: Penalties shall be applied against Contractor according to Detailed Program submitted as per sub-clause 8.3

9. TESTS ON COMPLETION

CONTRACTOR’S OBLIGATIONS	9.1	Add to this sub-clause: The Contractor shall provide a complete set of As-Built drawings and documentation to the Engineer in an approved format together with all the test results as called for in the various sections of the Specifications, Schedules and Drawings.

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Clause Description	Clause No	Amendment

10. EMPLOYER'S TAKING OVER

TAKING OVER OF THE WORKS AND SECTIONS	10.1	Notwithstanding the various provisions of this Clause, if the Employer is not the end-user, it is the Contractors responsibility to ensure that all Works are completed, inspected and approved to the satisfaction of the end-user.

11. DEFECTS AFTER TAKING OVER

12. MEASUREMENT AND VALUATION

EVALUATION	12.3	This Sub-Clause is amended as follows: • The percentage in sub-paragraph (b)(i) is amended to 20% • The percentage in sub-paragraph (b)(ii) is amended to 1.0% • The percentage in sub-paragraph (b)(iii) is amended to 5.0% Add to this sub-clause: The provisions for measurement are as per the Bill of Quantities and payment shall be made according to the progress on site and for material delivered to site before 7 days prior to the Contractor's Application for Interim Payment. The percentage payment of the material rate for material delivered to site is indicated in the Particular Conditions of Contract sub-clause 7.7.

13. VARIATIONS AND ADJUSTMENTS

RIGHT TO VARY	13.1	Add to this sub-clause: The Employer reserves the right, in terms of the Clause, to request the Contractor to undertake Variations to the Contract outside the boundaries of the site but within the property boundary of land owned by the Employer.
VARIATIONS	13.3	Add to this sub-clause: All variations to the contract shall be priced in accordance with the rates agreed in the Contract Agreement for items where rates are available for work of similar nature
AJUSTMENTS FOR CHANGES IN COST	13.7	This Clause is not applicable to Contracts where the Contract price is a Fixed Contract amount. If the Contract Data under the Particular Conditions of Contract makes allowance for Contact Price Adjustment for long lead items, these conditions shall apply: (a) No CPA claims will be accepted which are submitted later than 60 days from the date of the Payment Certification of the applicable equipment. (b) CPA claims submitted on the basis of one or more provisional indices, shall be treated as final claims. (c) CPA claims shall have a fixed portion of the Contract Unit Rate Price which shall not be subject to Price adjustment, if the fixed portion is not specifically detailed the fixed portion

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Clause Description	Clause No	Amendment
		value shall default to 15% of the applicable rate. This percentage shall be applied to the cost adjustment of each item.
		(d) No CPA shall apply to early or advance payments certified.
		The following SEIFSA price adjustment will be applicable to these items for fluctuations in cost of labour and material (excluding cables).

(i) FLUCTUATIONS IN COST FOR POWER TRANSFORMER

Fluctuation in cost of all labour and material for the power transformer shall be calculated in accordance with the following formula:

$$F = (1 - x)[a\left(\frac{Lt}{Lo}\right) + b1\left(\frac{Mt1}{Mo1}\right) + b2\left(\frac{Mt2}{Mo2}\right) + b3\left(\frac{Mt3}{Mo3}\right) + b4\left(\frac{Mt4}{Mo4}\right) + b5\left(\frac{Mt5}{Mo5}\right) - 1]$$

Where,

x = 10 % Fixed Portion.

a = 15 % Table C3: Actual Labour Cost (All Hourly Paid Employees).

Lo = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

b1 = 15 % Table E-A: Steel (Hot Rolled Plates).

Mo1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) as ruling at date of Tender.

Mt1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) ruling for month prior to month during which work was performed.

b2 = 23 % Table F: Copper RCP (Metric ton).

Mo2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) as ruling at date of Tender.

Mt2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) ruling for month prior to month during which work was performed.

b3 = 5 % Table G: Electrical Engineering Materials.

Mo3 = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt3 = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

b4 = 6 % Table M: Transformer Oil.

Mo4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) as ruling at date of Tender.

Mt4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) ruling for month prior to month during which work was performed.

b5 = 26 % Table J: Materials used in the manufacture of Power Transformers.

Mo5 = SEIFSA Index of Materials used in the manufacture of Power Transformers as ruling at date of Tender.

Mt5 = SEIFSA Index of Materials used in the manufacture of Power Transformers ruling for month prior to month during which work was performed.

(ii) FLUCTUATIONS IN COST FOR NECRT

Fluctuation in cost of all labour and material for the power transformer shall be calculated in accordance with the following formula:

$$F = (1 - x)[a\left(\frac{Lt}{Lo}\right) + b1\left(\frac{Mt1}{Mo1}\right) + b2\left(\frac{Mt2}{Mo2}\right) + b3\left(\frac{Mt3}{Mo3}\right) + b4\left(\frac{Mt4}{Mo4}\right) + b5\left(\frac{Mt5}{Mo5}\right) - 1]$$

Where,

x = 10 % Fixed Portion.

a = 15 % Table C3: Actual Labour Cost (All Hourly Paid Employees).

Lo = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

b1 = 15 % Table E-A: Steel (Hot Rolled Plates).

Mo1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) as ruling at date of Tender.

Mt1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) ruling for month prior to month during which work was performed.

b2 = 23 % Table F: Copper RCP (Metric ton).

Mo2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) as ruling at date of Tender.

Mt2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) ruling for month prior to month during which work was performed.

b3 = 5 % Table G: Electrical Engineering Materials.

Mo3 = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt3 = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

b4 = 6 % Table M: Transformer Oil.

Mo4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) as ruling at date of Tender.

Mt4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) ruling for month prior to month during which work was performed.

b5 = 26 % Table J: Materials used in the manufacture of Power Transformers.

Mo5 = SEIFSA Index of Materials used in the manufacture of Power Transformers as ruling at date of Tender.

Mt5 = SEIFSA Index of Materials used in the manufacture of Power Transformers ruling for month prior to month during which work was performed.

(iii) FLUCTUATIONS IN COST FOR CABLES

Due to the volatility of material, labour and other costs, prices are based on those costs ruling as published by Price Waterhouse Coopers (auditors) and the Associations of Cable Manufacturers of South Africa for cables and steel core prices as published by SCAW South Africa materials, the Steel and Engineering Industries Federation of South Africa (SEIFSA) Table C4 – for labour. The adjustment formula applicable is as follows:

$$AP = T \pm (CxV + XxV + LxV + HxV + PxV + SxV + SCxV + DC)$$

Where,

AP = Adjusted price per kilometre.
T = Tender price per kilometre.
C = Copper price (see note 1).
X = Aluminium price (see note 1).
L = Labour and other related services (see note 2)
P = PVC price (see note 1).
H = XLPE price (see note 1).
S = Steel wire price (see note1).
SC = Steel core (see note 1) – (ACSR).
V = Relevant variation factor per kilometre.
D = Cable drum cost (see note 3).
DC = DAP costs (see note 3).

Note 1 – Difference between base price on which quoted prices are based and the ruling price the time of adjustment
Note 2 – Difference between base index on which quoted prices are based and the ruling index (alternatively the last published index) at the time of adjustment.
Note 3 – Difference between base cost (Rand/km cable) on which tender prices are based and the cost at the time of adjustment.

*All prices and costs shall be in South African Rand (ZAR)

(iv) FLUCTUATIONS IN COST FOR 132 kV ISOLATORS

Fluctuation in cost of all labour and material for the 132 kV isolators shall be calculated in accordance with the following formula:

$$F = (1 - x)[a\left(\frac{Lt}{Lo}\right) + b1\left(\frac{Mt1}{Mo1}\right) + b2\left(\frac{Mt2}{Mo2}\right) + b3\left(\frac{Mt3}{Mo3}\right) + b4\left(\frac{Mt4}{Mo4}\right) + b5\left(\frac{Mt5}{Mo5}\right) + b6\left(\frac{Mt6}{Mo6}\right) - 1]$$

where

x = 10 % Fixed Portion.

a = 48 % Table C3: Actual Labour Cost (All Hourly Paid Employees).

Lo = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

b1 = 10 % Table E-A: Steel (Hot Rolled Plates).

Mo1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) as ruling at date of Tender.

Mt1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) ruling for month prior to month during which work was performed.

b2 = 5 % Table F: Copper RCP (Metric ton).

Mo2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) as ruling at date of Tender.
Mt2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) ruling for month prior to month during which work was performed.

b3 = 10 % Table G: Electrical Engineering Materials.

Mo3 = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt3 = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

b4 = 15 % Table R: 99.70 Melting Ingot.

Mo4 = SEIFSA Index of Price of Aluminium Products per Ton (99.70 Melting Ingot) as ruling at date of Tender.

Mt4 = SEIFSA Index of Price of Aluminium Products per Ton (99.70 Melting Ingot) ruling for month prior to month during which work was performed.

b5 = 1 % Table F: Zinc.

Mo5 = SEIFSA Index of Metal Prices (Zinc) as ruling at date of Tender.

Mt5 = SEIFSA Index of Metal Prices (Zinc) ruling for month prior to month during which work was performed.

B6 = 1 % Table Q-2 (A): 304 Stainless Steel 2mm and 3mm.

Mo6 = SEIFSA Index of Stainless Steel Flat Products, Cold Rolled Steel (2mm and 3mm 304) as ruling at date of Tender.

Mt6 = SEIFSA Index of Stainless Steel Flat Products, Cold Rolled Steel (2mm and 3mm 304) ruling for month prior to month during which work was performed.

(v) FLUCTUATIONS IN COST FOR 132 kV CURRENT TRANSFORMER

Fluctuation in cost of all labour and material for the 132 kV Current Transformer shall be calculated in accordance with the following formula:

$$F = (1 - x)[a\left(\frac{Lt}{Lo}\right) + b1\left(\frac{Mt1}{Mo1}\right) + b2\left(\frac{Mt2}{Mo2}\right) + b3\left(\frac{Mt3}{Mo3}\right) + b4\left(\frac{Mt4}{Mo4}\right) + b5\left(\frac{Mt5}{Mo5}\right) + b6\left(\frac{Mt6}{Mo6}\right) + b7\left(\frac{Mt7}{Mo7}\right) - 1]$$

where

x = 10 % Fixed Portion.

a = 38 % Table C3(A): Actual Labour Cost (All Hourly Paid Employees).
Lo = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

b1 = 5 % Table E-A: Steel (Hot Rolled Plates).

Mo1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) as ruling at date of Tender.

Mt1 = SEIFSA Index of Domestic Producers Price Steel (Hot Rolled Plates) ruling for month prior to month during which work was performed.

b2 = 20 % Table F: Copper RCP (Metric ton).

Mo2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) as ruling at date of Tender.

Mt2 = SEIFSA Index of Metal Prices (Copper RCP: Metric ton) ruling for month prior to month during which work was performed.

b3 = 6 % Table G: Electrical Engineering Materials.

Mo3 = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt3 = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

b4 = 7.5 % Table M: Craft Paper.

Mo4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Craft Paper) as ruling at date of Tender.

Mt4 = SEIFSA Index of PPI Selected Materials, Packing Materials (Craft Paper) ruling for month prior to month during which work was performed.

b5 = 8 % Table M: Transformer Oil.

Mo5 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) as ruling at date of Tender.

Mt5 = SEIFSA Index of PPI Selected Materials, Packing Materials (Transformer Oil) ruling for month prior to month during which work was performed.

b6 = 4.5 % Table J: Materials used in the manufacture of Power Transformers.
Mo6 = SEIFSA Index of Materials used in the manufacture of Power Transformers as ruling at date of Tender.

Mt6 = SEIFSA Index of Materials used in the manufacture of Power Transformers ruling for month prior to month during which work was performed.

b7 = 1 % Table F: Zinc.

Mo7 = SEIFSA Index of Metal Prices (Zinc) as ruling at date of Tender.

Mt7 = SEIFSA Index of Metal Prices (Zinc) ruling for month prior to month during which work was performed

(vi) FLUCTUATIONS IN COST FOR 11 kV METALCLAD SWITCHGEAR

Fluctuation in cost of all labour and material for the 11 kV Metalclad Switchgear shall be calculated in accordance with the following formula:

$$F = (1 - x)[a1\left(\frac{Lt1}{Lo1}\right) + a2\left(\frac{Lt2}{Lo2}\right) + b\left(\frac{Mt}{Mo}\right) - 1]$$

where

x = 10 % Fixed Portion.

a1 = 30 % Table C3(A): Actual Labour Cost (All Hourly Paid Employees).

Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

a2 = 30 % Table U: PPI (Electricity and Water).

Lo2 = SEIFSA Index of Production Price (Electricity and Water) as ruling at date of Tender.

Lt2 = SEIFSA Index of Production Price (Electricity and Water) as ruling for month during which work was performed.

b = 30 % Table G: Electrical Engineering Materials.

Mo = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

If the Tenderer wishes to base his tender on values of x, a and b, different to those specified above, he shall state the relevant figures separately. The effect of the figures so tendered shall be calculated on the basis of the tender amount and shall be considered when appointing a Contractor.

(vii) FLUCTUATIONS IN COST FOR LABOUR

If the project is phased fluctuation in cost of all labour for subsequent phases shall be calculated in accordance with the following formula:

$$F = (1 - x)[a1\left(\frac{Lt1}{Lo1}\right) + a2\left(\frac{Lt2}{Lo2}\right) - 1]$$

where

x = 10 % Fixed Portion.

a1 = 80 % Table C3(A): Actual Labour Cost (All Hourly Paid Employees).

Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

a2 = 10 % Table D: CPI (Consumer Price Index).

Lo2 = Statistics SA Consumer Price Index as ruling at date of Tender.

Lt2 = Statistics SA Consumer Price Index as ruling for month during which work was performed.

(viii)FLUCTUATIONS IN COST FOR ELECTRICAL MATERIAL

If the project is phased fluctuation in cost of all material for subsequent phases shall be calculated in accordance with the following formula:

$$F = (1 - x)[a1\left(\frac{Lt1}{Lo1}\right) + a2\left(\frac{Lt2}{Lo2}\right) + b\left(\frac{Mt}{Mo}\right) - 1]$$

where

x = 10 % Fixed Portion.

a1 = 30 % Table C3 (A): Actual Labour Cost (All Hourly Paid Employees).

Lo1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling at date of Tender.

Lt1 = SEIFSA Index of Actual Labour Cost (All Hourly Paid Employees) as ruling for month during which work was performed.

a2 = 15 % Table D: CPI (Consumer Price Index).

Lo2 = Statistics SA Consumer Price Index as ruling at date of Tender.

Lt2 = Statistics SA Consumer Price Index as ruling for month during which work was performed.

b = 45 % Table G: Electrical Engineering Materials.

Mo = SEIFSA Index of Production Price (Electrical Engineering Materials) as ruling at date of Tender.

Mt = SEIFSA Index of Production Price (Electrical Engineering Materials) ruling for month prior to month during which work was performed.

Clause Description	Clause No	Amendment

14. CONTRACT PRICE AND PAYMENT

ADVANCE PAYMENT	14.2.1 – 14.2.3	This advance payment sub-clause shall not apply to this contract. However, should the Employer agree, an upfront payment can be negotiated, whereby the Contractor will be required to issue the Employer with a guarantee for the exact amount of the upfront payment. The costs involved to obtain this guarantee will be for the Contractor's account.

C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
APPLICATION FOR INTERIM PAYMENT CERTIFICATES	14.3	A single copy of the Contractor Statement in an electronic format will be deemed adequate. An original, hard copy, invoice shall be raised by the Contractor upon Certification of the Contractors Claim by the Engineer. This Sub-Clause is amended as follows: • Delete the words "end of the period" in the first paragraph and replace with "7 days prior to the 25th day of each month." Add the following at the end of this Sub-Clause: • In the event that the Contractor fails to submit a Statement on time, any late submission will only be evaluated in the next month.
SCHEDULE OF PAYMENTS	14.4	The content of this Clause is not applicable. The Contractor shall submit together with the Programme an estimated Cash Flow based on tasks in the Programme.
CURRENCIES OF PAYMENT (Rate of Exchange)	14.15 (f)	If the Contract Data under the Particular Conditions of Contract makes allowance for Rate of Exchange Adjustment for long lead items, these conditions shall apply: (a) No CPA claims will be accepted which are submitted later than 60 days from the date of the Payment Certification of the applicable equipment. (b) CPA claims submitted on the basis of one or more provisional indices, shall be treated as final claims. (c) CPA claims shall have a fixed portion of the Contract Unit Rate Price which shall not be subject to Price adjustment, if the fixed portion is not specifically detailed the fixed portion value shall default to 15% of the applicable rate. This percentage shall be applied to the cost adjustment of each item. (d) No CPA shall apply to early or advance payments certified. (e) The country of manufacturing origin's exchange rate shall be used i.e. a USD – ZAR exchange rate will not be accepted for equipment not manufactured in the USA. (f) No Cost Adjustment will be applicable to this contract as whole. The Tenderer must therefore allow for changes in the Rate of Exchange in his unit prices. However, provision will be made for Rate of Exchange adjustments only on long lead items listed in the Contract Data. Rate of exchange will only apply to imported material, to cater for upward and downward fluctuations in cost.
ISSUE OF INTERIM PAYMENT CERTIFICATES	14.6	The content of sub-clause 14.6.1 is amended as follows: The Engineer will issue the Interim Payment Certificate within 7 - 28 days after the receipt of the Statement and supporting documentation

Clause Description	Clause No	Amendment

15. TERMINATION BY EMPLOYER

16. SUSPENSION AND TERMINATION BY CONTRACTOR

17. CARE OF THE WORKS AND INDEMNITIES

18. EXCEPTIONAL EVENTS

EXCEPTIONAL EVENTS	18.1	Add this sub-clause: It is explicitly noted that no claims by the Contractor will be entertained for work stoppages due to riot, commotion, disorder, any blockade or embargo, strikes or lock outs by local labourers which are in the employ of the Contractor. If the Contractor has not reasonable provided against foreseeable community unrest stoppages by including a community desk, any claims by the Contractor shall not be entertained for stoppages caused by persons other than the Contractor's personnel. Note: for an event to be classified as an "exceptional event", the requirements of all four sub-paragraphs (i) to (iv) of clause 18.1 must be satisfied.

19. INSURANCE

20. EMPLOYER'S AND CONTRACTOR'S CLAIMS

21. DISPUTES AND ARBITRATION

CONSTITUTION OF THE DAAB	21.1	The DAAB shall be adhoc in the event where dispute(s) arise between parties

22. ADDITIONAL GENERAL PROVISIONS

These conditions are adopted from Clause 5 of the FIDIC Conditions of Contract for EPC/Turnkey Projects. (First Edition 1999)

PERIOD OF VALIDITY OF TENDER	22.1	Add this sub-clause: The period of the tender validity shall be 90 days, with extension by mutual agreement between the Engineer and the Contractor
TAX INVOICES	22.2	Add this sub-clause: The Contractor shall issue an invoice to the Employer for all amounts to be paid to the Contractor under the Contract. If VAT is payable on any amount certified by the Engineer for payment under the Contract, the Contractor shall ensure that the invoice complies with the requirements of a Tax Invoice under the Value Added Tax Act no. 89 of 1991 (as amended). No payment shall be made by the Employer on invoices not meeting this requirement and the Employer shall not be liable for interest for such non-payment.

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C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
EMPLOYER'S RIGHT TO STEP-IN	22.3	Add this sub-clause: If the Contractor fails to carry out any obligation under the Contract and fails to make good the failure and remedy it despite being required to do so by the Engineer by notice under Sub-Clause 15.1 [Notice to Correct] (within the specified reasonable time), the Employer, without prejudice to its other rights, powers and remedies under the Contract or in law, shall be entitled to make good the failure and remedy it either himself or via other persons, and the reasonable costs of doing so shall be for the account of the Contractor. The Contractor shall co-operate with the Employer and facilitate and permit the use of all required Goods, information, materials and other matter (including Contractor's Documents and all other drawings, CAD files, technical data, models, plans, designs, diagrams, evaluations, details, specifications, schedules, reports, calculation results, manuals or other documents or recorded information (electronic or otherwise) which have been or are at any time prepared by or on behalf of the Contractor under the Contract or otherwise for and/or in connection with the Works) and shall generally do all things required by the Engineer to achieve this end.
RECORD AND DATA KEEPING	22.5	Add this sub-clause: The Contractor shall maintain all data, records, electronic communications and documentation relating to this Contract and keep full and proper records and accounts in connection with the Works (whether contained in documents or in electronic format), during the execution of the Works and for a period of 5 (five) years after the latest of the expiry dates of the Defects Notification Periods (or the earlier termination of the Contract for any reason whatsoever, as the case may be) and shall ensure that all Subcontractors do likewise. The Employer's Personnel and the Employer's other authorised representatives and agents shall be entitled to examine, audit, copy and inspect all such books, records, systems, processes, procedures and documents at all reasonable times during the execution of the Works and during the said 5 (five) year period in order to verify compliance by the Contractor with its obligations, and/or to assess any entitlement or claimed entitlement of the Contractor under the Contract. The Contractor shall provide access to all such books, records, systems, data and documents of the Contractor and to any premises and personnel of the Contractor for this purpose and shall co-operate and render all assistance requested by the Employer's Personnel and the Employer's other authorised representatives and agents. All data, communications, records and accounts are to be kept in a lockable storeroom and adequately protects against loss which includes, but is not limited to, fire, theft, vermin, etc.

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C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
DAMAGES FOR THE LATE SUPPLY OF DOCUMENTATION	22.6	Add this sub-clause: If the Contractor fails to provide any of the documents listed by the dates specified in the Contract, the Contractor shall pay damages to the Employer for this default. **These damages shall be the same amount stated in the Contract Data under sub-clause 8.8 for delay damages, which shall be paid for each day which shall elapse between the time the document in question was to have been delivered and when it was actually delivered**. These damages shall not relieve the Contractor from his obligations to provide the said document, or to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.
RETESTING & RE-INSPECTION	22.7	If the Works or any Section fails to pass any Progress Tests, Completion Tests, Progress Inspections, Completion or Take Over Inspection, the Engineer may require such Tests and Inspections to be repeated on the same terms and conditions. All costs to which the Employer may be put due to repetition of the Tests under this sub-clause shall be deducted from the Contract price. The Contractor shall be liable to pay R 20 000.00 penalty to the Engineer for scheduled inspections or tests failed, per failure, for time wasted.
GENERAL DESIGN OBLIGATIONS	23.1	The Contractor shall be deemed to have scrutinised, prior to the Base Date (28 days before the Tender Closing Date), the Engineer's Requirements (including design criteria and calculations, if any). The Contractor shall be responsible for the design of parts of the Works and for the accuracy of such Engineer's Requirements (including design criteria and calculations), except as stated below The Engineer shall not be responsible for any error, inaccuracy, or omission of any kind in the Engineer's Requirements as originally included in the Contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information, except as stated below. Any data or information received by the Contractor, from the Engineer, Engineer or otherwise shall not relieve the Contractor from his responsibility for the design and execution of the Works. However, the Engineer shall be responsible for the correctness of the following portions of the Engineer's Requirements and of the following data and information provided by (or on behalf of) the Engineer. a) Portions, data, and information which are stated in the Contract as being immutable or the responsibility of the Engineer, b) Definitions of intended purposes of the Works or any parts thereof, c) Criteria for the testing and performance of the completed Works, and d) Portions, data, and information which cannot be verified by the Contractor, except as otherwise stated in the Contract.

C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
CONTRACTOR'S DOCUMENTS	23.2	The Contractor's Documents shall comprise the technical documents specified in the Engineer's Requirements, documents required to satisfy all regulatory approvals, and the as-built documents requirements, and operation and maintenance manual requirements. Unless otherwise stated in the Engineer's Requirement, the Contractor's Documents shall be written in the language for communications defined in Sub-Clause 1.4 (Law and Language). The Contractor shall prepare all Contractor's Documents and shall also prepare any other documents necessary to instruct the Contractor's Personnel. Each review period shall not exceed 21 days, calculated from the date on which the Engineer receives a Contractor's Document. The Contractor's Documents shall state the level of compliance with the Contract, or the extent to which it does not comply. The Engineer may, within the review period, give notice to the Contractor that a Contractor's Document fails (to the extend stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted, and reviewed in accordance with the Sub-Clause, at the Contractor's cost. For each part of the Works, and except to the extent that the Parties otherwise agree: a) Execution of such part of the Works shall not commence prior to the expiry of the review periods for all the Contractor's Documents which are relevant to its design and execution. b) Execution of such part of the Works shall be in accordance with these Contractor's Documents, as submitted for review; and c) If the Contractor wishes to modify any design or document which has previously been submitted for review, the Contractor shall immediately give notice to the Engineer. Thereafter, the Contractor shall submit revised documents to the Engineer in accordance with the above procedure. Any such agreement (under the preceding paragraph) or any review (under this Sub-Clause or otherwise) shall not relieve the Contractor from any obligation or responsibility.
CONTRACTOR'S UNDERTAKING	23.3	The Contractor undertakes that the design, the Contractor's Documents, the execution, and the completed Works will be in accordance with: a) The Laws in the Country, and b) The documents forming the Contract, as altered, or modified by Variations.

C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
TECHNICAL STANDARDS AND REGULATIONS	23.4	The design, the Contractor's Documents, the execution, and the completed Works shall comply with the Country's technical standards, building, construction and environmental Laws, Laws applicable to the product being produced from the Works, and other standards specified in the Engineer 's Requirements, applicable to the Works, or defined by the applicable Laws. All these Laws shall, in respect of the Works and each Section, be those prevailing when the Works or Section are taken over by the Engineer under Clause 10 (Engineer's Taking Over). References in the Contract to published standards shall be understood to be references to the edition applicable on the Base Date, unless stated otherwise. If changed or new applicable standards come into force in the Country after the Base Date, the Contractor shall give notice to the Engineer and (if appropriate) submit proposals for compliance. In the event that: a) The Engineer determines that compliance is required, and b) The proposals for compliance constitute a variation, then the Engineer shall initiate a Variation in accordance with Clause 13 (Variations and Adjustments).
TRAINING	23.5	The Contractor shall carry out the training of Engineer's Personnel in the operation and maintenance of the Works. If the Contract specifies training which is to be carried out before taking-over, under Sub-Clause 10.1 (Taking Over of the Works and Sections) until this training has been completed.
AS-BUILT DOCUMENTS	23.6	The Contractor shall prepare, and keep up to date, a complete set of "as-built" records of the execution of the Works, showing the exact as-built locations, sizes and details of the work as executed. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Two copies shall be supplied to the Engineer prior to the commencement of the Tests on Completion. In addition, the Contractor shall supply to the Engineer as-built drawings of the Works, showing all Works as executed, and submit them to the Engineer for review under Sub-Clause 5.2 (Contractor's Documents). The Contractor shall obtain the consent of the Engineer as to their size, the referencing system, and other relevant details. Prior to the issue of any Taking-Over Certificate, the Contractor shall supply to the Engineer the specified numbers and types of copies of the relevant as-built drawings. In accordance with the Engineer's Requirements. The Works shall not be completed for the purposes of taking-over under Sub-Clause 10.1 (Taking Over of the Works and Sections) until the Engineer has received these documents.
OPERATION AND MAINTENANCE MANUALS	23.7	Prior to commencement of the Tests on Completion, the Contractor shall supply to the Engineer provisional operation and maintenance manuals in sufficient detail for the Engineer to operate, maintain, dismantle, reassemble, adjust, and repair the Plant. The Works shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 (Taking Over of the Works and Sections) until the Engineer has received final operation and maintenance manuals in such detail, and any other manuals specified in the Engineer's Requirements for these purposed.

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C1.4 - PART 2B: SPECIAL PROVISIONS

Clause Description	Clause No	Amendment
DESIGN ERROR	23.8	If errors, omissions, ambiguities, inconsistencies, inadequacies, or other defects are found in the Contractor's Document, they and the Works shall be corrected at the Contractor's cost, notwithstanding any consent or approval under the Clause.

Note: The Contractor is advised to extend the liability for penalties to equipment manufacturers in order to cover the Contractor's liability if the project is delayed due to delayed manufacturing.

C1.4.1. ANNEXURE TO PCC – RAINFALL

No extension of the completion time will be granted in respect of normal rainfall. Extension will only be granted in respect of abnormal rainfall or abnormally wet conditions in accordance with the formula set out hereunder:

In the event of an extension being granted in accordance with the formula, no additional payment will be granted in respect of the "time related" items scheduled in Section 6: Preliminary and General of the Schedule of Quantities nor for any other costs incurred.

$V = (Nw - Nn)\frac{Rw}{Rn}$, if $N_w > N_n$ and where

V = Extension of time in calendar days in respect of any particular month

N_w = Actual number of days during the corresponding month during which precipitation exceeds 10 mm

N_n = Average number of days during the corresponding month during which precipitation exceeded 10 mm

R_w = Actual rainfall during the corresponding calendar month

R_n = Average rainfall recorded during the corresponding calendar month

Calculations will be done for each month.
Calculations for part of a month are carried out using pro rata figures for N_n and R_n.
If R_w / R_n is greater than 2,5, its value shall be taken as 2,5.
If any month Nw is smaller than Nn, no extension of time will be granted for that month.
The following values of Nn and Rn shall be used for this Contract. They are based on figures supplied by the Weather Bureau, for the Vanderbijlpark area.

Table 4: Average monthly rainfall

MONTH	AVERAGE NUMBER RAIN DAYS	Nn AVERAGE NUMBER OF DAYS EXCEEDING 10 MM	Rn AVERAGE RAINFALL IN MM
JANUARY	14,2	4	127,3
FEBRUARY	10,2	2	72,5
MARCH	9,8	3	74,6
APRIL	7,5	2	54,0
MAY	3	0	16,7
JUNE	1,7	0	9,1
JULY	1	0	8,6
AUGUST	1,9	0	8,2
SEPTEMBER	4,1	1	22,7
OCTOBER	9,1	3	66,5
NOVEMBER	12,9	3	100,3
DECEMBER	13,3	3	103,4

AVERAGE PER YEAR: 88,7 days and 663,9 mm

C1.4.2. ANNEXURE TO PCC – SCHEDULE OF SUB-CONTRACTORS

The Tenderer shall list below any Sub-Contractors he wishes to employ to carry out part(s) of the work.

The acceptance of this tender shall not be construed as being approval of all or any of the listed Sub-Contractors. Should any or all of the Sub-Contractors not be approved subsequent to the acceptance of the tender, it shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding even in the event of a Sub-Contractor not listed below being approved by the Employer.

Table 5: Schedule of Sub-Contractors

PART OR TYPE OF WORK	PROPOSED SUB-CONTRACTOR	WORK RECENTLY EXECUTED BY SUB-CONTRACTOR

**This table must correspond with Table 2 in Section T2.2 Returnable Schedules*

SIGNED ON BEHALF OF TENDERER : ……

DATE : ……..

C1.4.3. ANNEXURE TO PCC – SCHEDULE OF NOMINATED SUB-CONTRACTORS

The following nominated Sub-Contractors shall be employed by the Main Contractor to carry out part(s) of the work.

The acceptance of this tender shall not be construed as being approval of all or any of the listed Nominated Sub-Contractors, appointment of the nominated sub-contractors shall be subject to approval. This schedule shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding, even in the event of a Nominated Sub-Contractor not listed below being approved by the Employer.

Table 6: Schedule of Nominated Sub-Contractors

TYPE	DESCRIPTION	NOMINATED SUB-CONTRACTOR
OHL	Repair of the Zamdela-Leitrim 88kV OHL	To be confirmed… (the Main Contractor will first be given the opportunity to quote on the work)
S/S	Recommissioning of Leitrim substation	To be confirmed… (the Main Contractor will first be given the opportunity to quote on the work)

SIGNED ON BEHALF OF TENDERER : ……

DATE : ……..

C1.5: FORM OF SECURITIES

C1.5: FORM OF SECURITIES

C1.5. FORM OF SECURITIES

C1.5.1. EXAMPLE PERFORMANCE SECURITY – SURETY BOND

Name of Contract / Contract No.: _____

Name and address of Beneficiary (the "Employer"): _____

_____

_____

We have been informed that _____
[*insert name of the Contractor*] (hereinafter called the "Principal"), is your Contractor under such Contract, which requires him / her to obtain a Performance Security.

By this Bond, _____

_____
[*insert name and address of Contractor*]

(who is your Contractor under such Contract) as Principal and: _____

_____
[*insert name and address of Guarantor*]

as Guarantor are irrevocably held and firmly bound to the Beneficiary in the total amount of

_____ (10%) _____

_____
[*insert in figures and words the maximum amount payable and the currency in which it is payable]* (the "Bond Amount") for the due performance of all such Principal's obligations and liabilities under the above named Contract.

[Such Bond Amount shall be reduced by _50__ % upon the issue of the Taking-Over Certificate for the whole of the Works under Clause 10 of the Conditions of Contract.]

This Bond shall become effective on the Commencement Date defined in the Contract.

Upon Default by the Principal to perform any contractual obligation, or upon the occurrence of any of the events and circumstances listed in Sub-Clause 15.2.1 of the Conditions of Contract, the Guarantor shall satisfy and discharge the damages sustained by the Beneficiary due to such Default, event or circumstances *[and shall not be entitled to perform the Principal's obligations under the Contract.]*. However, the total liability of the Guarantor shall not exceed the Bond Amount.

The obligations and liabilities of the Guarantor shall not be discharged by any allowance of time or other indulgence whatsoever by the Beneficiary to the Principal, or by any variation or suspension of the Works to be executed under the Contract, or by any amendments to the Contract or to the constitution of the Principal or the Beneficiary, or by any other matters, whether with or without the knowledge or consent of the Guarantor.

C1.5: FORM OF SECURITIES

Any claim under this Bond must be received by the Guarantor on or before _____

_____

[*insert the date six months after the expected expiry of the Defects Notification Period for the Works*] (the "Expiry Date"), when this Bond shall expire and shall be returned to the Guarantor.

The benefit of this Bond may be assigned subject to the provisions for assignment of the Contract, and subject to the receipt by the Guarantor of evidence of full compliance with such provisions.

The Bond shall be governed by the law of _____
[*insert the law governing the Bond*] being the same country (or other jurisdiction) as that which governs the Contract. This Bond incorporates and shall be subject to the Uniform Rules for Contract Bonds, published as number 524 by the International Chamber of Commerce, and words used in this Bond shall bear the meanings set out in such Rules.

Whereas this Bond has been issued by the Principal and the Guarantor on _____
[*date*]

Signatures for and on behalf of the Principal:

_____ _____
(signature) *(signature)*

_____ _____
(name) *(name)*

Date: _____

Signatures for and on behalf of the Guarantor:

_____ _____
(signature) *(signature)*

_____ _____
(name) *(name)*

Date: _____

C1.5: FORM OF SECURITIES

NOTE: Payment shall be executed within 30 days of receiving instruction from the Engineer.

Instruction to be addressed to the following person's attention:

Name : ……

Telephone : ……...…….

E-mail : ……

The address for submission of the Engineer's instruction to call upon the bond for payment:

Name : …….

Telephone : …….

E-mail : …….

Address : …….

C1.5.2. EXAMPLE RETENTION GUARANTEE

Guarantee No.: _____ [*insert guarantee reference number*]

The Guarantor: _____
[*insert name and address of place of issue, unless indicated in the letterhead*]

Name of Contract / Contract No.: _____
[*insert reference number or other information identifying the contract between the Applicant and the Beneficiary on which the guarantee is based*]

The Beneficiary (the "Employer"): _____

_____
[*insert name and address of the Beneficiary*]

We have been informed that _____
[*insert name and address of the Contractor*] (hereinafter called the "Applicant")

is your Contractor under such Contract and wishes to receive an early payment of [part of] the retention money, for which the Contract requires him / her to obtain a guarantee.

At the request of the Applicant, we _____
[*insert name of Guarantor*] hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of

_____

_____
[*insert in figures and words the maximum amount payable and the currency in which it is payable*] (the "Guaranteed Amount") upon receipt by us of your demand in writing and your written statement that the Applicant has failed to carry out his / her obligation(s) to rectify the following defect(s) for which he / she is responsible under the Contract [*state the nature of the defect(s)*].

At any time, our liability under this guarantee shall not exceed the total amount of retention money released to the Applicant by you, as evidenced by interim payment certificates issued under Sub-Clause 14.6 of the Conditions of Contract with a copy being submitted to us.

Any demand for payment must contain your signature(s) which must be authenticated by your bankers or by a notary public. The authenticated demand and statement must be received by us at the following office _____

_____

_____ [*insert address of office*]

on or before _____ [*insert the date 70 days after the expected expiry of the Defects Notification Period for the Works*], (the "Expiry Date"), when this guarantee shall expire.

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C1.5: FORM OF SECURITIES

We have been informed that the Beneficiary may require the Applicant to extend this guarantee if the Performance Certificate under the Contract has not been issued by the date 28 days prior to such Expiry Date. We undertake to pay you the Guaranteed Amount upon receipt by us, within such period of 28 days, of your demand in writing and your written statement that the Performance Certificate has not been issued, for reasons attributable to the Applicant, and that this guarantee has not been extended.

The party liable for the payment of any charges:

_____ [*insert the name of the party*].

This guarantee shall be governed by the laws of _____ [*insert the law governing the guarantee*] and shall be subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

SIGNED by:

_____ _____

(signature) *(name)*

SIGNED by [(1)]:

_____ _____

(signature) *(name)*

Date: _____

[(1)] *Whether one or more signatories for the bank are required will depend on the bank and / or applicable law.*

C1.5.3. EXAMPLE SITE HANDOVER CERTIFICATE – BEGINNING OF THE WORKS

PROJECT : _____ *[Insert Project Name]*

CONTRACT NO : _____ *[Insert Project Number]*

SCOPE OF WORKS : _____ *[Insert Project Description]*

The site for the works, as stated above, is herewith handed over by the Employer/Local Authority namely: _____,

to the appointed Contractor for the works, namely, _____.

The Contractor shall become *"the Mandatory"* when the Occupational Health and Safety Agreement is signed, with regards to Section 37(2) of the OHS Act 85 of 1993.

The Contractor shall take full responsibility for all aspects related to the above works and all portions thereof. The Employer/Local Authority shall remain responsible for related aspects and areas not affected by the Scope of Works. All infrastructure established as part of the works shall remain the responsibility of the Contractor until the site/works is handed over to the Employer / Local Authority.

Should the Contractor remove from site due to any contractual obligations not being met by the Employer/Local Authority, the Contractor shall notify the Employer/Local Authority that the Employer/Local Authority shall take over responsibility of the site until the relevant contractual obligations are met by the Employer/Local Authority.

SECTION OF WORK: [*Insert Project Scope/Section Of Work]*

CONTRACTOR'S REPRESENTATIVE	: _____ *(Full names)*
CONTRACTOR'S FIRM	: _____ *(Company)*
EMPLOYER / LOCAL AUTHORITY'S REPRESENTATIVE	: _____ *(Full Names)*
EMPLOYER / LOCAL AUTHORITY'S	: _____ *(Company)*
CONSULTING ENGINEER'S REPRESENTATIVE	: _____ ***(Pr. xx.)***
CONSULTING ENGINEER'S FIRM	: **LYON AND PARTNERS (PTY) LTD**
DATE	: _____ **20 _____**

.....	.....
SIGNATURE (LOCAL AUTHORITY/CLIENT)	SIGNATURE (CONTRACTOR)
.....	.....
SIGNATURE (CONSULTING ENGINEER)	WITNESS

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SECTION 4 -
C2: BILL OF QUANTITIES

METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG
1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 4:
C2 – BILL OF QUANTITIES

LYON AND PARTNERS (Pty) Ltd
Electrical Consulting Engineers
P O Box 3925
VANDERBIJLPARK
1900

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C2.1: PRICING INSTRUCTION

C2.1 – PRICING INSTRUCTION

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C2.BILL OF QUANTITIES

C2.1. PRICING INSTRUCTION

C2.1.1.PREAMBLE

1. This Schedule of Quantities forms part of the Contract Documents as listed in the Schedule of Documents and shall be read in conjunction with the General Conditions, the Specifications and the Drawings and must be submitted, duly completed, on the closing date of Tenders.

2. The short description of items in the Bill of Quantities are for identification purposes only, the work covered by the items being fully specified in the relevant clauses in the Specifications. The Tenderer must therefore allow in the unit price for ordering, obtaining, supplying, delivering to site, installation and commissioning of the relevant equipment with their accessories.

3. Except where Sum Amounts are required or where Provisional Amounts have been indicated, the Tenderer shall enter an applicable rate in the Rate Column of the Schedule of Quantities for each scheduled item. He shall also enter an applicable sum in the Amount Column for each scheduled item. Should the Schedule not be completed in the manner herein specified, the tender may either be rejected or the Contractor will not be paid for items against which rates or sum amounts, as applicable, have not been entered. In the event of the latter procedure items not paid for will be regarded as covered by other rates entered in the Schedule of Quantities.

4. Tenderers must complete the Schedule of Quantities and fill in the unit rates for material and labour as well as total amount for each item. The unit rate is for a single item only. Errors of the arithmetic calculation to calculate the total amount, as entered in the Schedule may be corrected by the Employer but rates will be binding.

An example of the calculations are as follows:

ITEM	DESCRIPTION	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
1	Supply and install a 9 m wood pole	No	100	R20,00	R100,00	R12 000,00
2	Excavate pole hole	m^3	100	R50,00	R0,00	R5 000,00
3	Supply and install 10 mm^2, 3-core cable	m	50	R5,00	R20,00	R1 250,00
4	Head office overhead cost	Sum	1	-	-	R15 000,00
TOTAL CARRIED FORWARD TO SUMMARY						**R33 250,00**

5. Tenderers are advised to check their items extensions and total additions as too many arithmetical errors occurring in the priced Schedule of Quantities will disqualify the Tenderer. Under no circumstances shall the Tenderer be permitted to change the specified quantities in the QTY column which will result in rejecting the tender or changing the quantity to the initial value and correcting the arithmetic's. If the Tenderer disagree with the quantity he must do so by means of an accompanied letter with full description and reference to the particular item.

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6. The quantities reflected in the Schedule of Quantities are approximate only and do not necessarily represent the actual amount of work to be done. Allowance for off-cuts and scrap shall be allowed for in the unit rates. The Contract Price for the completed Contract shall be computed from the actual quantities of authorised work done to the satisfaction of the Engineer valued at the prices tendered against the respective items in the Bill of Quantities, and shall include such authorised provisional amounts and items of extra work as have become payable in terms of the Contract Documents. Extra material shall not be paid for and shall be removed from site.

7. The Contractor shall submit equipment technical data sheets and measured quantities for approval prior to placing any equipment orders. This information shall be submitted by the Contractor to the Engineering within 14 days of being appointed.

8. Unit prices quoted in the Schedule of Quantities must include for such small installation materials as are required for the complete installation in accordance with the Specifications.

9. Payment based on the rates tendered in the Schedule shall cover all the services and incidentals included in the works covered by the Contract and shall be made in accordance with the General Conditions, the Specifications and the Agreement pertaining to the Contract.

10. Where the Contractor is required to furnish detailed drawings and designs or other information in terms of the Contract Documents, all costs shall be deemed to have been provided for and included in the unit rates and sum amounts tendered for the items scheduled in the Schedule of Quantities and separate additional payment will not be made.

11. Writing in the Schedule must be done in black to facilitate clear photocopying.

12. The Contractor shall keep record of all material delivered to site, and shall submit such record to the Engineer at every site inspection. Material not installed shall be kept in the site yard or store and the material shall be kept readily available for inspection.

13. Application for payment, accompanied by supporting documentation, shall be submitted to the Engineer on a predetermined date which date shall be a suitable date in each month, agreed upon by all parties concerned with the payment. Claims for additional work in a particular month, for which no written instruction has not yet been issued, if applicable, must also accompany the monthly application for payment. Late claims will not be considered.

14. **All unit rates and sum amounts shall exclude Value Added Tax, as applicable from 1 October 1991 and in accordance with the ruling rate as laid down by the Government, and all prices shall be quoted in South African currency.**

15. The Contractor's attention is drawn to the fact that the allowance for PROVISIONAL AMOUNTS/SUMS for escalation in costs and allowance for contingencies shall only be spent at the discretion of the Engineer and will fall away in part or in whole if not required. It is emphasized that prior to any variation, official approval must be granted.

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C2.1 PRICING INSTRUCTION

16. Bidders must keep a copy of the completed excel spreadsheet BOQ which may be required during the evaluation processes. Failure to comply with the above-mentioned terms and conditions will deem your bid disqualified.

SIGNATURE OF TENDERER : _____

DATE : _____

C2.2: BILL OF QUANTITIES

C2.2 – BILL OF QUANTITIES

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BILL OF QUANTITIES (BID:MLM 12/2021/22)
VAALDAM SUBSTATION AND THEMBA KHUBEKA ELECTRIFICATION
SUMMARY - OPTION 1

ITEM NO	DESCRIPTION OF THE ITEM	LIST	PRICE
1	Preliminary and General	List A	
	VAALDAM SUBSTATION EXTENSION		
2	Site Works	List B	
3	Earth Grid	List C	
4	Substation Fencing	List D	
5	Civil Work	List E	
6	Buildings	List F	
7	Steel Work	List G	
8	Equipment	List H	
9	Control Plant	List I	
10	Training & Spares	List J	
	THEMBA KHUBEKA ELECTRIFICATION		
11	Themba Khubeka Reticulation - MV Network	List K	
12	Themba Khubeka Reticulation - LV Network	List L	
13	Themba Khubeka Reticulation - House Connections	List M	
14	Themba Khubeka Reticulation - Switchgear	List N	
	88 KV LINE REPAIRS, 88 / 11 KV SUBSTATION REPAIRS & OTHER		
15	Other	List O	
16	**SUBTOTAL A - LIST A to O**		**R -**
17	Plus: 10 % Contingencies		R -
18	Plus: 5 % Escalation		R -
19	**SUBTOTAL B**		**R -**
20	Plus: 15 % VAT		R -
21	**TOTAL TENDER PRICES - SUBTOTAL B & VAT** **(Carried forward to Section 3, Part C1.1, Page 1 of tender document)**		**R -**

TENDERER'S SIGNATURE: _____

COMPANY NAME: _____

ADDRESS: _____

NOTE: - TENDERERS ARE RESPONSIBLE TO INSERT ALL EXCEL FORMULAS AND CHECK FOR ARITHMETIC ERRORS
- THE TENDERER SHALL POPULATE THE BILL OF QUANTITIES BY HAND IN THE BID SUBMISSION DOCUMEN
- THE TENDERER SHALL EMAIL THE POPULATED BOQ IN PDF AND RAW EXCEL FORMAT TO LYON@LYON.CO.ZA AT THE TENDER CLOSING TIME (FOR EVALUATION PURPOSES

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
1.	**PRELIMINARIES**				
	Amount allowed for all expenses, regarding the following:				
1.1	**CONTRACTUAL REQUIREMENTS - FIXED AMOUNT**				
1.1.1	Nett price for the fulfilment of the Tender Requirements, Conditions of Contract and Performance				
	Security/Security Bond. Performance Security to remain valid until date of issue of the Final Completion				
	Certificate or within 28 days after expiry Defects Notification Period	Sum	1		
1.1.2	Insurance of the Works in the **joint** names of the Employer and Contractor, Insurance of the Construction				
	Plant to its full replacement value and Third Party Insurance	Sum	1		
1.1.3	Site establishment, which includes, site office, site store, laydown area, temporary housing, security fence,				
	sanitary, toilets, obtaining water, electrical connection, etc.	Sum	1		
1.1.4	Pegging and surveying of the route by a qualified surveyor: MV route including all pole positions,				
	anchors, stand boundaries for cable positions, etc.	Sum	1		
1.1.5	Surveying of the as-built route by a qualified surveyor: MV route including all pole positions,				
	anchors, stand boundaries for cable positions, etc.	Sum	1		
1.1.6	Pegging and surveying of the route by a qualified surveyor: LV route including all terminal pole and bend				
	points, etc.	Sum	1		
1.1.7	Pegging and surveying of the substation terrace by a qualified surveyor: Substation levels, fence position,				
	equipment positions and reference pegs	Sum	1		
1.1.8	Reinstating of missing S.G. pegs prior to construction of any works and obtaining Surveyors Certificate of				
	Compliance (Pr. Land Surveyor)	Sum	1		
1.1.9	Determining and locating of existing services as well as management of wayleaves througout the delivery of				
	the works,	Sum	1		
1.1.10	Erecting of temporary obstructions and barricades	Sum	1		
1.1.11	CONSTRUCTION NOTICE BOARD (mm. 2600 X 1600)	Each	2		
1.1.12	Cleaning of the site, removal of all refuse, rubble, rock, etc. prior to handing over of every phase	Sum	1		
1.1.13	Obtaining permits, arranging for outages and switching with relevant Authorities	Sum	1		

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
1.1.14	Obtaining access to the Eskom Website *(scot.eskom.co.za)* for access to the relevant Eskom Standards,				
	and obtaining Eskom FSOU authorisation before executing the Works	Sum	1		
1.1.15	Tools, material, safety clothing, and the appropriate PPE for the labourers (incl. local labourers) to conduct				
	their work in accordance with safety requirements	Sum	1		
1.1.16	Medical evaluation and induction cost for all staff	Sum	1		
1.1.17	As built drawings and manuals (5 x sets). As builts to include surveying of the works by a qualified				
	surveyor, i.e. MV and LV conductors, equipment positions and any relevant site information (drawings to be				
	issued in CAD format)	Sum	1		
1.1.18	Removal from site following completion of the Works	Sum	1		
1.1.19	Temporary removal from site for an undetermined period following completion of a section of the work and				
	re-establishment to complete the remainder of the Works	Sum	0		
1.2	**COMPLY WITH THE FOLLOWING SAFETY, HEALTH, ENVIRONMENTAL AND**				
	QUALITY (SHEQ) REQUIREMENTS - FIXED AMOUNT				
1.2.1	Adherence to Construction Regulations of the OHS Act	Sum	1		
1.2.2	Compile a Health and Safety Plan (H & S Plan)	Sum	1		
1.2.3	Compile a Risk Assessment for activities (RA)	Sum	1		
1.2.4	Comply with Environmental Management Plan (EMP)	Sum	1		
1.2.5	Submit proof of calibration of equipment, eg. Crimper, HV test apparatus, breaking failure test of				
	terminations and joints of ACSR OH Lines etc.	Sum	1		
1.2.6	Compile a SHEQ File to also include all the above distinct sections	Sum	1		
1.2.7	Construction work notification and permit application (assist the Employer to obtain a construction permit)	Sum	1		
1.3	**TOTAL TIME RELATED COST BASED ON MONTHLY EXPENDITURE - ADJUSTABLE**				
	WITH CONTRACT PERIOD	Sum	1		
	The running cost of the project related to the contract period, which will also be used to adjust the cost if an				
	event occurs that becomes the Employers Risk				
1.3.1	Head office overhead cost and contractual obligations	Sum	1		

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
1.3.2	Site overhead cost	Sum	1		
1.3.3	Material-store cost on site	Sum	1		
1.3.4	Material-store cost off site	Sum	1		
1.3.5	Maintenance of setting out of the works by a qualified surveyor	Sum	1		
1.3.6	Contracts Manager/ Contractor's Representative : Office and Site based	Sum	1		
1.3.7	Health, Safety and Environmental Officer	Sum	1		
1.3.8	Site Supervisor / Planner : Office and Site based	Sum	1		
1.3.9	Site Agent and SHE Representative: Site based	Sum	1		
1.3.10	Comply with SHEQ requirements by Safety Officer e.g. regular review and update of Health and Safety File	Sum	1		
1.3.11	Site offices cost , including ablution facilities, site administration, transport, accommodation etc.	Sum	1		
1.3.12	Coordination and working together with other Contractors / Sub-Contractors / Nominated Sub-Contractors	Sum	1		
1.3.13	Periodic medical, fitness and induction costs	Sum	2		
1.3.14	Security for site camp and work on site	Sum	1		
1.3.14	Local labour management cost for:	Sum	1		
1.3.14.1	Overhead cost to manage SMME's that will execute a portion of the contract (30% of labour portion)	Sum	1		
1.3.14.2	Community Liaison Officer (R 5000.00 p/month)	Sum	1		
1.3.14.3	Community liaison and communication	Sum	1		
1.3.14.4	Community and Labour desk for community liaison, communication, to receive complaints and enquiries, and				
	proactively manage relations	Sum	1		
1.3.14.5	Employment of local people for the duration of the project (R 5000.00 p/month per worker)	Sum	1		
1.3.14.6	Training of semi-skilled labourers	Sum	1		
1.3.14.7	Management of local labourers	Sum	1		

ITEM	DESCRIPTION	UNIT	QTY	UNIT RATE	TOTAL
1.4	**COMPLY WITH THE FOLLOWING SHEQ REQUIREMENTS- TIME RELATED**				
1.4.1	Monthly adherence to Construction Regulations of the OHS Act	Sum	1		
1.4.2	Monthly review and update the Health and Safety Plan (H & S Plan)	Sum	1		
1.4.3	Monthly review and update the Risk Assessment for activities (RA)	Sum	1		
1.4.4	Monthly review and update the Environmental Management Plan (EMP)	Sum	1		
1.5	**ITEMS NOT COVERED ELSEWHERE**				
1.5.1	Servitude compensation	PC	0		
1.5.2	~~Town planner - servitude registration process~~	PC	0		
1.5.3	~~Pr. Land Surveyor - servitude registration at S.G.~~	PC	0		
1.5.4	~~Attorney - servitude registration on deed~~	PC	0		
1.5.5	~~Servitude compensation~~	PC	0		
1.5.6	~~Standing time compensation for local labour~~	PC	0		
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES				

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
2	**BULK EARTHWORKS**	**SANS 1200**					
2.1	**GENERAL**						
2.1.1	Before starting the work the Contractor is to satisfy himself as to the accuracy of the Engineer's drawings.						
	All calculations will be based on this unless notified prior to site clearance and excavations commencing.	1200 A	Sum	1			
2.2	**SITE CLEARANCE AND PREPARATION**	1200 D					
2.2.1	Allow for clearing the areas and scarifying for trenches, ponds and roads of all grass, weeds, shrubs, trees						
	trunks not exceeding 150 mm girth, builder's rubble, premix, etc., including grubbing up all roots, scoffing up						
	as required and carting away of all vegetation and debris.		m²	1160			
2.2.2	Remove topsoil to nominal depth of 200 mm, stock pile and maintain. Stock pile site to be determined by						
	Contractor.		m²	0			
2.2.3	Remove topsoil to a nominal depth of 600mm and dispose within a free haul distance of 5km		m²	0			
2.2.4	Remove and grub large trees and tree stumps and spoil off site of girth of over 150 mm and up to 2 m		Sum	0			
2.2.5	Remove and grub large trees and tree stumps and spoil off site of girth of over 2 m and up to 3 m		Sum	0			
2.2.6	Remove and grub large trees and tree stumps and spoil off site of girth of over 3 m		Sum	0			
2.2.7	Remove redundant foundations present on site.		Sum	1			
2.3	**BULK EXCAVATIONS**	1200 D					
	Note: Contractors are to note that the prices for the bulk excavations are to include for the formation of						
	buttered banks required for lateral support and for ramps for the removal of excavated material and shall						
	also include for all tests required.						
2.3.1.	Bulk excavation and **dispose** within a free haul distance of 5 km, in all materials.		m³	627			
2.3.2	Bulk excavation and stockpile for use as backfill (150mm layer of insitu material).		m³	208			
2.4	**EXTRA OVER BULK EXCAVATION**						
2.4.1.	Intermediate excavation		m³	50			
2.4.2	Hard rock excavation		m³	50			
2.4.3	Boulder excavation Class A		m³	50			
2.4.4	Boulder excavation Class B		m³	50			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
2.5	**SPECIAL WATER CONTROL**						
2.5.1	Allow for keeping excavations free of water for the duration of the contract.		Sum	1			
2.6	**BULK BACKFILL & IMPORTING OF MATERIALS FROM COMMERCIAL SOURCES (INCL.**	8.3.4a					
	HAULING)						
	Substation Platform						
2.6.1	Selected 400mm x 500mm "Building Sand" for earth grid.		m³	144			
2.6.2	Selected Grade G5 material stabilized, including 3% cement, compacted in layers 150mm thick to 98%						
	Mod AASHTO to a moisture content of +-2% of optimum, including MOD tests on the material to be						
	used and submitted for the engineer's approval (Measured tight). [IMPORT]		m³	198			
2.6.3	Selected Grade G5 material compacted in layers 150mm thick to 96% Mod AASHTO to a moisture content						
	of +-2% of optimum, including MOD tests on the material to be used and submitted for the						
	engineer's approval (Meausured tight). [IMPORT]		m³	198			
2.6.4	Selected Grade G6 material compacted in layers 150mm thick to 93% Mod AASHTO to a moisture content						
	of +-2% of optimum, including MOD tests on the material to be used and submitted for the						
	engineer's approval (Measured tight). [IMPORT]		m³	198			
2.6.5	Rip and recompact 150mm insitu material to 90% Mod AASHTO. [BACKFILL INSITU STOCKPILE]		m³	198			
	Roadway						
2.6.6	Selected Grade 3 wearing course material, compacted in layers 150mm thick to 98% Mod AASHTO						
	to a moisture content of +-2% of optimum, including MOD tests on the material to be used and						
	submitted for the engineer's approval (Measured tight).		m³	10			
2.6.7	Selected Grade G5 material compacted in layers 150mm thick to 96% Mod AASHTO to a moisture content						
	of +-2% of optimum, including MOD tests on the material to be used and submitted for the						
	engineer's approval (Meausured tight).		m³	10			
2.6.8	Selected Grade G5 material compacted in layers 150mm thick to 93% Mod AASHTO to a moisture content						
	of +-2% of optimum, including MOD tests on the material to be used and submitted for the						
	engineer's approval (Measured tight).		m³	10			
2.6.9	Rip and recompact 150mm insitu material to 90% Mod AASHTO		m³	10			
2.7	**GABIONS AND PITCHING**						
	Supply and install complete as per manufacturers specification-stone pitching or precast blocks or similar						
2.7.1	For embankment erosion control / light (grouted) pitching		m²	0			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
2.8	**TOP SOILING**						
2.8.1	Using material from stockpiles and placing 150 mm layer topsoil on embankments before grassing.	8.3.10a	m³	0			
2.8.2	Spoil remaining of stock pile material. Spoil site to be determined by Contractor.		m³	0			
2.8.3	Top layer of 25mm stone dolomite or granite, 150mm thick layer.		m³	208			
2.9	**TRANSPORT**						
	Disposal of burden to a site identified by the Contractor.						
2.9.1	Limited haul		m³	627			
2.9.2	Long haul		m³	50			
2.10	**ADDITIONAL TESTS REQUESTED BY THE ENGINEER**						
	The Contractor is to allow in his rates for all density tests required to comply with relevant specifications and						
	drawings and in order to ensure that the required densities are obtained. The Contractor shall only be paid						
	under the following items for test over and above the required tests as specified by the Engineer to be done						
	by an independent laboratory.						
2.10.1	DCP - Dynamic Cone Penetrometer test to be done on substation platform. Positions to be indicated by		Each	4			
	the Engineer						
2.11	**EXCAVATION / BACKFILL**						
2.11.1	Excavate all materials for trenches, backfill, compact and dispose of surplus material.		m³	20			
2.11.2	Excavate and dispose of unsuitable material in trench bottom		m³	20			
2.11.3	Grassing		m³	0			
2.12	**HERBICIDES**						
2.12.1	Application of Herbicides and Pesticides over the complete terrace (After terrace completion, during						
	construction, before hand over and before lapse of 12 month maintenance period).		Each	4			
2.12.2	Application of Herbicides and Pesticides over all gravel roads		Sum	1			
2.13	**SITE SURVEY**						
2.13.1	As-built survey of the entire substation c/w foundation levels and section levels.		Sum	1			
2.14	**ACCESS ROAD GRADING**						
2.14.1	Grading of the existing access road - for ease of access to the site.		m	150			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
3.1	**INSTALLATION OF EARTH GRID**	VE9335-6-EARTH					
	METHOD: Earth grid to be excavated and installed when the terrace / platform is 600 mm below finished						
	level. Grid to be clearly marked with reference pegs following the installation. Tails to be marked and						
	protected during backfilling of terrace layers.						
3.1.1	Setting out and maintaining of longitudinal and transverse stakes indicating earth grid layout & level		Sum	1			
3.1.2	Performing cross-cuts to determine the position of the existing substation earth grid		Sum	1			
3.2	**SUPPLY AND INSTALL COMPLETE EARTH GRID**						
	Note: Copper quantified is for the earth grid only, and not for the earthing of the hold-down bolts. Copper						
	for holding down bolts to be priced and allowed for with the foundations.						
3.2.1	10 mm dia. round Copper main earth grid 1 m below final level.	D-DT-5240	m	600			
3.2.2	10 mm dia. Copper equivalent CAMO CCS		m	280			
3.2.3	150 mm² Copper Equivalent CAMO CCS		m	0			
3.2.4	50 mm x 3 mm flat copper for earth tails connected to the earth grid and equipment foundation and all						
	building and foundation reinforcing as shown on drawing VE9335-6-EARTH	D-DT-5240	m	81			
3.2.5	50 mm x 3 mm flat copper for earth tails to the fence and fence corner gate post (CGP).	D-DT-5240	m	12			
3.2.6	run						
	in the cable trench / cable rack.	D-DT-5240	m	0			
3.2.7	50 mm x 3 mm flat copper for earthing and earth-tails for equal potential foot plates.	D-DT-5240	m	13			
3.2.8	Sacrificial earth anode	D-DT-5240	Each	0			
3.2.9	1 x 16 mm dia, 2 m deep earth spike		Each	0			
3.2.10	2 x 16 mm dia, 2 m deep earth spike in a 100 mm predrilled hole and backfilled with conductive concrete						
	(provisional)		Each	10			
3.2.11	2 x 16 mm dia, 30 m deep earth spike in a 100 mm predrilled hole and backfilled with conductive concrete						
	(provisional)		Each	6			
3.2.12	1 x 10 mm dia, 5 m deep earth rod in a 200 mm predrilled hole and backfilled with a Bentonite slurry mixture						
	(provisional)		Each	18			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
3.2.13	Transformer earthing, 80 mm x 6 mm galvanised steel earth strap (to be measured and bent on site)	D-DT-5232	m	8			
3.2.14	Insulated Earth 10 mm Round to earth bar inside buildings (to pass through Roxtec seals)		m	0			
3.2.15	Equal potential foot plate		Each	9			
3.3	**JOINTS AND BONDING - ALL FOUNDATION COPPER TO MAIN EARTH GRID**						
3.3.1	Main earth grid bonding 10 mm round to 10 mm round.	D-DT-5240	Each	127			
3.3.2	Main earth bonding to earth tails diameter 10 mm to 50 x 3 mm flat.		Each	94			
3.3.3	Flat tail bonding 50 x 3 mm to 50 x 3 mm (foundations).	D-DT-5240	Each	83			
3.3.4	Flat tail bonding 50 x 3 mm to equal potential foot plates.	D-DT-5240	Each	13			
3.3.5	Flat tail bonding 50 x 3 mm to fence and corner gate post.		Each	11			
3.3.6	Main earth bonding to the existing substation earth grid.		Each	20			
3.4	**EXCAVATION & BACKFILL**						
	After the substation terrace is excavated to -600mm, then 400mm wide trenches shall be excavated to						
	-1100mm for the earth grid installation at -1000mm.						
	Excavate, backfill and compaction of trenches for Earthgrid (Earth grid level 1100mm below finished						
	substation level) for:						
3.4.1	i) 10 mm round copper.		m	660			
3.4.2	ii) 50 mm x 3 mm flat copper		m	75			
3.4.3	ii) Excavate and backfill of imported soil for earthing.		m	66			
3.5	**Design and Testing**						
	It is the responsibility of the Substation Contractor to test the earth grid resistance on completion of the earth						
	mat.						
3.5.1	The results shall be certified by an independent third party and compared to the design values.		Sum	1			
3.5.2	Investigation and recommendation by specialist if earth resistance measures > 1 Ω		Sum	1			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
4	**STEEL FENCING**						
4.1	**SUBSTATION FENCING (NEW)**						
	Supply and install new diamond-mesh and electrical substation fence (2.4m high fence).						
	All binding/strain wire and required nuts/bolts/washers to be supplied with the fence.						
4.1.1	Galvanised posts, taper locking post including locking recess mechanism, posts sealed with a UV stabilized						
	polymer cap. (3.6 m high, tapering 85 mm to 45 mm, with depth of 85 mm).		Each	0			
4.1.2	Posts for safety fence (2.4m) (Intermediate Post)	D-DT-5237s5A	Each	11			
4.1.3	Posts for safety fence (2.4m) (Corner Post)	D-DT-5237s5A	Each	1			
4.1.4	Diamond mesh fence class A (1.8 m high).	D-DT-5237s5A	m	80			
4.1.5	Razor wire flat wrap - 500mm class A (*meters of fence to cover*)	D-DT-5237s5A	m	80			
4.1.6	Diamond mesh (1.8m high) security gate - 5m (*including gate post and post struts*)	D-DT-5237s5A	Each	3			
4.1.7	Diamond mesh (1.8 m high) pedestrian swing gate *(including gate post and post struts)*	D-DT-5237s5A	Each	0			
4.1.8	Fence anti-tunnelling (*excludes area underneath 5m security gates*)	D-DT-5237s5A	m	65			
4.1.9	Fence curbing	D-DT-5237s5A	m	85			
4.2	**SUBSTATION FENCING (EXISTING)**						
	Remove the portion of the existing fence.						
4.2.1	Remove the existing fence, posts and curbing as indicated.	VE9335-6-GA	m	65			
4.2.2	Modify existing corner post to strainer post (*for the construction of the new fence from the existing fence*)		Each	2			
4.2.3	Remove the existing security gate - 5m		Each	3			
4.2.3	Delivery of removed fence & gate to Vaalpark CNC		Each	3			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
5	**CIVIL WORKS**	**SANS1200**					
5.1	**GENERAL**						
5.1.1	Before starting the work the Contractor is to satisfy himself as to the accuracy of the Engineer's drawing.						
	All calculations will be based on this unless notified prior to site clearance and excavations commencing.	1200 A	Sum	1			
5.2	**FOUNDATIONS / PLINTHS**	1200LC					
	Excavate, dispose of burden within free haul distance of 5km, backfill, compaction, supply and cast complete						
	concrete foundations with holding down bolts, fdn, with holding down bolts, fdn, internal earthing and earth						
	connections detailed in the drawings, Rates for concrete to include for taking concrete to include for taking						
	concrete samples and obtain test certificates for 9,14 & 28 days. General rules applicable to casting of						
	concrete: cast below 35°C; use steel shuttering as far as possible, use slow curing concrete; use low shrinking						
	concrete. Concrete maximum shrinkage, stress and modules of elasticity obtainable from the specification.						
	Only steel shuttering may be used						
5.2.1	132kV Isolator Support Foundation (Type 3) (2.4m Phase Spacing)	5202s1e	Each	3			
5.2.2	Tube Busbar Supt. Fdn. 132kV	5208s1	Each	6			
5.2.3	132kV Circuit Breaker Foundation (Type 2)	5200s1C	Each	1			
5.2.4	Med. Equip. Supt. Foundation For Current Transformer	5206s1	Each	3			
5.2.4.1	Standard Transformer Plinth 5-20MVA	5231s1	Each	1			
5.2.4.2	Standard Transformer Slipway As Per D-DT	5231s1 &					
		VE9335-6-FDN	Each	1			
5.2.4.3	Standard Self Contained Oil Containment Area	5232s2B	Each	1			
5.2.5	NEC/NER/Aux TRFR 33/22/11kV Foundation	5207s1b	Each	1			
5.2.6	6.6kV-44kV Post Insulator Support Fdn	5221s1	Each	2			
5.2.7	Bkr. 22kV Foundation Details	5214s1a	Each	3			
5.2.8	Isolator 22kV Supt Foundation	5205s1	Each	7			
5.2.9	Column Supt. Foundation	5223s2	Each	6			
5.2.10	Med. Equip. Supt. Foundation (132kV CT)	5206s1	Each	3			
5.2.11	Med. Equip. Supt. Foundation (22kV VT)	5206s1	Each	1			
5.2.12	Lighting-Lightning Mast 21 M Tubular Support Foundation (1 x Provisional)	5217s6	Each	3			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
5.2.13	Yard AC Distribution Board Support	5276s1A	Each	1			
5.2.14	Steel Templates For The Above Holding Down Bolts - To Be Approved Prior To Foundation Construction		Sum	1			
5.2.15	Lighting-Lightning Mast 14 M Tubular Support Foundation (Provisional)	5217s1B	Each	3			
5.3	**CABLE DUCTS AND COVERS**	1200LC					
	Excavate, dispose of burden within free haul distance of 5km, backfill, compaction, supply and cast/erect						
	complete concrete walls c/w covers detailed in the drawings (NOTE: Brick built trench walls will not be						
	considered or accepted, 1.2m.K/W bedding to be used for power cables						
5.3.1	Complete 750 mm wide cable trenches as per drawing	5254s5A	m	47			
5.3.2	Complete 1500 mm wide cable trenches for T-type section complete with braces and kerbing	5254s5H	Each	2			
5.3.3	Complete LV Cable Road Duct 6-Pipe (complete with facebrick walls, covers, concrete slope, etc.)	5254s3C	Sum	1			
5.3.4	Bedding test certificate (1.2m.K/W)		Sum	1			
5.3.5	**Extra over 750mm wide cable trench for:**						
5.3.5.1	Closed end		Each	2			
5.3.6	**Extra over excavations for:**						
5.3.6.1	Intermediate excavation		m^3	1			
5.3.6.2	Hard rock excavation		m^3	1			
5.4	**FENCE/GATE FOUNDATION AND CURBING**						
5.4.1	Fence Foundations - Welded Mesh	5237s5A	Each	12			
5.4.2	Gate Concrete Foundation	5237s3	Each	3			
5.4.3	Remove the existing fence curbing and anti-tunneling.		m	83			
5.4.4	Remove existing gate ramp foundations		Each	3			
5.5	**ROAD CURBING**						
5.5.1	Substation road curbing	5254s2B	m	40			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
6	**FACILITIES**						
6.1	**REPAIRS TO EXISTING 88 kV CONTROL ROOM**						
6.1.1	Supply and installation of plasterboard ceilings in existing control room.		m²	22			
6.1.2	Supply and installation of new fluorescent light fixture and tubes (2 x 5ft tubes, 58W per tube)		ea	1			
6.1.3	Relocation of the existing control room DB.		ea	1			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
7	**ERECTION OF STEELWORK**						
	Equipment Support - Manufacture, supply and install equipment support for the following:						
	Manufacture, supply and install equipment support for the following:						
	Isolator 132kV 2500A 25kA Bull - Bussection	**4630s1**					
7.1	Isolator Std 132kV Manual Lattice Support - 2.4m Phase Crs	5202s2K	Each	2			
	Non Extendable Busbar 132kV Onto Bussection	**4655s2**					
7.2	66/132kV Tubular Busbar Support	5208s2	Each	6			
	Isolator 132kV 2500A 25kA Cent - Trfr Bay	**4623s1**					
7.3	Isolator Std 132kV Manual Lattice Support - 2.4m Phase Crs	5202s2K	Each	1			
	Breaker 132kV 3150A 40kA Cent	**4618s1**					
7.4	Circuit Breaker - 132kV Tubular Support Steelwork	5200s2a	Each	1			
	Current Transformer 132kV 2500A 25kA 2P2M2B	**4631s1**					
7.5.1	Medium Equipment Support Cap M1 Adjustable Fixing Centres	5206s5	Each	3			
7.5.2	Medium Equipment Support Steelwork 2.5m High	5206s3	Each	3			
	Transformer 88/22kV 10 MVA OLTC Cent To Bull	**4608**					
7.5.3	Transformer Aux Cable Rack (Max.)	5231s1C	m	8			
	NEC/NER/Aux Transformer 22kV 360A Bull	**4613**					
7.6	NECR'T/Aux. Trfr 6.6-22kV Lattice Support - 1.5m	5207s2A	Each	1			
	22kV Road Crossing	**4801s1**					
7.7	1200 Phase Centres, High Level, Lipped Channel Support - Type A	5221s2	Each	2			
	Trfr Breaker 22kV 1250A 20kA Bull (Combo-Units) (CTB36 Outdoor CB With CT)	**5216**					
7.8	Bkr. 22kV Steel Support	5216s3B	Each	1			
	Isolator 22kV 2500A 25kA Bull - Transformer Bay	**4626s1**					
7.9	Isolator 22kV Supt.	5205s2A	Each	1			
	Mv Busbar 22kV Bull Basic Bay	**4755s3**					
7.10	Mv Box Structure Standard Steelwork (Without Busbar/Bay Isolator Channels)	5223s6	Each	1			
	Mv Busbar 22kV Bull Ext Bay	**4755s4**					
7.11	Mv Box Structure Standard Steelwork (Without Busbar/Bay Isolator Channels)	5223s6	Each	1			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
	Isolator 22kV 2500A 25kA Bull - Bussection	**5223s6**					
7.12	Isolator 22kV Supt.	5205s2A	Each	1			
	Isolator 22kV 2500A 25kA Centipede - Breaker Isolator	**5223s6**					
7.13	Isolator 22kV Supt	5205s2	Each	2			
	Fdr Breaker 22kV 1250A 20kA Centipede (Combo-Units) (CTB36 Outdoor CB With CT)	**5216**					
7.14	Bkr. 22kV Steel Support	5216s3B	Each	2			
	Isolator 22kV 2500A 25kA Centipede - Feeder Isolator	**4626s1**					
7.15	Isolator 22kV Supt	5205s2	Each	2			
	Voltage Transformer 22kV/110V	**OEM**					
7.16.1	Medium Equipment Support Cap M1 Adjustable Fixing Centres	5206s6	Each	1			
7.16.2	Medium Equipment Support Steelwork 2.5m High	5206s3	Each	1			
	Ac Yard Board						
7.17	Yard Ac Db Steel	5276s2A	Each	1			
	Substation Lighting Mast 21m						
7.18	Lighting-Lightning Mast 21m Tubular Support Steelwork (1 x Provisional)	5217s2E	Each	3			
	Steel Fire Barrier						
7.19.1	Steel Fire Barrier - Module A & B	5218s2A	Each	2			
7.19.2	Steel Fire Barrier - Lattice Support	5218s2A	Each	3			
	Provisional Substation Lighting Mast 14m						
7,19	Lighting-Lightning Mast 14m Tubular Support Steelwork (Provisional)	5217s2D	Each	3			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
8	**INSTALLATION OF EQUIPMENT**						
8.1	**SUPPLY, INSTALLATION AND COMMISSIONING OF THE FOLLOWING EQUIPMENT**						
	(Tenderer to allow for cost of commissioning by the OEM or accredited agency):						
8.1.1	Isol 132kV 2500A 25kA CRDB H/O 31mm (2.4m Phase Spacing)	6150s1	Each	3			
8.1.2	Circuit Breaker 132kV 3150 40kA 3P, 31mm/kV	6250	Each	1			
8.1.3	CT 132kV 2500A 40kA 2P2M2B (500)	6190s1	Each	3			
~~8.1.4~~	~~88 kV / 110V Voltage Transformer 100VA.~~	~~D DT 6171~~	~~Each~~	~~0~~			
8.1.5	Transformer 10MVA 88/22kV OLTC Ynd1, 31mm/kV	6128	Each	1			
8.1.6	NEC/NER/AUX Transformer 22kV 360A 100kVA 22kV/420/240V 31mm/kV	6141	Each	1			
8.1.7.1	CTB36 Outdoor Vacuum CB	6252	Each	3			
8.1.7.2	Composite CT - 1200/800/200/1A Class 0.2	OEM	Each	9			
8.1.7.3	22kV Surge Arrestor & Assembly	0261s1	Each	9			
8.1.8	Isolator 22kV 2500A 25kA CRDB H/O 31mm/kV	6154s2	Each	6			
8.1.9	22kV MV Bull Basic Bay Equipment (Clamp Pistol, Long Rod Insul, Line Post Insul Etc.)	4755s3	Each	1			
8.1.10	22kV MV Bull Ext Bay Equipment (Clamp Pistol, Long Rod Insul, Line Post Insul Etc.)	4755s4	Each	1			
8.1.11	VT 1 Ph 22kV/110V 100/50VA	6173	Each	3			
8.1.12	Ac Yard Board	11200	Each	1			
8.1.13	Insul Post Stn 132kV	6230	Each	6			
8.1.14	Insul Post Stn 22kV	6235	Each	6			
8.1.15	S/Arr S/Cl 88kV MCOV 56kV	6211	Each	3			
8.1.16	S/Arr S/Cl 22kV MCOV 24kV	6215	Each	12			
8.1.17	S/Arr S/Cl 66kV MCOV 48kV	6212	Each	1			
8.2	Testing And Commissioning By Oem On Site						
8.2.1	132 kV Isolator		Sum	3			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
8.2.2	132 kV Current Transformer		Sum	1			
8.2.3	132 kV Circuit Breaker		Sum	1			
8.2.4	88/22 kV Power Transformer		Sum	1			
8.2.5	22 kV NECR/T		Sum	1			
8.2.6	22kV Outdoor Circuit Breaker With Current Transformer		Sum	3			
8.2.7	22kV Isolator		Sum	6			
8.2.8	22kV Voltage Transformer (1 X New & 1 X Existing)		Sum	6			
8.2.9	Yard AC Distribution Board And Interface Box		Sum	1			
8.3	**FACTORY ACCEPTANCE TEST (FAT)**						
	Provision For Three (3) Engineer And Three (3) Employer Representatives And One (1) Contractor						
	Representatives To Witness FAT At Manufacturer As Specified In Clause 1.4 (L) For The Following						
	Equipment:						
8.3.1	10 MVA 88/22 kV Ynd1 Transformers I		Sum	1			
8.3.2	22 kV NEC Transformer		Sum	1			
8.4	Clamp Assemblies, Stringing, Stranded Conductor & Tubular Conductor						
	Supply And Install The Following Which Must Be Capable Of Carrying 650 A:						
8.4.1	Clamp, Tube TBSS 120/127	6118s1	Each	3			
8.4.2	Clamp, Tube TBC 120/120	6116	Each	3			
8.4.3	Clamp B/Comp 26.5mm-38mm 0Dg EXC-B (KC2)	6006s2	Each	18			
8.4.4	Clamp Peg Al Cent 26.5mm EPC-26	6115s1	Each	18			
8.4.5	Clamp B/Comp 26.5mm Palm 0Dg EPC-A	6018	Each	15			
8.4.6	Clamp B/Comp 26.5mm Palm 45Dg EPC-B	6018	Each	3			
8.4.7	Clamp Cross 26.5mm - 26mm K2 EX-B	6002s2	Each	6			
8.4.8	Clamp B/Comp 26.5mm-26mm 0Dg EXC-A (KC1)	6006s1	Each	3			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
8.4.9	Clamp B/Comp 38.3mm-38mm 0Dg EXC-C (KC3)	6006s3	Each	9			
8.4.10	Clamp Cross 16.3mm - 38mm K3 EX-C	6002s3	Each	6			
8.4.11	Clamp T/Comp 26.5mm - 38.3mm 0Dg	6010s4	Each	6			
8.4.12	Lug Al Hornet 1B M12 0Dg	3074s1	Each	6			
8.4.13	Clamp T S/Comp TBCT-120/38C1 0Dg	6090	Each	9			
8.4.14	Clamp Bus Coupler TBFC120-76	6086s1	Each	3			
8.4.15	Clamp Bus Coupler TBSC120-76	6086s2	Each	3			
8.4.16	End Cap TBEC 120 With F/Clamp	6040s2	Each	6			
8.4.17	End Cap TBEC 120 Plain No F/Clamp	6040s1	Each	6			
8.4.18	Clamp B/Comp 38.3mm Palm 0Dg EPC-D	6018s3	Each	6			
8.4.19	Clamp B/Comp 38.3mm - 38mm 45Dg EXC-E (Kc4)	6006s4	Each	18			
8.4.20	Clamp Peg Al Bull 38.3mm EPC 38	6115	Each	18			
8.4.21	Clamp T/Comp 38.3mm - 38.3mm 0Dg TC10	6010s2	Each	6			
8.4.22	Clamp Tub Tap-Off TBTC 120/C1-26	6119	Each	6			
8.4.23	Clamp Bus Coupler TBFC 120-127	6086s2	Each	6			
8.4.24	Clamp T S/Comp TBCT 80/38C1 45Dg	6090s2	Each	3			
8.4.25	Clamp Cross 26.5mm - 38mm K4 EX-C	6002s3	Each	3			
8.4.26	Clamp B/Comp 26.5mm-38mm 45Dg EXC-F	6006s3	Each	18			
8.4.27	Clamp EUT-C 18.8mm - 26.5mm (Chicadee-Centipede)	6099	Each	6			
8.4.28	Clamp EUT-D 26.5mm - 18.1mm (Centipede-Hornet)	6099	Each	6			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
8.5	Miscellaneous Assemblies						
8.5.1	Clevis Ball 16mm IEC 120kN	6059s1	Each	21			
8.5.2	Sock Tongue 16mm IEC 120kN	6061s1	Each	15			
8.5.3	Ball Joint For Portable Earth 20kA	6081s1	Each	57			
8.5.4	Bracket, Control Cable	6065s1	Each	11			
8.5.5	Clamp Cover Acrylic ACC4	6055s1	Each	3			
8.5.6	Putty, Scotchfill 38mm W Roll	6292s1	Each	9			
8.5.7	Tape, Elect Epr 18W X 0,76 Thk	6292s1	Each	15			
8.6	**STRINGING, STRANDED CONDUCTOR & TUBULAR CONDUCTOR**						
	Supply and install the following tube and conductor:						
8.6.1	22kV Road Crossing- Aluminium Tube 120 x 4 mm x 10 m.	6000s1	Each	3			
8.6.2	132 kV Busbar - Aluminium Tubes, 120 x 4 mm thick x 10 m lengths excl. Centipede vibration damping.	6000s1	Each	3			
	Centipede vibration damping measured in 8.6.3.						
8.6.3	Stringers and droppers - Hornet		m	26			
8.6.4	Stringers and droppers - Centipede		m	104			
8.6.5	Stringers and droppers - Centipede Insulated		m	82			
8.6.6	Stringers and droppers - Bull		m	98			
8.6.7	Stringers and droppers - Bull Insulated		m	32			
8.7	**PORTABLE EARTH**						
8.7.1	Supply portable earths suitable for earth balls.		Set	0			
8.7.2	Supply link stick		Set	0			
8.8	**EQUIPMENT LABELLING**						
8.8.1	Supply and install outdoor equipment labels (chromadek c/w bolts, brackets etc).	5047	Each	12			
8.8.2	Supply and install phase identification disks (Blue/Red/White).	5047	Each	36			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
8.9	**PIPES**						
8.9.1	Supply and install µPVC pipes, 50 mm diameter for lighting circuits		m	60			
8.9.2	Supply and install nextube pipes, 110 mm diameter for transformer bays		m	0			
8.10	**LIGHTING / LIGHTNING MASTS**						
	Supply and install the following:						
8.10.1	FLOODLIGHT LED 90W, 10 800 LM, 120LM/W, FLT conforming to Eskom Standard 240-113163905.	6009s1	Each	9			
	Note: All masts to be supplied complete with wiring and circuit breaker etc. as per drawing.						
8.10.2	FLOODLIGHT LED 60W, 7 200 LM, 120LM/W, FLT conforming to Eskom Standard 240-113163905.	6009s1	Each	9			
	Note: All masts to be supplied complete with wiring and circuit breaker etc. as per drawing. (Provisional)						
8.10.3	Supply, make off and install 4c x 10 mm² cable for lighting		m	80			
8.11	**LABELS**						
	Supply and install the following signs to security fence:						
8.11.1	Prohibitive		Each	4			
8.11.2	Unauthorised Entry and Interfering		Each	6			
8.11.3	Hard hat area		Each	3			
8.11.4	Substation name & owner at all new gates "ESKOM 88/22 kV Vaaldam Substation"		Each	3			
8.11.5	Gate number		Each	3			
8.11.6	In case of Emergency		Each	4			
8.11.7	Equipment Label, size: Label 3 as per Eskom D-DT	5047	Each	6			
8.11.8	Equipment Label, size: Label 4 as per Eskom D-DT	5047	Each	6			
8.11.9	Equipment Label, size: Label 5 as per Eskom D-DT	5047	Each	108			
8.12	**CLOSING SPAN**						
8.12.1	Supply and install the closing spans from the existing Themba Khubeka OHL (double circuit Chickadee) to the		Each	2			
	substation 22kV feeder bays.						
8.13	**TEMPORARY CONNECTION REMOVAL**						
8.13.1	Remove the temporary connection between the Themba Khubeka OHL and the "Gevangenis" feeder line.		Sum	1			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
9	**CONTROL CABLE WORK**						
	Supply, installation and commissioning of the following control cables:						
9.1	**CABLE LAYING**						
9.1.1	Cable 1 kV 4c 2,5 mm² Armoured (No 3)		m	420			
9.1.2	Cable 10 Pair Telecommunication Cable (CW1308)		m	80			
9.2	**CABLE MAKE OFF**						
	Supply, making off and commissioning of cable ends.						
9.2.1	Cable 1 kV 4c 2,5 mm² Armoured (No 3)		Each	12			
9.3	**TESTING AND COMMISSIONING**						
9.3.1	Megger testing of all LV cables before energising and confirming their destination		Sum	1			
9.4	**CONTROL PANELS (INDOOR SWING FRAME)**						
	Design, supply, install and commission panels as follows.						
9.4.1	88/22 kV Transformer Protection and Tap Change Panel - 48U swing frame panel with 4TM7101	D-DT-5413	Each	1			
	transformer protection scheme & 4TC5200 tap-change scheme.						
9.4.2	Underfrequency and Feeder Protection panel - 48U swing frame panel pre-wired to move existing under-	D-DT-5413	Each	1			
	frequency relay to new panel. Panel also to house two (2) x rural feeder protection schemes 4RF1100.						
9.5	**METERING PANEL (TARIFF AND STATISTICAL)**						
	Tariff and Statistical metering panel including all accessories as specified as follows:						
9.5.1	Metering Panel - 48U swing frame panel to house: 1 x Main Tariff meter & 1 x Check Tariff meter per		Each	1			
	rural feeder (2 x feeders). Panel also to house: 1 x Transformer statistical meter. All meters to be class 0,5s,						
	Elster A1700.						
9.6	**OTHER EQUIPMENT**						
9.6.1	AC Yard Board according drawing D-DT-11200 including 1 x chop over systems with distribution						
	equipment		Each	1			
9.6.2	Junction box VRW20 with CT insert	D-DT-5406	Each	1			
9.6.3	Junction Box VRW20 with VT insert	D-DT-5406	Each	1			
9.6.4	Interface Junction Box		Each	1			
9.6.5	All ancillary equipment/control wiring to interface existing new panels to existing D20 SCADA controller.		Each	1			

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
9.6.6	Replace missing 1 x VN95 cell in BTU.		Each	1			
9.7	**FACTORY ACEPTANCE TEST (FAT)**						
	Provision for three (3) Engineer and three (3) Employer Representatives and one (1) contractor						
	representatives to witness FAT at manufacturer for the following equipment:						
9.7.1	88/22 kV Transformer Protection and Tap Change Panel		Sum	1			
9.7.2	Underfrequency and Feeder Protection Panel		Sum	1			
9.7.3	Metering Panel		Sum	1			
9.8	**TESTING AND COMMISSIONING BY OEM ON SITE**						
9.8.1	Transformer Protection and Tap Change panel. Test of protection relays to be done with Omicron Testing						
	Equipment as per Eskom requirements.		Sum	1			
9.8.2	Underfrequency and Feeder Protection panel. Test of protection relays to be done with Omicron Testing		Sum	1			
	Equipment as per Eskom requirement.						
9.8.3	Metering Panel		Sum	1			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
10.1	**TRAINING**						
10.1.1	Elster A1700 Power Meter - Basic Training Course		Each	4			
10.1.2	CT Labs Vecto III QoS - Basic Training Course		Each	4			
10.1.3	ORHVS Training & Registration		Each	4			
10.1.4	SEL University: APP 101: Hands-On Introduction to SEL Relays		Each	4			
10.1.5	SEL University: TST 101: SEL Relay Testing Basics		Each	4			
10.1.6	SEL University: TST 103: SEL Feeder Relay Testing		Each	4			
10.1.7	SEL University: PROT 301: Protecting Power Systems for Technicians		Each	4			
10.1.8	SEL University: PROT 300: Symmetrical Components Theory and Application		Each	4			
10.1.9	SEL University: PROT 401: Protecting Power Systems for Engineers		Each	4			
10.1.10	SEL University: PROT 403: Distribution System Protection		Each	4			
10.1.11	SEL University: PROT 411: Substation Equipment Protection		Each	4			
10.1.12	SEL University: APP 751: SEL-751 Feeder Protection Relay		Each	4			
10.2	**AS BUILT INFORMATION**						
	Compile and submit comprehensive As Built manuals and drawings. (Information to be submitted in hard and						
	soft copy).		Each	1			
10.3	**SPARES**						
10.3.1	SEL 751 Directional Relay - Touchscreen		Each	1			
10.3.2	CT Labs Vecto III portable Quality-of-Supply meter complete with carry-case.		Each	2			
10.3.3	MOXA rackmount IEC61850 Ethernet switch: PT-7728-R-HV-HV		Each	1			
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES						

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL:
11.1	**POLE LENGTHS**						
	Supply, delivery to pole hole and planting of the following pole sizes: (Poles to be 63 Mpa strength and						
	creosote treated)						
11.1.1	9 m wood pole 180-200 mm dia top (Transformer)	0055	No	53			
11.1.2	11 m wood pole 180 - 200 mm dia top (MV 1733/1734/1735/1736)	0051	No	145			
11.1.3	11 m wood pole 180 - 200 mm dia top (MV 1730)	0051	No	117			
11.1.4	12 m wood pole 180 - 200 mm dia top (*Provisional*)	0053	No	2			
11.1.5	2.5 m wooden cross-arm (For transformer drop-out fuses)	0061	No	53			
11.1.6	2.5 m wooden cross-arm (Section links)	0061	No	15			
11.2	**MV STRUCTURES/ASSEMBLIES - NOTE INSULATION COORDINATION**						
	Supply and dressing of the following MV Structures.						
11.2.1	Intermediate assembly 0 deg delta 3 ph (600mm steel X-arm D-DT 0335 Sheet 2)	1730	No	117			
11.2.2	Strain assembly vertical 0 deg 3 ph	1733	No	7			
11.2.3	Strain assembly delta 1 - 60 deg 3 ph	1734	No	81			
11.2.4	Strain assembly delta 61 - 90 deg 3 ph	1735	No	18			
11.2.5	Terminal assembly delta 3 phase	1736	No	39			
11.2.6	Strain assembly H-Pole 1-60 deg 3 ph (provisional)	1763	No	0			
11.2.7	Section / Equipment links (solid / disconnector assembly)	1848	No	15			
11.2.8	Delta 3 ph T-off assembly from strain	1803	No	18			
11.2.9	H-pole transformer structure complete with Transformer platform, bolts, nuts, anti-climb barb wire, warning						
	labels, etc. (Poles, cross arm pole and transformers measured elsewhere).						
	Similar to D-DT1861 - See project drawing	VE9335-7-TRFR	No	53			
11.2.10	Complete Transformer "sample" assembly prior to construction	VE9335-7-TRFR	No	1			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL:
11.3	**MV STAYS / STRUTS**						
	Supply, dress and tension of the following MV stays / struts						
11.3.1	Conventional pole stay assembly 380 x 380 plate (2m stay rod) - note insulation co-ordination	0341	No	72			
11.3.2	Flying stay complete with pole (provisional)	0343	No	1			
11.3.3	10m wood strut for 9m pole & assembly (provisional)	0342	No	1			
11.3.4	12m wood strut for 11m pole & assembly (including anti-climbing barb wire)	0351	No	67			
11.4	**TRANSFORMERS**						
	Supply, installation, connection, testing and commissioning of the following:						
	Transformers as specified with surge arrestors						
11.4.1	Transformer general arrangement and assembly with all aux. equipment						
	(e.g. insulators, jumpers, S.A.'s etc.)	VE9335-7-TRFR	No	53			
11.4.2	22kV / 420 V - 100 kVA	3021	No	45			
11.4.3	22kV / 420 V - 200 kVA	3021	No	8			
11.5	**TRANSFORMER/LOAD BREAKS**						
	Supply, installation, connection, testing and commissioning of the following load breaks:						
11.5.1	Section links cut/out or disconnectors (solid links)	0293	Set	15			
11.5.2	Drop-out fuses 10 amp assembly with 10 amp fuses (2.5m wooden X-arm measured elsewhere)	0290	Set	45			
11.5.3	Drop-out fuses 20 amp assembly with 20 amp fuses (2.5m wooden X-arm measured elsewhere)	0290	Set	8			
11.5.4	LV Fuses Morsdorfers 160A (3 per set)	3182	Set	50			
11.5.5	LV Fuses Morsdorfers 315A (3 per set)	3182	Set	61			
11.6	**CABLE TERMINATIONS STRUCTURE**						
	Supply, installation, connection of the following cable termination structure, complete with surge arrestors,						
	100 mm dia x 2 500 mm galvanised kicking pipe and galvanised steel kite bracket suitable for cable make off						
11.6.1	22 kV, 10 kA surge arrestor for 120 mm2 Al	0852	Set	0			
11.6.2	22 kV, 10 kA surge arrestor for 95 mm2 Al	0852	Set	3			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL:
11.7	**EARTHING**						
	Supply and install a 3 point star earth for MV network - Consisting of 4 x 1,8 m x 16 mm copper						
	cladded steel earth rod as specified and subject to approval	0627	No	53			
11.7.1	Conductive concrete						
	Supply and install conductive concrete per 3 point star on all earth rods (subject to approval)		No	0			
	(provisional)						
11.7.2	Testing earth resistance		No	53			
11.7.3	Insulation coordination & bonding as per 03TB-34		Sum	1			
11.8	**CONDUCTORS**						
	Supply, stringing and tensioning of the following conductors:						
11.8.1	FOX (42,8 mm sq ACSR)	3136	m	38200			
11.8.2	MINK (73.6 mm sq ACSR)	3136	m	0			
11.9	**JOINTS**						
	Supply, jointing and tensioning of the following conductors:						
11.9.1	Full tension line splice for FOX ACSR		No	39			
11.9.2	Full tension line splice for MINK ACSR (subject to approval)		No	0			
11.10	**EXCAVATION**						
	Digging holes, backfilling and compaction to initial soil conditions for poles and anchors						
11.10.1	Holes for stays/struts 20 x 2 000						
11.10.1.1	Earth and soft rock		No	127			
11.10.1.2	Hard rock (compressor work)		No	64			
11.10.1.3	Hard rock (drilling)		No	5			
11.10.1.4	Blasting including over and extra		No	0			
11.10.2	Hole for 9 m trfr pole						
11.10.2.1	Earth and soft rock		No	53			
11.10.2.2	Hard rock (compressor work)		No	27			
11.10.2.3	Hard rock (drilling)		No	2			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL:
11.10.2.4	Blasting including over and extra		No	0			
11.10.3	Hole for 11 m trfr pole						
11.10.3.1	Earth and soft rock		No	53			
11.10.3.2	Hard rock (compressor work)		No	27			
11.10.3.3	Hard rock (drilling)		No	2			
11.10.3.4	Blasting including over and extra		No	0			
11.10.4	Hole for 11 m pole						
11.10.4.1	Earth and soft rock		m^3	262			
11.10.4.2	Hard rock (compressor work)		m^3	131			
11.10.4.3	Hard rock (drilling)		m^3	10			
11.10.5	Blasting including over and extra		No	0			
11.10.6	Bags of 50 kg cement added to backfill material as specified on Reticulation layout drawing		No	131			
11.10.7	Identify and expose water and sewer services by means off hand cross cut excavations		Lot	1			
11.11	**NUMBERING**						
11.11.1	Provide a pole number - 2 m above ground level with 15 mm punch on 60 mm x 80 mm x 1 mm						
	aluminium plate and fix with 2 x clout nails		Lot	1			
11.11.2	Transformer Numbering:						
	Number transformers on TRF pole - 2 m above ground level as follows:						
	"TRFR _ " Themba Khubeka and fix with 2 x clout nails:						
	Sheet metal, yellow painted with black letters - 50 mm x 350 mm						
	Letter size to be 28 mm x 15 mm		No	53			
11.11.3	Provide an additional pole number label - 2.5m above ground level out of Sheet metal, yellow painted with		No	262			
	black letters - 50mm x 350mm. Letter size to be 28mm x 15mm.						
11.12	**CABLE & AUXILIARY WORK AT SWITCHING STATION**						
	Supply, installation and commissioning of the following MV cable.						
11.12.1	95 mm^2, 3 core, Al, 12.7/22 kV PILC, FRPVC SWA		m	83			
11.12.2	120 mm^2, 3 core, Al, 12.7/22 kV PILC, FRPVC SWA		m	83			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL:
11.13	**MV CABLE ENDS**						
	Supply, making off and commissioning of cable ends equal or similar to Raytech outdoor type end.						
11.13.1	95 mm², 3 core, Al, 12.7/22 kV PILC, FRPVC SWA (indoor)		Set	3			
11.13.2	95 mm², 3 core, Al, 12.7/22 kV PILC, FRPVC SWA (outdoor)		Set	3			
11.13.3	120 mm², 3 core, Al, 12.7/22 kV PILC, FRPVC SWA (indoor)		Set	0			
11.13.4	120 mm², 3 core, Al, 12.7/22 kV PILC, FRPVC SWA (outdoor)		Set	0			
11.14	**CABLE TRENCH**						
	Excavation, backfilling and consolidation of cable trenches.						
11.14.1	Hard rock (compressor) - excavation and backfill		m	0			
11.14.2	Soft rock and soil - excavation and backfill		m	45			
11.14.3	Add a concrete slab, 800mm wide x 100mm deep, 250mm above cables in trench to improve cable		m	55			
	security. (On new feeder cables & existing incomer cables)						
11.15	**BEDDING**						
	Supply and installation of a 1.2 m.K/W bedding layer per running meter of soft sieved soil in trenches		m	45			
	as well as backfilling and consolidation as specified.						
11.16	**DANGER TAPE**						
	Supply and installation of danger tape to a depth of 300 mm.		m	45			
11.17	**CABLE TERMINATION**						
11.17.1	Supply and install a cable termination bracket including surge arrestors and auxiliaries	D-DT-0851	Each	3			
11.17.2	Improve cable termination security - fill galvanised kicking pipe with concrete.		Each	3			
11.18	**CABLE TESTING**						
	Perform the following tests and supply certificates:						
11.18.1	Factory testing of cables with certificates		Sum	1			
11.18.2	Bedding test certificates (three tests)		Sum	1			
11.18.3	Commissioning test certificates		Sum	1			
TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES							

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	CONTRACT TOTAL:
12.1	**POLE LENGTHS**						
	Supply and install the following 63 MPa, creosote treated wood poles						
12.1.1	7 m wooden pole 120 - 139 mm dia top (kicker pole)	0050	No	51			
12.1.2	9 m wooden pole 160 - 179 mm dia top	0055	No	818			
12.2	**LV STRUCTURES**						
12.2.1	Intermediate/Suspension (0 - 30 deg)	1100	No	520			
12.2.2	Strain assembly (0 - 60 deg)	1121	No	50			
12.2.3	Strain assembly (60 - 90 deg)	1122	No	89			
12.2.4	Terminal assembly	1120	No	300			
12.2.5	T-off assembly from intermediate	1140	No	58			
12.2.6	T-off assembly from strain	1142	No	19			
12.2.7	Cross intermediate-intermediate assembly	1141	No	9			
12.2.8	Cross intermediate-strain assembly	1143	No	1			
12.2.9	Complete pole top box and house connection "sample" assembly prior to construction		Lot	1			
12.3	**L V ANCHORS**						
	Supply, dress and tension the following LV stays / struts						
12.3.1	Conventional pole stay assembly (300 x 300 plate & 1.5m stay rod)	0341	No	405			
12.3.2	Flying stay complete with pole (*provisional*)	0343	No	1			
12.3.3	10 m wood strut for 9 m pole	0351	No	63			
12.4	**SERVICE CONNECTION BOXES**						
	Supply and install Pole Mounted Split Meter Box:						
12.4.1	1-2 way service dist pole top box (VE9335-7-PTB) (Allbro Alltilt)	3055	No	227			
12.4.2	1-4 way service dist pole top box (VE9335-7-PTB) (Allbro Alltilt)	3055	No	452			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	CONTRACT TOTAL:
12.4.3	1-6 way service dist pole top box (VE9335-7-PTB) (Allbro Alltilt)	3055	No	28			
12.4.4	40 A MCB, slow curve 1, 5 kA		No	2361			
12.4.5	LV lightning arrestor, Hy-mag clip in type SAL		No	2361			
12.5	**EXTRA EARTHING**						
12.5.1	Supply and install a 3 point star earth for LV network - Consisting of 4 x 1,8 m x 16 mm copper						
	earth rod as specified and subject to approval	0637	No	111			
12.5.2	Conductive concrete						
	Supply and install conductive concrete per 3 point star on all earth rods (subject to approval)		No	0			
12.5.3	Testing earth resistance		No	111			
12.6	**STRINGING**						
	Supply and stringing of the following aerial bundle conductor (ABC)						
12.6.1	3 x 35 mm sq aerial bundle conductor + bare neutral conductor	3141	m	10150			
12.6.2	3 x 70 mm sq aerial bundle conductor + bare neutral conductor	3141	m	14100			
12.7	**JOINTS (Subject to Approval)**						
12.7.1	35 mm sq ABC (4 core)		No				
12.7.2	70 mm sq ABC (4 core)		No				
12.8	**POLE NUMBERING**						
	Numbering of LV poles		No	869			
12.9	**EXCAVATION OF POLE HOLES**						
	Holes for stays and struts (12 x 1500 rod)						
12.9.1	Ground and soft rock		No	386			
12.9.2	Hard rock (compressor)		No	10			
12.9.3	Hard rock (drilling)		No	10			
12.9.4	Blasting including over and extra		No	0			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	CONTRACT TOTAL:
	Hole for 7 m pole						
12.9.5	Ground and soft rock		No	47			
12.9.6	Hard rock (compressor)		No	2			
12.9.7	Hard rock (drilling)		No	2			
12.9.8	Blasting including over and extra		No	0			
	Hole for 9 m pole						
12.9.9	Ground and soft rock		No	738			
12.9.10	Hard rock (Compressor)		No	40			
12.9.11	Hard rock (Drilling)		No	40			
12.9.12	Blasting including over and extra		No	0			
12.9.13	Bags of 50 kg cement added to backfilling		No	435			
12.9.14	Identify and expose sewer and water services by means of hand cross cut excavations		Sum	1			
12.10	**TESTING AND COMMISSIONING OF LV NETWORK PER TRANSFORMER AREA**		No	53			
TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES							

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	CONTRACT TOTAL:
13.1	**HOUSE CONNECTIONS**						
13.1.2	Supply, delivery, installation and commissioning of ready boards complete with light-fitting and lamp as						
	specified. One socket outlet to comply with the requirements of SANS 164-2. Includes backboard or	0360	No	2361			
	mounting rails.						
13.1.3	Supply, delivery, installation and connecting of drip looped 10 mm² split concentric SNE Airdac house						
	connection cable as specified (SNE Separate Neutral Earth)	3140	m	162 900			
13.1.4	interface						
	and Din Rail Mounted Power Line Carrier Meter	3145					
13.1.4.1	DIN Rail RF Meter Control Unit (Conlog or Similar - to comply/correspond with existing installation)		No	2361			
13.1.4.2	DIN Rail RF User Interface Unit (Conlog or Similar - to comply/correspond with existing installation)		No	2361			
13.1.4.3	EA VARISTOR PDZ32 440CW 5kA 40V Metal Oxide.		No	2361			
13.1.4.4	Suitable Cable Gland, Nylon, with Lock Nut, for SNE Airdac.		No	2361			
13.1.4.5	Supply and installation of weather proof type York wall mounted box with wooden backing plate to						
	accommodate prepaid meter on outer side of house		No	0			
13.1.4.6	Supply and installation of Airdac strain clamps complete for fixing at pole and house with pigtail hook or						
	bracket suitable for both wooden truss or wall mounting	0360	No	2361			
13.1.4.7	Supply and install pigtail bolt assembly (M10 x 280 mm)		No	2361			
13.1.4.8	Supply and installation of 5 m wooden shack pole complete with excavation, subject to approval	0058	No	2361			
	(*provisional)*						
13.1.4.9	Testing and quality control (ID number, Co-ordinates, etc.) of house connection installation and issuing of a						
	certificate of compliance for each house connection by an accredited person as specified.		No	2361			
13.1.4.10	Issue a CoC for each installation.		No	2361			
13.2	**LOCAL SUB-CONTRACTORS**						
13.2.1	Allow R300,00 / house connection for labour of local subcontractors.		No	2361			
13.2.2	Tools, Training, PPE & Management of local sub-contractors		Sum	1			
	Note: Local sub-contractors to be appointed as employees of the main contractor for task related services						
	(Main Contractor liability insurance shall cover the sub-contractor)						
TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES							

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
14.1	**22 kV SWITCHGEAR & CONTROL GEAR**						
	Supply, installation and commissioning by OEM of metal clad switchgear equal or similar to Alstom type	VE9335-7-SGS					
	1250 A SBV24L, vacuum switchgear as specified and as shown on drawings. A single busbar system, rated						
	25 kA. An aluminium ladder to be provided to access all equipment.						
14.1.1	Feeder panels, 800 A	VE9335-7-SGS	Each	3			
14.1.2	Protection IED (local on switchgear) - RING FEEDER (O/C E/F)	VE9335-7-SGS	Each	3			
14.1.3	Chauvin Arnoux Enerium Enerdis-50 type Measuring centres	VE9335-7-SGS	Each	3			
14.1.4	Protection IED software licensing (fault analysis)		Sum	1			
14.1.5	MV Control plant section of the SCADA system c/w terminations, glanding, schemes, programming and all						
	related auxiliaries		Sum	1			
14.1.6	Supply and install 50x50x6MM angle iron bolted to concrete to traverse across trench for switchgear	VE9335-7-SGS	Each	6			
	support and mounting.						
14.2	**EARTHING OF MV SWITCHGEAR**						
14.2.1	250 mm^2 Earth bar, connection of switchgear earth bar to **existing** trench earth bar.		Sum	1			
14.2.2	Earthing of CB racking plates and connection of surface bed reinforcing to earth.		Sum	1			
14.3	**COMMISSIONING & TESTING**						
	Provision for two (2) Engineer representatives and two (2) Employer representatives and one (1) contractor						
	representatives to witness FAT at manufacturer as specified for the following equipment:						
14.3.1	22 kV Switchgear Panels [including metering (energy) at the manufacturers works]		Sum	1			
14.3.2	SAT Commissioning of Switchgear Panels		Sum	1			
14.3.3	Commision existing SCADA system connected with the new feeder panels		Sum	1			
14.3.4	Site protection re-commissioning, setting & testing by Lyon and Partners		PC	1	R 15 000,00		R 15 000,00
14.4	**SCADA**						
14.4.1	Implement the necessary communication wiring to control the new feeder panels via the existing local SCADA		Each	1			
	system.						
14.4.2	Add the new feeder panels to the existing HMI (panels should be able to be remotely operated from the HMI).		Each	1			

ITEM	DESCRIPTION	REF.	UNIT	QTY	UNIT LABOUR RATE	UNIT MATERIAL RATE	TOTAL
14.4.3	Supply and install the necessary Email software package for the existing Orion LXm RTU so that an email is		Each	1			
	automatically sent when there is an alarm on the HMI.						
14.4.4	Supply and setup a desktop and 24inch screen for Metsimaholo LM's workshop. Desktop to be set up as a						
	"Viewer" for the HMI. Desktop computer with 8GB RAM, 256GB SATA SSD, 1TB HDD.		Sum	1			
14.4.5	All cabling & other auxiliaries		Sum	1			
14.5	**COMMUNICATION & CONTROL CABLING C/W ALL AUXILIARIES**						
14.5.1	Any wiring requirements not catered for elsewhere i.e. between switchgear and SCADA control panel		Sum	1			
14.6	**TELEMETRY**						
	Supply and install the necessary gateway/repeater/communication hardware at Metsimaholo LM's workshop to						
	interface the desktop mentioned above with the SCADA system. *Take note of the as-built information*						
	regarding the SCADA systems communication link between the Themba Khubeka S/S, Metsimaholo LM's workshop and Metsimaholo LM.						
14.6.1	Configuration		Sum	1			
14.6.2	Testing and Commissioning		Sum	1			
14.6.3	Training of the customers personnel		Sum	0			
14.6.4	Telemetry Equipment required for integration at Metsimaholo LM's workshop so that the HMI can be viewed						
	on the desktop and screen that is to be supplied under "*SCADA*" (gateways/RTU/switch etc. that may be		Sum	1			
	required)						
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ITEM	DESCRIPTION	REF	UNIT	QTY	TOTAL
15.1	**88 KV LINE REPAIRS**				
15.1.1	**Provisional sum** for the repair of the OHL as outlined in the project specifications.		PC	1	R 3 650 000,00
15.2	**88 / 11 KV SUBSTATION REPAIRS**				
15.2.1	**Provisional sum** for the repair of the Leitrim Substation as outlined in the project specifications.		PC	1	R 3 900 000,00
15.3	**OUTSTANDING SERVITUDE COMPENSATION FOR THEMBA KHUBEKA BULK PHASE 1**				
15.3.1	**Provisional sum** for the outstanding servitude compensation for the Themba Khubeka double-circuit				
	overhead line (Bulk Phase 1).		PC	1	R 80 000,00
	TOTAL CARRIED FORWARD TO SUMMARY OF BILL OF QUANTITIES				**R 7 630 000,00**

SECTION 5 -
C3&4: SCOPE OF WORKS AND SITE INFORMATION

METSIMAHOLO LOCAL MUNICIPALITY
P O Box 60
SASOLBURG, 1947

VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 5:
C3 & C4 – SCOPE OF WORKS AND SITE INFORMATION

LYON AND PARTNERS (Pty) Ltd
Electrical Consulting Engineers
P O Box 3925
VANDERBIJLPARK
1900

C3: SCOPE OF WORKS

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C3 – SCOPE OF WORKS

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C3.1: GENERAL SPECIFICATIONS

C3. SCOPE OF WORKS

The Contractor to be appointed by Metsimaholo Local Municipality will undertake the full scope of work which, at high level, comprises of the supply, delivery, installation, testing, commissioning, and handing over, complete with auxiliary equipment, of:

a) The extension of the existing Eskom Vaaldam substation yard by extending the substation platform, earth grid and construction of a new fence to accommodate the following additions:
   - 1 x 88kV bus-section with two 132kV isolators.
   - 1 x Complete 88/22 kV 10 MVA transformer bay.
   - 1 x 22kV road crossing structure.
   - 1 x 22kV transformer breaker.
   - 1 x 22kV bus-section isolator.
   - Extension of the existing 22kV busbar by installing a new 22kV bus-section.
   - 1 x 22kV busbar VT.
   - 2 x 22kV feeder bays with composite unit circuit breakers and current transformers
   - 3 x swing frame panels to house protection schemes and metering.

b) Medium voltage reticulation, low voltage reticulation, and house connections within Themba Khubeka, comprising of
   - 38.2 km of 22kV medium voltage overhead lines (Fox ACSR), with 53 transformer areas.
   - 24.25 km of low voltage aerial bundled conductor overhead lines
   - 2361 overhead house connections.

This scope of work includes information that specifies and describes the goods, services, engineering, construction works and requirements for the works to be executed by the Contractor. Constraints relating to the execution of the contract work are given.

However, all aspects cannot be covered in the smallest detail and therefore the Contractor, being the expert concerning the execution of construction activities, shall be liable to deliver the entire works in accordance with specifications for its intended use, which includes all auxiliary and related claims.

The Scope of Works includes four distinct sub-sections namely:
- C3.1 – General requirements for the Scope of Works
- C3.2 – Vaaldam Substation Extension
- C3.3 – Themba Khubeka Electrification
- C3.4 – 88 kV Line Repairs, 88/11 kV Substation Repairs & Other

The purpose of the works is to progress on the Themba Khubeka Medium Voltage Bulk Electricity supply and the electrifications of 158 house connections completed as part of Phase 1 of the project. The subsequent phases of the project comprise of the extension of the Eskom Vaaldam 88/22kV substation, completion of the 22kV supply, and completion of the remaining electrification within the Themba Khubeka Township. The aim of this project is to provide electricity to all registered residential stands within Themba Khubeka, with sufficient MV backbone capacity to allow for future expansions and future connection of all relevant, non-residential, zoned stands.

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The site is remote to Metsimaholo Local Municipality's Electrical Workshops and is identified as a high security risk site. Therefore, the system includes SCADA and high bandwidth communication equipment to assist Metsimaholo Local Municipality with operating the site.

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C3.1. GENERAL REQUIREMENTS FOR THE SCOPE OF WORKS

C3.1.1. DESCRIPTION OF THE WORKS (BACKGROUND & DISCUSSION)

The establishment of an extension of Vaaldam substation and installing the electrical network in Themba Khubeka will enable the Municipality in reaching its electrification objectives as outlined in the IDP to fully energise approximately 2600 households in Themba Khubeka and in conjunction with the Department of Energy's Integrated National Electrification Program. Due to the cost and scope the Themba Khubeka project will be phased over a possible two financial years as funding becomes available.
The reticulation networks to be constructed within Themba Khubeka include house connections for proclaimed erven for approximately 2600 residences. The bulk electrical supply point to be constructed at Vaaldam Substation caters for future expansions of Themba Khubeka to the West, and development of the farm Knoppiesfontein.

The income derived from sales of electricity, especially in the rural or poor communities is entirely inadequate to fund electrical projects, therefore the Department of Mineral Resources and Energy (DMRE) was approached to assist with funding in order to provide a sustainable supply to these communities. It should also be noted that with the current increase in tariffs, demanded by Eskom, Municipalities are running on the brink of profit on electricity sales making it virtually impossible to fund electrical bulk supply projects from Municipal budgets.

Internally, the Municipality does not have sufficient financial, material and human capital to render a project of this magnitude possible. Therefore, the project will be implemented through Department of Mineral Energy funding, a consulting electrical engineer appointed on Metsimaholo's panel of electrical engineers and a 8 EP CIDB registered contractor will be required to execute the works. The main contractor may be required to appoint one civil subcontractor with a 5 CE only CIDB rating for construction of the electrical reticulation.

The contractor shall be responsible for detail designs based on his equipment offered, installation, construction, erection, commissioning, testing and handing over of the works, complete with all auxiliary equipment where the works at a high level comprises of:

- The Eskom owned Vaaldam Substation (88kV/22kV) shall be extended. Due to limited capacity available at Vaaldam Substation to allow for the electrification of the Themba Khubeka community, the substation shall be extended to provide capacity for Metsimaholo LM's Themba Khubeka Switching Station. The works shall be executed as a Self-Build project and handed over to Eskom upon completion. The extended substation shall be connected to the existing Themba Khubeka double circuit 22kV overhead line (OHL), which is currently energised by a temporary auto-recloser connection on the "Gevangenis" feeder.

- The Themba Khubeka community shall be electrified (approximately 2361 households). The Themba Khubeka Switching Station and the OHL from Vaaldam Substation to the switching station has been constructed. The necessary MV switchgear shall be added to the Themba Khubeka Switching Station for the required MV feeder circuits. The additional 22kV panels shall be integrated into the SCADA system. The community shall be electrified by means of overhead lines, pole mounted transformers, aerial bundle conductor and airdac.

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Additional works at a different site (non-DMRE funding):

- The Zamdela-Leitrim 88kV power line and the Leitrim Substation shall be repaired and commissioned. The Zamdela-Leitrim power line connects the Zamdela (Eskom) substation with the Leitrim (Metsimaholo LM) substation. The power line has design/construction defects, and has therefore not been operational. The power line shall be repaired/altered and commissioned. The Leitrim Substation shall be serviced, all vandalism to be repaired and re-commissioned.

C3.1.2. CONSTRAINTS WITH EXECUTION OF THE WORKS

a) The Themba Khubeka Switching Station is currently energised from a temporary connection at Vaaldam Substation. Limited capacity is available on the temporary connection and will be insufficient to electrify the whole Themba Khubeka Community. The Vaaldam Substation shall first be extended while a limited number of house connections are done (approximately 800 connections can be supplied from the temporary connection). Once the substation has been completed, the required number of house connections can be energised, and the temporary connection shall be removed.

b) Grant funding is provided by the National Treasury through DMRE's Integrated National Electrification Plan. For the respective financial years, the funding allocation to execute the works is R 30 400 000.00 for 2021/2022 which must be spent before June 2022, a provisional R 20 000 000.00 for 2022/2023, which must be spent before June 2023 and a provisional R 19 580 000 for 2023/2024, which must be spent before June 2024. The Contractor shall plan his works according to the above. Although not ideal, withdrawal and re-establishment to site must be catered for.

c) From the above it is clear that all resources must be allocated for a high progress pace to have the 2021/2022 budget spent before June 2022, thereafter the progress pace must be planned to spend the 2022/2023 budget over the corresponding period. For the 2021/2022 Grant funding, the Vaaldam S/S is to be extended (approx. R20 000 000 incl. fees & other). The remaining amount (approx. R10 400 000) shall be allocated towards the electrification of Themba Khubeka (including fees & other). Approximately 500 households shall be electrified using the 2021/2022 funding, although more connections can be accommodated on the temporary supply.

d) **All the material shall be provided by the Contractor.** The Contractor shall take full responsibility for material orders and shall administer material with a store bookkeeping system (computer aided). **A stock taking report must be submitted to the Project Manager on a two-weekly basis.**

e) **No work shall be permitted to proceed without the work being surveyed & pegged by the Contractor (subject to the Engineer's approval).**

f) The Engineer, Project Manager and his Clerk of Works will have full access to the site, the Clerk of Works is expected to visit the site once a week. A site meeting or inspection will be conducted every second week on a rotational basis and **it is expected from the Contractor to forward a <u>weekly</u> (summary) progress report, and a monthly (detail) report to the Project Manager by email.**

g) Any variation or modification with a cost implication must be approved by the Engineer before work can commence. No variation claim without prior approval will be entertained.

h) Payment application will be assessed once a month and the progress claim must be approved and certified by the Engineer. Progress claim statements applying for interim payments shall be submitted by the Contractor to the Engineer on or before the 17th of each month. **Progress claims will not be considered without the Contractor's progress report in a format acceptable to the Engineer.**

i) **No equipment shall be delivered to the site prior to the Contractor submitting routine OEM test reports to the Engineer, and approval thereof by the Engineer.**

j) The handing over document must be signed and handover must take place 7 days prior to the official energising of the project.
The handing over document must be accompanied by commissioning certificates of the OEM as follows (Hard & soft copy):
- 88/22 kV Transformer
- 132 kV Current Transformers
- 132 kV Circuit Breaker
- 132 kV Isolators
- 22 kV NECRT
- 22 kV Circuit Breakers
- Protection Schemes (Eskom)
- Metering Schemes
- 22 kV Switchgear Panels
- 22kV Protection Schemes (Metsimaholo Local Municipality)
- SCADA Systems

Handing over will not be signed prior to receipt of all as-built information. This may result in penalties.

k) The Contractor must adhere to statutory requirements and the Employer's Health and Safety requirements stipulated.

l) The Contractor shall be responsible for arranging Factory Acceptance Tests (FAT) at the OEM and the Site Acceptance testing (SAT) on site, which will be attended by the Engineer and the Employer's personnel. The OEM shall issue a list of all proposed tests to be conducted during the FAT to the Engineer for approval.
The following equipment shall be subjected to Factory Acceptance Testing:
- 132 kV Outdoor breakers.
- 132 kV Current transformers.
- 88kV/22kV transformer.
- NECRT.
- 22 kV Outdoor breakers.
- 22 kV Indoor Switchgear Panels
- Metering/Protection/Control Panels.

m) If any of the above listed equipment is manufactured and/or assembled outside the Gauteng Province or South Africa, the Contractor shall make all the necessary

arrangements for two (2) Engineer representatives and two (2) Employer representatives and one (1) Contractor representative to witness the FAT at the manufacturer. The cost thereof shall be for the account of the Contractor.

n) The Contractor shall also be responsible for arranging training for all equipment by the OEM at their offices and on site, which will be attended by the Maintenance Personnel of the Employer and the Engineers Representative. The training shall include a practical "hands-on" session. Training shall be provided in a classroom environment, the OEM shall provide relays or equipment for each delegate attending the training session which will allow for practical interaction with various control, monitoring and measuring equipment.
Training shall be provided for the following equipment:
- All IED's in the substation
- All measuring equipment used in the substation
- All switchgear and operation sequences
- The Contractor shall also arrange training and testing in the relevant ORHVS modules required to operate and maintain HV Voltage equipment. The ORHVS training shall be done at an accredited institution and an ORHVS Authorisation Certificate shall be issued to the successful delegates (min. five delegates). Training shall be in accordance with all parts of the latest version of NRS 040.

C3.1.3. PROJECT SPECIFICATIONS

The project specifications deal with the technical installation aspects relating to this project. Any discrepancy between the Particular Specification, Bill of Quantities and Drawings must be reported to the Engineer who will clarify such contradiction before closing of tender.

If any discrepancies exist between parts of this document, the following order of preference will take place:
a) The Contract Agreement (if any)
b) The Letter of Acceptance
c) The Letter of Tender
d) The Particular Conditions of Contract
e) The General Conditions of Contract
f) The Specifications and Scope of Works
g) The Drawings, and
h) The Schedules and any other documents forming part of the Contract

As part of achieving a standard specification country wide and with Eskom playing a leading role in the compilation thereof, Eskom's specification has been used throughout this document. It is therefore an explicit requirement and condition of contract that all Contractors must have access to the Eskom specifications, via the Eskom Web. Application can be made to:

Mrs Brenda Morrison
Assistant Officer
Tel : (011) 629 5266
Fax : (086) 662 6387
E-mail : Brenda.morrison@eskom.co.za
Please note that a fee is payable to Eskom for this service.

Eskom specifications and equipment standards are adopted for the delivery of the works.

C3.1.4. GENERAL SPECIFICATIONS

Note:
Failure to duly complete Technical Schedules, in full, at tender stage will result in the disqualification of the tenderer's offer.

No change in supplier is permitted without a written application by the contractor and written consent by the Engineer. Should any change in supplier be noted at any stage during implementation of the project the Engineer will instruct the Contractor to revert back to suppliers as per the tender offer with any time and cost implications for the Contractors account.

It shall be noted that specifications are for the general use of project construction, certain sections or paragraphs may not be relevant to this particular contract in which case such irrelevant items are to be considered as not applicable. Any uncertainties shall be communicated to the Engineer. Where equivalent South African standards (SANS / NRS) exist, such standards are to be used in preference to foreign standards quoted.

The documents referenced contain provisions that constitutes requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

I / We, the undersigned _____ hereby acknowledge that I / We have obtained copies of the mentioned documents and confirm that I / We fully understand them and the consequences of non-compliance.

SIGNED AT _____ ON BEHALF OF THE FIRM _____

ON THIS _____ DAY OF _____ 20_____

NAME _____

SIGNATURE _____

CAPACITY _____

Specification as listed below shall apply to this project:

C3.1.4.1. LAW - NATIONAL AND INTERNATIONAL STANDARDS

All IEC, NRS, SANS, ASCE, ISO codes and National Law applicable to the disciplines listed below shall apply to this project:

1. Electrical Cable Works
2. Civil reinforced concrete works
3. Building Works
4. High Voltage Works

ACT	31		Fencing Act.
ACT	73	1989	Environmental Conservation act.
ACT	85	1993	Machinery and Occupational Safety Act 85 of 1993 with special reference to Section 1 (Act & Regulations), Section 2 (Administrative Regulations), Section 6 (Electrical Installation Regulations) and Section 16 (General Safety Regulations)
ACT	OHS	1993	Occupational Health and Safety Act 1993

Standards are obtainable on the SABS Web store www.store.sabs.co.za.

C3.1.4.2. ESKOM SPECIFICATIONS / STANDARDS

In order to achieve a countrywide standard, the Eskom Specifications for outdoor substations will be applicable to this project. These listed specifications are included on the Tender CD issued together with the Tender. It is the responsibility of the Contractor to ensure that he/she obtains the tender CD. In addition, these specifications are also available on the Eskom website (www.scot.eskom.co.za).

Table 1: Eskom Specifications/Standards

NO.	REV / YEAR	DESCRIPTION
240-68973110	2014-2019	Specification for power transformers rated for 1.25MVA and above and with highest voltage of 2.2kV or above
240-53113923	2014-2019	Specification for substation clamps for tube aluminium conductors
240-56062765	2014-2019	Inductive voltage transformers: Eskom specific requirements for up to 132 kV in accordance with NRS 030.
240-56063815	3	Specification for high voltage outdoor disconnectors and earth switches.
240-56065131		Specification for 11kV to 33kV withdrawable pattern air-insulated indoor primary switchgear standard
240-57648848		Specification for combined three-phase neutral electromagnetic couplers with neutral earthing resisters and auxiliary power transformers (NECRT's)
240-75660336	2017-2022	Substation and network equipment label specification
240-83382076	2014-2019	Standard for operational floodlighting in substations
240-83382122	2015-2020	Emergency lighting in substations
240-86100853	0	Standard for Barricading prohibited area and live chamber

NO.	REV / YEAR	DESCRIPTION
240-87605434	2015-2020	Quality control process for the checking of distribution substation construction before handing over for commercial operation
240-56063756	2	Specifications for outdoor circuit breakers for systems with nominal voltages from 11 kV up to and including 765 kV.
34-1241	2012-2017	Distribution group`s specific requirements for the use of furniture in substations buildings
34-1245	Latest	Distribution Standard – Part 2: Earthing Section 3. Substation earthing
34-1439	2012-2017	Standard for the labelling of substations and networks
34-1513	0	Specification for Control panels labels and cable markers.
34-1687	0	Distribution Group`s Specific Requirements for 11 kV, 22 kV and 33 kV Outdoor Kiosk Type Switchgear.
34-1689	2012-2017	Current Transformers: Eskom specific requirements up to 132 kV in accordance with NRS029.
34-195	Latest	Distribution group's specific requirements for standard drawing practice for substation design layout
34-1985	Latest	Distribution Standard – Part 2, Earthing Section 1. MV and LV reticulation earthing
34-213	Latest	KIPTS Natural ageing test procedure for outdoor insulator products section 1 – particular requirements for post, long rod and stand-off insulators
34-224	Latest	KIPTS natural ageing and pollution performance test procedure for outdoor insulator products Section 0 - General Requirements
34-254	Latest	Manufacturing Specification for Distribution Equipment Labels
34-2057	2010-2015	Sweep frequency response analysis test procedure
34-304	2012-2017	Generic Substation Design
34-333	1	OHS act requirements to be met by principal contractors employed by Eskom Distribution.
34-396	1	Specification for a VRW20 Junction Box.
34-419	0	Specification for station class metal oxide surge arresters without spark gaps.
34-464	1	Distribution Specification for a Swing frame Panel (19 inch rack) and blanking plates.
474-218	2012-2017	Specification for substation clamps for stranded aluminium conductors
DISASAAA0S	Latest	Standard for passive fire protection in distribution substation yards
DSP0030	1	Specification for non-lethal electrified fences for use at substations and buildings
ESKPBAAA9	Latest	Environmental impact assessment procedure

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NO.	REV / YEAR	DESCRIPTION
ESKPBAAD6	Latest	Environmental management policy
ESKPVAAL7	Latest	Environmental impact assessment procedure
ESKPVAAZ1	2	Environmental Management Programme (EMP) Procedure
SCSSCAAZ2	0	Distribution group`s specific requirements for A.C./D.C. distribution units.

C3.1.4.3. SUBSTATION SPECIFICATIONS

The following National and International standards shall be adhered to and can be obtained through the SABS webstore.

C3.1.4.4. CABLES

IEC 61089	-	Round wire concentric lay standard conductor
IEC 60332	-	Test on electrical cables under fire conditions
IEC 60502	-	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV)
SANS 10142	-	The wiring of premises
IEC 60228	-	Conductor of insulated cables
SANS 1507	-	Electrical cables with extruded solid dielectric insulation for fixed installation (300/500 V to 1900/3300 V)
SANS 97	-	Electric cables – Impregnated paper – insulated metal-sheathed cables for rated voltages 3.3/3.3 kV to 19/33 kV (excluding pressure assisted cables)
SANS 1339	-	Electric cables — Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV
SANS 10198	-	The selection, handling and installation of electric power cables of rating not exceeding 33 kV (all parts)
NRS 013:2007	-	Medium-Voltage cables
NRS 053	-	Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33kV)
NRS 074-1	-	Low-voltage (600/1 000 V) cable systems for underground electrical distribution (all parts
SANS 529	-	Heat-resisting wiring cables.
SANS 1507	-	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) (all parts)
SANS 6138	-	Resistance of cables and cords to flame propagation - Single vertical (IEC 60332) insulated cable or cord.

Relevant Eskom specifications as listed.

C3.1.4.5. POWER TRANSFORMERS

IEC 60076	-	Power Transformers (all applicable parts)
IEC 60137	-	Bushings for AC voltages above 1000V
NRS 054	-	Design of large Power transformers

Relevant Eskom specifications.

C3.1.4.6. EARTHING AND LIGHTNING PROTECTION SYSTEM

SANS 725/IEEE 80	-	Guide for safety in AC Substation Grounding
IEEE 81	-	Guide for measuring earth resistivity, ground impedance and earth surface potentials of a ground system
SANS 10199		The design and installation of an earth electrode
IEC 62305	-	Protection against lightning
SANS 10292	-	Earthing of low-voltage (LV) distribution systems
SANSA 10313	-	Protection against lightning – Physical damage to structures and life hazards
NRS 060	-	Code of Practice for clearances for electrical systems with rated voltages up to and including 145 kV, for the safety of persons
IEC 61024	-	Protection of structures against lighting

Relevant Eskom specifications.

C3.1.4.7. HIGH VOLTAGE DISCONNECTORS AND EARTHING SWITCHES

IEC 62271-102	-	High Voltage Switchgear and Control Gear – Alternating current Disconnectors and earthing switches
NRS 031	-	Alternating Current Disconnectors and Earthing Switches (Up to 145 kV)

Relevant Eskom specifications.

C3.1.4.8. SURGE ARRESTERS

IEC 60099	-	Surge Arrestors. Metal-Oxide. Surge Arresters without gaps for AC Systems.

Relevant Eskom specifications.

C3.1.4.9. HIGH VOLTAGE CIRCUIT BREAKERS

IEC 62271-100	-	High Voltage Switchgear and Control Gear – Alternating current Circuit-breakers
IEC 60376	-	New Sulphur Hexafluoride
IEC 60694	-	Common specification for high-voltage switchgear and control gear standards
IEC 62271-301	-	High-voltage switchgear and control gear Part 301: Dimensional standardisation of terminals
IEC 62271-310	-	High-voltage switchgear and control gear Part 310: Electrical endurance testing for circuit breakers of rated voltage 72,5 kV and above

Relevant Eskom specifications.

C3.1.4.10. INSULATION

SANS 1019	-	Standard voltages, currents and insulation levels for electricity supply
IEC 60273	-	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
IEC 60168	-	Tests on indoor and outdoor post insulators of ceramic material or glass for systems greater than 1000 V

IEC 60383	-	Insulators for overhead lines with a nominal voltage above 1000 V
IEC 60815	-	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
IEC 60168	-	Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V
IEC 60455	-	Resin based reactive compounds used for electrical insulation
IEC 60071-1	-	Insulation co-ordination

Relevant Eskom specifications.

C3.1.4.11. VOLTAGE AND CURRENT TRANSFORMERS

IEC 61869-1	-	Instrument Transformers – Part 1: General Requirements.
IEC 61869-2	-	Instrument Transformers – Part 2: Additional Requirements for Current Transformers.
IEC 61869-5	-	Instrument Transformers – Part 5: Additional Requirements for Capacitor Voltage Transformers
IEC 60186	-	Voltage transformers
IEC 66044-1	-	Current Transformers
IEC 66044-2	-	Voltage Transformers
NRS 029:2012	-	Current Transformers

Relevant Eskom specifications.

C3.1.4.12. ELECTROMAGNETIC COMPATIBILITY

IEC 61000-6-2	-	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
IEC 61000-6-5	-	Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for power station and substation

Relevant Eskom specifications.

C3.1.4.13. HIGH VOLTAGE TECHNIQUES

IEC 60060	-	High Voltage Test Techniques
IEC 60071	-	Insulation Coordination
IEC 62271-1	-	High Voltage Switchgear and Control Gear Standards. Common Specifications
IEC 60270	-	High-voltage test techniques - Partial discharge measurements

Relevant Eskom specifications.

C3.1.4.14. BATTERY TRIP UNITS

Battery Chargers:

SANS 1652	-	Battery chargers – Industrial type
IEEE1115-1	-	Recommended Practice for Sizing Nickel-Cadmium Batteries for Stationary Applications

Nickel Cadmium Batteries:

SANS 1632–1	-	Batteries: General information – Definitions, abbreviations and symbols
SANS 1632-2	-	Batteries - Part 2: Vented-type stationary lead-acid cells and batteries.
SANS 1632–3	-	Batteries: Vented-type prismatic nickel-cadmium cells and batteries
SANS 60623	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented nickel-cadmium prismatic rechargeable single cells
IEC 60993	-	Electrolyte for vented nickel-cadmium cells
IEEE1115-1	-	Recommended Practice for Sizing Nickel-Cadmium Batteries for Stationary Applications

C3.1.4.15. PROTECTION RELAYS AND CONTROL RELAYS

IEC 60255	-	Electrical relays
IEC 60447	-	Basic and safety principles for man-machine interface, marking and identification. Actuating principles
IEC 60073	-	Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuations
IEC 60870	-	Telecontrol equipment and systems
IEEE 829	-	Software test documentations

Relevant Eskom specifications.

C3.1.4.16. METERING EQUIPMENT

IEC 62052 / IEC 62053	-	Electricity metering equipment (a.c.) [relevant parts]
IEC 62056-21	-	(EMC) - Part 4-30: Testing and measurement techniques
IEC 61000-4-30	-	Power quality measurement methods
NRS 048	-	Electricity Supply – Quality of supply (all relevant parts)

Relevant Eskom specifications.

C3.1.4.17. SCADA AND TELECONTROL

IEEE1815-2012	-	Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)
NRS037	-	Telecontrol Protocol (all parts applicable)
IEC 60870	-	Telecontrol equipment and systems (all parts applicable)
IEC 61850	-	Communication networks and systems in substations
IEEE C37.1-2007	-	Standard for SCADA and automation systems
IEC 1588-2002	-	Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems

NERC CIP-005	-	Security
IEC 60870-5	-	Transmission Protocols - Companion standard for the informative interface of protection equipment
NRS-040-2	-	Voltage Colour Coding for Diagrammatic Displays

Relevant Eskom specifications.

C3.1.4.18. AUXILIARY SERVICE SYSTEM, CONTROL AND OTHER

IEC 61439	-	Low-voltage switchgear and control gear assemblies
IEC 60947	-	Low-voltage switchgear and control gear
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)
IEC 60158	-	Low voltage control gear
SANS 10139	-	Fire detection and alarm systems for buildings – System design, installation and servicing
SANS 10142-1	-	Wiring of Premises Part 1 : Low Voltage Installations
SANS 1091	-	National colour standards of Paint

Relevant Eskom specifications.

C3.1.5. SITE ESTABLISHMENT

The Contractor shall supply, transport and off-load his own facilities such as sheds, water, electricity, lighting, etc. on the site. The Contractor shall be responsible for removing all facilities established on site after his work is completed.

It shall be expected of the Electrical Contractor to establish a site office with surrounding security fence. The surrounding fence to be at least 1,8 m high, with Y shape frame on top and equipped with barbed wired. Lockable gates must form part of the surrounding fence. The site yard shall provide adequate security to all material stored. The site office must be equipped with furniture for meeting purposes and the Contractor must make arrangements to have a full time security guard, keeping watch over all material stored in this yard. The Contractor must also provide for toilets, electricity connection, water supply, rain gauge etc.

The Contractor shall make provision for lay down areas for equipment (such as poles) inside a fenced perimeter.

The Contractor shall install a name board, with a minimum size of 2 600 mm x 1600 mm, at a suitable position to be approved by the Engineer. The name board layout is shown below:

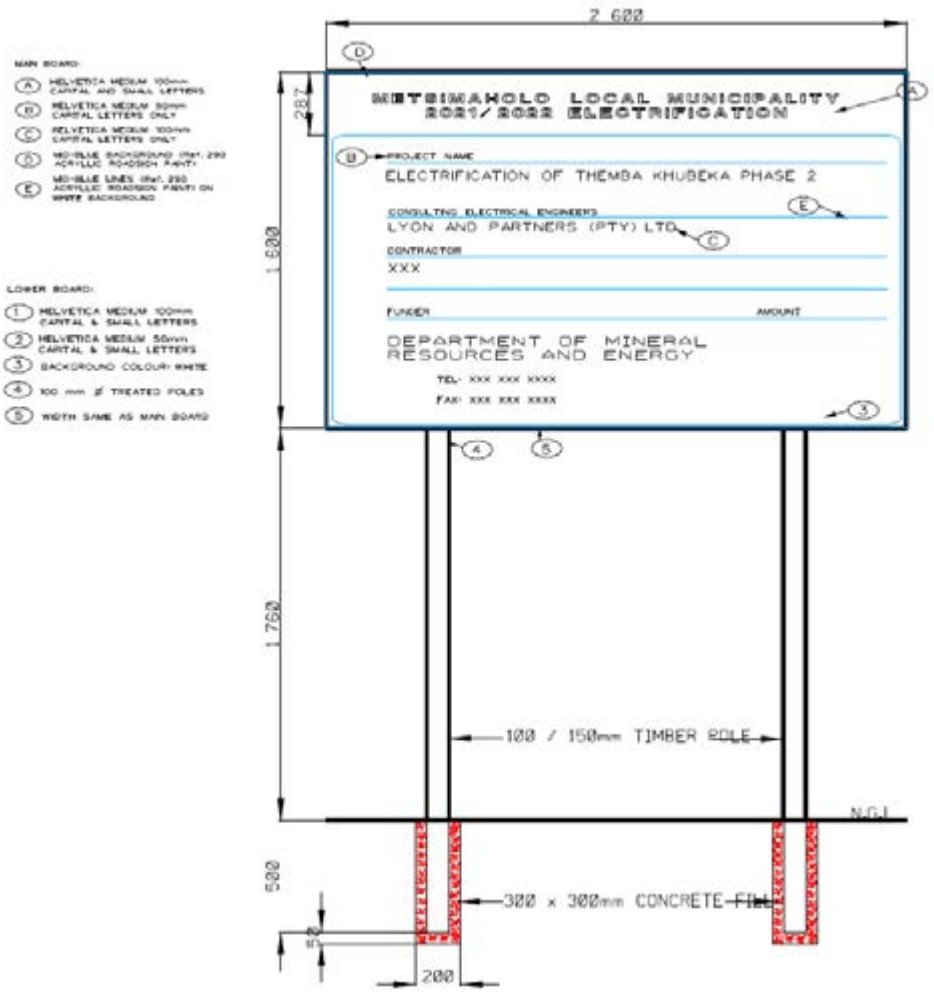

Figure 1: Construction Name Board

The preferred site office location will be indicated by the Engineer and the Contractor shall submit a Site Establishment application to the Municipality's Building and Land Use Department on the prescribed application form.
Pin boards shall be provided in site facilities to accommodate all project and construction drawings.

C3.1.6. SITE INSTRUCTION BOOK & DAILY DIARY

The Contractor shall provide a site instruction book (triplicate pages) which shall be kept in the site office at all times. All instructions and variations shall be written in this site instruction book by the Engineer while attending the site. The responsibility will be on the Contractor to confirm such instructions and variations in writing, if the Engineer neglects to do so within 14 days after the issuing of this instruction, especially if it has a cost implication.

All instructions given to the Contractor while the Engineer is not on site, shall be populated into the Site Instruction Book by the Contractor. The Contractor shall present the populated pages to the Engineer for signature upon the Engineer's next site visit.

The Contractor provide a Daily Diary which shall be kept in the site office at all times. The Contractor shall record the following information in the Daily Diary:

- Site activities.
- Work executed.
- Safety issues & incidents.
- Environmental issues & incidents.
- Quality issues.
- Community related matters
- Weather conditions and record rainfall.
- Material received and used.

C3.1.7. SECURITY

The Contractor must arrange 24-hour security with a reputable security company to protect the construction works. The Contractor must take cognisance that he will be responsible for any material theft and the replacement thereof until 28 calendar days after the date of signing of the Handing Over Certificate.

C3.1.8. REQUIREMENTS FOR THE PROGRAMME

This tender document must be accompanied by a preliminary programme, based on prior experience and accounting for site conditions.

The tender shall be accompanied by a cash flow projection. The projection is required for adjudication of the tender and to determine the escalation on the project, if applicable.

It is essential that the Contractor refers to the General Conditions of Contract for specific requirements for the programme.

The detailed programme for the execution of the works shall be submitted by the Contractor to the Engineer within 28 days of issuing of the Letter of Acceptance.
The programme must make provision for delivery dates of material as quoted by their suppliers. The Contractor shall be responsible for late delivery of material. The Engineer may alter the programme to meet the priorities of the Client. Such amendments must allow the Contractor to complete the works within the tendered construction time.

When compiling the project programme the Contractor shall consider the Health and Safety file, which may require a permit application before the construction can initiate. Adequate allowance for this process shall be included in the programme, if needed. Due to the Employers' limited capacity, the Contractor shall assist the Employer to obtain a construction permit.

The Contractor must take cognisance to allow for normal rainfall during this period in his programme.

The expected delivery dates of long lead material must be recorded in the section of this document containing forms to be completed.

The programme shall be compiled using Microsoft Projects showing actual and scheduled progress in percentages. A Gantt chart shall be provided with carefully planned task linkage, the critical path, float allowance and the baseline programme.

C3.1.9. TIME FOR COMPLETION

- The Contractor must allow sufficient time in the delivery period for delays due to climate and weather according to the average rainfall for this area, as indicated in the special conditions of contract. Extensions of time will only be granted if evidence can be provided that the delays were caused by **abnormal** weather conditions.

- Claims for rework will not be considered and is an issue for insurance.

- The Contractor shall allow slack in the construction programme to cater for any unforeseen circumstances.

- The penalty for late completion of the works is indicated in the contract conditions and it is emphasized that time is of the essence. Commencement of the contract will be as indicated in the acceptance letter.

- **The Contactor shall note that strikes/protest action from the community is anticipated. Therefore, strikes/protest actions do not constitute Force Majeure conditions, which are defined as unforeseeable events. No claim for extension of time and/or cost shall be approved.**

C3.1.10. SURVEY

C3.1.10.1. SUBSTATION SURVEY

The Contractor must appoint a qualified Land Surveyor to peg the substation equipment centre lines according to the issued Construction Drawings. The Land Surveyor shall also peg the corners of the cadastral boundaries of the substation property, and the fence position.

Prior to commencement of any phase of the project, as indicated on the drawings, the Contractor must do a thorough survey to ensure that all pegs applicable to this project are installed. Missing pegs must be reported in writing to the Engineer. The Contractor will be responsible for re-installing all missing pegs at his/her own expense on the day of handover of a particular phase.

Any cadastral pegs, where applicable, which are removed accidentally or intentionally by the Contractor during the execution of the works shall immediately be reported to the Engineer.

If the Employer's Land Surveyor re-installs missing pegs, it shall be at the expense of the Contractor. The Contractor must issue a certificate obtained from a professional Land Surveyor to verify that all pegs are installed correctly to set out the works. A CAD drawing indicating all pegs set out shall be submitted to the Engineer to overlay on the construction drawings in order to confirm the correctness of the pegs set out.

The Contractor shall, after completion of the contract, employ a Land Surveyor acceptable to the Engineer and Employer to certify the correctness of the constructed infrastructure. This certificate must be submitted to the Engineer together with the survey in a CAD format.

C3.1.10.2. RETICULATION SURVEY

The Contractor shall appoint a qualified Land Surveyor to peg the line according to the issued construction drawings. The Contractor's surveyor shall certify the constructability of the network and immediately inform the Engineer if areas are found that may cause construction difficulty.

Prior to commencement of any phase of the project as indicated on the drawings, the Contractor shall execute a thorough survey to ensure that all pegs applicable to the project are installed. Missing pegs must be reported to the Engineer in writing. The Contractor will be responsible for re-installing all missing pegs, not reported, at his/her own expense on the day of handover of a particular phase.

For MV structures, each and every position shall be pegged; for LV structures the first structure, last structure and any line deviation points shall be pegged.

ALL CADASTRAL BOUNDARIES, R.O.W.S.'s AND SERVITUDES ALONG ROUTES, SHALL BE PEGGED BY A PROFFESIONAL LAND SURVEYOR.

Any cadastral pegs, where applicable, which are removed accidentally or intentionally by the Contractor in the course of his/her activities, shall immediately be reported to the Engineer. The Employer's Land Surveyor shall re-install such pegs at the expense of the Contractor or the Contractor shall appoint a Professional Land Surveyor to reinstate these pegs. The Contractor must issue a certificate obtained from a Professional Land Surveyor to verify that all pegs are installed to correctly set out the works. A CAD drawing indicating all pegs set out shall be submitted to the Engineer to overlay on the construction drawings in order to confirm the correctness of the pegs set out.

The Contractor shall employ a Land Surveyor acceptable to the Engineer and Employer to certify the correctness of the constructed infrastructure. This certificate must be submitted to the Engineer together with the survey in a CAD format.

C3.1.11. MEASUREMENTS

Before ordering equipment, the measurements must be confirmed on site by the Contractor who shall confirm the measurements with the Engineer. The accuracy or inaccuracy of the Bill of Quantities will not influence the validity of the tender. The quantities in the Bill are measured from a drawing and serve only as an indication to obtain base unit rates during the tender. At the end of the Contract period, a final re-measurement, based on actual quantities, will be performed, according to which the Contractor's payment upon completion will be confirmed.

C3.1.12. FINAL INSPECTION

After completion of each section of the project, the Contractor must perform an internal, thorough inspection on all the work done, to satisfy himself that the work complies with the specifications, and then apply in writing to the Engineer for a final inspection. The Contractor will be liable to pay the Engineer in time, according to the newest gazetted ECSA rates or as indicated in the conditions of contract, for re-inspections.

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The application for the final inspection must be accompanied by the as-built drawings. The installation will not be approved before submission of the as-built drawings.

C3.1.13. QUALIFIED PERSONNEL

During the tender stage the Contractor must submit a list of the staff allocated to this project with proof of their qualifications and experience in the construction and erection of similar works. The Contractor shall provide the Employer and Engineer with the names of the supervisory personnel on site before commencement of the contract works. Deviation from the lists during construction of the works shall not be permitted without the written consent of the Engineer.

The Contractor shall submit a certificate issued by the Chief Inspector of the Department of Labour, indicating that he is fully competent to perform electrical construction work. No work will be allowed before submission of these documents.

If the Contractor, during any stage of the contract and for whatever reason, desires to change the supervisory personnel on site, he will do so in writing to the Engineer. Failure to do this will result in the Engineer halting the contract works until such time the necessary documentation is provided and the changes approved. Any such delays will not be considered by the Engineer for late completion of the contract.

C3.1.14. CONTRACTOR'S RESPONSIBILITY

All the material shall be supplied by the Contractor and shall include manufacturing, according to the relevant standards and specification, transporting to site, installation, testing and commissioning.

The Contractor shall be responsible for any damage caused by excavation work, whether caused directly or indirectly and whether written permission has been granted for machine excavation or blasting, or not.

The Contractor shall be responsible for all Health, Safety, Environmental, Quality and Community matters on the construction site.

C3.1.15. MATERIAL MANAGEMENT

The Contractor shall be responsible for the transporting of all materials and equipment to the site or off-site storage facility and the Contractor shall provide for the off-loading, rigging, lifting, handling and placement thereof into the permanent position as planned. The Employer shall not provide any assistance or plant for the placing of equipment into position.

All materials shall be provided by the Contractor unless otherwise specified. The Contractor shall take full responsibility for this material received and shall administer this material according to store bookkeeping system by means of computer aid.

The contractor shall compile a material ordering list stating the supplied, order date and delivery date within 28 days of issuing the Letter of Acceptance.

A stock taking report shall be submitted to the Project Manager on a two-weekly basis.

All material must comply with the requirements of the latest SANS Standards. If the offered material does not comply or fails the specified tests, the Contractor shall at his cost replace the material or equipment that does not comply or has failed the specified tests. All replacement equipment or material shall comply with the relevant specifications.

C3.1.16. WORKSHOP ASSEMBLY

To avoid problems with the erection and installation activities on site, components, equipment and sub-assemblies must be pre-assembled in the place of manufacture to ensure proper fitting and operation on site.

Such pre-assemblies which are to be tested in the place of manufacture, shall be set up in a simulated mode, using the specified peripheral equipment as far as possible in a temporary connected condition to simulate site conditions as accurately as possible. This requirement is, in particular, applicable to field equipment for electrical and electronic installations.

The purpose of such preliminary testing, shall further be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results, as set out in the various parts of the document.

Measurements of equipment shall be taken into consideration to ensure that such equipment and materials can be handled on site and can be placed into the specified positions.

Additional costs or delays resulting from failure on the part of the Contractor to check access conditions, positions, openings, etc., will be for the Contractors account.

Individual units of equipment shall be clearly marked by employing an identification code in such a manner that actual re-assembly, erection and installation on site can be done in the minimum of time with a minimum of fitting and adjusting on site.
Equipment should be delivered to site in the largest sub-assemblies that are practical.

Equipment of the same type shall all be obtained from one manufacturer and sub-components shall be changeable. Prior to manufacture, the Contractor shall ascertain all critical dimensions and points of entry.

The Engineer may, upon request by the Contractor, inspect existing installations of prototype assemblies in the factory to determine whether the extent and workmanship of such units are of the required standard for the particular Contract. This may be done to obviate the possibility of having to replace unacceptable equipment already installed.

Prior to the delivery of any equipment, the Contractor shall submit OEM routine tests to the Engineer for approval.

C3.1.17. DELIVERY OF EQUIPMENT

The Contractor shall make the necessary arrangements to get all equipment delivered to site in accordance with the Programme of the works and in an undamaged condition.

The Contractor shall pack equipment and material for transport and delivery in soundly constructed crates or other packages fitted with removable lids or openings for inspection.

All parts of the equipment prior to packaging, shall have been thoroughly protected to preclude damage during transport and storage.

Any damage that may occur in transit or storage must be repaired, corrected or replaced by the Contractor before such materials or equipment is installed. Any parts of items found to be defective after installation on site, shall be replaced or repaired at the Contractor's expense and the Engineer's approval.

The Contractor shall be responsible for the acquisition of any insurance cover that may be required for equipment in transit and temporary storage on and off site.

All the lifting and erection equipment required by the Contractor to off-load, install or erect equipment on site is deemed to have been allowed for by the Contractor in the Contract price, as no assistance in this regard will be provided by the Employer or other Contractors.

If no item has been measured in the Pricing Schedules, Schedule of Quantities or Bills of Quantities for such handling equipment, the rate of the item to be handled shall include such handling costs.

Materials stored off-site must be repacked or protected, after inspection, to provide the necessary protection thereof for transport to site.

C3.1.18. OFF-SITE HANDLING OF MATERIALS AND SAFETY

Equipment and materials stored off-site shall be stored in a safe, dry and clean environment and shall be protected against damage, from the elements and theft. Electrical and electronic equipment shall not be assembled, stored or tested in areas where grinding, welding or painting work takes place. Damaged equipment and materials, stored in factories or stores of the Contractor, will be rejected upon inspection.

Areas in stores or places of manufacturing for testing or inspections of equipment and materials by the Engineer shall be clean and safe for the purpose of testing or inspections. Floors must be free of loose materials, dirt and debris.

Equipment and materials will not be inspected in noisy or dirty environments and also not in areas where welding, grinding, and painting or any other manufacturing processes are underway. Testing or inspections will not be undertaken in hazardous or explosive atmospheres.

All material and equipment for the contract shall be separated within the storage facility and clearly marked with the contract number and project name.

Materials stored in the stores of the Contractor or in alternate storage space, and which is acceptable to the Engineer for off-site certification for payment, shall only be certified for payment under the conditions as laid down in this document.

C3.1.19. ON-SITE HANDLING OF MATERIALS AND SAFETY

Equipment and materials stored on site shall be stored in a safe, dry and clean environment and shall be protected against damage, from the elements and theft.

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Heavy materials shall be stored in a manner as not to create a danger to the Contractor, other Contractors, the Employer or the Engineer.

Small materials shall not be left lying around on site. Expensive, small items such as instrumentation or electronic components shall be kept under lock and key until the installation thereof.

Storerooms used by the Contractor shall be kept locked to prevent unnecessary loss of materials.

Redundant material, which is the property of the Employer, shall be removed from site and either be reused elsewhere or returned to the Employer through the relevant processes. If clear directions are not available in this regard, the Contractor shall obtain instructions for the removal of the equipment from the Engineer. No redundant material shall become the property of the Contractor or any other party and shall remain the property of the Employer unless decided otherwise by the Engineer.

C3.1.20. RE-LABELLING

The Contractor shall be responsible to attend to all labelling requirements that arise with any system installation. All labelling requirements shall be allowed for in the unit rates of the Contractors priced bill of quantities. A schedule of labels shall be compiled by the Contractor and submitted to the Engineer for approval. Labelling shall include relabelling of existing works where the new installations affect the original labelling.

C3.1.21. CONSTRUCTION METHODS

Before initiating any construction, the Contractor shall compile a list of all defects per sectional area and verify such defects alongside a duly authorized representative. The repair of any damage not listed shall be the full responsibility of the Contractor, the Employer shall under no circumstances be held responsible for payment of damages done by the Contractor or damages not listed prior to initiating construction.

Where the Contractor will perform trench work, it shall be the Contractor's responsibility to request that the employer scans the trench for any existing services, especially cables at substations. The Contractor shall mark the trench positions clearly by means of chalking.

The Contractor shall ensure that all wayleaves are approved prior to commencement of any work and shall be responsible for marinating any pre-approved wayleaves.

C3.1.22. SITE SAFETY

Safety requirements are as follows:

- Only harnesses and no safety belts must be used in alleviated positions.
- No labourers will be allowed to stay on site. A night watch shall be appointed to guard the site at night.
- Sufficient barricading and visible warnings shall be applied if work is executed near energised plant or equipment.
- All excavations shall be visible barricaded
- No short pants will be allowed on site.
- Safety clothes (PPE) suitable for the specific task must be worn at all times.

- Toilet facilities shall be available on site.
- Day visitors will be able to enter via the visitor's log.
- Hard hats and safety boots are compulsory on the construction site.
- All operators must be trained and competent.
- All equipment must be in a good working order.
- The Contractor must have a first-aid kit on site and all injuries must be reported.
- The Contractor must keep complete record of all man hours.
- No work shall proceed without all statutory Health & Safety appointments by the Contractor.

The requirements of the Occupational Health and Safety Act, Act 85 of 1993 and the Construction Regulations shall be complied with as far as site safety is concerned.

Excavations shall be barricaded, backfilled and compacted as soon as possible after excavating to allow safe passage for persons and traffic on site.

Contractors shall not allow any workers to work in excavations deeper than 1m, unless the sides of the excavations are properly shored and supported, especially in sandy or wet soil conditions.

Open manholes shall be barricaded.

Deep waterlogged excavations shall be pumped empty as soon as possible after flooding or shall be solidly barricaded until pumped dry.

Open, live or unsafe power connections shall not be left unguarded or unprotected.

The construction site shall be kept clean and tidy on a daily basis.

Off-cuts and rubbish shall be removed from the site and deposited in the designated dumping place on a daily basis.

The Contractor shall adhere to all safety rules and regulations as may be in existence on a site or as may be required by the Employer or the Engineer. The Contractor shall also ensure that their workforce on site adhere to safety rules.

Contractor shall not drive or allow a vehicle or machine to be driven close to excavations.

Contractor shall keep all power connections and/or live equipment with voltages above 30V, temporary or permanent, in a good and safe condition and shall keep all doors, shutters and covers closed on such equipment, during construction, testing and commissioning and shall take all steps to prevent accidental contact of live equipment by any person.

The Contractor shall take control over any power cable or power circuit connected from equipment installed by him, or under his control and which operates at a voltage higher than 30V. The Contractor shall not energise such a cable or circuit and shall not grant permission to any other person on the site to energise such a cable or circuit without first having made sure that such action does not create a dangerous situation.

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The Contractor shall not connect any portion of an installation to the point of supply of a Supply Authority without first having complied with the requirements and regulations of such an Authority as far as tests, certification or clearance from the Authority is concerned and also not until permission is obtained from the Engineer in this regard.

Any damage to equipment of other contractors or the Employer due to equipment being supplied by such an unauthorized power connection shall be for the account of the Contractor for this Contract.

The Contractor shall not energise any portion of an installation until the earth points of power equipment in such installation have been properly bonded and earthed to a known good earth point with a value of 5 ohm or less, referred to zero, as tested with a null balance megger.

C3.1.23. EXISTING SERVICES

The Contractor shall consider all possible existing cables and other services. The services may be buried and cannot be accurately pinpointed. Therefore, all excavations must be done with care.

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

The Electrical Contractor shall accept full responsibility for any damage caused by excavation work, whether caused directly or indirectly and whether written permission has been granted for machine excavation or blasting, or not.

Repair of damaged services undertaken by the Electrical Contractor shall be to the satisfaction of the owner of the service. The cost of repair work undertaken by the owners of the service as well as consequential losses due to the damaging of the service will be recovered from payments due to the Electrical Contractor without notice, unless proof of direct payment to the owners can be produced.

The Contractor shall report any damaging of existing services immediately to the Engineer as well as the owner of the service, irrespective of whether the damage is considered a minor damage or not. Apart from reporting damage, an entry shall be made in the site diary, indicating the time of occurrence, extent of the damage, time reported and names of the persons reported to at the Consulting Engineers as well as Owners of the service.

Penalties shall be levied for damage caused to existing services caused under the following circumstances:

a) Damage due to machine excavation or blasting without the written permission of the Engineer.
b) Damage which the Contractor failed to report to the Engineer as well as the owners of the service, or which the Contractor failed to enter comprehensively in the site diary.

The penalties referred to above, shall be 100 % of the cost of repair work carried out by the owner of the service as well as 100 % of the value of consequential losses as calculated by the

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owners of the service. Any such penalties shall be recovered from any payments due to the Contractor.

C3.1.24. DESIGN RESPONSIBILITY

Preparation of all detail designs, manufacturing drawings and documentations for approval specified throughout the enquiry document shall initiate once the successful Contractor has received a Letter of Acceptance.

The Contractor shall be responsible for furnishing all equipment detailed designs. The Contractor shall submit the initial design drawings to the Engineer for a design review and the allowed duration for the design review by the Engineer shall be 10 working days. The design freeze will be only granted after approval by the Engineer. The Contractor shall submit all outline drawings and design details including supporting documents requested within a reasonable time frame and prior to the commencement of the equipment manufacturing.

It is envisaged that the detail design of the following shall be required.

- 132 kV breakers.
- 10 MVA 88 / 22 kV transformer.
- NECRT
- 22 kV Indoor Switchgear.
- 22kV Outdoor breakers.
- Control/protection schemes and panels.
- Conductor
- Pole mounted transformers
- All auxiliary equipment

Note: all drawings shall be submitted in hard and soft copy – soft copies shall be in editable dxf / dgn format.

C3.1.25. AS-BUILT INFORMATION

The Contractor shall ensure that accurate as-built records are kept of all infrastructure installed or relocated during the contract. A marked-up set of drawings shall also be kept and updated by the Contractor. This information shall be supplied to the Engineer's Representative on a regular basis (monthly). All information in possession of the Contractor required by the Engineer and/or the Engineer`s Representative to complete the as-built/record drawings, shall be submitted to the Engineer's Representative before a Certificate of Completion will be issued. Three sets of the following information are required on completion of the works:

- OEM Manuals of all equipment
- Operation and Maintenance manuals.
- Commissioning Reports.
- Design Drawings.
- Factory Acceptance Testing Reports.
- Commissioning Reports.
- As-built drawings.
- Soft copy of all documentation

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C3.1.26. PAYMENTS

Payment application shall be assessed once a month and the claim must be agreed to and approved by the Engineer. The progress claim, together with a progress report, must reach the Engineer's office by the 17th of each month.

The Engineer will not issue any certificate for interim payment of any equipment and material that is stored on or off site in such a way as to hinder inspection thereof.

The Employer reserves the right to be under no obligation to pay for material delivered to or off site and shall take preference for payment to the Contractor after commissioning of the works. The Contractor shall price the preliminary and general section of the bill of quantities adequately, allowing for all overhead costs during the construction period.

Materials or equipment stored on or off site and packed in crates or boxes must be opened for inspection and the serial numbers, types or quantities must be easily identifiable by the Engineer before payment for such materials will be processed.

Payment will not be certified for small materials such as short pieces of cable, conduit, wire, conduit boxes, saddles, screws, etc., that are stored on or off site. Payment for such materials will only be certified once the materials have been built in, installed or commissioned. In special cases, 80% payment for material on site may be considered subject to approval.

Interim payment will only be considered subject to the following conditions:

a) The equipment must be complete and in a ready state for installation or commissioning. Loose components which are not yet built into, or which will form part of, the large materials mentioned in the previous paragraph, will not be considered for payment.

b) The materials which are to be type tested, performance tested, or safety tested should have already passed inspections and/ or tests by the Contractor and/or the supplier of the equipment.

c) The Contractor shall, prior to submitting interim payment claims, procure financial assurance by means of the guarantee from a registered bank, on the format and to the amount stated in the Conditions of Contract.

The material must be stored in a cordoned off area in the stores of the Contractor and a notice must be affixed to this area stating that the materials stored in that area are the property of the Employer. The area must be safe and not near flammable liquids or explosive equipment and must be kept clean and dry.

C3.1.27. USE OF OWN MANPOWER

- The Contractor shall only use skeleton staff and skilled staff for implementation of the project. The contactor shall appoint local labourers for all unskilled tasks. Should it prove to be impossible to identify people from the community to perform the expected tasks identified by the Contractor, written approval shall be obtained from the Engineer, or the community, prior to utilising his own manpower to complete the project.

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- The Contractor's own personnel will be responsible for all specialised work. The Contractor shall therefore use only skilled labour of his own workforce. All other unskilled labour required shall be local labour.
- The Contractor shall take full responsibility to manage local labour

The different tasks and responsibilities are as follows:

a) CLO - Community Liaison Officer
b) Security Guards (an additional security guards must be ready on standby):
   - Manage access to and from the construction site;
   - Manage access to and from the site camp;
   - Move around perimeters;

   (The above guards shall rotate to prevent "sleeping on the job")
c) Unskilled labourers

The contractor shall provide for the necessary facilities for the workforce i.e. water, toilets, guard houses, stationary, PPE, identification etc.

C3.1.27.1. DUTIES, TASKS AND RESPONSIBILITIES

C3.1.27.1.1. CLO

d) Act as Liaison Officer between Community, Contractor and Employer.
e) Identify and recruit manpower.
f) Ensure labourers obey Contractors instructions.
g) Terminate, retrench, expel and discipline workers
   - Not obeying Contractors instructions
   - Refuse to work
   - Not reporting for work without excuse
   - Misbehave, steel, drink, intimidating etc. during working hours etc.
h) Settlement of disputes.
i) Obtain wayleaves.
j) Man and manage a community desk for enquiries, complaints, and recommendations to assist in preventing work stoppages by the community.
k) Any other reasonable instructions required by the Contractor, Project Manager or Employer.

C3.1.27.1.2. SECURITY OFFICER

a) Keep close watch over all material, site yard and equipment of Contractor.
b) Protect material and equipment. Report all incidents to the Contractor.
c) Work 8 hours shifts as follows:
   - Shift 1: 06:00 to 14:00
   - Shift 2: 14:00 to 22:00
   - Shift 3: 22:00 to 06:00
d) Any other reasonable instructions required by the Contractor, Project Manager or Employer.

C3.1.27.1.3. LOCAL LABOUR

a) Perform and execute tasks such as:

- Digging holes
- Digging trenches
- General unskilled labour

b) Any other reasonable instructions required by the Contractor, Project Manager or Employer.

C3.1.27.1.4. CONTRACTOR

a) Employ the CLO, security officers and local labour.
b) Provide and supply all clothing, tools and materials to perform the tasks required.
c) Manage the workforce with the assistance of the CLO to ensure that the programme to carry out the work is met.
d) Manage all material. The Contractor will be responsible for the management, issuing and verification of all material.
e) Conduct and convene meetings on a daily base, to delegate work and tasks and to record progress.
f) To ensure all safety requirements are met.
g) Pay and remunerate the workforce once a month by means of a cash cheque and record all payments with relevant signatures.
h) The Contractor will register all local labourers for unemployment insurance.
i) Enter into written agreement with CLO and workforce and appoint workforce in writing.

C3.1.27.1.5. CONDITIONS OF EMPLOYMENT

a) Obey Contractors instructions.
b) Sign time sheets and report for work from Monday to Friday.
c) Work overtime if required by Contractor.
d) Working hours is 45 hours per week from 07:00 to 16:30 with 30 minutes lunch break from 12:00 to 12:30.
e) Payment will be effected according to attendance register, with no work no pay policy.
f) Payment will be done by means of a cash cheque once a month on the last Friday of the month at 14:00.
g) Unemployment insurance funds will be deducted.
h) Tax will be deducted if applicable and when deducted, IRP5 certificates will be issued.
i) Payment categories:
   - CLO - Estimated R 5 000,00 per month or pro rata for days working
   - Security Guards - Estimated R 4 000 per month or pro rata for days working
   - Labourers - Estimated R 223,00 per day

   The above are estimated minimum amounts and shall be negotiated between the Contractor, Municipality and relevant manpower. To prevent disputes arising any manpower shall not be paid more or paid less than the rates being used within the Municipal area.
j) Overtime will be paid according to time plus a third.
k) If the required progress is not met after actions taken by the CLO, the Contractor will have the right to strengthen his own workforce with the approval of the Project Manager.

C3.2: VAALDAM SUBSTATION EXTENSION

C3.2 – SCOPE OF WORKS:
Vaaldam Substation Extension

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C3.2. VAALDAM SUBSTATION EXTENSION

Note: if required, and upon request, the primary plant and control plant Eskom design reports for the extension of Vaaldam Substation can be made available to tenderers. The successful Contractor will be issued with the Eskom detail design report prior to initiating construction.

C3.2.1. DESCRIPTION OF THE WORKS

The contractor shall be responsible for the detail designs based on equipment offered, installations, construction, erection, commissioning, testing and handing over of the works, complete with all auxiliary equipment where the works at high level comprise of:

The substation section of the project entails the extension of the existing Vaaldam substation (Eskom) by adding a 10 MVA, 88kV/22kV transformer bay and 2 x 22 kV feeder bays. The two feeder bays will supply the existing Themba Khubeka (Metsimaholo Local Municipality) switching station, which will be used to electrify approximately 2 600 households within the area. The Vaaldam substation is owned and operated by Eskom. The extension of the substation will thus be executed as a "Self-Built" project for Eskom. All equipment, procedures and specifications shall therefore be in accordance with the relevant Eskom specifications/standards.

The substation terrace will be extended in the north-northwestern direction. A new fence will be constructed and the substation platform will be extended.

An 88kV bus-section will be added to supply the 10MVA transformer – this will be accomplished by adding 2 x 132kV bus-section isolators, the required busbars and support structures. An 132kV transformer isolator, CT's and 132kV breakers will be installed to supply the transformer. A 22kV NECR/T, 22kV road crossing structure and the relevant breakers/isolators will also be installed.

A 22kV busbar bay will be constructed with 1 x 22kV transformer bay and 2 x 22kV feeder bays. A 22kV bus-section isolator will be installed to interface the proposed 22kV busbar bay with the existing 22kV busbars. The 22kV section isolator will be operated under the normally open condition.

In a previous project, the Themba Khubeka double-circuit Chickadee feeder line was constructed from the Vaaldam substation to the existing Themba Khubeka switching station. Two 22kV feeder bays are required to feed the double-circuit line.

The closing spans from the existing double-circuit feeder line to the 22kV feeder bays must be installed once the substation extension is completed. The contractor will be responsible to arrange an outage with Eskom and Metsimaholo Local Municipality to disconnect the existing 22 kV overhead line from the temporary supply and connect to the newly constructed 22 kV feeder bays.

All the material shall be supplied by the Contractor which includes the manufacturing, according to Eskom Specification, transporting to site, offload, installation and commissioning will all be undertaken by the successful tenderer.

Prior to energizing, commissioning certificates must be submitted by the OEM for the transformer, 132 kV Circuit Breakers, 132 kV Current Transformers, 10 MVA Power

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Transformer, 22kV NECRT and 22kV Circuit Breakers. Prior to the energising of the 10 MVA transformers and the 22 kV NECRT`s an oil sample must be taken and the oil sample shall not be older than 30 days at the time of energising.

The 22 kV overhead power lines are the asset of Metsimaholo Local Municipality and Metsimaholo Local Municipality is responsible for the maintenance of the lines. The extension of Vaaldam Substation will be handed over to Eskom.

C3.2.2. HIGH LEVEL SCOPE OF WORKS

The scope of works is outlined below. The new equipment shall match existing equipment as far as practically possible and where Eskom standards allow.

Table 1: High level primary plant scope of work

1.	Extend the existing substation yard by extending the substation platform and constructing a new substation fence (the existing fence will be kept where possible or rerouted until construction is completed to ensure that the substation will be fenced off at all times).
2.	Construct an 88kV bus-section with two 132kV isolators to connect to the existing 88kV busbars.
3.	Install a complete 88/22kV transformer bay
4.	Install a 22kV road crossing structure
5.	Install a 22kV transformer breaker
6.	Install a 22kV transformer/busbar isolator
7.	Extend the existing 22kV busbar-section
8.	Install a 22kV isolator to interconnect the existing 22kV busbars to the extension.
9.	Relocate the existing 22kV VT (due to space constraints that will be induced when the 22kV bus-section isolator is installed).
10.	Install 22kV busbar VT's
11.	Install 2 x 22kV feeder bays (new "combo" 22kV breakers)
12.	Install a 22kV NECRT
13.	Construct a fire barrier between the existing and new transformer bay
14.	Connect the existing feeder lines to the feeder bays by constructing the closing spans (Chickadee ACSR)

Table 2: High level control plant scope of work

1.	**PROTECTION**
1.1.	Manufacture and install a new swing frame panel to house the new transformer protection and control scheme.
1.2.	The new 10MVA transformer will utilise a 4TM7101 protection scheme. No separate/distinct protection scheme will be required for the NEC/NER.
1.3.	Install a tap-change control scheme (scheme 4TC5200) in the new transformer protection panel.
1.4.	Manufacture and install a new under frequency panel to house the existing under frequency relay and the protection and control scheme for the two new 22kV feeder lines.
1.5.	Install a VT junction-box on the new 22kV busbar VT's.
1.6.	Install a CT junction-box on the new 88kV transformer-bay CT's
1.7.	Pre-commission and commission the new installation.
Note: *The existing under frequency panel will be de-commisioned and the underfrequency relay transferred to the newly constructed panel. A new panel will be required because the*	

feeder protection scheme needs to be installed on the under frequency panel due to space constraints. The schemes will be integrated into the existing RTU via serial communication.	
2.	**METERING**
2.1.	Manufacture and install a new swing frame panel to house the main and check meters for the 22kV feeders and the statistical meter for the transformer.
2.2.	Install tariff metering for the new 22kV feeder bays on the new metering panel. Two meters are to be installed per feeder bay (Main & Check). Class 0.5s meters will be used.
2.3.	Install statistical metering on the new metering panel. Class 0.5s meters will be used.
2.4.	Install a quality-of-supply module.
2.5.	Provide control and supervisory cabling accordingly.
2.6.	Pre-commission and commission the new installation.
Note:	*All equipment to interface with the existing RTU as per the Eskom schemes.*

C3.2.3. EQUIPMENT SPECIFICATION

The following equipment forms part of the Vaaldam substation extension:

Table 3: Equipment Schedule (Substation Extension)

DESCRIPTION	DRAWING NUMBER	QTY
ISOL 132kV 2500A 25kA CRDB H/O 31mm (2.4m Phase Spacing)	D-DT-6150s1	3
BREAKER 132kV 3150 40kA 3P	D-DT-6250s3	1
CT 132kV 2500A 40kA 2P2M2B (1600)	D-DT-6190s1	3
TRANSFORMER 10MVA 88/22kV OLTC Ynd1	D-DT-6128	1
NEC/NER/AUX TRANSFORMER 22kV 360A 100kVA 22kV/420/240V 31mm/kV	D-DT-6141	1
ACTOM CTB36 22kV, 1250A, 25kA OUTDOOR COMBO VCB 31mm/kV	D-DT-6252	3
ACTOM COMPOSITE CT – 1200/800/200/1A CLASS 0.2	OEM	9
22kV SURGE ARRESTOR ASSEMBLY FOR ACTOM CTB36 VCB	D-DT-0261s1	9
ISOLATOR 22kV 2500A, 25kA, CRDB H/O 31mm/kV	D-DT-6154s2	9
22KV MV BULL BASIC BAY EQUIPMENT (CLAMP PISTOL, LONG ROD INSUL, LINE POST INSUL ETC.)	D-DT-4755s3	1
22KV MV BULL EXT BAY EQUIPMENT (CLAMP PISTOL, LONG ROD INSUL, LINE POST INSUL ETC.)	D-DT-4755s4	1
VT 1 PH 22kV/110V 100/50VA	D-DT-6173	1
AC YARD BOARD	D-DT-11200	1
INSUL POST STN 132kV	D-DT-6230	6
INSUL POST STN 22kV	D-DT-6235	6
S/ARR S/CL 88kV MCOV 56kV	D-DT-6211	3
S/ARR S/CL 22kV MCOV 24kV	D-DT-6215	3
S/ARR S/CL 66kV MCOV 48kV	D-DT-6212	1
FLOODLIGHT LED 90W, 10 000 LM, 120LM/W, RND	D-DT-6009	9

C3.2.4. SUBSTATION EQUIPMENT

a) Bus-section Isolator (D-DT-4630s1):
2 x sets 132 kV, 2500 A, 25 kA, Bull, 31 mm/kV isolator with 2.4m phase spacing.

b) Transformer Bay Isolator (D-DT-4630s1):
1 x sets 132 kV, 2500 A, 25 kA, Cent, 31 mm/kV isolator with 2.4m phase spacing.

c) Circuit Breaker (D-DT-6250s3):
1 x 132 kV, 2500 A, 40 kA, 3P, 31mm/kV, Centipede

d) Current Transformer (D-DT-6190s1):
1 x 132 kV, 2500 A, 40 kA, 2P2M2B500, 31mm/kV

e) Power Transformer (D-DT-4608):
1 x 88/22 kV, 10MVA, OLTC, Centipede to Bull

f) NEC/NER/AUX Transformer (D-DT-6141s1):
1 x 22kV 360A, 100kVA, 22kV/420/240V, 31mm/kV

g) Post Insulator (132kV) (D-DT-6230):
6 x 88 kV Post Insulator, 31 mm/kV

h) Post Insulator (22kV) (D-DT-6235):
6 x 22 kV Post Insulator, 31 mm/kV

i) Isolator (22kV) (D-DT-6154s1):
6 x 22 kV, 2500 A, 25 kA, CRDB, H/O, 31 mm/kV

j) Outdoor Circuit Breaker Kiosk (22kV) (D-DT-6252)
3 x 22 kV, 1250 A, 25kA

k) Voltage transformer (D-DT-4640):
1 x $\frac{22\,000/\sqrt{3}}{110/\sqrt{3}}$ V, 100 VA, 31 mm/kV, Centipede (D-DT 6173)

C3.2.5.GENERAL

C3.2.5.1. ESKOM SELF-BUILD PROJECT

The Contractor or Subcontractor responsible for the extension of Eskom's Vaaldam Substation shall be conversant with Eskom standards, procedures and requirements, shall have a valid Eskom vendor number, and be able to get authorised to perform work in FSOU.

All work shall be in accordance with Eskom's self-build procedure. Only equipment approved through Eskom's National Contracts shall be permitted to be installation.

The Contractor shall be responsible for all primary plan and control plant aspects associated with the Vaaldam Substation extension, including detail OEM drawings.

Eskom will recommission and energise the substation extension. However, the Contractor shall pre-commission and test all equipment installed in accordance with Eskom's requirements.

C3.2.5.2. SITE WORKS

The Contractor shall remove all vegetation and neutralise the site before construction can begin.

The bulk earth works portion of the contract to establish the substation platform is included under the Eskom contract in full. The Contractor will be responsible to hand over and certify the setting out and levels of the bulk earth works.

The external access road to the substation is sufficient as is and the Contractor is not required to create any new access roads. The existing access road shall be graded for ease of access.

C3.2.5.3. BULK EARTH WORKS AND ROAD WORKS

The bulk earth works comprises of:

- Site Clearance and Preparation
- Bulk Excavations
- Bulk Backfilling
- Platform preparation
- Gabions and Pitching
- Top-soiling and grassing
- Testing
- Site Survey
- Herbicides and Pesticides application

The internal road works comprises of:

- Concrete gate entrances ramps
- Substation road curbing

C3.2.5.4. WORK SPECIFICATION

C3.2.5.4.1. Disposal of excavated material shall include:

a) Removal of excavated Black Turf or any other soil unsuitable for backfilling and transporting it to borrow pits.
b) The excavated material shall be disposed of in borrow pits or a suitable place, indicated by the Engineer or his site representative or the Employer's environmental representative.
c) The Contractor shall make his own arrangements for the provision to dispose of the excavated material on such a disposal place.
d) Free haul shall be the distance within a radius of 1,5 km from the substation position.
e) Limited haul shall be the first 1 km beyond the end of the free haul distance via the shortest practicable route.
f) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.

C3.2.5.4.2. Importing soil shall include:

a) Transporting imported soil from borrow pits to substation position.
b) In areas where the excavated soil is Black Turf, imported soil shall be used for the soil / cement mixture.
c) The Contractor shall make his own arrangements for the provision of a suitable borrow pit for the importing soil.
d) Free haul shall be the distance within a radius of 1,5 km from the substation position.
e) Limited haul shall be the first 1 km beyond the end of the free haul distance by the shortest practical route.
f) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practical route.

C3.2.5.4.3. Transportation shall include:

a) Transporting all material and equipment from the construction camp to the substation position.
b) Free haul shall be the distance within a radius of 1,5 km from the substation position.
c) Limited haul shall be the first 1 km beyond the end of the free haul distance by the shortest practicable route.
d) Long haul shall be the remainder of the distance beyond the limited haul by the shortest practicable route.
e) If the Contractor is planning to use a batching plant not located in the construction camp, the cost due to transporting the concrete from the batching plant to the construction camp shall be at the expense of the Contractor.

C3.2.5.5. MATERIAL SPECIFICATION

C3.2.5.5.1. Disposal of excavated material:

a) The Contractor shall be responsible for disposing of excavated soil not used for backfilling.
b) The Contractor shall transport all the excavated soil not used for backfilling to the suitable borrow pit.

C3.2.5.5.2. Importing soil:

a) The Contractor shall be responsible for supplying imported soil. If not otherwise specified, the imported soil shall be in accordance to SANS 1200.
b) The imported soil shall not contain notable quantities of organic matter or stones of average dimension exceeding 150 mm.
c) The Contractor shall transport all the imported soil from the borrow pit to the substation position.

C3.2.5.5.3. Transportation:

a) The Contractor shall transport the concrete from the batching plant to the substation position.

C3.2.6. INSTALLATION OF EARTH GRID

C3.2.6.1. WORK SPECIFICATION

NOTES:

a) The earth grid shall be installed in accordance to Eskom Earthing Standard D-DT5240 and to the Earth Grid Layout drawing.
b) All labour and transport cost must be included in the quoted rate.

C3.2.6.1.1. EXCAVATE EARTH GRID TRENCHES SHALL INCLUDE:

a) Excavating in all material 450 mm wide trenches.
b) The main earth grid shall be laid in 1000 mm deep trenches.
c) Risk of collapse and keeping excavations free of water shall be included in the quoted rate.

C3.2.6.1.2. INSTALLING THE EARTH GRID SHALL INCLUDE:

Horizontal earth electrode

a) Round annealed copper rod with a 10 mm diameter, is to be used for the earth electrode.
b) A 200 mm layer of imported soil with a resistivity less than 100 Ω.m shall be compacted at the bottom of the trench before placing the copper conductor in the trench.
c) The copper conductor shall be placed on this bed of compacted soil.
d) The main earth grid trenches shall be back filled and compacted with imported soil with a resistivity less than 100 Ω.m, in layers not exceeding 150 mm.
e) Copper rods shall be installed under the switch house foundation and welded to the main substation earth grid.

Vertical earth electrode:

a) Round annealed copper rod with a 10 mm diameter, is to be used for the earth electrode.
b) Holes with an inside minimum diameter of 100 mm must be drilled to the required depth. The vertical copper electrodes (two rods per hole) will be positioned in the hole, which will then be filled with conductive concrete. It must be poured as a slurry into the holes.

Welding of joints, crossings and earth tails shall include:

a) All copper rod crossings and joints shall be welded according to Earthing Standard D-DT-5240. This includes the vertical electrodes welded to the horizontal electrodes.
b) At positions indicated on Earth grid drawing, earth tails shall be welded to the earth grid.
c) These earth tails shall protrude above the substation floor level, long enough for bonding to the substation fence and steel support footings.
d) No joint in earth tails shall be made above the ground level.
e) Bonding of the earth tails to the steelwork, equipment and substation fence is covered in the documents handling the installation of the relevant parts.
f) Earth tails for bonding to the terminal towers shall be installed as shown on the Earth grid Layout drawing. The line Contractor shall do the bonding to the terminal tower.

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Connection to the existing earth:

a) The Contractor shall perform cross-cuts to determine the position of the existing earth grid. The newly installed earth grid shall be welded according to Earthing Standard D-DT-5240 to the existing earth grid.

Testing of earth grid shall include:

a) The earth resistance of the earth grid shall be tested before the earth wires of the Themba Khubeka line are connected to the earth grid.
b) The preferred method for testing the earth grid resistance is the 'Wiener Bridge' method.
c) The test shall be done from one of the corners of the main substation earth grid.
d) The measurements shall be carried out and logged by the Project Engineer.

Additional earthing shall include:

a) The total earth resistance of the earth grid before the overhead line is connected should be less than [the resistance calculated in CDEGS].
b) If the values for the earth resistance for any are above the mentioned values, additional vertical earthing should be installed, after the project Engineer has been notified.
c) The additional vertical electrodes shall be welded to the existing horizontal grid according to Earthing Standard D-DT-5240.
d) The earth resistance shall again be measured as described.
e) If the value for the earth resistance is still above the mentioned values, the Project Engineer shall be notified once again.

C3.2.6.2. MATERIAL SPECIFICATION

Unless otherwise specified, The Contractor shall supply the copper and all the material necessary for installing the earth grid. The Contractor shall further be responsible for the safekeeping of the copper.

All earthing outside the substation perimeter fence shall be the Copper Cladded Steel (CAMO type) equivalent to the copper earthing specified.

Installing the earth grid:

a) 10 mm Diameter annealed copper rods shall be used for the main earth grid conductors as well as for the counter poise conductors.
b) The resistivity of the imported soil shall be less than 100 Ω.m for the soil to be back filled in the earth grid trenches.

Welding of joints:

a) Unless otherwise specified the earth tails shall be 50 mm x 3 mm flat copper strips.

Testing earthing resistance:

a) The Contractor / Project Engineer shall carry out the tests.

Additional earthing:

a) 10mm Diameter annealed copper rods shall be used for the additional counter poise conductors.
b) All material for the additional earthing shall be supplied by the Contractor.

Conductive concrete for vertical electrodes:

The conductive concrete must have a resistivity of less than 0.01 Ωm. It must be made from high quality (99% Carbon) petroleum coke with a closely graded particle size. The mixture of the conductive concrete should be 7 parts carbon, one-part cement.

C3.2.7. CIVIL WORKS

C3.2.7.1. WORK SPECIFICATION

NOTES:

a) All foundations shall be erected according to Eskom's standard foundation drawings.
b) All work shall be in accordance the relevant SANS 1200 documents and the latest revision of drawing D-DT 5240.
c) All labour and transport costs shall be included in quoted rate.
d) Risk of collapse and keeping excavations free of water shall be included in the quoted rate.

Foundations:

a) Supply and erect complete foundations to standard Eskom drawings including formation, reinforcing, holding down bolts, back filling and compaction around the foundations.
b) A steel template shall be used for setting all holding down bolts.
c) Formation shall be extended to at least 100 mm below the natural ground level.

Transformer plinths:

a) Supply and erect a complete transformer plinth and runway according to the foundation drawing including formation and reinforcing. A sump, leading to the oil holding dam shall be established inside all bund walls.

Cable trenching and kerbing:

a) Supply and install complete cable trench as shown on the Foundation Drawing including back filling and compaction around the trenches.
b) The substation kerb shall enclose the substation as shown on the Foundation Drawing.
c) All ramps shall be a concrete slab reinforced with mesh as shown on Foundation Drawing.

Yard stoning:

a) The 25 mm - 38 mm yard stone shall be spread over the entire substation yard to a thickness of at least 150 mm.
b) The yard stone shall be lightly compacted to set levels.

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Herbicides, insecticides, etc. shall include:

a) Treating of yard surface with Eskom approved herbicides, insecticides, etc.
b) Forming of V-grooves along foundation walls and treating with additional insecticides approved by Eskom.
c) Herbicides shall be applied after completion of the substation terrace, during commissioning of the substation and before the 12-month maintenance and guarantee period lapses.

C3.2.7.2. MATERIAL SPECIFICATIONS

The Contractor shall supply, transport and offload all material and equipment necessary for completing all the civil works.

Foundations:

a) All material used for the foundations shall be in accordance to the relevant foundation drawings and SANS documents mentioned on these drawings.
b) All holding down bolts complete with nuts. The Contractor shall supply washers.
c) All holding down bolts shall be galvanised to SANS 1461 or ISO 1461 for all foundations.
d) All holding down bolts shall be in accordance to SANS 135 with a strength grade of 4.6.

Cable trenching and kerbing:

a) The concrete used for the cable trench walls shall be in accordance to the Foundation Drawings.
b) The concrete covers shall be reinforced with mesh reinforcing in accordance to Foundation Drawings.
c) The sand on the inside of the cable trench shall be river sand.

Yard stoning:

a) The stone shall be clean, hard, sound crushed stone having a nominal size not less than 25 mm as approved by Eskom.

Herbicides, insecticides, etc.:

a) All herbicides, insecticides, etc. and the application thereof shall be in accordance to Eskom's latest corporate Environmental Policy.
b) A guideline for selecting herbicides used in substations shall be acquired from the Eskom's Environmental Department.
c) Prior to the use of any herbicides, insecticides, etc. approval from Eskom's environmental representative shall be obtained.
d) Consultation on herbicides and the effectiveness thereof, as well as advice on any other aspect of herbicides, can be obtained from Eskom's Environmental Department.

C3.2.8. STEELWORK

C3.2.8.1. WORK SPECIFICATION

NOTES:

a) Unless otherwise specified, all steelwork shall be standard equipment supports according to Eskom's standard equipment support drawings.
b) All labour and transport cost must be included in quoted rate.

Erecting steelwork shall include:

a) Supply and erect all steelwork shown on Steelwork Schedule and according to standard Eskom drawings.

C3.2.8.2. MATERIAL SPECIFICATION

Unless otherwise specified, the Contractor shall supply all material necessary for installing the steelwork.

Erecting steelwork:

a) The steel for the supporting structures shall be in accordance to the specific support structure drawings.
b) The steel shall be hot dipped galvanised to SANS 1461 or ISO 1461.

C3.2.9. INSTALLATION OF EQUIPMENT

C3.2.9.1. WORK SPECIFICATION

NOTES:

a) All work shall be in accordance to Eskom's standards and specifications.
b) Unless otherwise specified, all installed equipment shall be labelled.
c) All equipment shall be positioned and all necessary stringing and earth bonding shall be done according to the following drawings:
   - Station electrical diagram.
   - General Arrangement diagram.
   - Sections diagram
d) All labour and transport costs must be included in quoted rate.

New Equipment:

a) Extension of the Substation as indicated.

Clamp Assemblies:

a) All clamps shall be installed as indicated on the Sections and Clamp Layout drawing.
b) The clamp assemblies shall be in accordance to the manufacturers' specifications.
c) All conductors shall be cleaned to a shiny finish at the point where the conductor clamps are to be applied.
d) A non-oxidation compound, approved by Eskom, shall be applied on all conductor and earthing connections.
e) After the application of the compound, the conductor shall be brushed with a steel brush.
f) The clamp assemblies will be done and torqued to the manufacturers' specifications.

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Stringing and Conductors:

a) All stringing shall be done in accordance with General Arrangement and the Sections and Clamps Layout Drawings.
b) The HV switchgear between the Busbar and TRFR shall be strung with Centipede ~~/ Bull~~ conductor
c) The stringing on the MV side of the transformer to the MV busbar shall be Bull Conductor.
d) The stringing from the MV feeder breakers to the ACSR shall be Centipede.

Earth Ball Joint Portable Earth

a) Install portable earth balls on the isolators' steelwork.

Equipment labelling:

a) Equipment labels shall be attached according to the Eskom specification to the relevant equipment support steelwork.
b) The label shall be attached to the supporting steelwork with a minimum of two M10 galvanised bolts with nuts and washers.
c) All labelling shall be in accordance with Eskom's latest labelling standards.
d) The outdoor breaker and isolator labels shall be fitted so that it is visible from the operating points.

Equipment bonding:

a) Bonding of all steelwork to 50 mm x 3 mm earth tails in accordance to the Earthing Standard D-DT 5240.
b) The steel support bolts shall be used to bond the earth tail to the equipment support footings.
c) Where connections are made painted steelwork the paint shall be removed over a minimum area to allow good contact between surfaces.
d) The earth tails shall be fixed to the steelwork according to the Earthing Standard D-DT 5240.
e) Where connections are made onto painted steelwork the paint shall be removed over a minimum area to allow good contact between surfaces.
f) A 50 mm x 50 mm area around the hole on the earth tail used for bonding shall be cleaned before the earth tail is bonded to the steel support.
g) A non-oxidising paste, approved by Eskom, shall be put between the cleaned earth tail surface and the steel support before it is bonded.
h) After bolting any scraped area not covered by the copper connection shall be painted using original types and colours of paints.
i) No joints shall be made above the ground level.
j) All visible copper earth tails protruding above the ground shall be painted using the same type and colour paints as the equipment or the equipment support to which it is bonded.

Lightning/lighting masts:

a) Lighting/lightning masts (with spikes) shall be installed according to D- DT 5217 and the lamps attached at 6 m with a support platform at 4 m. Refer to substation layout drawing for the orientation of the lamps on masts.

C3.2.9.2. MATERIAL SPECIFICATION

The Contractor shall supply all the equipment necessary to install the material.

If material is supplied by the Contractor, then those products will be in accordance with Eskom standards and specifications and the Eskom buyers' guide. All materials shall be approved by Eskom and be marked with the manufacturers' logo/trademark and specific part number.

An ordering schedule with SAP numbers shall be provided by the Contractor for approval prior to placing any material orders.

New Equipment

a) The holding down bolts for the equipment shall be supplied by the Contractor.
b) All holding down bolts with nuts and washers shall be hot dipped galvanised to SANS 1461 or ISO 1461.
c) All holding down bolts shall be in accordance to SANS 135 with a strength grade of 4.8

Clamp assemblies:

a) Clamps shall be as in the Substation Bill of Materials.

Stringing and conductors

a) Conductors shall be as specified in the Substation Bill of Materials.
b) The conductors shall be in accordance to SANS 182-2:2020 & SANS 182-3:2003.

Earth Ball Joint Portable Earth

a) Portable Earth Ball Joints shall be in accordance to SANS 61230 and Eskom specification SCSSCAAN3.

Equipment labelling:

a) The Contractor shall supply all fixing bolts with nuts and washers for the labels.
b) All bolts nuts and washers shall be hot dipped galvanised to SANS 1461 or ISO 1461.
c) All bolts shall be in accordance to SANS 135 with a strength grade of 4.8.
d) Eskom shall supply all labels.
e) The supports for the labels shall be supplied by the Contractor according to 0.54/400 and 0.54/402 (Including concrete foundations if required), unless otherwise indicated on the design drawings and Bill of activities.
f) All labels shall be in accordance with Eskom's latest labelling standards.

Equipment Bonding:

a) All bolts with nuts and washers used for bonding shall be hot dipped galvanised to SANS 1461 or ISO 1461 and shall be supplied by the Contractor.
b) All bolts shall be in accordance to SANS 135 with a strength grade of 4.6.

Lighting/lightning masts:

a) All bolts shall be in accordance to SANS 135 with a strength grade of 4.6.

C3.2.10. SUBSTATION FENCING

C3.2.10.1. WORKS SPECIFICATION

NOTES:
a) All work shall be in accordance to Eskom's standards and specifications.
b) All labour and transport cost must be included in quoted rate.

Fencing shall include:
a) Installing the complete security fence of welded mesh (high security) on the perimeter of the substation extension as shown on the Foundation and Steelwork drawings including excavations, foundations and erection of the fence.
b) Earth tails shall be bonded to the security fence at all strain, corner posts in accordance to Eskom Earthing Standard D-DT 5240.
c) Where indicated a 1.8 m diamond mesh separation fence shall be installed.

Installing complete gates shall include:
a) 5 m gates shall be provided where indicated.
b) All gates shall be bonded to the gate post with hot dipped galvanised bolts.

Installing signs shall include:
a) Warning sign shall be installed on the security fence next to the gate.
b) All signs and notices shall be in accordance to SANS 1186.
c) The following signs shall be attached to the fence next to the gate:
   - Unauthorised Entry & interfering prohibited.
   - Procedure in case of fire.
   - Warning of electrical shock.
   - "No copper" where CCS is installed
d) On the fence a warning of electrical shock sign must be attached.
e) The signs on the fence shall not be more than 15 m apart.

C3.2.10.2. MATERIAL SPECIFICATION

The Contractor shall supply the fence, the gates and the signs as well as the necessary material for erecting the substation fence and attaching the signs.

C3.2.11. SUBSTATION LABELS

- All substation and feeder names shall be written out in full without abbreviation.
- All equipment names shall be abbreviated.
- The labelling shall provide positive identification of individual plant, which it controls; and the labelling of plant shall not conflict with any other labelling. Refer to Standard for Labelling of substation and networks.

C3.2.12. LV SUPPLY TOWARDS THE SUBSTATION

For construction, testing and commissioning activities, a temporary low voltage supply can be made available.

All costs relating to the temporary low voltage auxiliary supply shall be for the contractor's cost.

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C3.2.13. ELECTRICAL INSTALLATION IN THE SUBSTATION

The electrical installation to conform to the requirements of SANS 10142-1:2017. The layout of the installation is shown on the attached project drawings forming part of this specification. All conduit work is to be surface mounted in an acceptable manner, with bosal conduit. **No Sprague tubing shall be accepted.**

The building electrical installation involves:
LIGHTING

- A.C. supplies to new equipment
- Earthing of new equipment
- Etc.

C3.2.14. POWER TRANSFORMERS (PSE 18)

This section of the specification provides for the manufacture, supply, testing before shipment, delivery, off-loading and positioning on a concrete base, installation, site testing, handing over in a working condition of one (1), 10 MVA, 88 000/22 000 V step down transformers with on-load tap changing equipment at Vaaldam Substation.

The Contract also includes the supply and delivery of all auxiliary materials and equipment necessary for a complete installation and all drawings, plans and instructions.

The power transformers to be supplied shall comply with the latest Eskom Specification (240-68973110) “SPECIFICATION FOR POWER TRANSFORMERS RATED FOR 1.25MVA AND ABOVE AND WITH HIGHEST VOLTAGE OF 2.2kV OR ABOVE”.

Transformers offered shall comply with the following specific requirements:

1.	Application:	Outdoor
2.	Number required	One (1)
3.	Dry type or oil immersed:	Oil immersed
4.	Rated Frequency:	50 Hz
5.	Continuous maximum rating at rated voltage:	10 MVA
6.	Vector Group:	Ynd1
7.	On load voltages	
	a. Primary	88 kV
	b. Secondary	22 kV
	c. Tertiary	
8.	Earthing	
	a. Primary	Solid or via 66 kV surge arrestor
	b. Secondary	NECRT
	c. Tertiary	Not Applicable.
9.	Anti-vibration	20 mm malthoid (Three ply)

If there is any uncertainty to any of the transformer parameters, it shall be clarified in writing with the Engineer prior to closing of the tender. Transformers within the substation shall be capable of short time parallel operation for load transfer.

The cooling system of the transformer shall be an Oil-Neutral and Air-Neutral (ONAN) system for the maximum transformer rating.

The transformers are required to be supplied with open air insulated tank top mounted bushings for both the 88kV as well as the 22kV side. The HV bushings on all transformers are to be of the Resin Impregnated Paper (RIP) condenser core type, with composite external insulation with silicone or porcelain weather sheds. The 22 kV side bushings of the transformers shall have a minimum insulation level for 33 kV with a creepage distance of 31mm/kV.

It is a requirement of this contract that the power transformers are equipped with radiator banks fitted to the transformer in the space allocated on the project drawings. The power transformer, radiator banks and auxiliary transformers shall be effectively earthed to the substation earth system.

C3.2.14.1. PHYSICAL ARRANGEMENT

The power transformer's maximum dimensions, including the bushings, cooler banks and conservator shall be:

Height:	< 3.1 m (plinth to tank cover)
	< 5 m (top of bushing stem)
	< 5.5 m (conservator tank top)
Length:	< 4.4 m (tank footprint)
	< 6.5 m (overall)
Width:	< 1.5m (tank footprint)
	< 5 m (overall)

NOTE: The conservator spatial orientation, with reference to the transformer main tank, must be adjustable to ensure the minimum safe working clearances are satisfied.

The power transformer's physical arrangement shall conform to the layout as per the sketch below.

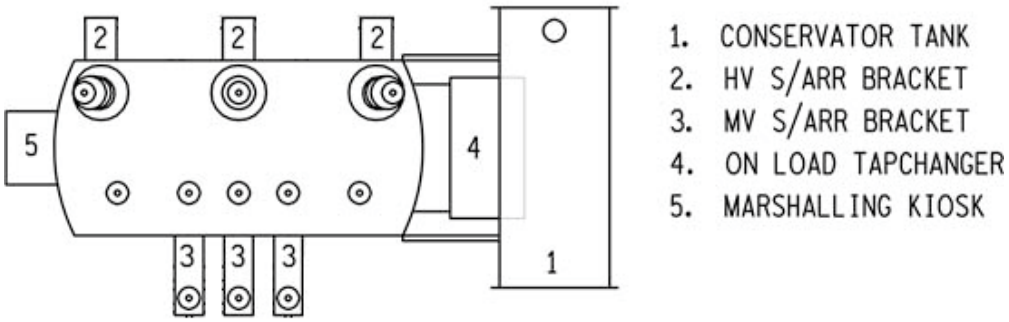

Figure 1: Transformer arrangement

Tenderers shall note that the transformer radiators / cooling fins shall be attached to the transformer main tank only and shall not destabilise the transformer to such an extent that radiator supports are required.

C3.2.14.2. BUSHINGS

The following shall apply to the transformer bushings:

1. The HV Bushing shall be symmetrically arranged about the overall transverse Centre line of the transformer.

2. All neutral bushings shall be fitted in line with the MV bushings.
3. Despite the actual operating voltage, the transformer bushings shall have an insulation level corresponding to a nominal system voltage of 33 kV. These bushings shall be equipped with a terminal stem of **38 mm diameter** for secondary side, **26 mm diameter** for primary side and **125 mm length**, have a minimum centre-to-centre spacing of not less than **400 mm for MV side**.
4. The MV bushings shall be of the capacitance graded type.
5. The minimum distance from the transformer base (plinth) to the bushing flange base shall be 2.5 m.
6. The bushing creepage distance shall be 31mm/kV (MV: at 33 kV).

C3.2.14.3. CLEARANCES

The electrical clearance shall be:

HV (88kV)		
	Phase – Earth	1000mm
	Working Clearance	3300mm (Vertical)
		1900mm (Horizontal)
MV (22kV)		
	Phase – Earth	320mm
	Working Clearance	2800mm (Vertical)
		1400mm (Horizontal)

C3.2.14.4. TAP CHANGER

The tap changer shall be of the vacuum type. The on-load tap changer shall operate in the range of +5% to -15% of the HV voltage in 16 equal steps of 1.25% each.

The tap changer shall be subject to the following testing:

1. 8 Complete Cycles – not energized
2. 1 Complete operation cycle – 85% of rated voltage applied
3. 1 Complete Cycle energized at rated voltage and frequency (no-load)
4. 10 Tap changes within +/- 2 steps of the principle tap

Care shall be taken to match the tap voltages to the voltage range of other transformers.

C3.2.14.5. CORE

There shall be no sparking that may upset Dissolved Gas Analysis (DGA) monitoring of the transformer, between bolted mechanical members during inrush or other transient conditions. This requirement shall apply even if DGA is not included at this stage.

The core shall be earthed to the core clamping structure at one point only, through a removable external link suitably situated and protected, to allow testing after installation of the transformer. The core earthing connection shall be larger than $80mm^2$.

Lifting lugs shall be provided for lifting the core and windings.

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C3.2.14.6. WINDINGS

The paper used in the winding insulation shall be thermally upgraded paper. The bracing of the windings and connections shall be such that these parts shall safely withstand the cumulative effects of stresses that may occur during handling, transportation, installation and service, including line-to-line and line-to-ground faults.

C3.2.14.7. AUXILIARIES

All contacts providing an alarm output shall be rated to carry 30 A for 200ms at 250 $V_{D.C.}$ and continuously carry 2 A at 250$V_{D.C.}$ All secondary wiring shall be 2.5mm^2 with 30 strands (660/100 V as per SANS 1507-2). The auxiliary wiring shall be neatly fitted into a cable tray or compartment onto the transformer.

A 400/230$V_{A.C.}$, 3ph, 4 wire, 50Hz auxiliary power supply shall be provided.

The marshalling box shall have a certified rating of min. IP55. The marshalling box shall preferably be free standing. All gauges such as oil and winding temperature indications shall be equipped within the marshalling box.

C3.2.14.8. TANK

a) The transformer tank cover shall be bolted.

b) The interior surfaces of the tank, the cover and the cooling equipment shall be cleaned and dried immediately prior to filling the transformer with oil. Interior surfaces (other than those of cooling tubes and headers) above a line that lies at least 50 mm below the oil level that corresponds to an oil temperature of 20 °C, shall be corrosion-protected by varnishing, priming or painting, using materials that are not affected by, or will not adversely affect, the electrical or chemical properties of the insulating oil.

c) The tank and cover shall be designed so that local heating due to stray flux in any structural part shall not exceed the top oil temperature limit specified for the transformer, by more than 10 °C.
Heating, due to stray flux, shall also not cause local temperature elevations of more than 15 °C relative to the oil temperature at that level.
Thermometer pockets shall be located so as to avoid errors in temperature indication due to the heating effects resulting from stray flux.

d) The under base shall be suitable for the movement of the transformer in any direction, by sliding on greased rails, and shall be provided with four hauling eyes not less than 50 mm in diameter, as near as possible to the extremities of the length and width of the tank with not less than 100 mm working clearance above them.

e) Four suitably and symmetrically placed jacking pads shall be provided in positions that shall be accessible when the transformer is loaded on to the transport vehicle, except where jacking pads are used as transport pads on vehicles with built-in jacking.
The position of the jacking pads shall be such that they do not restrict the direction in which the transformer could be moved (forward, backward and sideways) once offloaded on site.

f) Four symmetrically placed lifting lugs shall be provided so that it will be possible to lift the complete transformer when filled with oil without structural damage to any part of the transformer. The factor of safety at any one point shall not be less than 2.

g) The lifting lugs shall be arranged and located as to be accessible for use when the transformer is loaded on the transport vehicle, and so as not to cause fouling of any of the transformer fittings and accessories.

h) Centre of gravity shall be clearly visible and indicated on all sides of the transformer tank.

i) The transformer primary will be solidly earthed without any Neutral Earthing Resistor. The OEM shall therefore take circulating currents into consideration when the tank wall thickness is calculated to prevent any interior or exterior corrosion.

Provision shall be made for earthing the transformer and associated apparatus as follows:

1. Transformer tank earthing
2. Transformer neutral(s) earthing (direct)
3. Transformer surge arrester earthing (line and neutral surge arresters)
4. All tank attached apparatus, including cable marshalling boxes, tap-changer operating gear and mechanism boxes, and fan and pump motors shall be bonded to their supporting structures.
5. Earthing pads shall also be provided on each end of the supporting structures for all separately mounted cooler banks and oil conservators and on all free-standing cubicles.
6. No copper shall be used as connections for the purpose of earthing.

C3.2.14.9. NEUTRAL BUSHING

The neutral bushing shall be solidly earthed by means of a 50 x 3 mm Cu strap painted silver. The neutral bushing must be equipped with two CT cores in turret arrangement as an integral or built in part of the transformer:

- Core 1 – Class X for LV REF Protection
- Core 2 – SEF Protection
- CT wiring to be brought out into a CT JB and wired to the transformer marshalling box or kiosk.

C3.2.14.10.INSULATION

The transformer bushing insulation level shall be 10% above the values given in the table below:

Table 4: Insulation level

U_m (kV_{rms})	U_n (kV_{rms})	Fault level (kA)	Lightning - BIL (kV peak)		Power Frequency 60s 50Hz		Bushings					Tap changer		
							Line		Neutral		Creepage (31mm/kV)			
			Line Terminal	Neutral Terminal	Separate source	Induced	BIL	60s 50Hz (kV_{rms})	BIL (kV peak)	60s 50Hz (kV_{rms})		U_n (kV_{rms})	BIL (kV peak)	60s ,50Hz (kV_{rms})
24	22	25	150	150	50	48	200	70	200	70	375	22	150	50
100	88	25	380	250	95	150	550	230	350	140	3100	44	250	95

C3.2.14.11.TRANSFORMER OIL

The transformer main tank oil insulation level shall be 70kV per 2.5mm for virgin oil prior to filling and 60kV per 2.5mm at time of taking over.

C3.2.14.12.TESTS

The transformer shall be tested in accordance with Eskom specification 240-68973110. The transformer shall be subject to the following test at the cost of the OEM to be witnessed by the Authority and Engineering representative:

1. Voltage Ratio and Phase displacement
2. Winding D.C. Resistance
3. Insulation Resistance to Earth
4. Insulation Characteristics and bushing dielectric loss
5. Separate source voltage withstand
6. Induced Over-voltage withstand
7. Partial Discharge Measurement
8. Lightning impulse Withstand
9. Switching Impulse Withstand
10. Insulation resistance to earth
11. Short circuit AC tests (Partial Discharge)
12. No load loss, magnetizing current and impedance voltage
13. Short Circuit Impedance and load loss
14. Zero Sequence Impedance
15. On load tap changing
16. Temperature rise & overload
17. Overpressure – Leakage Test
18. Oil DGA
19. Determining of Sound Levels / acoustic noise
20. Frequency Response analysis (Factory & Site)
21. Paint thickness & quality
22. Auxiliary wiring functionality & pressure test (Factory)
23. Impact Recorders during transport, loading and offloading

Short circuit withstand calculations for the transformer shall be provided.

The transformer test methodology and connection diagrams for testing shall be submitted together with the bid offer.

C3.2.14.13.TRANSFORMER OFFLOADING

Loading and offloading of the transformers shall be done by means of rigging on skids. The transformer mounted on the low bed vehicle will be brought into position adjacent to the transformer bay. The transformer must be lifted with jacks to install railway rails underneath the transformer. By means of a system of packers and jacks, the tank is then lowered onto a pair of greased railway rails along which it can be slid to its position over the plinth. The required position of the tank on the plinth must be accurately marked. When the tank is correctly positioned on the plinth, it must then be carefully examined for any signs of damage or any other indication that it might have been abused during transport.

The impact recorder that has been fitted for transport shall now be read or downloaded and then switched off and removed. Any additional clamping that has been applied to the core and windings for transport must now be removed according to the instruction manual. The coolers, pipework, bushing, turrets, etc. which were removed for transport, will now be fitted and connected, requiring the removal of blanking plates giving access to the tank.
Such opening of the tank must be kept to a minimum time to reduce the possibility of moisture entering the tank. If the transformer has been transported with the tank full of nitrogen, it is necessary to perch this fully with dry air.

When all bushings have been fitted, access covers replaced, conservator and Buchholtz pipe work erected as well as associated pipe work installed and connected to the radiators, preparation can begin with the filling of the transformer with oil.

C3.2.15. NECRT (PSE 20)

This section of the specification provides for the manufacture, supply, testing before shipment, delivery, off-loading and positioning on a concrete base, installation, site testing, handing over in a working condition of combined oil-immersed 22 kV three phased neutral electro-magnetic couplers with neutral earthing resistors and auxiliary transformers (NECRT's)

The Contract also includes the supply and delivery of all auxiliary materials and equipment necessary for a complete installation as well as drawings, plans and instructions as further specified herein.

The NECRT's to be supplied shall comply with the latest Eskom Specification (240-57648848) "SPECIFICATION FOR COMBINED THREE-PHASE NEUTRAL ELECTRO-MAGNETIC COUPLERS WITH NEUTRAL EARTHING RESISTORS AND AUXILIARY TRANSFORMERS (NECRT's)".

1.	Application:	Outdoor
2.	Number required:	One (1)
3.	Continuous maximum rating at rated voltage of auxiliary transformer:	100 kVA
4.	Indoor or outdoor:	Outdoor
5.	Dry type or oil immersed:	Oil immersed

6.	Rated Frequency:	50 Hz
7.	Normal "on-load" voltages:	
	a. Primary for NECRT	22 kV
	b. LV for Aux. Trfr.	420 V
8.	Method of system earthing	
	a. MV System	via NEC / NEC
	b. LV	Solid
9.	Vector group of NEC	Zig-Zag
10.	Vector group of auxiliary transformer	Dyn 11

The NECRT's will be installed on concrete plinths as indicated on the project drawings.

All low voltage circuit breakers to be supplied for this project shall be complete with flash barriers and inter phase barriers with rear insulating screens, Cable and Power connectors, chassis side plates as well as IP40 Escutcheons.

The connection of the AAC conductor and clamps, as well as the LV supply connections between the transformer and the auxiliary transformers form an integral part of this part of the contract.

The auxiliary transformer will be fitted with the following integrated mechanical protection devices, complete with the necessary wiring to the abovementioned control cable boxes:

- Oil/winding over temperature alarm and trip contacts.
- Gas (Buchholz) over pressure alarm and trip functions, complete with sufficient alarm and trip contacts to comply with the protection scheme, shall be provided.
- A common set of alarm/trip contacts for alarm and indication functions in the transformer protection panel.
- A common set of alarm and trip contacts to provide alarm and trip indication for the SCADA system.
- The contractor shall make allowance for the witnessing of the FAT by the Employer / End-User and the Engineer, in the priced unit rate.

C3.2.16. SUBSTATION FOUNDATIONS AND STRUCTURAL WORK (PSE 23)

C3.2.16.1. FOUNDATIONS

All foundation shall be constructed according to the Eskom standard foundations as specified in the Project Specifications, Bill of Quantities and project drawings.
The oil containment wall shall be brick built according to D-DT-5232s2B and the dimension shall be as indicated on the project drawings.

The transformer plinth shall be constructed according to D-DT-5231s1 & VE9335-6-FDN and the dimension shall be adjusted as indicated on the project drawings.

Transformer fire walls shall be a steel fire barrier as per D-DT-5218s2A

Concrete ramps shall be provided at all gates and over cable trenches as indicated.
The level of the gate's sliding beams shall be coordinated in detail to prevent the yard stone level from being higher than any foundation top level.

Anti-tunnelling systems / kerbs shall be provided underneath the perimeter fence. The mesh must be anchored into/onto the centre of the anti-tunnelling and the bottom rail of the panels must be flush with the anti-tunnelling. The anti-tunnelling shall be100mm (wide) x 600mm (deep) concrete (15MPa) between posts. The mesh must be anchored into/onto the centre of the anti-tunnelling.

Table 5: Foundation Schedule

DESCRIPTION	DRAWING NUMBER	QTY
132kV ISOLATOR SUPPORT FOUNDATION (TYPE 3) (2.4m Phase Spacing)	5202s1e	3
TUBE BUSBAR SUPT. FDN. 132kV	5208s1	6
132kV CIRCUIT BREAKER FOUNDATION (TYPE 2)	5200s1C	1
MED. EQUIP. SUPT. FOUNDATION FOR CURRENT TRANSFORMER	5206s1	3
STANDARD TRANSFORMER PLINTH 5-20MVA	5231s1	1
STANDARD TRANSFORMER SLIPWAY	5231s1 & VE9335-6-FDN	1
STANDARD SELF-CONTAINED OIL CONTAINMENT AREA	5232s2B	1
NEC/NER/AUX TRF 33/22/11kV FOUNDATION	5207s1b	1
6.6kV-44kV POST INSULATOR SUPPORT FDN	5221s1	2
BKR. 22kV FOUNDATION DETAILS	5216s1	3
ISOLATOR 22kV SUPT FOUNDATION	5205s1	6
COLUMN SUPT. FOUNDATION	5223s2	6
MED. EQUIP. SUPT. FOUNDATION (132kV CT)	5206s1	3
MED. EQUIP. SUPT. FOUNDATION (22kV VT's)	5206s1	2
LIGHTING-LIGHTNING MAST 21 m TUBULAR SUPPORT FOUNDATION (1 x PROVISIONAL)	5217s6	3
AC YARD BOARD	D-DT-5276s1A	1
FENCE FOUNDATIONS - WELDED MESH	D-DT-5237s5A	12
GATE FOUNDATION DETAILS	D-DT-5237s3	3
750mm CABLE TRENCH	D-DT-5254s5A	47m
1500mm WIDE CABLE TRENCH FOR T-TYPE SECTION	D-DT-5254s5H	2
LV CABLE ROAD DUCT 6-PIPE	D-DT-5254s3C	1

C3.2.16.2. STEELWORK

All steelwork shall be according to the Eskom standard steelwork as specified in the Project Specifications, Bill of Quantities and project drawings.

Table 6: Steelwork Schedule

DESCRIPTION	DRAWING (D-DT)	QTY
ISOLATOR 132kV 2500A 25kA BULL - BUSSECTION	5202s2K	2
NON-EXTENDABLE BUSBAR 132kV ONTO BUSSECTION	5208s2	6
ISOLATOR 132kV 2500A 25kA CENT - TRFR BAY	5202s2K	1
CURRENT TRANSFORMER 132kV 2500A 25kA 2P2M2B	5206s5&5206s3	3
TRANSFORMER 88/22kV 10 MVA OLTC CENT TO BULL	5231s1&5231C	1
NEC/NER/AUX TRANSFORMER 22kV 360A BULL	5207s2A	1
22kV ROAD CROSSING	5221s2	2
TRFR BREAKER 22kV 1250A 20kA BULL (COMBO-UNITS)	6254	3
ISOLATOR 22kV 2500A 25kA	5205s2A	6

DESCRIPTION	DRAWING (D-DT)	QTY
MV BUSBAR 22kV BULL BASIC BAY (without busbar/bay isolator channels)	5223s6	1
MV BUSBAR 22kV BULL EXT BAY (without busbar/bay isolator channels)	5223s6	1
VOLTAGE TRANSFORMER 22kV/110V	5206s3&5206s6	1
AC YARD BOARD	5276s2A	1
SUBSTATION LIGHTING MAST 21m (*1 x Provisional*)	5217s2C	3
STEEL FIRE BARRIER (MODULE A&B)	5218s2A	2
STEEL FIRE BARRIER (LATTICE SUPPORT)	5218s2A	3

C3.2.17. OUTDOOR HV SWITCHGEAR (PSE 25)

C3.2.17.1.1. CIRCUIT BREAKERS

The substation extension shall use one (1) new 132 kV type outdoor circuit breakers & three (3) new 22kV outdoor kiosk type circuit breakers, each of which shall fully comply with Eskom standard 240-56063756.

The circuit breakers shall be mounted on suitable mounting structures as indicated on the project drawings.

The following high voltage circuit breaker is required as part of this contract:

- 132 kV SF_6 three pole circuit breaker: 2500 A, 40 kA, 31 mm/kV, $110V_{D.C.}$ control voltage; [D-DT-6250]
- 22kV three pole, 1250A, 25kA, 31mm/kV, $110V_{D.C.}$ kiosk type outdoor vacuum breaker (CTB 36) [D-DT-6252].

Detailed type test certificates for the circuit breaker as offered, proving compliance with specifications shall be submitted with all tenders. Failure to provide the required test certificates may result in the respective tenders to be disqualified.

The operating mechanisms for these circuit breakers shall be of the motor wound spring operated type and shall be in a fully accessible positions from ground level. The mechanism box shall also be easily accessible under all circumstances.

All circuit breaker mechanisms shall be equipped with a sufficient number of auxiliary contacts for remote control and indication from the local substation control room as well as from the supervisory control and indication system. A sufficient number of spare contacts shall also be provided and shall not be less than 20%.

The operating mechanism motor, tripping, closing and control circuits shall be operated from the $110V_{D.C.}$ supply, obtained from the dual battery system to be installed in the battery room of the substation building.

The circuit breakers shall be provided with completely separated duplicate trip coil systems, operating totally independent electrically as well as mechanically. One trip coil shall be used for protection purposes and the other for control facilities.

The circuit breaker, mechanism boxes and mounting structures shall be earthed to the main substation earthing system.

The circuit breaker mechanism boxes shall also be equipped with approved padlock ready selector switches, selecting between “local” and “remote” operation, completely preventing remote control of the circuit breaker when selected in the “local” position for local control or maintenance purposes.

Control of the circuit breakers shall be possible either from the “local” control position on the circuit breaker itself, from the protection and control cubicles in the substation control room or from the supervisory or SCADA control system.

All mechanism boxes of the circuit breakers shall be equipped with a suitable anti condensation heater to prevent any condensation taking place in the early hours of the morning.

Full type test certificates, indicating compliance of all breakers with SANS 62271 and Eskom specifications shall be submitted with tender submissions. Failure by the Contractor to submit these required type test certificates with their respective tender submissions may result in their tenders being disqualified.

C3.2.17.1.2. ISOLATORS

The substation shall be equipped with three (3) new 132 kV type outdoor double break centre rotate isolators, each of which shall fully comply with Eskom standard 240-56063815.

The substation designs are based on 132 kV 2500 A centre rotating double side breaking outdoor type isolators: 25 kA short time current, 31 mm/kV creepage, hand operated, 1 x F contact, 5 x M contacts, 8 x g contacts, 2 x N contacts and any additional contact required for interlocking.

The following isolators shall be supplied and installed at the relevant substation locations:
- 1 x 132 kV busbar isolators;
- 2 x 132 kV bus-section isolators;

These isolators are intended for visible isolation and earthing.

All outdoor type centre rotating isolators to be used on this project shall be equipped with the required earth switches for earthing purposes.

All the isolator units and all earth switches shall be manual, hand-operated type units.

Special care shall be taken to ensure that all isolator mounting frames, as well as operating mechanisms and associated supporting drive assemblies are fully earthed to the substation main earthing system. Bonded and earthed isolator foot plates shall be provided with all isolators.

The earth switch mechanisms on the isolators shall be fitted with an electrical and integral mechanical interlocking system in order to prevent closing thereof under certain prescribed conditions detailed later on in this specification.
The operating mechanism boxes for the isolators shall be mounted in an approved and fully accessible position. These operating mechanisms shall all be equipped with a sufficient number of auxiliary contacts for the remote indication of the isolator and earth switch status as well as for the necessary electrical interlocking schemes. In addition, at least 20% spare contacts shall be allowed for possible future use. Approved facilities shall furthermore be provided on all isolator mechanism boxes to accommodate the necessary interlocking schemes.

All isolators shall be of the free-entry/free-exit (FE/FE) type with spring loaded multiple finger type contacts, with a knuckle action on opening and closing. Isolators with a single tubular main contact with a single pair of spring-loaded recipient contacts will not be acceptable.

All isolators shall be equipped with the necessary arcing contacts to prevent the unnecessary erosion of the main contacts during opening or closing operations.

All isolator mechanism boxes shall be equipped with suitable condensation heaters to prevent any condensation taking place during moist conditions.

These mechanism and kiosk heaters shall be operated from a $220V_{A.C.}$ supply to be initiated by a photocell and/or timer circuit in the control building.
Full type test certificates, indicating compliance of all isolators with IEC 62271-102, NRS 031 and Eskom specifications shall be submitted with tender submissions. Failure by the Contractor to submit these required type test certificates with their respective tender submissions may result in their tenders being disqualified.

C3.2.18. VT'S (PSE 53)

New high voltage transformers to be supplied and installed consist of the following:

- 1 x electromagnetic, single phase $\frac{22}{\sqrt{3}}$ kV voltage transformers with $\frac{110}{\sqrt{3}}$ V outputs on the secondary windings, 150kV BIL, 31 mm/kV creepage and 100 VA Class 0.2 burden.

All voltage transformers shall be mounted on suitable outdoor type mounting structures, fully complying with the steelwork requirements.

The supporting structures and voltage transformers shall each be separately earthed to the local substation earthing system.

Voltage transformers shall comply with the relevant specifications and standards listed in the general specification section of this enquiry.

The existing 22kV voltage transformer shall be moved as indicated on the project drawings.

C3.2.19. CONTROL PLANT SPECIFICATIONS

The contractor will be responsible for all aspects of the control plant installation.

C3.2.19.1. PROTECTION PHILOSOPHY

In order to achieve the necessary performance requirements at all voltage levels, protection of the network shall follow the philosophy whereby no single failure of protection and its associated systems shall permit a fault to remain connected to the primary system.

To implement this philosophy, it is necessary to ensure that all faults are detected by independent high speed protection systems, including Main and Back-Up protections, the outputs of which are selectively allocated to independent tripping systems with separate D.C. supplies.

Circuit-breaker fail protection shall be provided to cater for failure of circuit-breakers and associated tripping circuits. The function shall be duplicated and integrated within both main protection systems.

Redundancy of critical functions (e.g. tripping) shall be achieved via hardwired signals in parallel with the specified communication protocol.

The successful Contractor shall be responsible for the detail design, detail schematic drawings, installation, testing, commissioning and handing over of the secondary plant according to the information and equipment offered. All drawings must be submitted to the Engineer for approval prior to manufacturing. The design shall be based on Eskom Distribution Standards.

The technology design shall be done according to the following schemes:
- 1 x Transformer protection scheme – Eskom scheme 4TM7101 Rev 0.
- 1 x Tap change protection scheme – Eskom scheme 4TC5200 Rev 2.
- 2 x Rural feeder protection schemes – Eskom scheme 4RF1100 Rev 2.
- 1 x Under frequency protection schemes – Eskom scheme 4LS1100.

The protection design philosophies for the above-mentioned schemes are outlined in the paragraphs to follow. Philosophies given are high level requirements, all details shall be submitted by the Contractor for approval, including a Functional Design Specification for approval detailing all proposed schemes.

C3.2.19.2. PROTECTION PANELS

The following protection panels shall be installed:

i. 1 x Transformer protection panel to house the transformer protection scheme (4TM7101) & tap change protection scheme (4TC5200).

ii. 1 x Feeder protection panel to house 2 x Rural feeder protection schemes (4RF1100) and 1 x Under frequency protection scheme (4LS1100). The existing under frequency panel will be decommissioned. The existing under frequency relay shall be transferred to the new panel.

C3.2.19.3. TRIPPING D.C CIRCUIT

Double-pole miniature circuit-breakers (DP MCBs) shall be provided for the protection and isolation of the D.C. supplies to each scheme.

C3.2.19.4. CLOSING D.C. CIRCUIT

Anti-pumping - In the event that a breaker is closed into a fault, while the operator is applying a closed signal via a closed control switch, the circuit breaker should trip and prevent closing again until the closing circuit has been de-energized by the operator's releasing the control switch.

C3.2.19.5. PROTECTION CT CIRCUITS

For each circuit the protection CT core shall feed onto standard terminals and then to the CT test block and IED measuring elements.

A MMLG test block shall be used in all the wired CT circuits. Each test block shall include integral shorting of the incoming terminals when the cover is removed.

For this application, the CT circuits shall be used for the Differential, REF, Breaker-fail, and Over-Current, Earth Fault, and Instantaneous Over-current protection functions and for the Measurements functions.

The neutral of each CT circuit shall be earthed at one place only: on the incoming neutral terminal inside the protection panel. A sliding link terminal shall be provided on the earth connection for isolation proposes in order to facilitate insulation resistance testing.

C3.2.19.6. 88 / 22 KV TRANSFORMER PROTECTION PHILOSOPHY

The 4TM7101 protection scheme shall be utilised. The scheme is shown below.

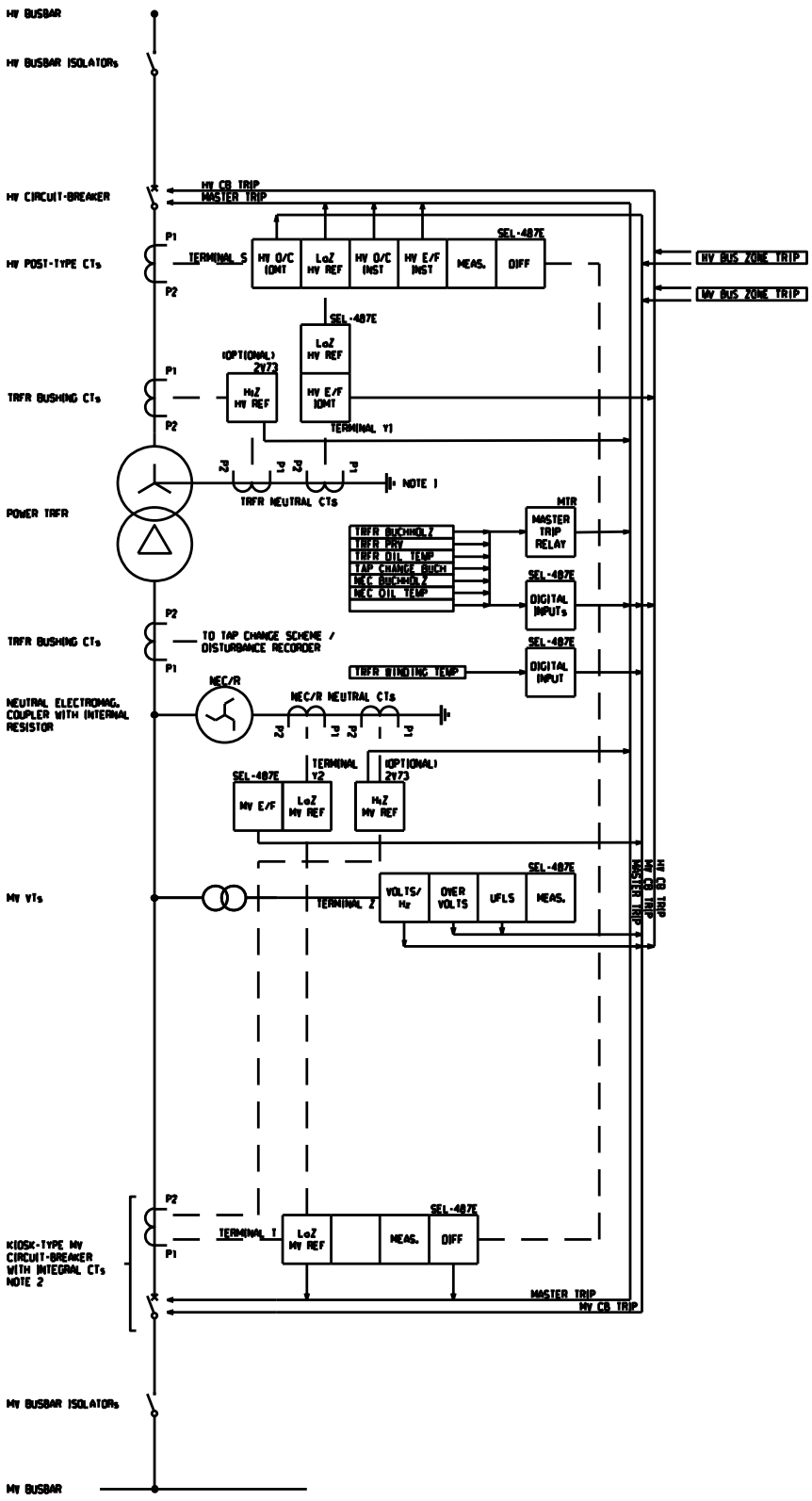

Figure 2: 4TM7101 protection scheme

Cabling requirements shall be as indicated on the project drawings. The contractor shall submit detail control cabling schedules indicating the cable types, sizes, glands, lengths, connector types etc. for approval.

C3.2.19.7. VOLTAGE TRANSFORMER REQUIREMENT

Voltage transformer (VT) input to the transducers will be obtained from the transformer's 22 kV, VT JB. The VT inputs to the Tap Change Schemes are to be looped from the transformer protection schemes.

C3.2.19.8. CURRENT TRANSFORMER RATIOS TO BE EMPLOYED

The new (2P2M2B) 132 kV, CT's will have two multi-ratio (MR) 1600/1 protection cores, two MR 1600/1 bus zone cores and two MR 1600/1 metering cores. The new (1P2M), 22 kV CT's include one protection and two metering (metering and indication) multi-ratio 1200/1 cores.

a) The high voltage (HV) restricted-earth-fault (REF) function is to operate via direction comparison of the currents from the Differential CT inputs and the transformer's HV **neutral CT**. The transformer's HV neutral CT has a fixed ratio of 300/1.

b) The HV differential protection (diff), HV REF and HV overcurrent functions are to receive CT inputs from the same sets of **post type CT** cores. A CT ratio of 200/1 will be used.

c) CT inputs to the high impedance LV REF will be provided via the 22 kV CT's and a neutral CT on the NEC/R.

d) CT inputs to the Transformer Differential protection will be provided via the 22 kV CT's and the post top HV CT's.

C3.2.19.9. 88 / 22 KV TRANSFORMER TAP CHANGER PROTECTION PHILOSOPHY

On-Load Tap Change Protection and Control shall be achieved using the Eskom scheme (4TC5200). The scheme shall be mounted below the transformer protection scheme in the transformer protection panel.

C3.2.19.10. INSTRUMENT TRANSFORMER REQUIREMENTS

The VT inputs to the Tap Change Schemes are to be looped from the transformer protection schemes (transformer protection panel).

Current transformer inputs to the tap change scheme are to be obtained from the transformer's MV bushing CT's.

C3.2.19.11. 22KV OUTDOOR KIOSK BREAKER

The 22kV outdoor feeder combo-breakers (i.e. CTB36 VCB) shall use the 4RF1100 Eskom rural feeder protection scheme. Two rural feeder protection schemes are required.

The feeder breaker protection scheme is shown below.

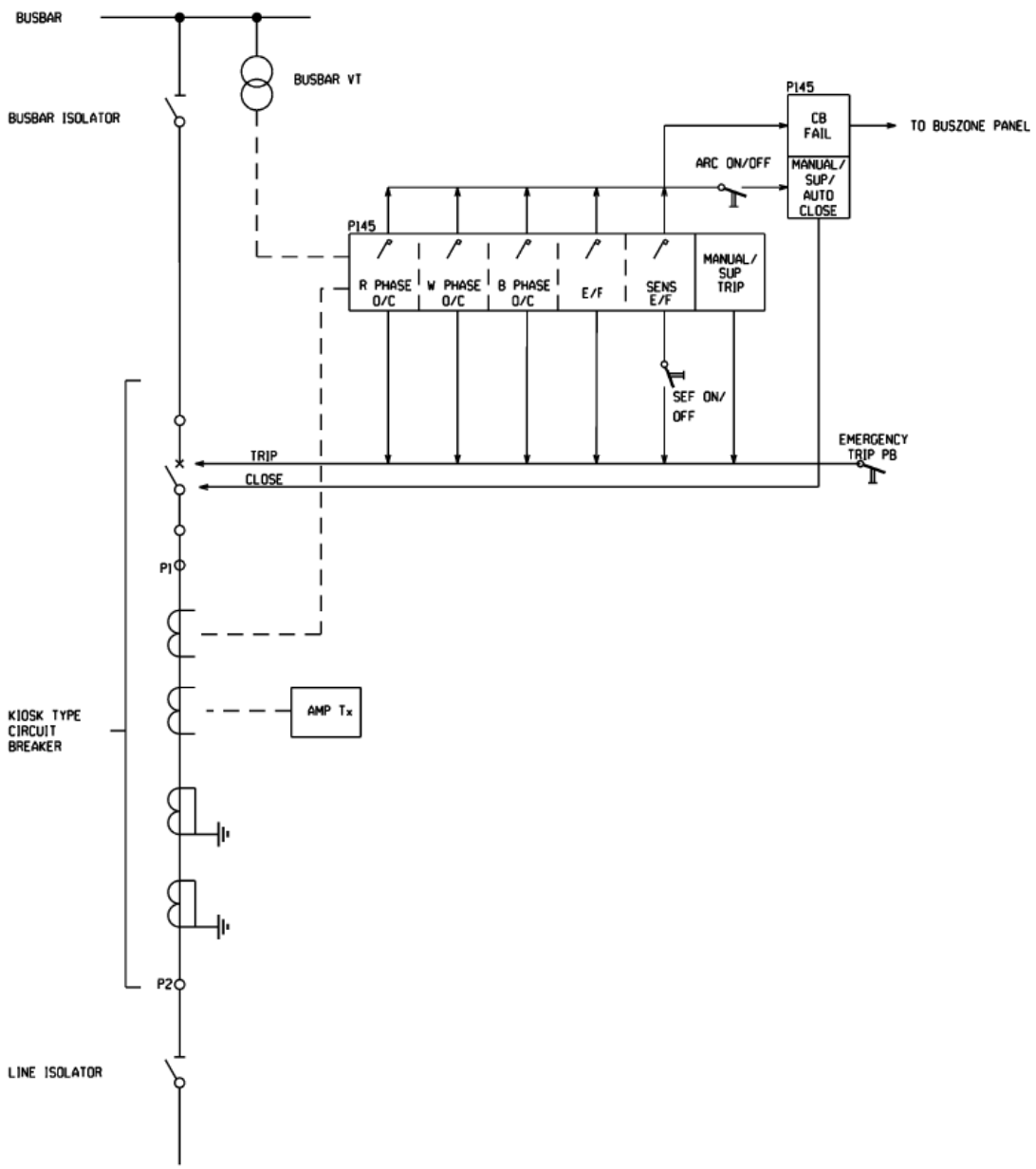

Figure 3: Feeder breaker protection scheme

C3.2.19.11.1. WORKS SPECIFICATION

Installation of control cable shall include:

a) All control cables shall be laid, glanded, numbered and terminated according to the protection drawings, specifications and bill of material.

b) Cable lengths shall be made to reach the furthermost terminal block in the panels, JB, etc. No joints shall be made.

c) Spare cores shall be earthed at one end only and not at both ends.

d) Ferrule numbering shall be done according to protection drawings.

e) Correct sizes of ferrule numbers shall be used per cable size and to Eskom standard - black lettering on yellow a background only (D-DT-6069).

f) All cable or wire numbering shall be so that it is readable from one position. Numbering shall not be inverted.

g) Where insulated lugs are used the correct crimping tool shall be used.
h) The correct size glands shall be used per cable size.
i) The correct type of lugs shall be used per cable size.
j) The screen of the control cable shall be earthed according to D-DT-5240.

C3.2.19.11.2. MATERIAL SPECIFICATION

Unless otherwise specified, the Contractor shall supply, transport and offload all the material and equipment necessary for installing all the cables in the substation.

Install control cable:
a) The cable strand numbering shall be black lettering on yellow a background only (D-DT-6069).

C3.2.19.12. METERING PANEL

Only 1 x metering panel will be required to house the following:
i. 2 x Main & 2 x Check tariff meters for the two 22kV feeder bays.
ii. 1 x Statistical meter for the 10MVA transformer.

C3.2.19.13. TARIFF METERING

The two 22kV feeders shall each be fitted with the following:

- 2 x Class 0.5s (Main & Check) tarrif meters per feeder.

The Eskom specified Elster A1700 meter shall be installed. The relevant Eskom SAP material number for the Elster meter is 0242600. The Contractor must supply the calibration certificates for the meters.

The meters shall interface with the existing RTU in the control room. The Contractor can assume that the existing RTU has enough communication ports available.

C3.2.19.14. STATISTICAL METERING

Statistical metering shall be installed for the 10MVA transformer. A class 0.5s meter shall be used.

The Eskom specified Elster A1700 meter with SAP number 0242600 shall be used.

The statistical meter shall interface with the existing RTU in the control room.

C3.2.20. CONTROL ROOM BUILDING (PSE 16)

The existing control room shall be used. The layout of the existing control room is shown below.

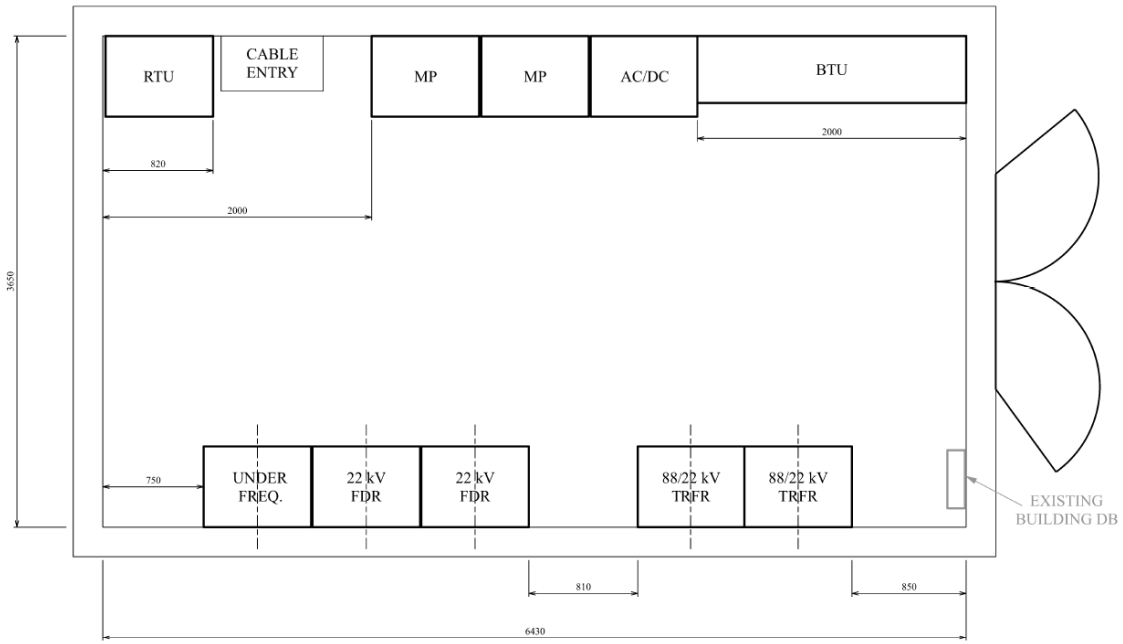

Figure 4: Existing control room layout

Due to space constraints in the building, the existing DB shall be moved so that the transformer protection panel can be placed against the wall where the DB is currently located. The proposed control room layout is shown in the project drawings.

The proposed control room layout is shown below.

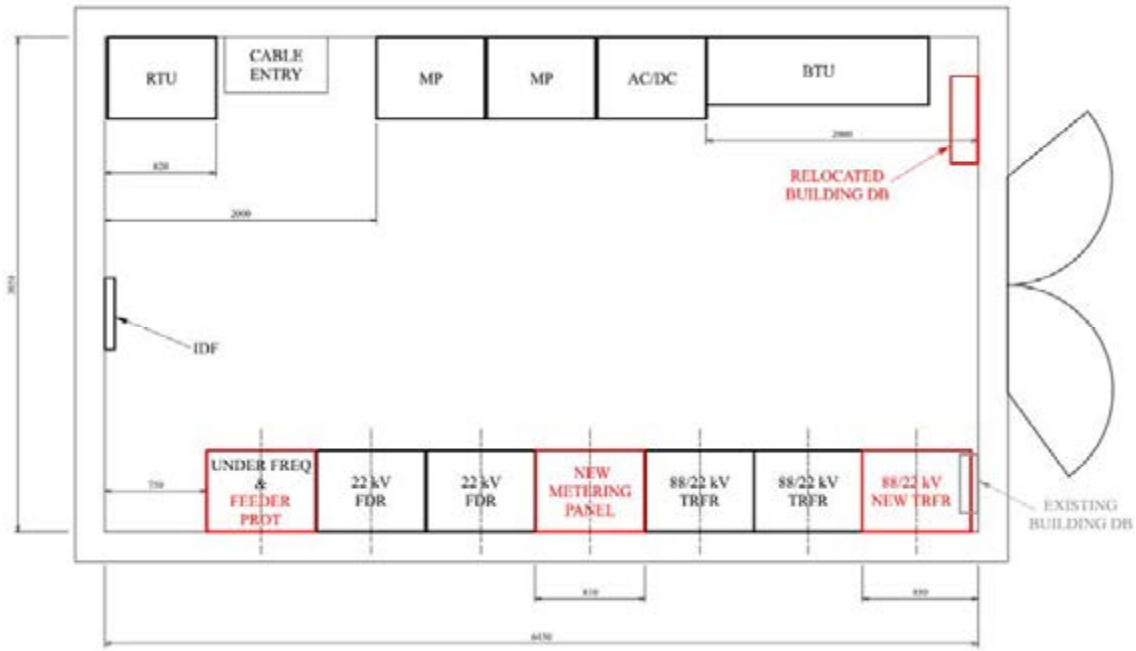

Figure 5: Proposed control room layout

The Contractor shall perform minor refurbishments to the building. This entails refurbishing fthe ceiling panel and installing a new light fixture with 2 x fluorescent tubes.

C3.2.20.1.1. Conduiting and wiring

Conduits shall be 20mm surface mounted galvanised steel conduits. The Contractor shall make provision for all saddles, bends, loop boxes and drawboxes required for the installation in the rate for the small power installation.

Wire to be used shall be 600/1000V PVC insulated, single core multi stranded copper conductors and green insulated copper conductors for earth continuity to SANS 175.

- Light circuits = 2,5mm² power & 2,5mm² Earth
- Power circuits = 4mm² power & 2,5mm² Earth
- No joints in conduits will be accepted.

C3.2.20.1.2. Power supply

The distribution board for the building electrical installation is currently fed from the existing AC yard boards for the two existing transformers. A supply from the new AC yard board for the building electrical installation is not required.

C3.2.20.1.3. Distribution board

The existing distribution board shall be moved due to space constraints inside the control room building.

C3.2.20.2. LIGHT FITTINGS

The existing light fitting inside the control room is faulty. The Contractor shall supply and install a new fluorescent light fixture and tubes (2 x 5ft tubes, 58W per tube).

C3.2.21. SUBSTATION SYSTEM TESTING AND COMMISSIONING

All site acceptance tests shall be performed in accordance with IEEE Std 1861:2014 “IEEE Guide for On-site Acceptance Tests of Electrical Equipment and System Commissioning of 1000 kV AC and Above”. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the requirements of the above guide. The tests shall apply to:

C3.2.21.1. POWER TRANSFORMERS

- Leak testing with pressure (tightness test)
- Winding resistance measurement
- Ratio tests
- Polarity check
- Insulation resistance test on each winding to ground and between windings including bushings
- Dissipation factor (tanδ) and capacitance measurement on each winding to ground and between windings
- Core and frame insulation check
- Tests on bushings
- Insulating oil tests
- Dissolved gas analysis (DGA) test
- Excitation current measurements at reduced voltage
- Frequency response analysis (FRA)
- Short-circuit impedance measurement at reduced current
- Applied voltage tests

- Induced voltage test with partial discharge measurement (IVPD)

C3.2.21.2. CAPACITIVE VOLTAGE TRANSFORMERS

- Insulation resistance measurement of capacitor voltage dividers' low-voltage terminal to earth terminal
- Capacitance and dissipation factor (tanδ) measurement of capacitor voltage dividers
- Tightness of the liquid-filled capacitor voltage dividers
- Winding resistance measurement of electromagnetic units
- Insulation resistance measurement of each component of electromagnetic units
- Connection check between components of electromagnetic units
- Tightness of electromagnetic units
- Accuracy checks (determination of error)
- Damper check

C3.2.21.3. BUSHING TYPE CURRENT TRANSFORMERS

- Insulation resistance tests
- Resistance measurements
- An applied voltage test on secondary windings
- Determination of error and polarity check
- An excitation test

C3.2.21.4. GAS INSULATED SWITCHGEAR

- Mechanical tests: leakage
- Mechanical tests: gas quality (moisture, purity, and density)
- Electrical tests: continuity, conductivity, and resistivity
- Electrical tests: low-frequency ac voltage withstand
- Electrical tests: low-frequency ac voltage withstand requirements and conditions
- Electrical tests: low frequency ac voltage withstand configurations and applications
- Electrical tests: assessment of the ac voltage withstand test
- Electrical tests: tests on auxiliary circuits
- Mechanical and electrical functional tests: checks and verifications
- Mechanical and electrical tests: documentation

C3.2.21.5. AIR INSULATED DISCONNECTORS SWITCHES / ISOLATORS

- Appearance check
- Dielectric tests on control and auxiliary circuits
- Mechanical test
- Measurement of the resistance of the main circuit
- Design and visual inspection

C3.2.21.6. BUSHINGS

- Visual inspection
- Tanδ and capacitance measurement
- Tap withstand voltage

C3.2.21.7. SURGE ARRESTORS

- Insulation resistance test of MOSAs
- Insulation resistance test of the bottom of the MOSAs

- Leakage current test
- Check of appearance
- Check of monitoring devices

C3.2.21.8. INSULATORS

- The insulation resistance should be tested at 5000 V. The tested value of insulation resistance of each piece of suspension insulator should not be lower than 5000 MΩ before installation.
- For the ac voltage withstand test, the test voltage for the suspension insulator is 60 kV. For the test method, refer to 14.1 of IEC 60383-1:1993.
- Post Insulators: The insulation resistance measurement should be performed on a transportation unit with 5000 V before installation. The value of the measured insulation resistance should not be lower than 5000 MΩ.

C3.2.21.9. INSULATOR OIL

No.	Items	Requirements
1	Visual examination	Transparent, inclusion-free, no suspended matter
2	Granularity in oil	Granularity (5 μm ~ 100 μm) ≤ 1000/100 mL Granularity (> 100 μm) None
3	Dielectric strength, kV	≥70（2.5 mm gap, spherical electrode）
4	Dissipation factor, 90 ℃, %	Before filling into equipment ≤ 0.5 After filling into equipment ≤ 0.7
5	Water content, 50 ℃, mg/kg	≤ 10
6	Total dissolved gas, %	≤ 0.5
7	DGA	Refer to relevant subclauses of this guide

C3.2.21.10.SYSTEM COMMISSIONING

No.	System commissioning items	Note
1	Measurement of UHV transmission line parameters at rated power frequency	
2	Test of UHV power transformer with current increasing from zero	*
3	Test of UHV ac transmission line with current increasing from zero	*
4	Test of UHV power transformer with voltage rising from zero	*
5	Test of UHV ac transmission line with voltage rising from zero	*
6	Switching on/off test of no-load UHV power transformer	**
7	Switching on/off test of UHV ac no-load transmission line	**
8	Ring closing (interconnection)/ Ring opening (splitting) test of UHV system	**
9	Induced current and induced voltage test of the double circuit/ multi-circuit UHV ac transmission lines on the same tower	**
10	Switching on/off test of tertiary connected reactor	**
11	Switching on/off test of tertiary connected capacitor	**
12	Artificial single phase to ground fault test	**
13	System dynamic disturbance test	**
14	Normal operation test	**

* The test system should be composed of the selected generator, substations, and transmission lines, which are completely isolated from the operating system electrically.

** The test should be performed in the operating system.

C3.2.22. SUBSTATION FENCE (PSE 54)

The substation fence shall be of similar style and configuration to the existing substation fence. The following shall be supplied:

- High security diamond mesh type perimeter fence with provision for:
  i. Razor wire flat wrap (500mm), "Class A" heavy galvanised.
- All required sliding gates and personnel gates as per project drawings.

A mock-up of the mesh security fence shall be made available for evaluation and approval. The correct wire sizes shall be used with the correct specified finishing, coatings and all auxiliary material.

The existing substation fence shall be removed by the Contractor as indicated on the project drawings. The fence post foundations shall also be removed.

C3.2.22.1. DIAMOND MESH FENCE

This specification covers material requirements and installation of security fencing and gates. The work included for the contractor is to furnish and install fences and gates, and accessories as required and shown.

The diamond mesh fence shall comply with the relevant specifications as indicated in D-DT-5237s5A.

The following information shall be submitted to the Engineer for approval prior to placing any manufacturing orders:

- Certificate of compliance for materials and coatings
- Shop drawing for gates
- Quality control program shall be submitted to the Engineer for review prior to
- commencement of any work.

The mesh must be anchored into/onto the centre of the anti-tunnelling and the bottom rail of the panels must be flush with the anti-tunnelling. The anti-tunnelling shall be 100mm (wide) x 600mm (deep) concrete (15MPa) between posts.

C3.2.22.2. PRODUCTS

All steel materials shall be of good commercial quality, galvanized steel. All pipes / columns shall be galvanized, one piece without joints. Provide moisture proof caps for all posts. Zinc coating shall be smooth and essentially free from lumps, globs, or points. Miscellaneous material shall be galvanized.

All gates shall be provided with a concrete ramp for the gate to be at least 100mm above the finished substation yard stone level.

C3.2.22.3. EXECUTION

Install all fencing and gates in accordance with the drawings, specifications, instructions, and as specified, lines and grades indicated. **Line posts shall be spaced at equal length intervals**. Terminal posts shall be set at abrupt changes in vertical and horizontal alignment.

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C3.2.22.4. POSTS

The posts shall comply with the specifications and details as set out in D-DT-5237s5A.

Post holes shall be cleared of loose material. Waste material shall be spread where directed by Engineer. The ground surface irregularities along the fence line shall be eliminated to the extent necessary.

Posts shall be set plumb, and follow the indicated alignment. All posts shall be set to the depth indicated on the design documents. Concrete shall be thoroughly consolidated around each post, free of voids, and finished with a domed shaped surface, with the base of dome at grade elevation. Concrete shall be allowed to cure prior to installing any additional components to the posts.

Concrete footings shall be carried down to at least the depth indicated on the design documents and shall not be smaller than the dimensions shown. Where a rock layer is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. Then the regular concrete footing shall be placed between the top of the rock and the top of the footing elevation as shown on the design documents. Posts shall be approximately centred in their footings. All concrete shall be placed promptly and consolidated by tamping or other approved methods.
Where the ground is firm enough to permit excavation of the post hole to neat lines, the concrete may be placed without forms by completely filling the hole. Curing may be achieved by covering the concrete with not less than four inches of loose moist material immediately after placing concrete, or by using a curing compound. All excess material from footings, including loose material used for curing, shall be disposed of as directed by the Engineer.
Where the ground cannot be satisfactorily excavated to neat lines, forms shall be used to place concrete for footings. Under these conditions the earth and forms coming in contact with the concrete shall be moistened and all ponded water shall be removed from the hole prior to placing concrete. When forms are removed, the footing shall be backfilled with moistened material, and thoroughly tamped. The top of the concrete shall then be covered with not less than 100 mm (4 in) of loose moistened material or use curing compound if the 7-days cure is not completed. All excess material from footings, including loose material used for curing, shall be disposed of as directed.

C3.2.22.5. ADJUSTING

Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
Confirm that latches and locks engage accurately and securely without forcing or binding.
Lubricate hardware and other moving parts.

C3.2.23. SURGE ARRESTORS (PSE 56)

The surge arresters to be supplied and installed shall primarily consist of the following:

- Supply and install 3 x 88kV heavy duty station class surge arresters close to the 88kV bushings of the new power transformer.
- Supply and install 3 x 22kV heavy duty station class surge arresters close to the 22kV bushings of the new power transformer.

- Supply and install 1 x 66 kV neutral surge arresters on the neutral star points of the primary winding on the power transformer.
- Supply and install 6 x 22 kV surge arrestor on the 22kV outdoor circuit breakers.

All the transformer primary and secondary surge arresters shall be mounted on tailor made supports to be fixed and fitted directly on the transformer.

The following surge arrestors are required as part of this contract:

1) 22 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 24 kV, maximum residual voltage of 85 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage; [D-DT-6215]
2) 66 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 48 kV, maximum residual voltage of 165 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage (used for the protection of unearthed transformer primary neutrals); [D-DT-6212]
3) 88 kV Surge arrestor: station class, gapless, metal oxide, polymer housed, minimum MCOV of 56 kV, maximum residual voltage of 210 kV, 10 kA discharge current, Class 2 - line discharge (IEC), 31 mm/kV creepage; [D-DT-6211]

Surge arresters shall all preferably be fitted with grading rings. Grading rings shall be rigid and shall be securely fitted to the surge arrester.
Surge counters are required to be provided and installed on all of surge arresters, an insulated base on all PCD attachments shall therefore be included on surge arrestor footings. The earthed ends of all surge arresters shall each be independently connected to the substation earthing system, by means of a copper earth conductor with a minimum cross-sectional area of 250mm^2. In the installation of the surge arrestor earth conductors, 90^0 bends in the earth conductors shall be avoided.

Type Test Certificates indicating full compliance with IEC 60099, IEC 60815 and the relevant Eskom Specification, shall be submitted with all Tenders.

C3.2.24. HIGH VOLTAGE CT'S (PSE 57)

Conventional high voltage outdoor post type current transformers shall be supplied and installed in the following positions:

- 3 x 132 kV transformer feeder CT's.
- 3 x 88 kV Transformer bushing CT's

The following post type high voltage current transformers are required as part of this contract:

1) Six cores - 2 x Protection (PX-multi ratio), 2 x Metering (0.2-multi ratio), 2 x Buszone (PX-multi ratio), 132 kV, 2500 A, 40 kA/3sec, 650 kV BIL, 31 mm/kV creepage

Further detail CT requirements are outlined under the protection philosophies.

Type test certificates indicating full compliance with Eskom DSP 34-1689, NRS 029 and the relevant IEC standards shall be submitted with all tenders. As in the case with all other equipment called for in this specification, failure by Contractors to supply the required applicable and approved type test certificates, may result in tenders being disqualified.

All conventional outdoor post type current transformers shall be mounted on suitable outdoor type medium support mounting structures.

All current transformers shall be equipped with the number of current transformer cores required for the respective circuits generally as shown on the project drawings.

All supporting structures as well as the current transformer tanks shall furthermore be separately earthed to the local substation earthing system.

C3.2.25. 22 KV CLOSING SPAN

C3.2.25.1. CONDUCTORS

The phase conductors that shall be used for the closing span to the existing double-circuit Themba Khubeka line shall be ACSR CHICKADEE.

Table 7: Conductors

Description	MV Phase Conductor
Type	ACSR CHICADEE
Stranding and wire diameter (mm)	18/1
Cross section area (mm^2)	212
Overall diameter (mm)	18.85
Unit Weight (kg/Km)	643
UTS (kN)	44.90
Final modulus of elasticity (kN/mm^2)	66.2
Coefficient of linear expansion	21.44 /°C $x10^{-6}$

C3.2.25.2. LINE HARDWARE

All line hardware shall be rated for 120 kN minimum.

Compression type dead-ends shall be used.

C3.2.26. LV PVC INSULATED LV CABLES (PSE 08)

C3.2.26.1. GENERAL

The cables and accessories shall comply with the general requirement as specified in GSE 08.

C3.2.26.2. TYPE OF CABLE

All low voltage cables to be supplied and installed as part of this Contract, shall be of the PVC/PVC/SWA/PVC type in accordance with NRS 074 and SANS 1507.

All such cables shall be of the new material and shall bear the SANS mark.

C3.2.26.3. EARTHING OF ARMOURING

The armouring of the cable shall be earthed.
The galvanised steel armouring shall not be used as an earth conductor.

C3.2.26.4. GLANDS

All cables shall be properly glanded off within the substation and within each of the appropriate kiosk / DB's / Boxes. Pratley glands shall be provided with the associated rubber boots properly applied to prevent the ingress of water into the armouring.

C3.2.26.5. JOINTS

Only resin filled joints shall be used jointing of all LV cables.

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

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

C3.2.26.6. TESTING

All commissioning tests in accordance with SANS 10198-13 shall be performed following installation of the cables.

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

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

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

C3.2.27. INSTALLATION OF CABLES (SE 09)

C3.2.27.1. GENERAL

The cable must be installed as per the general requirement specified in GSE 09 and as shown on the project drawings.

Cable installation shall comply with SANS 10198-8.

C3.2.27.2. CABLE ROUTE DESCRIPTION

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

Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Engineer beforehand and shall be clearly marked by the Contractor on the as-built information.

The Engineer reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates. The removal of obstructions along the cable routes shall be subject to the approval of the Engineer.

C3.2.27.3. TRENCH DIMENSIONS

Where cables are installed directly in ground the trench dimensions for cable trenches will be as follows:

a) Width : min. 300 mm
b) LV depth : 700 mm
c) Length : Length of cable
d) Crossings depth : 1 500 mm

The width shall be increased where more cables are installed to allow for the spacings.

The bottom of the trenches must be even and shall follow the contour of the natural ground level.

C3.2.27.4. BEDDING LAYER

The Electrical Contractor must clean the "trench"; remove all rocks before the installation of the bedding layer.

Bedding shall be of a suitable soil sifted through a 6 mm mesh and levelled off. Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,2 K.m/W) may be used for this purpose. Local excavated material may be used upon approval by the Engineer and laboratory testing confirming the above specified soil thermal resistivity. A bedding layer of 100 mm shall be installed prior to cable laying and a blanket layer of 150 mm following laying of cables. The bedding under joints shall be fully consolidated to prevent subsequent settling.

Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for bedding. Where local excavated soil is used for bedding and adequate thermal resistivity is proven, the saving shall be given through to the Employer.

Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used.

Table 8: Soil Types (SANS 10198-5)

SOIL TYPE	DESCRIPTION	THERMAL RESISTIVITY	SUITABLE FOR BEDDING & BLANKET	SUITABLE FOR BACKFILL
Chalk	Soft white / grey porous	Low (wet) High (dry)	No (if drying out is likely)	Yes
Clay	Dense, compact, greasy to touch when wet, shrinks while drying	Low (good)	No	Yes
Loam	Reddish to dark brown (may contain organic matter), crumbles well – can be well compacted	Satisfactory (good)	Yes	Yes
Mine Sand	Highly corrosive	Low (good)	Used with caution	Used with caution
Ouklip	Decomposed granite, varying in particle size	Low (undisturbed) High (disturbed)	No	If mixed with loam/ clay
Peat (humus)	Mainly organic material, black /dark brown	High (when dry)	No	Used with caution
Sand (sea / river)	Crumbly, spherical particles and gritty to touch even when wet, cannot be easily compacted	High (when dry)	No (unless mixed with loam/ clay)	If mixed with loam/ clay

C3.2.27.5. BACKFILLING

After installation of the cables, the Contractor shall be responsible for backfilling and compaction of all these trenches to original compaction with suitable soil to ensure settling without voids. The maximum allowable diameter of stones present in the backfill material is 20 mm. This must be done to the satisfaction of the Engineer and Employer.

Where the soil excavated is not suitable for backfilling, the Contractor shall import backfilling from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for backfilling purposes shall be included in the unit rates for excavation and backfilling. All excavations in hard rock shall imply that excavate material is not suitable for backfilling and these excavations shall be priced accordingly.

The backfill shall be compacted in layers of 150 mm and sufficient allowance shall be made for final settlement. A water cart shall be used during backfilling to moisten backfill material. The Contractor shall maintain the refilled trench at his expense for the duration of the contract. Surplus material shall be removed from site and suitably disposed of at the cost of the Contractor.

On completion, the surface shall be made good to match the surrounding area. DCP test certificates shall be provided to prove compaction is equal or harder than undisturbed natural ground. Positions for tests shall be indicated by the Engineer, the Contractor shall allow for a DCP test every 100 m. The contractor shall care not to damage the cables during compaction testing.

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

After the cable trench has been refilled and compacted, the Contractor must level the area and remove all excess soil and refuse.

C3.2.27.6. INSPECTION OF CABLES AND CABLE TRENCHES

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

A logbook, in triplicate, shall be kept by the Contractor on the site, in which each part of the installation that has been inspected can be recorded after inspection and approval.

C3.2.27.7. SECURITY

The Contractor must arrange 24-hour security with a reputable security company to protect the cable for the duration of exposed cable. The Contractor must take cognisance that he will be responsible for any cable theft and replacement of stolen cable.

C3.2.27.8. TESTING

The cables installed shall be tested as specified in GSE 09.

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

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SIGNATURE OF TENDERER : _____

DATE : _____

C3.3: THEMBA KHUBEKA SWITCHGEAR AND RETICULATION

C3.3. THEMBA KHUBEKA ELECTRIFICATION

C3.3.1. DESCRIPTION OF THE WORKS

The contractor shall be responsible for the detail designs based on equipment offered, installations, construction, erection, commissioning, testing and handing over of the works, complete with all auxiliary equipment where the works at high level comprises of:

The Themba Khubeka community shall be electrified and the works shall be handed-over to Metsimaholo Local Municipality. The existing Themba Khubeka switching station shall be used as the supply point for the area.

The medium voltage reticulation through the community shall be done using an overhead network, with standard Eskom structures. The transformers used shall be pole mounted and the low voltage reticulation shall also be done using an overhead network. Wooden poles shall be used to reticulate the area.

The necessary medium voltage switchgear shall be installed and integrated into the existing SCADA system at the Themba Khubeka switching station.

The Contractor shall engage with all the relevant stakeholders during construction;

C3.3.2. HIGH LEVEL SCOPE OF WORKS

The scope of works is outlined below.

Table 1: High level scope of work

1.	Install 22kV Metalclad switchgear in the existing Themba Khubeka Switching Station. The switchgear shall be similar to the existing switchgear.
2.	Install a HMI viewer at Metsimaholo LM's workshop.
3.	Integrate the new 22kV switchgear panels into the existing SCADA system.
4.	Update the HMI to reflect the change in switching station configuration.
5.	Survey and peg all MV structure positions. Only survey and peg the terminal and strain LV structures. Survey and peg the erven boundaries.
6.	Install 100kVA & 200kVA, 22kV/0.4kV pole mounted transformers.
7.	Install FOX ACSR using 11m wooden poles. Utilise standard Eskom delta structures.
8.	Install 35mm^2 & 70mm^2 ABC using 9m wooden poles.
9.	Install pole top boxes.
10.	Install 10mm^2 Airdac to reticulate approximately 2361 stands.
11.	Install 2361 x ReadyBoards.
12.	Issue CoC for each installation/stand.

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C3.3.3.EQUIPMENT

The equipment to be provided, at high level, comprises of the following:

Table 2: Equipment to be provided

DESCRIPTION	QTY
ACTOM SBV24L, 22kV, 800A, VCB INDOOR SWITCHGEAR	3
THREE CORE, ALUMINIUM, 95 mm^2, PILC, FRPVC SWA FRPVC, 12.7/22kV (TABLE 20)	83m
INDOOR CABLE ENDS (95mm^2, 3 CORE, Al, PILC, FRPVC SWA)	3
OUTDOOR CABLE ENDS (95mm^2, 3 CORE, Al, PILC, FRPVC SWA)	3
FOX (42.8mm^2) ACSR	38 200m
DELTA INTERMEDIATE MV STRUCTURE (D-DT-1730) (STEEL CROSS-ARM)	117
DELTA STRAIN MV STRUCTURE (D-DT-1733, 1734, 1735, 1736) (STEEL CROSS-ARM)	145
SECTION LINKS (D-DT-1848)	15
22kV/0.4kV, 100kVA TRANSFORMER (D-DT-3021)	45
22kV/0.4kV, 200kVA TRANSFORMER (D-DT-3021)	8
10A, DROP-OUT FUSE SET (FOR TRANSFORMERS) (D-DT-0290)	45
20A, DROP-OUT FUSE SET (FOR TRANSFORMERS) (D-DT-0290)	8
11m, WOOD POLE 180-200mm (D-DT-0051)	262
9 m, WOOD POLE 180-200mm (D-DT-0055)	53
MV STAY ASSEMBLY (D-DT-0341)	72
MV STRUT, 12m WOOD POLE (D-DT-0351)	67
35mm^2 AERIAL BUNDLE CONDUCTOR + BARE NEUTRAL	10 150m
70mm^2 AERIAL BUNDLE CONDUCTOR + BARE NEUTRAL	14 100m
1-2 WAY SERVICE POLE TOP BOX (ALLBRO ALLTILT)	227
1-4 WAY SERVICE POLE TOP BOX (ALLBRO ALLTILT)	452
1-6 WAY SERVICE POLE TOP BOX (ALLBRO ALLTILT)	28
40A MCB, SLOW CURVE, 5 kA	2361
9m, WOOD POLE 160-179mm (D-DT-0055)	818
7m, WOOD POLE 120-139mm (D-DT-0050) (KICKER POLE)	51
LV STAY ASSEMBLY (D-DT-0341)	405
LV STRUT, 10m WOOD POLE (D-DT-0351)	63
INTERMEDIATE/SUSPENSION (0-30 deg) (D-DT-1100)	520
STRAIN ASSEMBLY (0-60 deg) (D-DT-1121)	50
STRAIN ASSEMBLY (60-90 deg) (D-DT-1122)	89
TERMINAL ASSEMBLY (D-DT-1120)	300
T-OFF ASSEMBLY FROM INTERMEDIATE (D-DT-1140)	58
T-OFF ASSEMBLY FROM STRAIN (D-DT-1142)	19
CROSS INTERMEDIATE-INTERMEDIATE (D-DT-1141)	9
CROSS INTERMEDIATE-STRAIN (D-DT-1143)	1
READY-BOARDS WITH SANS 164-2 SOCKET	2361
SEPARATE NEUTRAL EARTH (SNE) AIRDAC 10mm^2	36 750m
DIN RAIL SPLIT SINGLE PHASE METER	2361
5m, WOOD POLE (SHACK POLES)	2361

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C3.3.4.SITE WORKS

The Contractor shall apply herbicides and pesticides to any excavations done inside the switching station building.

THE BULK EARTH WORKS COMPRISES OF:

- Bulk Excavations & Stock Pile (Reticulation)
- Bulk Backfilling (Reticulation)
- Testing (Reticulation & Switching Station)
- Site Survey (Reticulation & Switching Station)
- Herbicides and Pesticides application (Switching Station)

C3.3.5.MEDIUM VOLTAGE CABLES (PSE 50)

C3.3.5.1. GENERAL

The general requirements for Medium Voltage Cables are covered by NRS 013:2007 as amended. Cables shall comply with the relevant SANS manufacturing standard and test voltages as prescribed by SANS10198-13 shall be applied during testing and commissioning.

Respective manufacturing standards:
SANS 97 (Paper insulated cables)
SANS 1339 (XLPE Cables)

The MV cables for this project shall comply with the requirements of

- SANS 97:2001 for Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/33 kV (excluding pressure assisted cables).
- NRS 013:2007 Medium-Voltage Cables.
- The installation and laying of cable shall be in accordance with SANS 10198-2:2016.

In addition to the standards and specifications mentioned the Medium Voltage cables and the installation thereof shall also comply with the following Eskom standards:

Unique Identifier	Description
240-56030635	General information and requirements for medium voltage cable systems
240-56063792	Specification for medium voltage XLPE and Impregnated Paper Insulated Cables Standard
SANS 60055-1:	Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas pressure and oil filled cables) – Part 1: Tests on cables and their accessories.
SANS 61442:	Electric cables: Test methods for accessories for power cables with rated voltages from 6 kV (Um – 7,2 kV) up to 30 kV (Um = 36 kV).
CENELEC 629.1 S1:	Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36 (42) kV – Part 1: Cables with extruded insulation.
CENELEC 629.2 S1:	Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36 (42) kV – Part 2: Cables with impregnated paper insulation.

SANS 60502-4:	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV).
NRS 053:	Accessories for medium voltage power cables (3,8/6,6 kV to 19/33 kV).
SANS 876 / NRS 012:	Cable terminations and live conductors within air insulated enclosures (insulation co-ordination) for rated a.c. voltages of 7,2 and up to and including 36 kV.

C3.3.5.2. JOINTS, TERMINATIONS AND ACCESSORIES

- The effect of a medium voltage cable accessory failure is generally severe in terms of customer outage as well as repair costs. It is therefore important to ensure that medium voltage cable accessories comply with specifications and are of high quality. To ensure the quality and performance of medium voltage cable accessories the stringent requirements of NRS 053 shall be adopted and applied to this project.

The following standards shall be applicable:

- NRS 053: Accessories for medium voltage power cables (3,8/6,6 kV to 19/33 kV).
- SANS 876 / NRS 012: Cable terminations and live conductors within air insulated enclosures (insulation co-ordination) for rated a.c. voltages of 7,2 and up to and including 36 kV.
- Paper Insulated cable joints and terminations shall be in accordance with SANS 10198-10:2010.
- Heat Shrink Joint Master or Raytech / Raychem joints shall be used.
- Raytech / approved dry type terminations shall be used.

C3.3.5.3. IMPREGNATED PAPER INSULATED CABLE

Where the cable enters through any walls, roofs or floors the openings created shall be such that the minimum bending radius of the cable is not exceeded. All such entries shall be sealed off by means of a watertight compression seals.

Type of cable	:	3C, Aluminium, PILC
System voltage	:	22 kV
Cable detail	:	Table 20; FRPVC AWA FRPVC
Cross sectional area	:	95 mm^2
Installation condition	:	Impregnated Paper
Conductor material	:	Aluminium

C3.3.5.4. TESTING AND COMMISSIONING

Testing and commissioning of cables following installation shall be in accordance with SANS 10198-13:2016. All commissioning tests shall be performed, which include:

- Insulation resistance
- Conductor resistance
- Overvoltage
- Diagnostic Testing
- Outer sheath test

C3.3.5.5. EXCAVATION AND BACKFILL

- Determination of the thermal resistivity of soil to be used as bedding shall be in accordance with SANS 101985-5:2004.
  The on-site method is preferred and shall be performed per batch of imported soil. Imported soil delivered to site shall be screened with sand to prevent the soil from washing away in raining conditions.
- Where cables are installed directly in ground the excavations for cable trenches shall comply with the dimensions as follows:
  Width : 450 mm
  Length : Length of cable
  Installation depth : 1 500 mm
  Road crossings depth : N.A.
- The bedding layer around the cable installation shall be imported loam soil with a thermal resistivity of 1.2 K.m/W, test certificates for the bedding shall be provided. A bedding layer of 50 mm shall be installed prior to cable laying and a blanket layer of 150 mm following laying of cables.
- Claims for hard or soft rock must be classified by the Engineer or his representative before any backfilling is being done. Backfilling must be done with compaction of 150 mm layers.
- Compactions certificates shall be provided every 100 m proving compaction of the cable trench is the same or better than adjacent undisturbed soil (i.e. two compaction tests every 100 m). The contractor shall care not to damage the cables during compaction testing.

Table 3: Soil Types (SANS 10198-5)

SOIL TYPE	DESCRIPTION	THERMAL RESISTIVITY	SUITABLE FOR BEDDING & BLANKET	SUITABLE FOR BACKFILL
Chalk	Soft white / grey porous	Low (wet) High (dry)	No (if drying out is likely)	Yes
Clay	Dense, compact, greasy to touch when wet, shrinks while drying	Low (good)	No	Yes
Loam	Reddish to dark brown (may contain organic matter), crumbles well – can be well compacted	Satisfactory (good)	Yes	Yes
Mine Sand	Highly corrosive	Low (good)	Used with caution	Used with caution
Ouklip	Decomposed granite, varying in particle size	Low (undisturbed) High (disturbed)	No	If mixed with loam/ clay
Peat (humus)	Mainly organic material, black /dark brown	High (when dry)	No	Used with caution
Sand (sea / river)	Crumbly, spherical particles and gritty to touch even when wet, cannot be easily compacted	High (when dry)	No (unless mixed with loam/ clay)	If mixed with loam/ clay

- The bottom of the trenches must be even and shall follow the contour of the natural ground level.
- The Contractor shall not commence with the backfilling of trenches without prior notification to the Engineer so that the cable installation may be inspected. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection will not be unreasonably delayed.
- After installation of the cables, the Contractor shall be responsible for backfilling and compaction of all these trenches to original compaction with suitable soil.
  The maximum allowable diameter of stones existing in the backfill material is 20 mm. This must be done to the satisfaction of the Engineer and Employer.
- Where the soil excavated is not suitable for backfilling, the Contractor shall import backfilling from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for backfilling purposes shall be included in the unit rates for excavation and backfilling. All excavations in hard rock shall imply that excavate material is not suitable for backfilling and these excavations shall be priced accordingly.
- **A 800mm wide, 200mm thick concrete slab shall be casted 250mm above the cables in the trench to improve the security of the cables.**
- MV and LV distribution cables must be measured on site before ordering of any cable. The cable lengths must be submitted to the Engineer on the day of the first site meeting.

C3.3.5.6. EXPLOSIVES

- Written approval shall be obtained from the Engineer prior to any blasting.
- The Contractor is to make adequate provision for blasting which, together with the necessary storage and handling of explosives, shall be carried out in strict accordance with the Explosives Act (No 26 of 1956, as amended) and Regulations. Care shall be taken that no damage is caused to existing works and property, and adequate protection shall be provided to prevent blasted materials scattered about. The size of charges shall be the minimum necessary for the purpose. The Contractor shall be solely responsible for damage and injury caused by or during blasting and shall make good at his own expense, and to the satisfaction of the Engineer, any unnecessary shattering of rock or disturbance of the surrounding ground. Careless use of explosives will render the Contractor liable to be forbidden for further use of explosives.
- Blasting will not be permitted in any situation where it is likely to endanger any existing foundation, structure or service and in such a situation, material must be removed by drilling and wedging or barring or by any other approved method which will not cause damage.
- At least one working day before commencing drilling and blasting operations on any new section of the works, the necessary safety precautions shall be arranged by the Contractor. No blasting is to be done before permission has been granted from the Engineer.

C3.3.5.7. SLEEVES

- The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.
- Where sleeves as installed by means of open excavation, not drilled, it is preferred that the sleeve installation is not backfilled prior to installation of the cable unless an open trench impacts vehicular traffic.

- For open sleeve trenches and ease of cable installation and to prevent sliding, the sleeve end shall be properly fixed to ground by either casting into concrete blocks or by using heavy duty sandbags for weight with steel “droppers” as anchors.
- After installation of cables the sleeves shall be filled with bentonite.

C3.3.5.8. INSPECTION OF CABLES AND CABLE TRENCHES

- The Contractor shall not commence with the backfilling of trenches without prior notification to the Engineer so that the cable installation may be inspected. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened at the Contractor's cost.
  Such an inspection will not be unreasonably delayed. After the cable trench has been refilled and compacted, the Contractor must level the sidewalks and remove all excess soil and refuse.
- A logbook, in triplicate, shall be kept by the Contractor on the site, in which each part of the installation that has been inspected can be recorded after inspection and approval.

C3.3.5.9. TESTING

- All cables shall be pressured tested by the Contractor in accordance with the relevant standard for XLPE, PILC, LV PVC cables respectively.
- For bedding thermal resistivity tests shall by submitted by the Contractor to the Engineer for approval.
- Compaction tests shall be performed by the Contractor (trench compaction shall be equal or better than undisturbed soil).
- Factory test certificates for all cables shall be provided by the Contractor.
- Commissioning test certificates for all cables shall be provided by the Contractor.
- Joint and termination certificates accompanied with a coordinate list of all joints shall be provided by the Contractor.

C3.3.6.MEDIUM VOLTAGE SWITCHGEAR (PSE12)

- The switchgear shall be of the single busbar type rated for operation at 22 kV in accordance with SANS 1885 and Eskom 34-1157.
- This specification shall be read in conjunction with the SCADA and protection specification.
- All wiring and SCADA requirements shall be covered by the priced unit rates for the switchgear.
- All CT’s shall be cleaned with isopropyl-alcohol, thereafter the busbars of all CT’s shall be “putty and taped” (i.e. 3M Denso tape) or a silicone rubber coating shall be applied to the full length of the CT. Partial discharge measurements shall be taken at the next commissioning as part of the SAT and just prior to the expiry of the 12 month guarantee period.
- **The switchgear provided shall be similar to the existing switchgear installed at the switching station. The Contractor is to consult the switchgear drawings under Project Drawings.**

C3.3.6.1. SCADA, CONTROL AND MIMIC

- The new switchgear shall be integrated with the existing SCADA system. The existing HMI shall be updated to show the new switchgear panels. The new switchgear panels shall also be remotely switchable.
- Remote operation is deemed operation by means of the **existing** remote T/N/C rotary switches situated on the existing MV control panel. In additional to the above remote operation, remote operation from the Clients' Engineering works shall be proven via the **existing** telemetry system and shall then be disabled.
- The contractor shall be responsible for the full system design, providing of drawings for approval, construction, installation, commissioning etc.

C3.3.6.2. SWITCHGEAR REQUIREMENTS

- The switchboards shall be installed in a single straight line.
- Switchgear shall be intended for normal indoor conditions as specified in SANS 1885. No special service conditions are required.
- All doors shall have stops to prevent over swinging when opened.
- The switchgear panels shall have withdrawable circuit breakers and rear cable entry.
- The circuit breaker panel and the circuit breaker shall have clear OPEN/CLOSE indications.
- Each circuit breaker panel shall have the following definite indication:
  - Circuit breaker open/close status;
  - Circuit breaker position (test, earth, service);
  - Circuit breaker fail;
  - Stored energy device charged/discharged;
  - Single busbar
  - Earth switch applied status open/close;
  - Non-resettable mechanical operation counter;
- All panels shall have CONSTANT trip circuit monitoring.
- Earthing facilities shall be provided for all main circuits.
- All spare inputs and outputs shall be wired to the terminal blocks on the front and rear of the panel and shall be clearly labelled.
- The earthing switches shall be the integral type that uses the circuit breaker.
- The circuit breaker transporting device shall be integral.
- No busbar earthing facility shall be provided. (non-Eskom standard)
- No bus section earthing facility shall be provided. (non-Eskom standard)
- OPEN/CLOSE (T/N/C) pistol grip control switches shall not be mounted on the switchgear panel. The existing T/N/C pistol grip control switches from the existing control panel shall be used to implement the tripping/close functions.
- Control compartment and circuit breaker compartments shall have single lever door opening handles.
- Unless otherwise specified all IED's for primary substations as well as switching stations shall be housed locally on the swing door of switchgear control compartment.
- Each switchboard shall be supplied with a metal notice board by the OEM stipulating the step-by-step circuit breaker racking procedure.
- The "Test", "Earth" or "Service" position of the circuit breaker shall be clearly visible on the outside of the circuit breaker compartment door.

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- A panel connector for local OPEN/CLOSE control shall be provided as backup to the remote OPEN/CLOSE control. Such local connector shall be of the ITT Cannon (small) trip / close socket type and shall be supplied with one short cord for testing purposes and one extended cord for operational purposes (chords – per switchboard)
- The closing mechanism shall be the spring charged coil type.
- The tripping circuit shall consist of a DC shunt trip coil with an adequately rated "a" contact in series. ("a" contact – make contact)
- **Main trip coils and backup trip coils shall be provided.**
- All designs shall include a separate trip coil for each pole of the relay or protection device. Thus a two overcurrent and one earth fault arrangement would require two trip coils on the phases associated with the overcurrent protective devices and a trip coil in the residual circuit.
- Six (6) spare auxiliary contacts shall be offered:
  - 3 x Normally open (N/O)
  - 3 x Normally close (N/C)
- Each individual switchgear panel shall have duplicated descriptive labels located at:
  - Front of switchgear panel above the circuit breaker compartment.
  - On the circuit breaker truck/trolley.
  - Back of the switchgear at the cable termination compartment.
- OEM shall be responsible for the on-site installation and on-site operation testing of the switchboard.
- Heaters shall be installed in the switchgear and the type of heater shall be stated in the switchgear technical schedule.
- Suitably rated electric heaters shall be located inside the cable and circuit-breaker compartments to prevent moisture from condensing and being deposited inside each of the defined panel compartments. Depending on the switchgear design considerations (e.g. location of busbar compartment relative to other heated compartments, busbar support method, etc.), switchgear performance history and OEM recommendations.
- The engineer reserves the right to request additional heaters in the busbar compartment(s). The heater size offered for each compartment shall be stated in the tender offer.
- Heaters shall maintain a dewpoint greater than the ambient temperature and shall circulate the air constantly to all parts of the enclosure. (NOTE: The use of humidity transducers to control the dewpoint and prevent condensation within the switchgear compartments will be considered.)
- Heaters shall be placed to avoid damage to temperature-sensitive components. Heater elements shall, where applicable, be protected. Leads, which are heated by the conduction of heat from the element, shall be insulated by heat-resistant insulating material, e.g. ceramic beads or silicone rubber. The type of insulating material offered shall be stated in the tender offer.
- On the front control compartment door of each panel a heater healthy lamp shall be provided in series with a heater on / off switch. The temperature dial and thermostat shall be situated at the rear of the panel at the cable termination box.
- The electrical supply for heaters shall be single-phase 230 V AC.
- The heater control circuits shall comply with the requirements of Eskom 240-56063705 and D-DT-5408.
- Where switchgear is connected to an overhead distribution system by short lengths of cable, surge protection shall be provided:
  - Only at the first pole for cable lengths less than 100m.

- At both ends of the cable for cable lengths more than 100m.

- Each panel shall be equipped with a copper earth bar to facilitate cable sheath and armour earthing. Under earth fault conditions, the current density of the earth bar shall be less than 200A/mm^2. The switchboard earth-bar shall be internal to the switchboard panels.

C3.3.6.3. RATING

- The switchboard shall be air insulated with vacuum interruption mediums.
- The rated voltage shall be 22 kV.
- The rated frequency shall be 50 Hz.
- The rated nominal currents for feeders shall be 800 A.
- The rated busbar current shall be 1250 A
- The rated peak lightning impulse withstand voltage shall be 125 kV.
- The rated short-duration power frequency withstand R.M.S. voltage shall be 50kV.
- The standard 3 s rated short-time withstand R.M.S. current shall be 25 kA and 63 kA rated peak withstand current.
- The auxiliary circuit voltage shall be 110VDC.

C3.3.6.4. POWER CABLE TERMINATION

- Cable terminations shall be in accordance with SANS 1885 Annex C – Type 2: lugs connected onto bushings or post insulators with a shrouded insulation termination.

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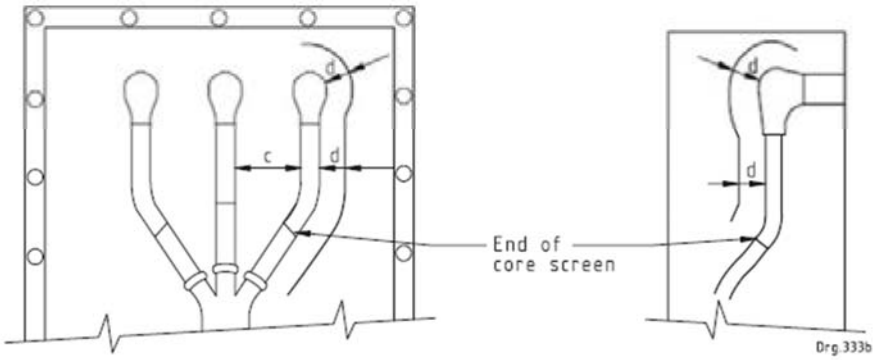

Figure 1: SANS 1885 Type 2 termination

- Creepage distance shall be 31mm/kV.
- All incomer panel cable termination compartments shall be fitted with aluminium gland plates.
- All panels shall be fitted with glands and cable clamps directly above the glands for air terminations.

C3.3.6.5. CURRENT TRANSFORMERS

- Current transformers shall comply with the requirements of SANS 60044-1.
- Three current transformer cores shall be provided in accordance with Eskom specifications for:
  - Protection;

- Metering;
- Instrumentation.

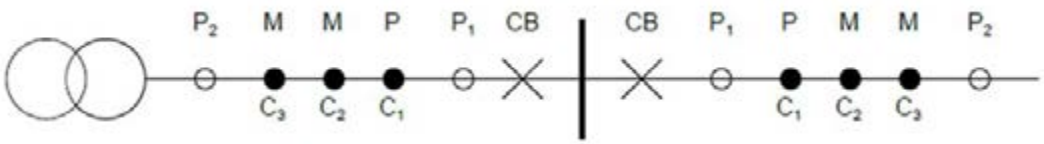

Figure 2: CT positioning (one set of protection CT cores in bus section)

- CT cores, ratios and wiring shall be in accordance with Eskom standard 34-1157 and D-DT5408.
- 800A feeder panel CT's shall comply with the following information:

SPECIFICATION OF MEASUREMENT CTs

TAPPING	RATIO	CLASS	BURDEN
S1 - S2	50/1	0,5	5 VA
S2 - S3	100/1	0,2	5 VA
S1 - S3	150/1	0,2	5 VA
S1 - S4	200/1	0,2	5 VA

SPECIFICATION OF PROTECTIVE CTs
(TO BE TESTED ON 1/400 TURNS RATIO)

TAPPING	RATIO	CLASS	MIN V_k	MAX I_e	MAX R_s at 75 °C
S1 - S2	1/200T	PX	83,3 V	300 mA	1 Ohm
S2 - S3	1/400T	PX	167 V	150 mA	2 Ohms
S1 - S3	1/600T	PX	250 V	100 mA	3 Ohms
S1 - S4	1/800T	PX	333 V	75 mA	4 Ohms

Figure 3: 800A feeder panel CT's

- All current transformer secondary connections shall be brought to a MMLG terminal block in the relay chamber.

C3.3.6.6. VOLTAGE TRANSFORMERS

- Voltage transformers shall be in accordance with the requirements of IEC 61869-3:2011.
- Voltage transformers shall comply with the following minimum requirements:
  - One-phase or three-phase – three phase
  - Ratio - $\frac{\frac{(V_{nom})kV}{\sqrt{3}}}{\frac{110V}{\sqrt{3}}}$
  - Class – 3P/0.2
  - Burden – 50VA
  - Voltage factor – 1.2 continuous; 1.9 for 30s
  - Test block location – LV compartment on switchgear panel
  - 3 Limb, Single Core or 5 Limb – 5 Limb or 3 separate cores
  - Position – Incomer cable VT's

C3.3.6.7. PROTECTION RELAYS

- Programmable IED LED's shall be programmed and labelled according to the Engineer's preference.
- Main / backup and auxiliary relays shall trip the circuit breaker directly and an indication shall be provided on the MV bay controller.
- **Secondary feeder** panels shall denote ring feeder or radial supplies where only OC/EF protection will be implemented. Relays to be applied shall be from Schweitzer Engineering Laboratories. Relays shall have sensitive earth fault functionality and 5"

displays. The relays shall have the same specifications as those currently installed in the existing switchgear.
- All relays shall be programmed to latch if a trip occurs – circuit breakers must only be able to close once the trip is acknowledged.
- Feeder breaker fail alarms and trip functionalities shall be wired to the respective incomer and bus section panel. When a MV feeder experiences an "breaker fail", the respective MV incomer and bus-section shall trip. The breaker fail function shall apply to all protection schemes.
- Arc protection relays shall be mounted locally on switchgear panels and shall form part of the main protection system (not stand-alone). Local terminal and test blocks shall be included for the arc protection relay circuitry. Each local arc protection relay shall be panel mounted and have a LED (per sensor) with a label denoting all respective arc sensors (i.e. Arc trip position mimic device). Arc relays shall reset on local switchgear i.e. it shall not be accepted to reset an arc trip on an adjacent panel. Zoning shall be possible, circuit breaker arcs shall isolate the entire zone and prevent back feeding by means of interlocking with ring feeders. Each panel shall be equipped with interlocking capabilities which shall be easy to implement should the panel be configured as a ring feed panel in the future. All zones shall be segregated by means of metal cladding as a minimum requirement for zone barriers. The Contractor shall use the same Arc relays as was used in on the existing switchgear in the Themba Khubeka switching station.

C3.3.6.8. INSTRUMENTS, TRANSDUCERS AND METERING

- All switchgear panels shall have local ENERDIS E50 Multifunction meters in accordance with IEC61557-12.
- MMLG test blocks shall be used for protection CT's. PK2 test blocks are not preferred but will be accepted for metering and indication of CT's. C&H test blocks shall not be accepted.
- Ammeters shall be in accordance with the requirements specified in SANS 1885.
- All control compartment doors shall be fitted with an earth strap. If the earth strap is not installed through the wiring sleeve, braided earth straps shall be enforced.
- All control compartment doors shall have permanently fixed durable rubber door seals installed.

C3.3.6.9. LUMINOUS INDICATORS

- All feeder panels shall have cable live indicators. An "integrated" voltage detection system (VDS) with fixed voltage indicators and test points in accordance with SANS 61243-5 shall be provided for cable live indication on each incomer and feeder panel. The VDS systems shall be fitted on the LV compartment door. A spare status contact from each VDS shall be wired to terminals in the LV compartment as per Eskom D-DT-5408.
- All trip indications shall be displayed on the switchgear panel locally. (For remote control gear trips must be reset at the remote relay location).
- The following indications shall be included on the front of the control compartment of the switchgear panels:
  - Semaphores if a mimic is specified (CB open/closed, CB earthed)
  - VDS as specified (busbar live on section and coupler panels, cable live on feeder and incomer panels)
  - Heater on/off switch with heater healthy light when on

- DC fail indication lamp (amber)
- Relay not healthy indication lamp (amber)
- Trip circuit healthy indication lamp with push to test button (constant trip circuit supervision to be wired to bay controller IED with alarm to SCADA from the IED and indication on the IED if not healthy)
- Lamp test button with indication

C3.3.6.10. ALARM CIRCUITS

- Circuit breakers alarm circuits shall be provided and wired in accordance with Eskom DST34-1692 and DDT5408.

C3.3.6.11. AUXILIARY CIRCUITRY

- All insulated auxiliary wires shall be multi-stranded copper, of the following cross-sectional areas:
  - auxiliary wires: 1,5 mm2; and
  - current transformers and voltage transformers: 2,5 mm^2.

C3.3.6.12. ACCESSORIES

- In accordance with SANS 1885.

C3.3.6.13. RATING PLATES

- In accordance with SANS 1885.

C3.3.6.14. LABELS

- In accordance with SANS 1885.

C3.3.6.15. TESTS

- Partial discharge test shall be performed:
  - during the FAT,
  - following commissioning (SAT)
  - with lapse of the 12 month guarantee period
- The Engineer shall charge the Contractor for inspection failures at ECSA rates.
- In accordance with SANS 1885.
- Tests shall be carried out by an accredited laboratory and tenderers shall provide assurances thereof. Tendered rates shall include the costs of all services such as tests, delivery and spares.
- Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) shall be arranged by the OEM and shall be witnessed and approved by the Engineer. If either the FAT or SAT is rescheduled, even once, due to a delay in progress the OEM shall be liable for penalties.
- All type test certificates shall be supplied when detail manufacturing drawings are issued by the OEM.
- All routing tests shall be performed as part of the FAT at the manufacturer's works.
- Some routine tests shall be redone on site at the Engineers discretion, commissioning shall include uploading and testing of the customer's protection settings and "test after erection on site" as per SANS 1885.

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- In addition to the paragraphs to follow, the following test shall be done during switchgear FAT and SAT:
  - CT magnetizing curves (to be provided prior to FAT)
  - All functionality tests i.e. instrumentation panels, breaker racking, breaker tripping, indications etc.
  - Protection function (10sec to trip) PS: 25% and TMS: 1
  - Protection function – grading and grading to incomers
  - Injection test to check ammeter calibration
  - ARC protection functionality and zone tripping
  - Energy meter calibration
  - HMI functionality test
  - Remote operation testing
  - SCADA functionality (primary substations)

C3.3.6.15.1. TYPE TESTS

- The type test certificates and reports shall be submitted for review during the tender or product evaluation stage.
- The indoor switchgear panels (functional units) shall be type tested in accordance with SANS 62271-200 and shall include the following tests:
  - equipment insulation level (SANS 62271-200 6.2);
  - temperature rise and measurement of resistance of circuits (SANS 62271-200 6.5 & 6.4);
  - current withstand – main circuit (SANS 62271-200 6.6);
  - current withstand – earthing circuit (SANS 62271-200 6.6);
  - circuit breaker short-circuits making and breaking capacities (SANS 62271-200 6.101 and SANS 62271-100 6.102 to 6.106);
  - circuit-breaker critical current tests (where applicable) (SANS 62271-100 6.107);
  - circuit-breaker double earth fault tests (SANS 62271-100 6.108);
  - circuit-breaker out-of-phase making and breaking tests (applicable if an out-of-phase rating is assigned) (SANS 62271-100 6.110);
  - circuit-breaker capacitive current switching tests (SANS 62271-100 6.111.5);
  - circuit-breaker electrical endurance tests (SANS 62271-100 6.112);
  - earthing switch making capacity (SANS 62271-200 6.101 and SANS 62271-102 6.101) – where applicable;
  - circuit-breaker mechanical operation test (SANS 62271-200 6.102 and SANS 62271-100 6.101.2.1 - 6.101.2.3);
  - circuit-breaker extended mechanical endurance tests (for class M2 circuit-breakers) (SANS 62271-100 6.101.2.4);
  - mechanical operation for the withdrawable circuit-breaker intended to be used as a disconnector (SANS 62271-200 6.102.1 and SANS 62271-102 6.102);
  - earthing switch mechanical operation (SANS 62271-200 6.102) – where applicable;
  - test to verify the proper functioning of the position indicating device for the earthing switch (SANS 62271-102 6.105) – where applicable;
  - verification of the protection (IP coding and mechanical impact) (SANS 62271-200 6.7);
  - tightness test (SANS 62271-100 6.8);
  - x-radiation test procedures for vacuum interrupters (SANS 62271-200 6.11);
  - internal arc (SANS 62271-200 6.106);
  - partial discharge test (SANS 62271-200 6.2.9);

- dielectric tests on cable testing circuits (SANS 62271-200 6.2.101); and (NOTE: The relevant cable standard for cable testing is SANS 10198-13. Test voltages of up to 3 x U0 are applicable for on-site cable commissioning tests.)
- additional tests on auxiliary and control circuits (SANS 62271-200 6.10).

C3.3.6.15.2. ROUTINE TESTS

- All tests are to be carried out at the factory where the switchgear is manufactured, whether it's local or overseas. The indoor switchgear shall be routine tested in accordance with SANS 62271-200 and shall include the following tests:
  - dielectric test on the main circuit (SANS 62271-200 7.1);
  - tests on auxiliary and control circuits (SANS 62271-200 7.2)
  - (NOTE: In the case of switchgear supplied from an overseas OEM where the wiring of auxiliary and control circuits is done locally, the tests on auxiliary and control circuits are to be done locally as part of the local factory acceptance testing)
  - measurement of the resistance of the main circuit (SANS 62271-200 7.3);
  - tightness test (SANS 62271-200 7.4);
  - design and visual checks (SANS 62271-200 7.5);
  - partial discharge measurement (SANS 62271-200 7.101);
  - mechanical operating tests on circuit-breaker (SANS 62271-200 7.102 and SANS 62271-100 7.101); and
  - tests of auxiliary electrical devices (SANS 62271-200 7.104).
  - The following quantities shall be measured and recorded during the mechanical operating tests (where applicable):
    - closing and opening speeds;
    - closing and opening times;
    - time taken to recharge the mechanism following an O, C and OCO operation;
    - synchronism across phases and between breaks of phases for an O, C and OCO operation;
    - timing tests on each type of auxiliary switch contact in relation to the main contacts;
    - time-current curves of the electrical tripping and closing circuits for normal operation. The resolution of the function times shall clearly be indicated on the test reports.
  - CTs shall be type and routine tested in accordance with SANS 60044-1.
  - CPATs shall be type and routine tested in accordance with their relevant standard.
  - Any additional tests as instructed by the Engineer.

C3.3.6.15.3. TESTS AFTER INSTALLATION ON SITE

(PRE-COMMISSIONING TESTS)

- Commissioning checks and a test programme (as determined by the manufacturer) shall be carried out in accordance with SANS 62271-200 7.105 and SANS 62271-100 10.2.101 – 10.2.102. This shall include checks after installation, circuit-breaker mechanical tests and measurements, checks of certain specific circuit-breaker operations and electrical tests and measurements.
- The contractor shall carry out their own internal quality checks, attend to all snags, and only thereafter provide the Engineer with 7 days' notice for a Site Acceptance Testing date. The SAT shall include all routine and functionality tests after which the Contractor shall upload the operational protection settings.
- The Engineer shall charge the Contractor for inspection failures at ECSA rates.

- Tests shall include, but are not limited to, the following:
  - 80 % power-frequency voltage tests of the main circuits in accordance with SANS 62271-200 7.105;
  - tightness tests for vacuum switchgear in accordance with SANS 62271-200 7.105 (dielectric test across the open contacts at a voltage stated by the manufacturer);
  - verification of remote control operation using the hand-held remote control unit for circuit-breaker switching and racking in and out of withdrawable parts.
- Mechanical tests and measurements on the circuit-breakers may include, but are not limited to, the following:
  - verification of the rated operating sequence; and
  - measurement of time quantities.
- Checks of certain specific operations for the circuit-breakers may include, but are not limited to, the following:
  - simulation of fault-making operation and check of anti-pumping device;
  - behaviour of the circuit-breaker on a closing command while an opening command is already present; and
  - application of an opening command on both releases simultaneously.
- Electrical tests shall include, but are not limited to, the following:
  - measurement of resistance of the main circuits of the assembly in accordance with SANS 62271-200; and
  - dielectric tests on auxiliary and control circuits in accordance with SANS 62271-200.
- For each measurement of the operating time, a recording shall be made of each individual operating coil current – namely close, trip I, trip II. The resolution of the function times shall be clearly indicated in the test reports.
- For the measurement of the steady-state contact resistance of the main circuit, a DC current of at least 50 A shall be used. The results shall be given in μΩ and the resolution shall be at least 1 μΩ.
- Reasons for differences between the results of the tests made on-site and the results of the tests as they were carried out at the OEM's works (the circuit-breaker pass sheet), shall be clearly stated and corrections shall be made.
- The results of pre-commissioning tests after installation on site shall be documented, signed off and a copy of the results included with the switchgear documentation for hand-over as part of the quality process. All tests shall be witnessed by the Engineer and a Client representative.

C3.3.6.16. SPARES

- Any spares ordered shall be delivered with the first delivery of switchgear, and shall be packed in sets in containers suitable for long periods of storage, and marked on the outside with the contract or order number, the supplier's name, the type and model of equipment and the date of packing.

C3.3.6.17. DOCUMENATION

C3.3.6.17.1. DOCUMENTATION WITH ENQUIRY

- The following documentation forms part of this enquiry:
- Single line configuration diagram with the following information:
  - the type of panel required (circuit-breaker, switch disconnector or switch fuse);
  - current rating of each circuit;

- busbar rating;
- power cable for each circuit;
- position of protection (on-board or remote); and
- an indication of the front view of the switchgear panel.

- Schedules A and B; and

C3.3.6.17.2. DOCUMENTATION WITH TENDER

- Tenderers shall provide the following documentation with each tender:
  - schedule B;
  - a typical drawing of each type of switchgear panel; (NOTE: This drawing should show all relevant dimensions including the height of the cable gland plate (if any) above floor level, the switchgear panel withdrawable dimensions, and a floor plan that gives the loads imposed on the foundations.)
  - a typical general arrangement of the switchboard; (NOTE: This drawing should illustrate cable boxes or cable clamping (or both) and the cable termination arrangement.)
  - a schematic diagram of the primary connections;
  - a comprehensive spare or replacement parts lists for each type of switchgear panel supplied, including recommended quantities to cover a period of 10 years, including parts required for commissioning;
  - a full list of type test certificates or reports; and
  - the number of units of the switchgear offered that are currently in use in South Africa.

C3.3.6.17.3. DOCUMENTATION WITH ORDER

- The successful tenderer shall submit the following as agreed upon between the purchaser and the supplier:
  - a schematic diagram of the auxiliary circuits of each type of switchgear panel; and
  - one set of operating and maintenance manuals.

C3.3.6.17.4. DOCUMENTATION ON HAND-OVER

- Before hand-over, the supplier shall supply a full list of routine test certificates/reports in soft copy and hard copy format.

C3.3.6.18. MEDIUM VOLTAGE SCHEMES

- The existing 22 kV board is protected by an ARC protection system integrating into the MV Bay Controller. Due to the risk of back feeding via the cable ring system, light only trips are acceptable – should an ARC relay activate but not be able to clear the fault the upstream feeders shall trip, such arcs are defined as being sustained for 500 ms. Sensors shall be provided for each of the CB and CT/Cable chambers and on the respective section of busbar. The CT chamber arc sensor trips that individual bay, and the CB/Busbar arc sensor trips the entire section of the board.
- All IED's implemented as bay controllers shall be equipped with dedicated control switch modules in the remote control room for breaker trip/close operation. The control switch modules shall be rotary switches with typically three positions namely "Trip", "Normal" and "Close". In all instances the contact position shall be monitored locally with LED's and remotely through the SCADA system.

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- The remote control room operations shall be implemented through the SCADA system and not hard wired.
  Full electrical control facilities will only be available from the remotely installed protection and control panels, as well as from the SCADA system specified elsewhere in this enquiry. Local control on the switch panel itself will only be available in the "racked out" position for testing purposes. In addition to the above electrical control, standard mechanical tripping and closing functions, will however still be available for each of the 22kV circuit breakers, for local mechanical control. In addition, an electronic and manual emergency trip facility will be provided on each panel.
- Full technical information, as well as type test certificates will be provided for a fully assembled switch cubicle of the proposed switchgear, indicating full compliance with the requirements of this specification, and will be submitted together with the tender. Failure by Tenderers to include these required test certificates, may result in the respective tender being disqualified.
- In depth training shall be provided by the OEM on the protection and communication capabilities of each type of IED offered by the contractor. The OEM shall also provide training for setting up of the IED's. During the Factory Acceptance Testing of the 22 kV boards the control panels shall be setup with full protection and control functionality as will be required when installed on site. The 22 kV boards will therefore be subject to system testing during Factory acceptance testing.
- The CT ratios for the 22 kV equipment shall be as specified on the project drawings.

C3.3.6.19. MEASUREMENTS AND METERING PHILOSOPHY

STATISTICAL METERING:

- Statistical energy meters are to be installed on all new panels.
- The meter must be wired according to 3 phase, 4 wire principle. The tenderer must allow in his tender price for the commissioning by the OEM.
- Meters to be used are Enerdis E50 (Communication: Modbus to RTU).

TRAINING:

- The equipment suppliers for all metering devices shall provide formal training to staff in a venue provided by the supplier. Training content shall be approved by the original equipment supplier if the supplier is not the original equipment manufacturer. Training material shall include the necessary equipment manuals and software. Training costs shall be specified in the tender; it shall indicate cost per attendee including subsistence and travelling.
- Training shall as a minimum have the following objectives.
  - Enable the trainee to operate the equipment with confidence.
  - Ensure that equipment shall be correctly maintained.

C3.3.7.DC PHILOSOPHY (PSE52)

- Each protection panel suite shall receive Main, Backup and Spring Charge DC supplies from the **existing** DC distribution board. All separate circuits such as, main protection, back-up protection, spring-charge, indication and close shall be supplied from different

MCBs installed in the control panels. All MCBs will be suitably rated to coordinate in terms of tripping times.

- DC supplies shall be bus-wired to the individual switchgear panels.

The existing DC scheme is shown below:

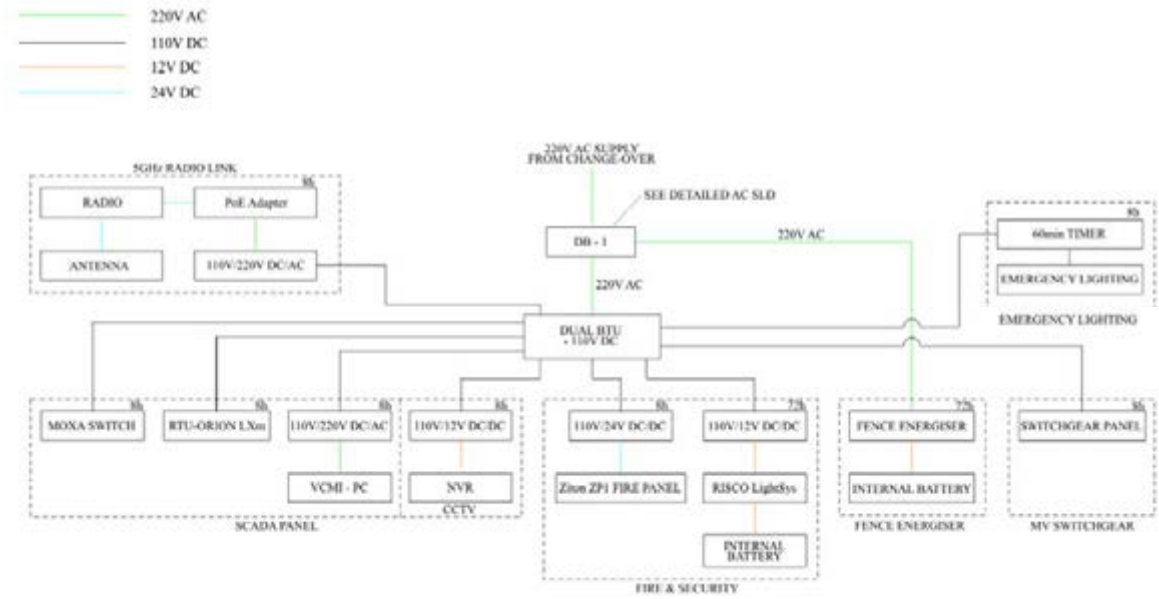

Figure 4: Existing DC Scheme

C3.3.8.SCADA (PSE 46)

- This section covers the detailed requirements for the SCADA Works. Reference should be made to the General Project Specifications in the application of these Specifications. In case of any apparent discrepancy between the General Project Specification and the Project Specification, the Project Specifications shall take precedence.
  (General Specification not included due to limited space)
- Different protocols among manufacturers pose a major problem for a utility in terms of backward / forward compatibility and compatibility among different elements of their system. For this reason, the system offered shall be based on IEC 61850 forward compatible equipment. Compliance and interchangeability are crucial aspects to this system, and Tenderers shall clearly state the extent to which their system has been tested for compliance, and the extent to which their system allows interchangeability with other leading manufacturers' components.
- A DNP3.0 over TCP/IP protocol shall be implement as an integrated solution that can in future be upgraded to IEC 61850 (all relevant parts) standard for the substation IED communications network (S-LAN). Solutions that offer a bay controller or 'master IED'

working as a data concentrator to slave IEDs using protocols other than IEC 61850 will be accepted.

- Provision must be made for a supervisory system to transmit the status and trip conditions of the new switchgear and energy consumption, maximum demand etc. to the Master station.

C3.3.8.1. HIGH LEVEL SCADA REQUIREMENTS

- Integrate the new switchgear panels into the existing, local SCADA system at the Switching station.
- Update the HMI that is hosted on the Master SCADA system that is located at Metsimaholo LM's offices.
- Install a HMI viewer at Metsimaholo LM's electrical workshop.
- Install the required email package/module on the existing RTU (OrionLX) so that the electrical superintendent as well as the electrical manager is notified of any trip or critical alarms.

C3.3.8.2. GENERAL REQUIREMENTS

- Non IEC61850 compliant protection relays / instruments will be accepted if all the SCADA controls, alarms, indications and analogues as specified can be relayed to the SCADA system by the IEC 61850 compliant single device (IED). In addition, all the data required for auto sequences and interlocking shall be available in the compliant device. For such a solution the contractor shall make provision for an interface between the IEC61850 infrastructure and the non-compliant IEDs for engineering access. This interface shall not be used for any purposes other than engineering access and it shall in no way interfere with the protection and control system.
- Communications between IEDs and the gateway must be by means of electrical or optical Ethernet networks using industrial grade switches or hubs (where applicable). Supply of all plant-side communication equipment is the responsibility of the Contractor.
- To cater for the failure mode where the relay detects an internal fault, but is still able to communicate with the gateway - such failure status may be communicated to the gateway provided that all other potentially corrupt data from the IED is flagged as 'offline' and communicated as such to the master station. Alternatively, if the IED detects an internal fault, it may be programmed to halt all communications to the gateway, whereupon the gateway will mark the data as indeterminate, generate an 'IED faulty' alarm and communicate such to the master station.
- Tenderers shall make adequate provision for configuration of the SCADA system.
- SCADA and IED software, configuration systems, software engineering and joint end-to-end commissioning shall be included in the contractor's scope. The complete integrated substation control solution shall interface directly with the Master Station.
- **ALL RELEVANT SOFTWARE AND SOFTWARE LICENSING SHALL BE PROVIDED TO THE ENGINEER WITH ALL COSTS COVERED IN THE TENDERED RATES.**

C3.3.8.3. SCOPE OF WORK

The successful Contractor shall provide all equipment, engineering, resources and whatever else is required to fulfil the said SCADA obligations. The SCADA scope will include (but not be limited to):

a) The contractor shall supply a complete and detailed communication architecture block diagram at tender stage.
b) Application drawings for the automation (HMI / RTU) schemes, inclusive of all interfacing, that is, terminations in marshalling kiosks, junction boxes, primary equipment and/or associated panels
c) Supply and installation of all IED to IED and Gateway network and communication equipment, all of which shall be DC powered from the substation DC system. Where alternative DC voltages are required the contractor shall provide for the relevant DC-DC converters.
d) All engineering to interface gateway to the protection IED units, the IED internal SCADA programming and required software modification and testing to realise compatibility with the SCADA master station will be the responsibility of the Contractor.
e) Installation of protection and control or automation schemes on site.
f) Control cabling between the protection and control or automation schemes, and associated equipment, including primary plant
g) Configuration and/or testing of SCADA master and local stations, including communications links between substation(s) and control centre(s)
h) Interfacing RTU to IEDs
i) **The supply of all diagnostic and configuration software and licences for the Gateway system shall be included in the offer.**
j) The provision of training to the utility technicians (3) and the Engineer (2) in the use of all related software and system configuration shall be included in the offer **(trainees to be involved during the configuration stage for experience).**
k) Supply and installation of all multicore cabling between Gateway and devices.
l) IED and SCADA software, configuration systems, software engineering is included within the scope of this specification.
m) All protection relay and SCADA IED configuration, programming and settings application will be the responsibility of the Contractor. The Contractor shall be responsible for the configuration of all aspects of the IED's offered to both the Protection and SCADA configuration of each IED.
n) Complete commissioning of all SCADA signals within the switching station is included in the scope of the contract
o) Provision of hard-wired, potential free, protection fail alarm and general alarm (breaker tripped) from each bay IED, to the hard-wired component of the system will be required.

C3.3.8.4. SCADA POINT LISTS

The points list for Master Station configuration is to be delivered in both printed and electronic form, either as a spreadsheet or database. A complete list of all configured points for the entire set of IEDs and hard-wired I/O, including spares, connected to the gateway is to be created.

C3.3.8.5. PLANT TO IED ADDRESSING SCHEME

- Where the IEDs are of the modular type that can be unplugged and swapped, a facility must be provided to prevent the IED address, and corresponding device tags from following the IED to a different switch bay position. The device address in such cases must be programmed into the IED frame, and not the removable module to prevent misrepresentation of switchgear status on SCADA (Bay swapping issue). Alternative interlock schemes to prevent this from happening will be considered.

C3.3.8.6. WEATHER STATION

- A weather station shall be added to the local SCADA structure providing data outputs through the Telemetry system and also recording locally.
- The sensor quantities are as follows:
  - Wind speed sensor = 1 outdoor
  - Solar radiation sensor = 1 outdoor
  - Ambient temp. sensor = 1 outdoor + 2 indoor (all rooms)
  - Humidity sensor = 1 outdoor + 2 indoor (all rooms)
- DNP3.0 or analogue signals will initiate from the sensors to the weather monitoring device / processor.
- DNP3.0 protocol is required for the data from weather monitor to the SCADA system.

C3.3.9.GATEWAY / RTU (PSE 47)

The existing RTU/Gateway shall be used. Contractor to refer to project drawings for as-built information.

C3.3.9.1. SCOPE

a) Install and terminate cables from all new IED's.
b) Label all cables on both ends.
c) Compile a database to accommodate all I/O.
d) Pre-commission from the furthest point and commission all points to the Mater Station.
e) Clean RTU cabinet and Control Room. Re-fit cover plates if necessary.
f) Obtain and install the necessary email protocol add-on software for the RTU. Set-up the RTU to send email's to the relevant persons when the SCADA system issues an alarm.

C3.3.9.2. INTERFACING OF SCHEMES

- Interfacing shall be through either an IDF or serial communication from the protection relay/IED ports to the RTU ports. For serial communication, the interface shall be done via a converter to be housed inside the RTU panel. Serial communications cable shall be used for connections between the converter and the IED. This shall be an armoured cable and shall be properly glanded on entry to panels.
- Each IED shall provide one hard-wired output contact, wired to the S-IED or gateway to indicate a protection failure alarm in the event of the IED device failing or an MCB trip rendering the protection system inoperable.
- The protection failure alarm contacts of the different IEDs shall be wired in a fail safe manner as a series connection of normally closed contacts. Provision shall be made for a second hard-wired, potential free, protection operated alarm (breaker tripped) contact from each bay IED, to the S-IED or gateway.

C3.3.9.3. TIME SYNC

- All new IED's on the new switchgear panels shall be integrated to receive Time-Sync information from the existing satellite clock.

C3.3.9.4. GATEWAY REQUIREMENTS

- The gateway must communicate with the IEDs by addressing each IED on an individual and polled basis – that is, the system must poll each IED as if it were a discreet module.

This enables the gateway to apply quality flags to the data elements derived from an individual IED – should the unit fail or communication to the unit fail, the data shall be marked as offline within the gateway real-time database and communicated as such to the master station.

C3.3.9.5. GATEWAY TO IED COMM. INTERFACE REQUIREMENTS

- Communications between IED's and the Gateway must be by means of electrical or optical Ethernet networks using industrial grade switches or hubs. Supply of all plant-side communication equipment is the responsibility of the contractor. IED's shall be IEC61850 ready, although a DNP3.0 protocol will be implemented.
- To cater for the failure mode where the relay detects an internal fault, but is still able to communicate with the Gateway - such failure status may be communicated to the Gateway provided that all other potentially corrupt data from the IED is flagged as 'offline' and communicated as such to the master station. Alternatively, if the IED detects an internal fault, it may be programmed to halt all communications to the Gateway, whereupon the Gateway will mark the data as indeterminate, generate an 'IED faulty" alarm and communicate such to the master station.
- Full support for data quality flags is required to ensure that indeterminate states are reported as such, and no possibility exists of communicating stale data to the SCADA Master Station as a result of the failure of a system component or the communication network.

C3.3.9.6. GATEWAY CONFIGURATION

- The gateway configuration will be the Contractor's responsibility. The points lists for both IEDs and hard-wired functions are to be presented by the Contractor and subsequently approved by the Engineer.

C3.3.9.7. TIME TAGGING

- Full support for time tagging of events to a resolution of at least 10 milliseconds, where the master station provides time synchronization through the protocol to the gateway, and on to the IEDs must be provided.

C3.3.10. OVERHEAD RETICULATION (PSE 01)

This is a list of all the drawings referenced or described, the list includes drawings which are standard and may not be attached but which are part of the PROJECT SPECIFICATIONS.

Table 4: Drawings

Title	Number	Rev
MV DRAWINGS		
POLE, WOOD 11 M (SHEET 1 - 4)	D-DT-0051	13
POLE, WOOD 9 M (SHEET 1 - 3)	D-DT-0055	12
EQUIPMENT MOUNTING ASSEMBLY SURGE ARRESTER	D-DT-0261	4
EQUIPMENT MOUNTING ASSEMBLY SINGLE PLATFORM (SHEET 1 - 2)	D-DT-0271	4
MV INTERMEDIATE ASSEMBLY (CROSS ARM BRACKET)	D-DT-0335	7
STAY ASSEMBLY (MV - 97 kN)	D-DT-0341	17

Title	Number	Rev
STRUT ASSEMBLY SWIVEL BRACKET 11 M AND 12 M POLES	D-DT-0351	4
EARTHING TRF SINGLE POLE MOUNTING (MV & LV ELECTRODE AT TRF) (SHEET 1 - 2)	D-DT-0627	7
EARTHING (ALT 1) LV ABC RETICULATION EARTHING (AT TRF) (SHEET 1 - 2)	D-DT-0637	7
DELTA INTERMEDIATE 0DEG STEEL CROSSARM	D-DT-1730	3
DELTA STRAIN 0 DEG STEEL CROSSARM	D-DT-1733	4
DELTA STRAIN 1-60DEG STEEL CROSSARM	D-DT-1734	4
DELTA TERMINAL STEEL CROSSARM	D-DT-1736	3
T-OFF 1300 STEEL CROSSARM	D-DT-1803	2
SECTION / EQUIPMENT LINKS CUT / OUT 2500 WOOD CROSSARM / SINGLE POLE	D-DT-1848	1
EQUIPMENT LINKS CUT / OUTS OR DISCONNECTORS 2500 WOOD CROSSARM ON POLE	D-DT-1849	1
TRANSFORMER 100-200KVA 2 POLE PLATFORM MOUNTED (H-POLE) EARTHING DETAILS (SHEET 1-2)	D-DT-1861	3
TRANSFORMER 100-200KVA 2 POLE PLATFORM MOUNTED (H-POLE)	VE9335-7 TRFR STRUC	0
11kV & 22kV DISTRIBUTION TRANSFORMERS 1 & 3 PHASE	D-DT-3021	11
CONDUCTOR, STRANDED	D-DT-3136	13
CONDUCTOR, STRANDED (SHEET 1 - 8)	D-DT-3136	12
FUSE HOLDER 1000V	D-DT3182	12
LV DRAWINGS		
POLE, WOOD 7,0 M	D-DT-0050	7
POLE, WOOD 9,0 M (SHEET 1 - 3)	D-DT-0055	12
STAY ASSEMBLY (LV - 35 kN)	D-DT-0341	16
STRUT ASSEMBLY FLAT 45 DEG BRACKET 7M AND 9 M POLES	D-DT-0342	3
MV AND LV FLYING STAY ASSEMBLY	D-DT-0343	4
EARTHING TRF SINGLE POLE MOUNTING (MV & LV ELECTRODE AT TRF) (SHEET 1 - 2)	D-DT-0627	7
EARTHING (ALT 1) LV ABC RETICULATION EARTHING (AT TRF) (SHEET 1 – 2)	D-DT-0637	7
THREE PHASE BARE NEUTRAL ABC SUSPENSION ASSEMBLY (0 - 30 DEG) WOOD POLE	D-DT-1100	4
THREE PHASE BARE NEUTRAL ABC TERMINAL ASSEMBLY WOOD POLE	D-DT-1120	5
THREE PHASE BARE NEUTRAL ABC STRAIN ASSEMBLY (0 - 60 DEG) WOOD POLE	D-DT-1121	5
THREE PHASE BARE NEUTRAL ABC STRAIN ASSEMBLY (60 - 90 DEG) WOOD POLE	D-DT-1122	5

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Title	Number	Rev
THREE PHASE BARE NEUTRAL ABC T-OFF ASSEMBLY FROM INTERMEDIATE WOOD POLE	D-DT-1140	5
THREE PHASE BARE NEUTRAL ABC CROSS INTERMEDIATE – INTERMEDIATE ASSEMBLY WOOD POLE(SHEET 1 -2)	D-DT-1141	5
THREE PHASE BARE NEUTRAL ABC T-OFF ASSEMBLY FROM STRAIN WOOD POLE	D-DT-1142	5
THREE PHASE BARE NEUTRAL ABC CROSS INTERMEDIATE – STRAIN ASSEMBLY WOOD POLE	D-DT-1143	5
BOX, POLE TOP DIST 4 + 8 WAY (SHEET 1 - 11)	D-DT-3055	20
COND, AERIAL BUND XLPE (SHEET 1 - 4)	D-DT-3141	10
THREE PHASE LV FUSE HOLDER CONNECTION (SHEET 1 – 4)	D-DT-0309	6
LV FUSE HOLDER 1 000 V (SHEET 1 – 6)	D-DT-3182	12
NEUTRAL S/A 6KV, 10KA	D-DT-3088	9
HOUSE CONNECTION DRAWINGS		
POLE, WOOD 5,0 M	D-DT-0058	7
SERVICE CONNECTION TO HOUSE (SHEET 1 - 5)	D-DT-0360	14
CABLE 1 kV SERVICE CONCENTRIC CU	D-DT-3140	9
UNDERGROUND SERVICES CONNECTION	D-DT-0367	5
METERING UNIT + ELECTRICITY DISPENSERS (SHEET 1 - 16)	D-DT-3145	7

The MV overhead line must comply with the requirements of SANS 10280 (NRS 041-1) and NRS 092.

The LV and MV wooden poles shall be 7 m, 9 m and 11 m respectively in length and shall comply with SANS 754 and NRS 073. Only Eucalyptus poles with a fibre stress of 63 MPa and with a minimum pole top diameter specified in the bill of Quantities shall be used.

C3.3.10.1. EXCAVATIONS

Excavations for pole holes and stays are indicated below and must comply with the requirements of NRS 092 and SANS 1200 DA. The Contractor must allow in his excavation rate for over excavations due to blasting, removing of additional rock etc.

The hole sizes are as follows:

Table 5: Hole Sizes

	11 m pole	9 m pole	7 m pole	5 m pole	Stay 1,5 m rod (LV Stay)	Stay 2,0 m rod (MV Stay)
Width	1,2	1,2	1,2	1,2	1,2	1,2
Breadth	0,6	0,6	0,6	0,6	0,6	0,6

Depth	1,8	1,5	1,3	1,0	1,3 (max)	2,15(max)
Excavation (m^3)	1,296	1,080	0,936	0,720	0,936	1,44
Add bags of cement to excavated soil	2	1	1	1	1	2

All poles must be planted at a distance of 0,5 m from the stand boundary as indicated on the drawings. Special care must be taken not to damage any existing services. In the event of hard rock nearby existing services, the Contractor shall make use of a compressor air drill to do excavations.

The maximum distance the eye of the stay may protrude out of the ground is 150mm. The minimum distance between the stay plate and the poles are as follows:
7,0 - 5 m
11,0 m - 7,5 m

All stays shall be installed as indicated on Eskom drawing D-DT-0350. The stay hole shall be backfilled and compacted as specified in Eskom Standard 240-75883148.

EXPLOSIVES:
The Contractor is to make adequate provision for blasting which, together with the necessary storage and handling of explosives, shall be carried out in strict accordance with the Explosives Act (No 26 of 1956, as amended) and Regulations. Care shall be taken that no damage is caused to existing works and property, and adequate protection shall be provided to prevent blasted materials scattered about. The size of charges shall be the minimum necessary for the purpose. The Contractor shall be solely responsible for damage and injury caused by or during blasting and shall make good at his own expense, and to the satisfaction of the Engineer, any unnecessary shattering of rock or disturbance of the surrounding ground. Careless use of explosives will render the Contractor liable to be forbidden for further use of explosives.
Blasting will not be permitted in any situation where it is likely to endanger any existing foundation, structure or service and in such situation material must be removed by drilling and wedging or barring or by any other approved method which will not cause damage.

At least one working day before commencing drilling and blasting operations on any new section of the works, the necessary safety precautions shall be arranged by the Contractor.

No blasting is to be done before permission has been granted from the Engineer.

C3.3.10.2. MARKING OF WOODEN POLES

The Contractor shall be responsible for providing numbering labels on all wooden poles.

The numbering labels shall be manufactured from galvanised sheet steel of minimum thickness 0,8 mm.

The numbering labels shall be fixed to poles at a height of 2,0 m above ground level, facing towards the street, by means of four galvanised 50 mm nails through pre-drilled holes at the four corners of the label.

The numbers shall be 10 mm high and be punched with a number and letter punch as indicated on the house connection drawings.

An additional numbering label shall be mounted on all MV poles. The number labels shall be fixed at a height of 2.5m above the ground level. The label shall be sheet metal, yellow painted with black letters. The letter size shall be 28mm x 15mm.

POLE MOUNTED TRANSFORMERS

Note: Pole mounted transformers must comply with the requirements of SANS 780.

The transformer shall be as follows:

Size	:	200 kVA
Type	:	Oil type
Voltage	:	22 000/420 V/242V
Vector group	:	Dyn 11
% Impedance	:	4.5%
Colour	:	Avocado green, code C12 of SANS 1091.

(2 x 22 000/220 V 16 kVA transformers are required for the auxiliary supply at the Themba Khubeka Switching station)

The transformer shall be installed at a height of 6 m minimum clearance between ground level and bushings.

As shown on the project drawings, all 100 kVA transformers shall be mounted on an 11 m and 9 m H-pole configuration, complete with 10 A dropout fuses mounted on a cross arm. The 200kVA transformers shall be supplied with 20 A dropout fuses. The dropout fuse cross arm shall be mounted 1 100 mm above the transformer bushings.

The Contractor must take special care to adjust the length of all tails to ensure that they are not too long or too short. The lightning arresters will be mounted on the transformers below the transformer MV bushings. The Contractor must obtain approval from the Engineer after completion with the first transformer installation and before proceeding with the rest.

All metal parts of the transformer shall be connected to the MV earthing system. The 35mm² ABC shall be protected by means of 160 A LV fuses mounted beneath the transformer with the appropriate bracket assembly as shown on drawing D-DT-0309 and D-DT-3182. The 70mm² ABC shall be protected by 2 x 160A LV fuses, or 1 x 315A LV fuse. Each fuse holder shall have a dedicated 70 mm² ABC jumper to the transformer.

The Contractor must take special care to use bi-metallic lugs to terminate the Aluminium cable onto the transformer LV copper bushing. The use of density paste in the lugs is also recommended to keep the moisture out.
The transformer manufacturer must specify the limit of overload capacity. All wiring shall be completed in the factory.

C3.3.10.3. POLE MOUNTED DISTRIBUTION BOARD

The pole top box shall be equal or similar to Allbro type No. 5 and shall be fitted to the pole with stainless steel straps, connected to the ABC with suitable piercing connectors (phase + neutral + earth). Cognizance must be taken that the pole top box will deviate from the Eskom

Standard and shall be equipped with 2, 3, 4, 5 or 6 Miniature Circuit Breakers (MCB) 5 kA, 50 A, slow curve 1 with a tag or label of the erf number.
A clip-in surge arrestor shall be installed per MCB in the pole top box enclosure. All wiring in the pole top box shall be 6 mm² for the phase and 6 mm² for the neutral and shall be pre-wired in the factory. Wires between the ABC and pole top box shall be 16 mm², UV protected and of suitable lengths. The pole top box must be locked with a special tool or key and must be dust proof.

The pole top box shall therefore be equipped with the following:
a) 50 A, 5 kA, Curve 1 MCB with cable sleeve tag of the erf number.
b) Conlog wBEC44 Split Single Phase DIN-Rail mounted with RF communication with cable sleeve tag of the erf number and lead seal.
c) Clip-in Surge arrestor.
d) 1 x Live, l x Neutral and 1 x Earth busbar.
e) 3 x 16 mm², Cu conductor, UV protected.
f) 6 mm² PVC wiring for the phase and the neutral.
g) Compression glands.
h) DIN rails.

C3.3.10.4. MV OVERHEAD RETICULATION

The MV overhead reticulation shall comply with the latest revision of the Medium Voltage Reticulation Standard, Part 4 as compiled by Eskom as well as the SANS and NRS specifications as envisaged below.

The various codes used on the drawings are according to the specification and the quality of material, construction procedures and the related items shall all be according to Eskom Specification. Various drawings referred to in the Eskom Specification are included in this Specification for reference purposes.

SANS 754	:	Eucalyptus poles, cross-arms and spacers for power distribution and communications systems
SANS 780	:	Distribution transformer
NRS 022	:	Stays and associated components
NRS 028	:	Cable lugs and ferrules
NRS 035	:	Drop-out fuses, etc.

The MV network consists of FOX conductor mounted on 11 m wood poles, 160 – 179 mm top in a delta configuration (with steel cross arm). All poles should be treated with creosote and must be 63 MPa. The transformer H-pole structure poles shall be 11 m and 9 m wood poles with a 180-199 mm top.

C3.3.10.5. LV OVERHEAD RETICULATION

The LV overhead reticulation shall comply with the latest revision of the Low Voltage Reticulation Standard, Part 3 as compiled by Eskom, SANS and NRS specifications as well as the general specifications as envisaged below. The various codes used on the drawings are according to the Specification and the quality of material, construction procedures and the related items shall all be according to the Eskom Specification. Various drawings referred to in the Eskom Specification are included in this Specification for reference purposes.

SANS 1418	:	Aerial bundled conductor systems (All parts).

SANS 1619	:	Small power distribution units (ready-boards) for single phase 230 V service connections.
NRS 018	:	Fittings and connectors for LV overhead power lines using aerial bundled conductors, Part 1, 2, 3 & 5
NRS 020	:	Aerial bundled conductor: Cable ties
NRS 022	:	Stays and associated components
NRS 032	:	Service distribution box for pole mounting, etc.

The LV aerial bundle conductor (ABC) layout is shown on the drawings. The LV bundle conductor shall consist of 3 phase conductors and 1 bare neutral conductor. The sizes of the conductor required are shown in the Bill of Quantities and the drawings.

The Contractor must also supply and install Conlog wBEC44 Split Single Phase DIN-Rail mounted with Radio Frequency (RF) communication. This meter must be supplied complete with customer interface unit and customer card. The contractor will be responsible for the management of these meters.

The Conlog meters shall be installed in the pole top box and shall be sealed with a lead seal and tagged or labelled with the erf number. The latch in the meter shall be set to trip at 20 A.

C3.3.10.6. EARTHING

The earthing must comply with the requirements of Eskom standard DST 34-1985. MV and LV earthing shall be separated at the transformer. A minimum separation distance of 5 m shall be maintained between the MV and LV earth electrodes.

The maximum earth resistance for the MV shall be 30 ohms and the maximum earth resistance for the LV shall be 10 ohms.

Earthing shall be done by four 1,8 m x 16 mm diameter copper earth rods installed in a three point star configuration. Refer to drawing D-DT-0627 and D-DT-0637 for detail. Future transformer poles shall also be earthed.

A 6 kV surge arrestor must be connected between the LV neutral bushing and the transformer earth stud as shown on drawing D-DT-1861 and according to drawing D-DT-3088.

The Contractor must obtain a null-balance megger and do an earthing survey which is to be tabled and submitted to the Engineer prior to final inspection. If an acceptable earthing value cannot be obtained, additional earthing electrodes or conductive concrete shall be installed as an extra to the contract.

C3.3.10.7. LIGHTNING IMPULSE WITHSTAND

The network design allows for a Basic Insulation Level of 300 kV, which will be achieved by means of bonding on all medium voltage and shared structures.

In accordance with Eskom 03TB-034, the conditions that system components are designed to meet are:

a. To withstand indefinitely the normal and maximum system operating voltages at supply frequency.

b. To withstand temporary supply frequency over-voltages up to the rated short duration power frequency withstand voltage.
c. To withstand lightning impulse over-voltages up to the rated withstand level
d. To restore the insulation level after a flashover.

All dressed structures shall have equipotential bonding between insulators, bonding wire shall be 3x3.5 galvanised steel wire. The same wire shall be nailed to wood poles up to the butt end of the pole to serve as a lightning down-wire.

A 500 mm BIL gap shall be maintained below the medium voltage insulators. At the top and bottom of the gap steel banded strapping shall be installed where the down-wire discontinues.

For share structure a second gap of 50 mm shall be maintained at 100mm below the low voltage equipment. The 500mm gap shall not be within 100mm of any low voltage equipment.

Stayed structures do not require a down-wire to be fixed to the pole, the anchor(s) serve as bonding. To achieve the required BIL only longrod fibreglass stay insulator shall be permitted in accordance with D-DT3144.

C3.3.10.8. READY BOARDS

The ready boards supplied under this contract shall comply with SANS 1619 and shall be equipped with a 50 A isolator earth leakage unit and 3 x 15 A switched socket outlets. One socket shall comply with the requirements of SANS 164-2. One switched socket outlet shall be protected by a 1 x 20 A MCB and the other two switched socket outlets with 1 x 15 A MCB. The ready board shall be complete with mounting brackets to facilitate the interface of the prepayment meter. When the ready board is fixed to a shanty, 6 mm sink bolts and nuts shall be used with 20 mm square washers. A light-fitting, complete with 20 W energy saver lamp and 5 m cabtyre shall be issued to every customer.

C3.3.10.9. AIRDAC

The Contractor shall supply and install 10 mm² Split concentric service cable (Airdac) with separate neutral and earth for the house connections. Communication cores are not required.

The Airdac shall comply with SANS 063. The house connection cable shall be installed overhead.

C3.3.10.10. TESTING AND COMMISSIONING

CERTIFICATE OF COMPLIANCE: COC
Occupational Health and Safety Act (OHS Act) Electrical Installation regulations, 1992 (EIR) Certificate of Compliance: Annex 1 (COC).

In terms of the above-mentioned requirements every electrical installation shall be inspected, tested and a COC issued to the owner and the supplier shall ensure that a COC has been issued before connecting the supply.

NOTE: In terms of the EIR 6(2) a COC must be issued before connecting the supply, but in order to carry out the tests, it is necessary to have the supply connected to the installation. This anomaly has been referred to the Chief inspector and he accepts that the supply can be

connected for testing, but if there is any reason for not being able to issue the COC than the supply must be disconnected immediate.

ELECTRICAL TESTS:

a) Voltage level tests:
The voltage level and polarity of the installation can be measured and recorded.

b) Test to ensure that wires have not been crossed:
Install a temporary earth spike of at least 300 mm, outside the dwelling. Connect a lead wire to the earth spike and measure the voltage between the temporary earth and the dwelling earth and neutral. If any reading is recorded the conductors are crossed and no COC shall be issued.

c) Insulation resistance test:
Disconnect the circuit breaker and record the result in M Ω between live and earth.

d) Earth fault loop impedance test:
Bridge the earth leakage circuit breaker. Plug the loop tester into ready board. The loop tester should indicate the voltage and correct polarity. Switch is to 20 Ω or 200 Ω and inject 25 A current. Record the reading on the test form.

e) Operation of the earth-leakage protection device and circuit breaker by plugging an ELCB tester into the ready board in increase milliamps until circuit breaker trips. Record results.

VISUAL INSPECTIONS:

A visual inspection shall be carried out for each service connection and installation by an accredited person signing the COC. This person shall be responsible for the quality control and shall be introduced to the Engineer and this quality control shall be his only task and function.
The Contractor shall supply the Engineer with the following information before any payments shall be made in an Excel spreadsheet format:

a) Stand number
b) Customer name and surname
c) Customer ID Number
d) Prepayment meter number
e) Customer Interface Unit number
f) Seal number
g) COC number
h) Length of Airdac
i) Completion Date

This information shall be recorded on Lyon and Partners type connection slips that will be issued to the successful contractor.

C3.3.10.11. PROGRESS REPORT

Commencement date: (Scheduled)…….,,……

(Actual)……

Original contract working period : …….. weeks
Delays granted : …….. working days
Revised contract working period : …….. weeks

	Delivery date of material		Installation date of material	
Activity	**Scheduled**	**Actual**	**Scheduled**	**Actual**
Site establishment				
Excavations: MV Pole holes				
Excavations: MV Stay holes				
Excavations: LV pole holes				
Excavations: LV Stay holes				
MV Overhead FOX Conductor				
Transformers				
LV cable ABC: 70 mm²				
LV cable ABC: 35 mm²				
Service connections				
MV poles planted				
LV poles planted				
MV stays planted				
LV stays planted				
Earthing				
Commissioning				

C3.3.10.12. ELECTRICAL TESTS AND INSPECTION

To ensure the safe and reliable operation of an urban reticulation system the following visual inspections, and tests must be done before and after energising. Results must be recorded on the attached record sheets.

VISUAL INSPECTIONS

The visual inspection is to make sure that the as Build System is in conformance with the design.

- INSTALLATION LAYOUT
  - Does the installation and layout drawing correspond?

- TRANSFORMERS
  - Is transformer installed as per Layout Drawing?
  - Is transformer installed labelled as per the Electrification Standard?
  - Is MV surge arresters fitted as per Drawing D-DT-0261, D-DT-0262 or D-DT-0263?
  - Is LV surge arrester fitted as per Drawing D-DT-1861 sheet 2?
  - Is the ABC neutral insulated on the transformer pole as per Drawing D-DT-0308?
  - Is the LV breaker labelled as per the Electrification Standard?
  - Is the MV and LV surge arresters earthed as per D-DT-0308 and D-DT-0340?
  - Is the transformer tank earthed as per D-DT-0630?
  - Is earthing leads protected on wood poles?

- LV FEEDERS
  - Are all LV stays bonded to earth as per drawing D-DT-0120, D-DT-0121 and D-DT-0122 or its equivalent drawings?
  - Is neutral bonded on all conductive poles as per D-DT-0305, D-DT-0306 and D-DT-0307?
  - Is the services take off (phases) equally distributed along the feeder as indicated on the Layout Drawing?
  - Are the clearances to ground and to shared services according to the Electrification Standard?
  - Are the shear heads of all IPC's off?
  - Is end caps on phase cores at termination points?
  - Is bundle strapped at attachment points to avoid unravelling of the bundle?
  - Is neutral and earth leads to the service distribution boxes separately connected on the neutral as per D-DT-0180?
  - Is the following points earthed:
    - All T-offs?
    - All terminal points?
    - Intervals not exceeding 150 m?
    - All LV poles one span away from transformer installations?
  - Are all concrete poles planted with broad face in line?

- SERVICE CONNECTIONS
  - Does the Service Cable continue into the back of the BEC as per the Electrification Standard?
  - Has a certificate of compliance been issued to all connected customers as per Electrical Installation regulations?
  - Are the customers satisfied with placing of the Ready Boards as per the Electrification Standard?
  - Is the installation in the customers dwelling neat and tidy?
  - Is BEC installed as per the Electrification Standard?

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ELECTRICAL TESTS:

- **INSULATION RESISTANCE TESTS**

  - Disconnect the LV Feeders at the Transformer. With all pole top box MCB's switched off use a 5 kV Megger and Megger between each phase and earth as well as between phases. Care must be taken to discharge the ABC before disconnection of Megger leads. Record Readings in attached test results sheet.
  - Expected results is 5 MΩ between phases and 5 MΩ between phase and neutral.

- **VOLTAGE LEVEL TESTS**

  - With the pole top box MCB's switched off the feeder shall be energized and the voltages measured at the terminal poles and recorded.
  - The individual pole top MCB's can now be switched on and the polarity of all the installations from each pole tested as well as the Voltage level in each house.
  - Polarity at the pole top boxes shall be tested by measuring the Voltage between the phase bar and the earth stud on the pole as well as between the earth bar and the earth stud and the neutral bar and the earth stud **only in the first instance a voltage should be measured**.
  - After all consumers are switched on the voltage at the terminal poles must be recorded again.

- **EARTH ELECTRODE RESISTANCE TEST**

Measurement of earth resistance

The best and most accurate method for measurement of relatively small earth electrode systems is described below and the method illustrated in Figure C.2, Connections for earth electrode resistance measurement - 61,8 % method.

- Identify the earth electrode to be tested. Establish the physical layout of the earthing system and type of electrodes being used, for example in the figure the earth electrode is a combination of horizontal counterpoise (trench) electrodes and vertical rods.

- Disconnect the earth electrode from the earthed equipment, preferably at the point where the wire from the equipment connects to the earth electrode.

- Identify the position of the current probe C2. Measurement should be exercised away from the line of any known trench earth, metallic pipe or underground cables. The distance between the electrode under test and the current probe C2 should be five times the biggest of the earth spike length, counterpoise length or the longest diagonal of the earthing system but not less than 30 m.

- Set the potential probe P2 in line with the tested electrode and the current probe C2 at a distance equal to 0,6 of the distance to the current probe. Water the area around the current probe C2 to reduce its resistance thus reducing its influence on the measurement.

- Connect the Earth Tester terminals C1 and P1 to the tested electrode, terminal P2 to the potential probe P2 and the terminal C2 to the current probe C2. Operate the Earth Tester and obtain the resistance reading.

- Repeat the measurements for potential electrode set up at the distances shown in the illustration, i e 0,2; 0,4; 0,5; 0,7 and 0,8 of the distance to the current electrode.

- The values obtained by measurement at the six positions (R2 to R6) should be recorded (Table C.1: Earth electrode resistance - 61,8 % method measurement results).

- The resistance of the electrode under test is equal to the value obtained from the graph and corresponding to the distance of 0,618X.

Alternatively calculate four values of R using the following formulas:-

a) R = - 0,1187R1 - ,4667R2 + 1,9816R4 - 0,3961R6
b) R = - 2,6108R2 + 0,0508R3 - 0,1626R4 - 0,2774R6
c) R = - 1,8871R2 + 1,1148R3 + 3,6837R4 - 1,9114R5
d) R = - 6,5225R3 + 3,6816R4 - 6,8803R5 + 0,7210R6.

Four values of R, obtained from calculations, should substantially agree and an average of the results may then be calculated. However it is possible that the result from equation (a) will be less accurate than the others. If the result of (a) does prove to be at variance with the others it can be ignored and an average obtained from the three more agreeable figures.

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VISUAL INSPECTION RECORD SHEET
INSTALLATION DRAWING NUMBER _____

	TRANSFORMERS	YES	NO	N/A
1	Is transformer installation labelled as per the Electrification Standard?			
2	Are MV surge arresters fitted as per Drawing D-DT-261, D-DT-0262 or D-DT-02632?			
3	Is LV surge arrestor fitted as per Drawing D-DT-1861?			
4	Is the ABC neutral insulated on the transformer pole as per Drawing D-DT-0308?			
5	Is the LV breaker labelled as per the Electrification Standards?			
6	Is the transformer tank earthed as per D-DT-0630?			
LV FEEDERS				
1	Is all LV stays bonded as per D-DT-0120, D-DT-0121 and D-DT-0122 or ITS equivalent drawings?			
2	Is neutral bonded on all conductive poles as per D-DT-0305, D-DT-0306, D-DT-0307?			
3	Is the services take offs (phases) equally distributed along the feeder as indicated on the Layout Drawings?			
4	Are the clearances to ground and to shared services according to the Electrification Standard?			
5	Is the shear heads of all IPC's off?			
6	Are end caps on phase cores at termination points?			
7	Is bundle strapped at attachment points to avoid unravelling of the bundle?			
8	Is neutral and earth leads to the service distribution boxes separately connected on the neutral as per D-DT-0180?			
9	Is the following points earthed? 1. All T-offs 2. All terminal points? 3. All intervals is not exceeding 150 m? 4. All LV poles one span away from transformer installations?			
10	Is all concrete poles planted with broad face in line?			

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TRANSFORMERS		YES	NO	N/A
SERVICE CONNECTIONS				
1	Does the Service Cable continue into the back of the BEC as per the Electrification Standard?			
2	Has a certificate of compliance been issued to all connected customers as per Electrical Installation regulations of the MOS Act dated 1992-10-23. Regulations R2920 Clause 3.(1)?			
3	Is the customer satisfied with placing of the Ready Boards as per the Electrification Standard?			
4	Does the ready-board contain a SANS 164-2 socket?			
5	Is the installation in the customers dwelling neat and tidy?			
6	Is BEC installed as per Clause 6.6, Part 3 Section 2 of the Electrification Standard?			

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TRANSFORMER INSTALLATION AND COMMISSIONING RECORD SHEET

TOWNSHIP RETICULATION SCHEME: _____

DATE: _____

TESTERS NAME: _____

ADDRESS: _____

_____

_____

TEL NR: _____

TRANSFORMER NR: _____

MV VOLTAGE: _____ kV.

LV ABC INSULATION RESISTANCE

R-W ..... MΩ	at	5 kV
W-B ..... MΩ	at	5 kV
B-R ..... MΩ	at	5 kV
R-N ..... MΩ	at	2,5 kV
W-N ..... MΩ	at	2,5 kV
V-N ..... MΩ	at	2,5 kV

Instrument used _____ Instrument Nr _____

NO LOAD VOLTAGE LEVELS AT TERMINAL POINTS ON

FEEDER 1

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

FEEDER 2

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

FEEDER 3

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

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VOLTAGE TESTS AT HOUSES

Is it within statutory limits: _____YES _____ NO

FULL LOAD VOLTAGE LEVELS AT TERMINAL POINTS ON

FEEDER 1

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

FEEDER 2

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

FEEDER 3

R-N ..... Volts R-W ..... Volts
W-N ..... Volts W-B ..... Volts
B-N ..... Volts B-R ..... Volts

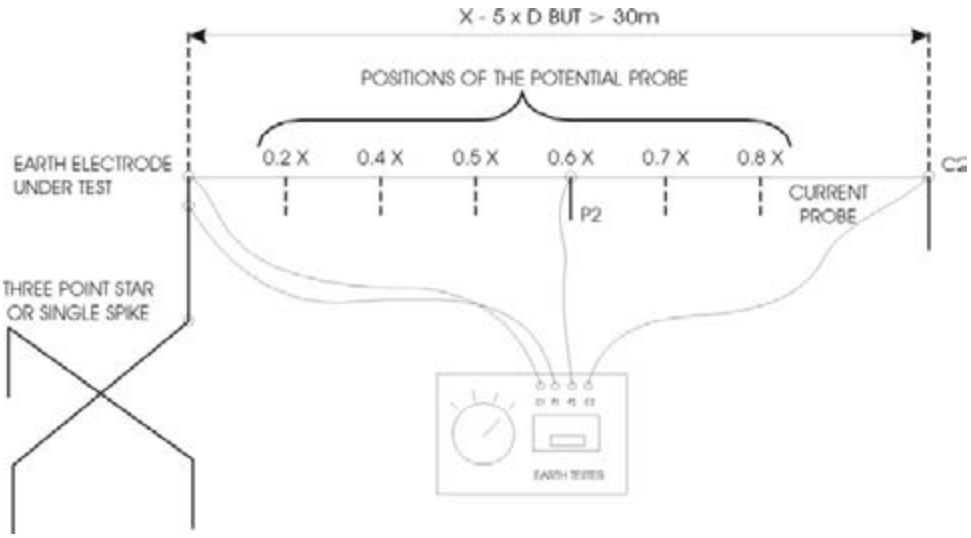

Figure 5: Connections for earth electrode resistance measurement - 61.8% method

Table 6: Earth electrode resistance - 61,8 % method

COMMENTS	REFERENCE	POSITION	ISTANCE (M)	RESISTANCE (M)
	R1	0,2X		
	R2	0,4X		
	R3	0,5X		
	R4	0,6X		
	R(T)	0,618X		
	R5	0,7X		
	R6	0,8X		

Table 7: Earth electrode resistance - 61,8 % method measurement results

R	= 0,1187 R1 - 0,4667 R2 + 1,9816 R4 - 0,3961 R6 = _____ ohm
R	= 2,6108 R2 + 0,0508 R3 - 0,1626 R4 - 0,2774 R6 = _____ ohm
R	= 1,8871 R2 + 1,1148 R3 + 3,6837 R4 - 1,9114 R5 = _____ ohm
R	= 6,5225 R3 + 13,6816 R4 - 6,8803 R5 + 0,7210 R6 = _____ ohm

C3.3.11. ELECTRICAL INSTALLATION IN THE BUILDING

The electrical installation to conform to the requirements of SANS 10142-1:2017. The layout of the installation is shown on the project drawings. All conduit work will be surface mounted in galvanized steel conduit in an acceptable manner. **No Sprague tubing shall be accepted.**

The building electrical installation involves all:

- Switchgear AC supply
- Earthing

C3.3.12. LV SUPPLY TOWARDS THE BUILDING

For construction, testing and commissioning activities, a temporary low voltage supply is available from the Themba Khubeka switching station.

C3.4: 88kV OVERHEAD LINE AND SUBSTATION REPAIR WORK

C3.4. ZAMDELA-LEITRIM 88KV OHL REPAIR & LEITRIM SUBSTATION REPAIR

Per Cost items are allowed for the work required on the Zamdela-Leitrim 88 kV overhead power line and Leitrim 88/11 kV substation. However, the Contractor will be given the opportunity to quite on the remedial work. If the quote by the Contractor is higher than the quotes already obtained and allowed for by the PC amounts in the Bill of Quantities, a nominated subcontractor will be selected to execute the work. All relevant data and information will be provided to the Contractor for pricing after the bid awarding. The information is withheld during the tender stage in order not to distract focus from the Themba Khubeka projects.

The funding source for the Zamdela-Leitrim remedial work is internal Municipal funding, and not DMRE grant funding.

C3.4.1. DESCRIPTION OF THE WORKS

The Contractor shall be responsible for the detail designs based on equipment offered, installations, construction, erection, commissioning, testing and handing over of the works, complete with all auxiliary equipment where the works at high level comprise of:

C3.4.1.1. ZAMDELA-LEITRIM 88KV OHL REPAIR

The OHL has multiple defects and shall be rectified. This may involve the detail design, construction, installation, erecting, commissioning, and testing of the rectified/repaired equipment/infrastructure. A Per Cost amount has been allocated towards the repair of the OHL.

The Contractor shall engage with all the relevant stakeholders during construction.

C3.4.1.2. LEITRIM SUBSTATION REPAIR

The Leitrim 88kV/11kV substation (Metsimaholo LM owned) needs to be serviced and be fully operational once the Zamdela-Leitrim 88kV OHL has been repaired. A Per Cost amount has been allocated towards the repair/servicing of the substation.

All the primary plant equipment shall be serviced and tested. The control plant equipment shall also be tested, repaired and re-commissioned. General housekeeping in the substation station shall also be done.

The Contractor shall engage with all the relevant stakeholders during construction.

C3.4.2. HIGH LEVEL SCOPE OF WORKS

C3.4.2.1. ZAMDELA-LEITRIM 88KV OHL REPAIR

The scope of works is outlined below.

Table 1: High level scope of work for Zamdela-Leitrim 88kV OHL Repair

1.	Replace Leitrim Substation terminal clamps.
2.	Re-tension all stays, tie-down all stay wires and compact stay excavation soil.
3.	OPGW trench excavation to be compacted.
4.	Ensure line terminal connected to substation earth grid at both substations.

5.	Apply bitumen paint to the bottom of all poles.
6.	Earth/footing resistance at each pole to be provided.
7.	Rectify unequal sagging/tensioning of the line.
8.	Replace corroded phase conductor on closing span to Leitrim substation.
9.	Verify tensioning of each span.
10.	Provide servitudes and wayleaves for the overhead line.
11.	Ensure post insulators on intermediate structures are effectively fixed to keyhole brackets.
12.	Burn-off time to provided for the OPGW and shield wire connected in parallel.
13.	Pole labels to be redone.
14.	"X" labels to applied to the applicable structures.
15.	The existing X-braced strain structure is not planted in the bi-sector. The structure shall be replanted and orientated correctly.
16.	General bush-clearing shall be done.
17.	Phasing discs shall be provided.
18.	Phase swapping shall be confirmed and indicated.

C3.4.2.2. LEITRIM SUBSTATION REPAIR

The scope of works is outlined below.

Table 2: High level scope of work for Leitrim Substation Repair

1.	Service 88kV Isolators
2.	Service 88kV Circuit Breakers
3.	88kV/11kV Transformer Oil Test and Servicing.
4.	Service 11kV NECRT
5.	Replace 630mm^2 x 1 Core, XLPE, 6.35/11kV cable (420m)
6.	Replace/Repair ABB RED670 Relay
7.	Commission "Zamedela Feeder 2" switchgear panel
8.	Repair/Re-commission SCADA system
9.	Install new radio link and connect to SCADA master
10.	Service 88kV BTUs
11.	Service 11kV BTUs
12.	Removal of weeds, application of herbicides and general housekeeping
13.	Re-instate Alarm System, install electric fencing, and install new CCTV system
14.	General maintenance.

C4: SITE INFORMATION

C4.1 – SITE INFORMATION:
Vaaldam Substation Extension

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SITE INFORMATION

The site falls within the jurisdiction of Metsimaholo Local Municipality.

The Contractor shall cater for his own water, electricity and sanitation requirements, and shall allow for the rental of a suitable site camp located nearby the construction site.

The onus will be on the Contractor to acquaint himself with the site conditions before the tender closing date.

It is recorded that the Contractor has, before signature of this Contract, carried out a site inspection to acquaint itself with the site conditions, access and all other matters relating to the site.

The contractor acknowledges that it has allowed for all conditions on site and agrees that extra claims arising from difficult site conditions in respect of transport, handling, loading, off-loading, labour, housing and any other matter relating to the site will not be entertained.

Figure 1: Locality (Vaaldam Substation)

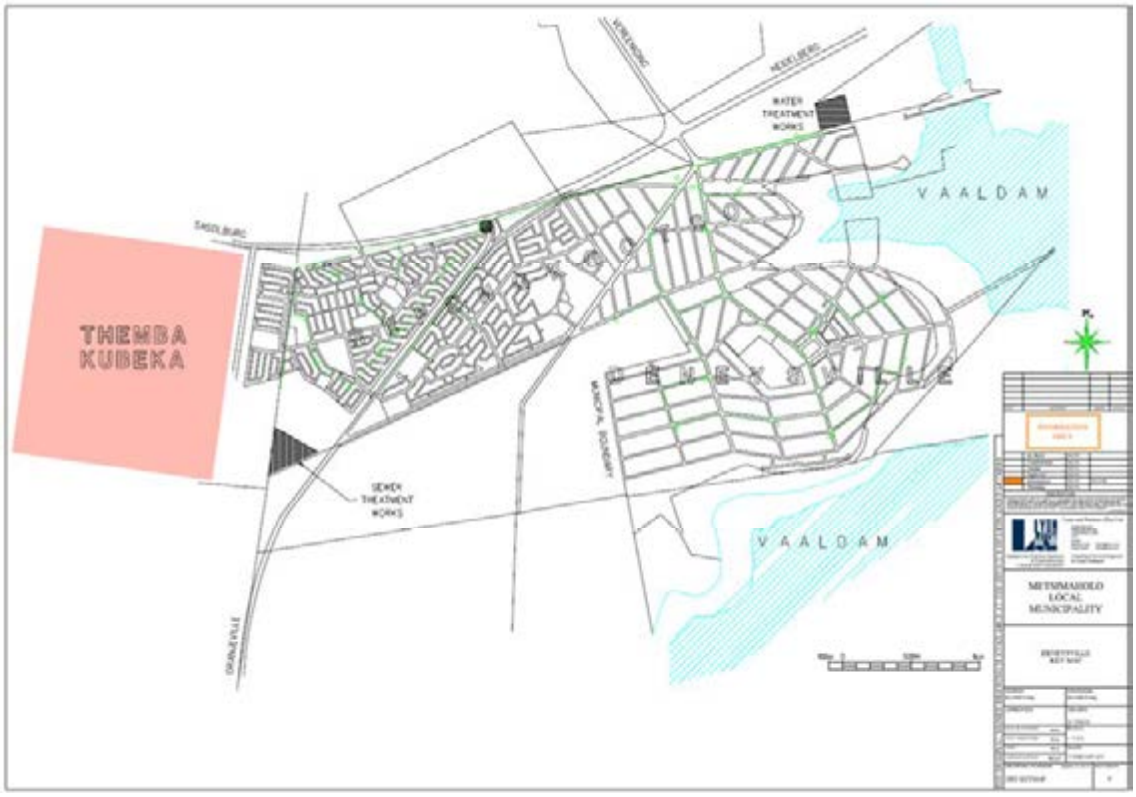

Figure 2: Refengkgotso Township (Themba Khubeka) Mooiplaats 1858

Table 1: Site information

Substation Information:	
Item	**Description**
Co-ordinates (Lat.) S/S cent	LAT: 26°53'04.3"S
Co-ordinates (Long.) S/S cent	LONG: 28°04'55.0"E
Stand size required for site camp	Sufficient space for a site office and laydown area
Land Ownership (S/S site)	Private (Eskom servitude)
Substation System Voltages	88 kV
HV Design Philosophy	AIS Outdoor
MV Design Philosophy	Outdoor Single Busbar with bypass
Preferred MV busbar orientation	Similar to existing (omit bypass for space)
Number of HV feeders	1xIncomers & 3xTrfr Feeders (end-state)
Number of MV feeders	8 (end state)
Number of Transformers	3
Transformer rating	10 MVA
Transformer oil catch pit	No
Transformer oil holding dam	N.A.
Site Climate Conditions:	
Item	**Description**
Ambient Temp Max. ºC	35 ºC
Ambient Temp Min. ºC	-8 ºC
Lightning Density	7.5 flashes to ground/km²/year
Rain Fall	600mm annualy
Thunder days/year (mean)	38
Snow days/year (mean)	0
Max. Wind m/sec	19 m/s
Topography	Flat grasslands (0.5% natural gradient)

The substation extension is not anticipated to create any stormwater concerns. However, all precautions shall be taken to prevent gathering of water on the new section of the substation, no water shall be discharged towards the existing section.

GEOTECHNICAL

A geotechnical investigation was completed on the remaining extent of the farm Knoppiesfontein 94 (substation site) and can be made available to the Contractor upon request.

The soil conditions are mostly rocky (fine grained sandstone) at various depths, but close the surface. The prevalent mode of rock weathering, is chemical decomposition.

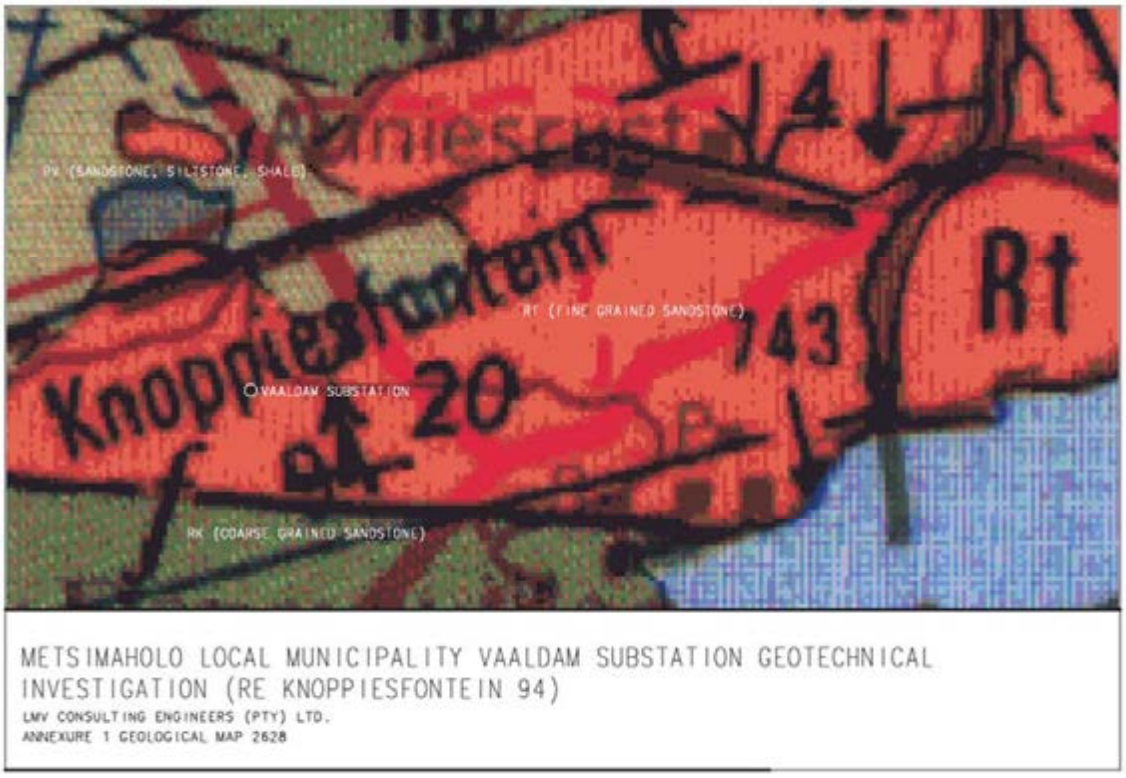

Figure 3: Geological map

A visual inspection- and the excavation of the test pits were done by a registered professional engineer, on 12 August 2020. The test pits were profiled, soil samples were collected and submitted to an accredited laboratory for testing.

Figure 4: Test pits

The topsoil layer is not suitable to be used as fill below structures or as subgrade material below roads, due to the extent of root intrusions and the number of large boulders that were observed in this layer. The topsoil layer is located between the depths of 0 and 600mm, must be removed entirely, and spoiled. All large builders shall be removed.
The depth of "cut-to-spoil" and quantity imported soil shall be as per the platform design as indicated on the project drawings.

The second soil layer is a well graded- and clayey gravel mixture, which is located between the depths of 600mm and 1400mm. Foundations for large load bearing structures can be constructed in this layer and the material can be utilised for the construction of the subgrade below the internal roads.

When the material from layer 2 is utilised for fill below structures, or for the construction of the subgrade below the internal roads, all rock fragments which exceed 100mm in size must be removed.

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Table 2: Shear strength parameters, bearing capacity factors, soil unit weight and bearing capacity magnitudes

Layer Description	Depths (m)	Φ (°)	cu (kN/m²)	Nc	sc	Nq	sq	Nφ	sφ	φ' (kN/m³)	φ (kN/m³)	qf' (kN/m²)	qf (kN/m²)
Layer 2	600 – 1400mm	28	0	26	1.2	14	1.2	13	0.5	6.190	16	126.771	327.680
Rock bed	The bearing capacity of the sandstone rock bed, where excavations can only be done by means of light blasting or with pneumatic picks (Table 12-1 of Robberts and Marshall, 2008)												1000

The site is situated in an area of the Republic of South Africa, where neither a detailed seismic design nor adherence to the minimum requirements of seismic design, will be necessary.

LOCAL COMMUNITY

The local community of Themba Khubeka has been without power for an extended period. Peoples' emotions can easily flare up resulting in the community becoming volatile. To prevent the need to apply for an extension of time for completion of the works, the Contractor's programme shall allow for a standing time period of at least three weeks. Sufficient provision shall be made by the Contractor in the Preliminary and General rates to cover the cost of this standing time. IT IS EXPLICITY NOTED THAT NO CLAIMS WILL BE ENTERTAINED FOR WORK STOPPAGES BY LOCALS WITHIN THE PROVISIONAL THREE WEEK PERIOD. In South Africa work stoppages are anticipated on most construction projects, these circumstances cannot be classified as force majeure (unforeseeable circumstances).

SIGNATURE OF TENDERER : _____

DATE : _____

C4.2 – SITE INFORMATION:
Themba Khubeka Switchgear & Reticulation

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SITE INFORMATION

The site falls within the jurisdiction of Metsimaholo Local Municipality.

The Contractor shall cater for his own water and sanitation requirements. An electricity supply is available at the Themba Khubeka switching station.

The Themba Khubeka (Refengkotso Ext. 5) site is situated in the Vaaldam / Deneysville surrounding.

Figure 1: Locality (Themba Khubeka)

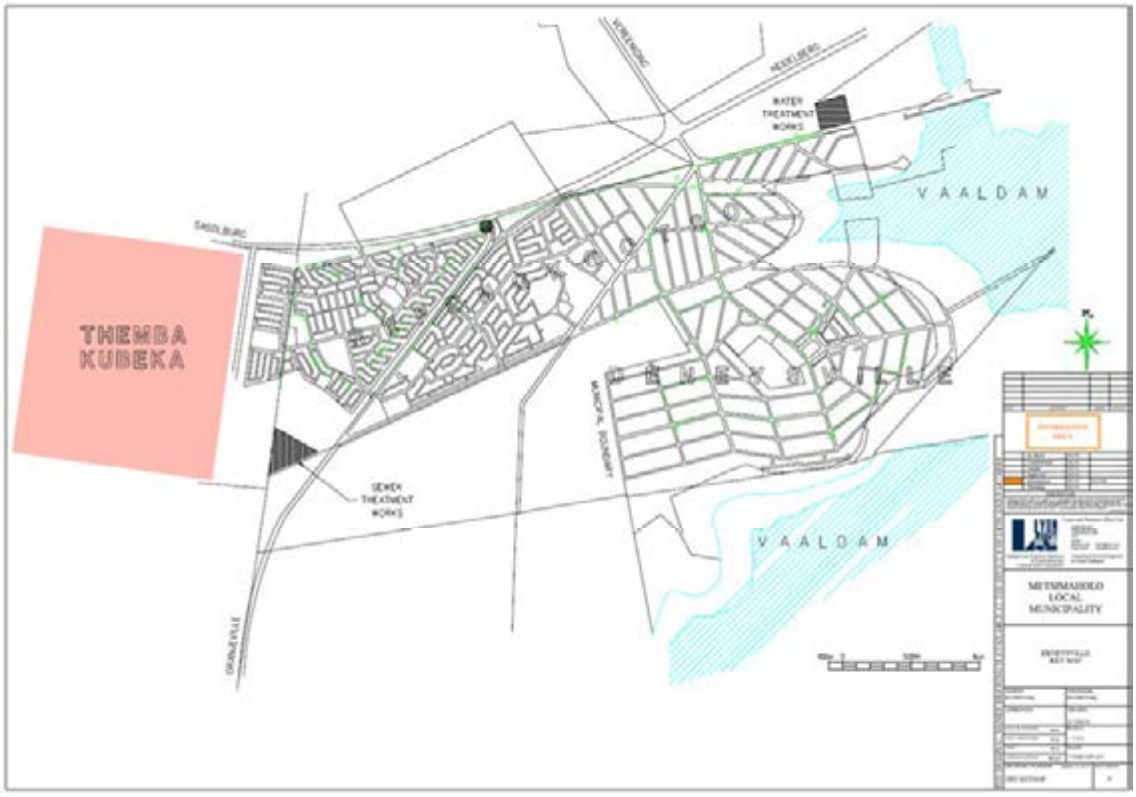

Figure 2: Refengkgotso Township (Themba Khubeka) Mooiplaats 1858

Special care shall be taken with works inside these areas as not to damage the existing housing. Where bush clearing is required the contractor shall plant a new tree / shrub / bush for the ones removed. Construction vehicles shall stick to existing gravel roads where possible.
There is no access to a water connection, Contractor to arrange this.

Care shall be taken by the Contractor with regards to safety and security throughout execution of the works.

The onus will be on the Contractor to acquaint himself with the site conditions before the tender closing date.

It is recorded that the Contractor has, before signature of this Tender / Contract, carried out a site inspection in order to acquaint himself with the site conditions, access and all other matters relating to the site.

SIGNATURE OF TENDERER : _____

DATE : _____

C4.3 – SITE INFORMATION:
Zamdela-Leitrim Overhead Line & Substation Repair

© Lyon and Partners (Pty) Ltd.

SITE INFORMATION

The site falls within the jurisdiction of Metsimaholo Local Municipality.

The Contractor shall cater for his own water and sanitation requirements. An electricity supply is available at the Leitrim substation.

The Zamdela-Leitrim 88kV OHL is located in the Zamdela area.

Figure 1: Zamdela-Leitrim OHL route

Figure 1: Communication between the SCADA master and Leitrim

Care shall be taken by the Contractor with regards to safety and security throughout execution of the works.

The onus will be on the Contractor to acquaint himself with the site conditions before the tender closing date.

It is recorded that the Contractor has, before signature of this Tender / Contract, carried out a site inspection in order to acquaint himself with the site conditions, access and all other matters relating to the site.

SIGNATURE OF TENDERER : _____

DATE : _____

SECTION 6 -
ANNEXURES AND DRAWINGS

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VAALDAM SUBSTATION EXTENSION AND THEMBA KHUBEKA ELECTRIFICATION

SECTION 6: ANNEXURES & DRAWINGS

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LIST OF ANNEXURES

ANNEXURE 1: Employer Health & Safety Specification

ANNEXURE 2: Employer Environmental Management Plan

ANNEXURE 3: Drawings

ANNEX. 1: EMPLOYER H&S SPECIFICATION

HEALTH AND SAFETY SPECIFICATION

REQUIREMENTS RELATED TO CONSTRUCTION WORK

G:\MEESTERS\HEALTH - SAFETY & ENVIRONMENTAL\Health & Safety\TENDER SPEC & CHECK LIST\HEALTH AND SAFETY SPECIFICATIONS 2017-08-18 Rev 1.docx

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COMPILED BY	Dave Redfearn for Lyon and Partners
APPROVAL DATE	2017-08-22
NEXT REVIEW DATE	T.B.C.

1. SPECIFICATION

This specification refers to the specific health and safety requirements related to construction work.

2. SAFETY AND HEALTH REQUIREMENTS

2.1. DURING TENDER STAGE

The contractor shall submit the following safety documentation during the tender stage:

- Proof that the contractor has implemented a safety management system in compliance with OHS Act 85 of 1993 (Construction Regulations 2015).

2.2. PRE-CONTRACT QUALIFICATION AUDITS

The Engineer may require a safety audit to be conducted on the contractor to ascertain whether the contractor has implemented a safety management system based on the relevant codes of practice.

Should the contractor not comply with the Engineer safety specifications the contractor may be omitted from the supplier's data base until such time that he obtains the relevant compliance.

3. DURING THE PROJECT STAGE

3.1. AGREEMENT

In accordance with the provision of Section 37(2) of the Occupational Health and Safety Act 85 of 1993, every contractor shall enter into a written agreement with the principle contractor.

3.2. SAFETY AND HEALTH FILE

Prior to any work on site the contractor shall compile a safety and health file based on the requirements of the Occupational Health and Safety Act 85 of 1993 – Construction Regulations 2014 for approval by the Engineer.

The safety file shall include but will not be limited to the following:

- Safety Policy
- SHE Plan
- Appointment letters as per OHS Act 85 of 1993
- Notification of construction work
- Hazard identification risk assessments
- Base line risk assessments
- Safe work procedures
- Daily task risk assessments
- Emergency evacuation plan
- Internal safety Audits
- Proof of induction training
- Contractor agreements (As per the OHS 85 of 1993 Act 37 (2))
- First aid box contents, training certificates
- Incidents and accidents reporting Annexure A
- Health and safety meetings
- Letter of good standing “Compensation fund number”
- COID
- Personnel protective equipment issue (PPE)
- Hand tool inspection list
- Electrical equipment checklist
- Vehicle inspection
- Fire extinguisher checklist
- Toolbox Talks
- PTO’s Task job observations

3.3. RISK ASSESSMENT

Contractor shall before the commencement of any construction work and during construction work, cause a risk assessment to be performed by a competent person appointed in writing and the risk assessment shall form part of the health and safety plan to be applied on the site and shall include at least-

- The identification of the risks and hazards to which persons may be exposed to
- The analysis and evaluation of the risks and hazards identified
- Documented plan of safe work procedures to mitigate, reduce or control the risks and hazards that have been identified
- Monitoring plan
- Review plan.

Contractor shall ensure that a copy of the risk assessment is available on site for inspection by an inspector or employee of the principle contractor.

- **Typically, the following identified risks could endanger the work done by the *Contractor*. The *Contractor* should identify mitigating actions for these risks, as well as identify any additional risks and submit at tender stage:**

Table 1: Risks

Typical Risk	Yes/No
Live underground cables	Yes
Work in live chambers/restricted areas	Yes
Live overhead conductors/crossings	Yes
Close proximity work to live equipment	Yes
Work in elevated positions/on ladders/from crane buckets	Yes
Operating of cranes/vehicle mounted	Yes
Static electricity/induction , step potential etc.	Yes
Work with chainsaws/mechanical cutters	Yes
Materials handling/ heavy equipment handling	Yes
Conductor stringing and tensioning	Yes
Vehicle risks	Yes
Work in open trenches/excavations	Yes
Biological/Health risks (camps)	Yes
Weather related risks (UV, heat, cold)	Yes
Environmental risks	Yes
Ergonomic risks (body position, fatigue)	Yes
Work on/dismantling of rusted & rotten poles and structures	Yes
Fire risks	Yes
Public safety risks	Yes

3.4. EMPLOYEES COMPETENCE

Prior to work the contractor shall provide the Engineer with the relevant training certificates (in-house and external) to ensure that all employees are competent to conduct the scope of work.

This training may include but is not limited to the following

- First aiders
- Induction
- Fire fighters
- Installation electricians (Proof of COC competence)
- Health and Safety representative

3.4.1 NUMBER OF HEALTH AND SAFETY PRACTITIONERS

When on site for more than two weeks the following shall apply:

- one trained Health and Safety Representative for every 10 employees or part thereof;

- one Health and Safety Officer for every 50 persons on site or part thereof. Part time Health and Safety Officers shall be allowed based on the risk profile and the type of work to be done – this shall be negotiated;

- one first aider trained to Level 2 per team of workers. The size of the team of workers shall be determined by the risk exposure and the nature of the work.

3.4.2 COMPETENCY REQUIREMENTS OF KEY PERSONNEL

- Curriculum Vitae, training certificates and proof of experience of key Health and Safety Personnel shall be submitted with the Health and Safety Plan.

- Health and Safety Competency assessments may be conducted by The Employer on Health and Safety practitioners before site establishment.

- The training requirements of key health and safety personnel shall include, but will not be limited to, the following:

3.4.3 CONSTRUCTION MANAGER (C.R 8.1 APPOINTEE)

a) Three years applicable experience in construction management
b) Risk Assessment training
c) Incident investigation and root cause analysis
d) Occupational Health and Safety Act orientation course
e) Training in the Construction Regulations

3.4.4 HEALTH AND SAFETY OFFICER (C.R 8.6 APPOINTEE)

a) Three years applicable experience in managing construction health and safety.
b) Health & Safety Risk Management
c) Risk Assessment training
d) Incident investigation and root cause analysis
e) OHS Act orientation course
f) Training in the Construction Regulations
g) Emergency Preparedness coordination training and experience

3.4.5 CONSTRUCTION SUPERVISOR (C.R 8.7 APPOINTEE)

a) Attended an accredited supervisors health and safety course
b) Risk Assessment training
c) Incident investigation training
d) Root cause analysis training
e) Introduction to the OHS Act

3.4.6 HEALTH AND SAFETY REPRESENTATIVES

a) Accredited Health and Safety Representative Training
b) Hazard identification and Risk assessment
c) General health and safety training

3.5. EQUIPMENT

Control of equipment:

All equipment shall be strictly controlled throughout the project if any equipment is lost or stolen it shall be reported immediately to the site supervisor

Checklists:

All equipment and facilities that will be used on site by the contractor shall be listed on a register. Inspections shall be conducted at least once a month as a minimum requirement.

3.6. SAFETY AND HEALTH COMMUNICATION

All contractual safety and health communication shall be in writing between the contractor and the Engineer.

Safety and Health meetings will be held on a monthly basis. It is compulsory for all contractors' safety representatives to attend these meetings.

Regular in-house safety communication must be conducted by means of:

- Daily Toolbox talks
- Meetings

3.7. PPE

Were required personnel protective equipment is compulsory, any employee that does not wear his / her PPE will be escorted from site and will not be allowed to enter the premises before a disciplinary hearing has been conducted. A copy of this disciplinary hearing and sanctions must be forwarded to the Engineer for information / comments.

3.8. WEATHER CONDITIONS

During any adverse change in weather conditions such as heavy rain, hail storms, thunderstorms and strong winds work may be stopped by the site supervisor. He shall inform all employees of the eminent dangers.

Once the weather changes back to normal, a risk assessment must be conducted before any work may commence again.

3.9. NOTICE BOARDS AND SIGNAGE

Each contractor shall display the necessary notices and signs.

The following information needs to be clearly displayed:

- No unauthorized persons
- No access
- Emergency contact details

3.10. SITE SAFETY AND HEALTH AUDITS

The appointed safety manager of the Engineer will conduct monthly site audits to ascertain that the safety and health file complies with legislation and safety specifications. Any deviations found are required to be rectified within 2 days after discovery.

The contractor must forward the corrective actions to the Engineer for approval or comments.

It remains the right of the Engineer to stop any contractor work when any safety transgressions occur or the safety and health file does not comply with the OHS Act 85 of 1993 – Construction Regulation requirements.

Should a contractor's work be stopped or delayed due to the non- conformance, costs incurred will be for the contractor's account.

Records of these audits shall be forwarded to the contractor and shall be filed on site in the contractor's safety file for reference purposes.

3.11. SECURITY CLEARANCE

It is the contractor's responsibility to ensure that their employees are subjected to security clearance before they are allowed to enter the premises to work.

3.12. TASK OBSERVATIONS

The contractor's site supervisor shall conduct regular task observations on employees.

It is compulsory that task job observations are conducted on a regular basis on employees during all stages of a project.

3.13. DISABLING INJURY FREQUENCY RATE (DIFR'S)

The Contractor shall ensure that injury and incident records versus man hours are filed in the safety file and submitted to the Engineer monthly on a specified date. These include all near hits, first aid, medical treatment and disabling lost time cases.

All documents shall be made available on site for inspection by the Department of Labour Inspectors as well as client as required by the Occupational Health and Safety Act, 85 of 1993.

3.14. ACCIDENT AND INCIDENT REPORTING AND INVESTIGATION

Should an accident investigation be required the contractor shall appoint a competent person in writing to conduct the said investigation.

The contractor shall ensure that the results of all investigations are communicated to the employees by means of incident recall discussions at prescribed communication sessions and/or meetings.
The contractor shall ensure that the investigations are kept for record purposes in accordance with the prescribed requirements set out in the OHSA.

If an incident/accident does occur, the contractor shall notify the Engineer within 24-hours of the occurrence.

The Engineer reserves the right to participate in all investigations into accidents or incidents.

3.15. TRANSPORTATION

Safe vehicular transport shall be provided by the contractor for his personnel working on the project to the workplace. This shall include adequate seating, side restraints and covers.

Road safety principles shall be adhered to on and off site.

No employees shall be permitted to be transported at the back of a loaded open pick-up (bakkie).

3.16. CONSTRUCTION VEHICLES

No vehicle shall be allowed to enter the premises without the relevant roadworthy certificate

Service and maintenance of the vehicles shall be of a high standard at all times, no oil leaks, faulty exhausts or unsafe loads shall be allowed on site.

Pre-start up inspections on all motorized equipment shall be conducted on a daily basis via a checklist. Deviations found shall be rectified and recorded.

3.17. FIRE FIGHTING EQUIPMENT

The Contractor shall ensure that adequate fighting equipment is available on site complies with the following:

- Extinguishers shall be placed in positions to ensure fast and easy access is maintained at all times.
- Placement of all extinguishers shall be depicted with the required pictograms.
- Extinguishers shall be serviced once annually, and after discharge or visible signs of depressurizations.
- The contractor shall ensure all employees are adequately trained in the safe use of the extinguishers.
- The contractor shall ensure a person is appointed to inspect the extinguishers on a monthly basis and the results of which are to be entered into a register designed for that purpose

3.18. SCAFFOLDING / WORKING AT HEIGHTS / FALL PROTECTION

Work involving scaffolding and work at heights shall comply with the requirements set out in the Construction regulations 2003 pertaining to these activities with reference to the SABS 085 code of practice. Fall protection planning shall be done in conjunction with the risk assessment process.

All scaffolds shall be erected under the control of a person trained and appointed to conduct such scaffold erection.

3.19. LIFTING MACHINERY AND TACKLE

The contractor shall ensure that the use of Lifting Machinery and Tackle is done in accordance with the requirements of the Regulations, which include but is not limited to the following:

- Lifting machinery and tackle to be used on site shall be marked with the Maximum Mass Load (MML), which is the safe limit in which the equipment may be used.
- Inspections on Lifting Machines and Lifting Tackle shall be inspected once per month on the register provided and the findings recorded.
- Daily pre-start checks shall also be conducted on all Lifting Machinery and Tackle.
- Records shall be kept of all lifting machinery and tackle inspections and Load Tests.
- Load tests shall be conducted a minimum of once per annum, and a certificate of compliance shall be kept on record.
- A valid logbook shall be maintained for all lifting machinery, which will comply with a minimum six-monthly service and maintenance.
- Lifting machinery shall be operated under supervision at all times with a trained bank's man who shall inspect all tackle before each lift.
- All lifting equipment operators shall be trained once every two years and a copy of such training shall be attached to the appointment, which is to be made on site.
- The Operators shall be tested for medical fitness.

3.20. LADDERS AND LADDER WORK

The following requirements shall be complied with regarding Ladders and Ladder work:

- Ladders shall be clearly numbered, and inspected on the register provided.
- A competent person shall be identified and appointed as the ladder inspector.
- Wooden ladders shall be straight grained, unpainted to allow for proper inspection of the grain for cracking.
- Ladders shall be secured at the top and chocked at the base to prevent slipping.
- Where chocking of the base is not possible, then the user shall ensure that the ladder is held in position by another employee when ascending the ladder.
- Ladders shall be inspected a minimum once per month by the person appointed as the ladder inspector.
- Proper storage shall be provided for all ladders when not in use.

3.21. LIGHTING AND POWER (SITE CONTAINERS AND OFFICES)

The contractor shall ensure lighting circuits and power circuits are fitted with suitable earth leakage in accordance with the legislation, which will include the following activities:

- Earth leakage system will be tested monthly.
- Malfunctions shall be repaired immediately or replaced.
- Lighting shall be so positioned as not to interfere with construction activities.

3.22. VESSELS UNDER PRESSURE (VuP) OR GAS BOTTLES

The contractor shall ensure they comply at all times with the requirements of Vessels under Pressure Regulations, with specific reference to the following but not limited to:

- Ensuring all Equipment owned and hired-in Vessels under pressure, comply with the 36-month pressure vessel inspection, and a certificate of testing is available on site.
- Ensuring that all personnel who shall use this equipment are competent and trained.
- Ensuring the users of this equipment is issued with the required PPE.
- Gas bottles must be chained and standing in an upright position.

3.23. PORTABLE ELECTRICAL TOOLS / EXPLOSIVE POWER TOOLS

The contractor shall ensure the following procedure is adhered to regarding Portable Electrical Tools and Explosive Powered tools but not limited to:

- Minimum compliance with legislation.
- Only competent persons shall be permitted to conduct routine and monthly inspections on the equipment.
- Persons competent to inspect the equipment shall be appointed in writing.
- Persons who are trained to operate such equipment shall be appointed and shall be the only authorised person to operate the equipment.
- The Site supervisor shall ensure operation of the equipment is in accordance with the approved Risk Assessment and Safe Working Procedure set out.
- All users shall undergo regular awareness training to ensure compliance.

3.24. EXCAVATIONS

Excavation work exceeding the specified depth as stipulated in the OHSA regulations, shall comply with the following requirements:

- The excavations are inspected before the shift starts, after heavy rain (inclement weather) and after any major condition which may affect the excavations stability and the findings are to be recorded and kept;
- All excavations regardless of the depth shall be adequately barricaded to prevent persons falling into the excavation;
- The safe working procedure shall be communicated to all employees who may be effected by the work; and
- The safe working procedures shall be enforced and maintained by the appointed excavation supervisor at all times.
- For high-risk activities, all personnel working in the excavation shall be attached by means of a lifeline.
- Material excavated shall be removed from the point of excavation.
- Ensure stability of adjoining structures.

3.25. FACILITIES FOR SAFE KEEPING / EATING AREAS

The contractor shall ensure that adequate safe keeping and eating facilities are provided for the personnel on site.

Waste bins shall be strategically placed and cleared regularly.

3.26. FIRST AID BOX AND CONTENTS

All Contractors with more than 5 employees shall supply their own first aid box. Contractors with more than 10 employees shall have a trained, certified first aider on site at all times.

The First Aid attendant shall be trained in accordance with the requirements set out in the OHSA.

Proof of training attended (certificate) shall be attached to the written acceptance of appointment.

The contents of the first aid boxes must be monitored. Inspections must be recorded on the register to ascertain that the contents is valid and has not reached the expiry date.

3.27. SAFETY AND HEALTH NON-CONFORMANCES

Non-compliance with the safety specifications can result in work stoppage and possible expulsion from site until the problem has been remedied including costs.

4. ENVIRONMENTAL REQUIREMENTS - SYSTEMS

4.1. MATERIAL SAFETY DATA SHEETS (MSDS)

Any hazardous chemicals that are used on site shall have an updated 16 point material safety data sheet.

The contractor shall ensure that the required training and information regarding the use and storage of HCS is provided, and that the use and storage of HCS is carried out as prescribed by the HCS Regulations.

The first aider shall be made aware of the MSDS and how to treat HCS incidents appropriately.

4.2. MATERIAL SAFETY DATA SHEETS (MSDS)

The storage facility must comply but is not limited to the following:

- Adequate ventilation must be available
- Spill control
- Adequately identifiable

Weekly inspections need to be conducted to ensure that the facility complies with legislation.

4.3. MATERIAL SAFETY DATA SHEETS (MSDS)

The contractor shall clearly indicate his procedure for the removal of waste.

Removal of any hazardous waste shall be carried out as set out in the relevant legislation.

4.4. EMP

This is not an Environmental Management Plan – refer to separate documentation (Environmental Management Plan) for detail Environmental Requirements.

ANNEX. 2: EMPLOYER ENVIRONMENTAL MANAGEMENT PLAN

ecosphere
Environmental Management Services

LYON VENNOTE PARTNERS

Environmental Management Plan

Vaaldam Substation Upgrade

2021

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12 June 2017

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07 September 2020
08 March 2021

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Version 1	Original EMPr
Version 2 12 October 2018	Revised to reflect the generic Environmental Management Programme (EMPr) applicable to an application for overhead electricity transmission and distribution infrastructure.
Version 3 07 September 2020	Reviewed to ensure compliance with the latest standards and legislation.
Version 4 08 March 2021	Reviewed to ensure compliance with the latest standards and legislation.

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Abbreviations

ACM	Asbestos-Containing Materials
CA	Competent Authority
CE	Consulting Engineer(s)
CEO	Contractors Environmental Officer
DEO	Developer Environmental Officer
DPM	Developer Project Manager
DSS	Developer Site Supervisor
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
EAR	Environmental Assessment & Remediations
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
EO	Environmental Officer
ERAP	Emergency Response Action Plan
FPA	Fire Protection Agency
GNR	Government Notice Regulation
HCS	Hazardous Chemical Substance
I&AP	Interested & Affected Parties
MSDS	Material Safety Data Sheet
NEM: AQA	National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PM	Project Manager
SAHRA	South African Heritage Resource Agency

Definitions

Aspect	Element of an organisation's activities, products or services that can interact with the environment.
Clearing	The clearing and removal of vegetation, whether partially or in whole, including trees and shrubs, as specified.
Construction camp	The area designated for key construction infrastructure and services, including but not limited to offices, overnight vehicle parking areas, stores, the workshop, stockpile and lay down areas, hazardous storage areas (including fuels), the batching plant (if one is located at the construction camp), designated access routes, equipment cleaning areas and the placement of staff accommodation,

	cooking and ablution facilities, waste and wastewater management.
Construction Waste	Construction waste means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.
Contractor	The Contractor has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract, are in line with the Environmental Management Programme and that Method Statements are implemented as described.
Environment	Our surroundings, including living and non-living elements, e.g. land, soil, plants, animals, air, water and humans. The environment also refers to our social and economic surroundings, and our effect on our surroundings.
Environmental Impact	A change to the environment, whether negative of positive, resulting from an organisation's activities, products or services.
General Waste	General waste means waste, excluding hazardous waste, that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreational purposes.
Hazardous Substances	A substance governed by the Hazardous Substances Act. 1973 (Act No. 15 of 1973) as well as the Hazardous Chemical and Substances Regulations, 1995.
Hazardous Waste	Hazardous waste means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste have a detrimental impact on health and the environment.
Impact	A description of the potential effect or consequence of an aspect of the project on the environment or people surrounding the project area.
Method statement	A written submission by the Contractor to the Project Manager in response to this EMPr or a request by the Project Manager and ECO. The Method Statement must set out the equipment, materials, labour and method(s) the Contractor proposes using to carry out an activity identified by the Project Manager when requesting the Method Statement. This must be done in such detail that the Project Manager and ECO is able to assess whether the Contractor's proposal is in accordance with this specification and/or will produce results in accordance with this specification: The Method Statement shall cover applicable details with regard to: (i) Construction procedures; (ii) Plant, materials and equipment to be used; (iii) Transporting the equipment to and from site; (iv) How the plant/ material/ equipment will be moved while on site; (v) How and where the plant/ material/ equipment will be stored; (vi) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur; (vii) Timing and location of activities; (viii) Compliance / non-compliance; and (ix) Any other information deemed necessary by the Project Manager.
Mitigation	Measures or actions designed to avoid or reduce the negative impacts on the environment.
Slope	The inclination of a surface expressed as one unit of rise or fall for so many horizontal units.
Solid Waste	All solid waste, including construction debris, hazardous waste, excess

	cement/ concrete, wrapping materials, timber, cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).
Spoil	Excavated material which is unsuitable for use as material in the construction works or is material which is surplus to the requirements of the construction works.
Topsoil	A varying depth (up to 300 mm) of the soil profile irrespective of the fertility, appearance, structure, agricultural potential, fertility and composition of the soil.
Works	The works to be executed in terms of the Contract.

1. Introduction

1.1 Background

Ecosphere has compiled this EMPr for Consulting Engineers to manage the way their activities may impact the environment. They is committed towards environmental conscientiousness and this EMPr will also serve as a guideline to all subcontractors with regards to environmental management.

The National Environmental Management Act 107 of 1998 (NEMA) requires that an environmental management programme (EMPr) be submitted where an environmental impact assessment (EIA) has been identified as the environmental instrument to be utilised as the basis for a decision on an application for environmental authorisation (EA). The content of an EMPr must either contain the information set out in Appendix 4 of the EIA Regulations, 2014, or must be a generic EMPr relevant to an application as identified and gazetted by the Minister in a government notice. Once the Minister has identified, through a government notice that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including but not limited to the applicant and the competent authority (CA).

1.2 Purpose

This Environmental Management Programme is relevant to new electricity distribution or transmission projects as well as the expansion of overhead electricity transmission and distribution infrastructure, and all listed and specified activities necessary for the realisation of such infrastructure.

1.3 Objectives

The objective of this EMPr is to prescribe and pre-approve generally accepted impact management outcomes and actions which can commonly and repeatedly be used for the avoidance, management and mitigation of impacts and risks associated with the development or expansion for overhead electricity transmission and distribution infrastructure.

This EMP is compiled using the following principles to strive towards a more sustainable and effective development:

1. **Continuous improvement:** The EMP must be continually reviewed and improved upon to enhance the environmental management.

2. **Wide level of commitment:** For the EMP to be successful and effective, commitment from all management levels as well as the workforce are required.
3. **Responsive and flexible:** The EMP is a “living” document, which has to respond to problems and incidents during the project lifespan. Therefore, regular review and revision of the EMP is required.
4. **Integration across operations:** The integration of the different operations (safety, health and environmental departments) within the EMP should be done to ensure that the environmental management are seen as a single domain.
5. **Legislation:** It is important that management personnel be aware that certain activities during the construction phase will require further licensing or environmental approval. The ECO must therefore be consulted on a regular basis during this phase.

The objectives of an EMPr are to:

- Ensure compliance with regulatory authority stipulations and guidelines;
- Ensure compliance with relevant legislation;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels; and
- Identify measures that could optimize beneficial impacts.

The EMPr focuses on the following:

- Avoiding potential negative impacts;
- Mitigation of negative impacts to a minimal or insignificant level;
- Minimising the negative impacts on the environment; and
- Monitoring and management of the impacts on the environment as a result of the development.

1.4 Scope

The scope of this EMPr applies to the development or expansion of overhead electricity transmission and distribution infrastructure.

The EMP will address issues related to the following activities:

- The construction of overhead lines (11 -132kV);
- Underground cable works;
- Refurbishments of old substations;
- Construction and/or expansion of new substation;
- Electrical maintenance work;
- Building electrical installations;
- Industrial electrical installations;
- Electrical installations;
- Engineer Procure and Construction project.

Applicable Voltages (SANS 1019-2001):

- Low Voltage (Less than 1000V)
- Medium Voltage (2.2kV, 3.3kV, 6.6kV, 11kV; 22kV; 33kV)
- Sub-transmission (44kV; 66kV; 88kV; 132kV)

1.5. Project specific details

Metsimaholo Local Municipality would like to further their goal of Electrification Universal Access. Approximately 2600 dwellings in Refengkgotso need to be electrified in the municipality's area of supply. This will add approximately 5MVA of load to Vaaldam substation – which cannot be provided by the two existing 10MVA transformers. Therefore, the requirement is to install an additional 10MVA transformer at Vaaldam substation.

The proposal is to install a third 88/22kV 10MVA transformer bay and 2 x 22kV feeder bays at Vaaldam substation. The new 2 x 22kV feeder bays will be for the double-circuit, Chickadee feeder line to Themba Khubeka, which has already been constructed. The 22 kV overhead power lines are the asset of Metsimaholo Local Municipality and they are responsible for the maintenance of the lines.

The scope of work for the substation extension is:

- Extend the existing substation yard by extending the substation platform and constructing a new substation fence – the existing fence will be kept where possible or rerouted until construction is completed to ensure that the substation will be fenced off at all times.
- Construct an 88kV bus-section with two 132kV isolators to connect to the existing 88kV busbars.
- Install a complete 88/22kV transformer bay.
- Install a 22kV road crossing structure.
- Install a 22kV transformer breaker.
- Install a 22kV transformer/busbar isolator.
- Extend the existing double 22kV busbar -section.
- Install a 22kV isolator to interconnect to the existing 22kV busbars.
- Relocate existing 22kV VT.
- Install 22kV busbar VT's.
- Install 2 x 22kV feeder bays.
- Install a 22kV NEC/NER.
- Construct a fire barrier between the existing and new transformer.
- Connect the existing feeder lines to the feeder bays by constructing the closing spans.

2. Details of the Author

This report was compiled by:

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3. Applicable legislation

The following legislation was taken into consideration during the preparation of the EMP:

- Conservation of Agricultural Resources Act (Act No. 43 of 1983). Government Notice No. 2687. Government Gazette: Pretoria.
- Department of Environmental Affairs and Tourism (DEAT) (2004): Integrated Environmental Management Information Series. Department of Environmental Affairs and Tourism (DEAT): Pretoria.
- Environmental Impact Assessment Regulations (Government Notice No. R. 982 of 2014).
- List of Activities and Competent Authorities (Government Notice No. R. 983 of 2014).
- List of Activities and Competent Authorities (Government Notice No. R. 984 of 2014).
- National Environment Conservation Act (Act No. 73 of 1989). Government Gazette: Pretoria.
- National Environment Management: Waste Act (Act No. 59 of 2008). Government Notice No. 32000. Government Gazette: Pretoria.
- National Environmental Management Act (Act No. 107 of 1998). Government Notice No. 19519. Government Gazette: Pretoria.
- National Environmental Management Laws Act (Act No. 14 of 2013). Government Notice No. 36703. Government Gazette: Pretoria.
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Government Notice No. 26436. Government Gazette: Pretoria.
- National Environmental Management: Protected Areas Act (Act No. 57 of 2003). Government Notice No. 26025. Government Gazette: Pretoria.
- National Heritage Resources Act (Act No. 25 of 1999). Government Notice No. 19974. Government Gazette: Pretoria.
- National Water Act (Act No. 36 of 1998). Government Notice No. 19182. Government Gazette: Pretoria.
- Spatial Planning and Land Use Management Act (Act No. 16 of 2013). Government Notice No. 559 of 2013.
- The Constitution of the Republic of South Africa (Act No. 108 of 1996).

4. Roles and responsibilities

The effective implementation of this EMPr is dependent on established and clear roles, responsibilities and reporting lines within an institutional framework. The table below provides guidance to the various environmental roles and reporting lines.

Function	Role and Responsibilities
Developer's Project Manager (DPM)	The Project Developer is accountable for ensuring compliance with the EMPr and any conditions of approval from the competent authority (CA). An independent environmental control officer (ECO) must be contracted by the Project Developer to objectively monitor the implementation of the EMPr according to relevant environmental legislation, and the conditions of environmental authorization (EA). The Project Developer is further responsible for providing and giving mandate to enable the ECO to perform responsibilities, and he must

	ensure that the ECO is integrated as part of the project team while remaining independent. Responsibilities: – Be fully conversant with the conditions of the EA; – Ensure that all stipulations within the EMPr are communicated and adhered to by the Developer and its Contractor(s); – Monitor the implementation of the EMPr throughout the project by means of site inspections and meetings. Overall management of the project and EMPr implementation; and – Ensure that periodic environmental performance audits are undertaken on the project implementation.
Developer Site Supervisor (DSS)	The DSS reports directly to the DPM, oversees site works, liaises with the contractor(s) and the ECO. The DSS is responsible for the day to day implementation of the EMPr and for ensuring the compliance of all contractors with the conditions and requirements stipulated in the EMPr. Responsibilities: – Ensure that all contractors identify a contractor's Environmental Officer (CEO); – Must be fully conversant with the conditions of the EA. Oversees site works, liaison with Contractor, DPM and ECO; – Must ensure that all landowners have the relevant contact details of the site staff, ECO and CEO; – Will issue all non-compliances to contractors; and – Ratify the Monthly Environmental Report.
Environmental Control Officer (ECO) (In cases where EA was not required, the contractor should have a representative with environmental experience to fulfil these responcibilities)	The ECO should be employed by the developer for the duration of the project. The ECO should have appropriate training and experience in the implementation of environmental management specifications. The primary role of the ECO is to act as an independent quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts. In this respect, the ECO is to conduct periodic site inspections, attend regular site meeting s, pre-empt problems and suggest mitigation and be available to advice on incidental issues that arise. The ECO is also required to conduct compliance audits, verifying the monitoring reports submitted by the CEO. The ECO provides feedback to the DSS and Project Manager regarding all environmental matters. The Contractor, CEO and DEO are answerable to the Environmental Control Officer for non - compliance with the Performance Specifications as set out in the EA and EMPr. The ECO provides feedback to the DSS and Project Manager, who in turn reports back to the Implementing Agent and potential and Registered Interested & Affected Parties (RI&AP's), as required. Issues of non-compliance raised by the ECO must be taken up by the Project Manager, and resolved with the Contractor as per the conditions of his contract. Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e. those that are deemed to be a variation, not allowed for in the Performance Specification) must be endorsed by the Project Manager. The ECO must also, as specified by the EA, report to the relevant CA as and when required. Responsibilities: – Be aware of the findings and conclusions of all EA related to the development; – Be familiar with the recommendations and mitigation measures of this EMPr; – Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them;

	– Undertake regular and comprehensive site inspections/ audits of the construction site according to the generic EMPr and applicable licenses in order to monitor compliance as required; – Educate the construction team about the management measures contained in the EMPr and environ mental licenses; – Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective; – Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements; – In consultation with the Developer Site Supervisor order the removal of person(s) and/or equipment which are in contravention of the specifications of the EMPr and/or environmental licenses; – Liaison between the DPM, Contractors, authorities and other lead stakeholders on all environmental concerns; – Issuing of site instructions to the Contractor for corrective actions required; – Compile a regular environmental audit report highlighting any non-compliance issues as well as satisfactory or exceptional compliance with the EMPr; – Validating the regular site inspection reports, which are to be prepared by the Contractor Environmental Officer (CEO); – Checking the CEO's record of environmental incidents [spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; – Checking the CEO's public complaints register in which all complaints are recorded, as well as action taken; – Assisting in the resolution of conflicts; – Facilitate training for all personnel on the site - this may range from carrying out the training, to reviewing the training programmes of the Contractor and/or sub-contractors; – In case of non-compliances, the ECO must first communicate this to the Senior Site Supervisor, who has the power to ensure this matter is addressed. Should no action or insufficient action be taken, the ECO may report this matter to the authorities as non-compliance; – Maintenance, update and review of the EMPr; – Communication of all modifications to the EMPr to the relevant stakeholders.
Developer Environmental Officer (DEO)	The DEOs will report to the Project Manager and are responsible for implementation of the EMPr, environmental monitoring and reporting, providing environmental input to the Project Manager and Contractor's Manager, liaising with contractors and the landowners as well as a range of environmental coordination responsibilities. Responsibilities: – Be fully conversant with the EMPr ; – Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures; – Ensure that all stipulations within the EMPr are communicated and adhered to by the Employees, Contractor(s) and its sub-contractor(s); – Confine the development site to the demarcated area; – Conduct environmental internal audits with regards to EMPr and authorisation compliance (on CEO); – Assist the contractors in addressing environmental challenges on site; – Assist in incident management: – Reporting environmental incidents to developer and ensuring that corrective action is taken, and lessons learnt shared; – Assist the contractor in investigating environmental incidents and compile

	investigation reports; – Follow-up on pre-warnings, defects, non-conformance reports; – Measure and communicate environmental performance to the Contractor; – Conduct environmental awareness training on site together with ECO and CEO; – Ensure that the necessary legal permits and / or licenses ore in place and up to date; – Acting as Developer's Environmental Representative on site and work together with the ECO and contractor; – Audit carried out by an independent auditor/consultant.
Contractor	The Contractor appoints the CEO and has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract are in line with the EMPr and that Method Statements are implemented as described. External contractors must ensure compliance with this EMPr while performing the onsite activities as per their contract with the Project Developer. The contractors are required, where specified, to provide Method Statements setting out in detail how the management actions contained in the EMPr will be implemented during the development or expansion for overhead electricity transmission and distribution infrastructure activities. Responsibilities – Project delivery and quality control for the development services as per appointment; – Employ a suitably qualified person to monitor and report to the Project Developer's appointed person on the daily activities on-site during the construction period; – Ensure that safe, environmentally acceptable working methods and practices are implemented and that equipment is properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely; – Attend on site meeting(s) prior to the commencement of activities to confirm the procedure and designated activity zones; – Ensure that contractors' staff (or sub-contractors) repairs, at their own cost, any environmental damage as a result of a contravention of the specifications contained in EMPr, to the satisfaction of the ECO.
Contractor Environmental Officer (CEO)	Each Contractor affected by the EMPr should appoint a CEO, who is responsible for the on-site implementation of the EMPr (or relevant sections of the EMPr). The Contractor's representative can be the site agent; site engineer; a dedicated environmental officer; or an independent consultant. The Contractor must ensure that the Contractor's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the Environmental Control Officer and the public. As a minimum the CEO shall meet the following criteria: The CEO ensures that all Sub-contractors working under the Contractor abide by the requirements of the generic EMPr. The Contractor is answerable to the Project Manager for all environmental issues associated with the project. Responsibilities: – Be on site throughout the duration of the project and be dedicated to the project; – Ensure all their staff are aware of the environmental requirements, conditions and constraints with respect to all of their activities on site; – Implementing the environmental conditions, guidelines and requirements as stipulated within the EA, EMPr and Method Statements; – Attend the Environmental Site Meeting; – Undertaking corrective actions where non-compliances are registered within the

	stipulated timeframes; – Report back formally on the completion of corrective actions; Assist the ECO in maintaining all the site documentation; – Prepare the site inspection reports and corrective action reports for submission to the ECO; Assist the ECO with the preparing of the monthly report; and – Where more than one Contractor is undertaking work on site, each company appointed as a Contractor will appoint a CEO representing that company.

5. Impact Management outcomes and actions

5.1. Environmental Awareness Training

Impact management outcome: All onsite staff are aware and understands the individual responsibilities in terms of this EMPr.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All staff must receive environmental awareness training prior to commencement of the activities; – The Contractor must allow for sufficient sessions to train all personnel with no more than 20 personnel attending each course; – Refresher environmental awareness training is available as and when required; – All staff are aware of the conditions and controls linked to the EA and within the EMPr and made aware of their individual roles and responsibilities in achieving compliance with the EA and EMPr; – The Contractor must erect and maintain information posters at key locations on site; – Environmental awareness training should include as a minimum the following: a) Description of significant environmental impacts, actual or potential, related to their work activities; b) Mitigation measures to be implemented when carrying out specific activities; c) Emergency preparedness and response procedures; d) Emergency procedures; e) Procedures to be followed when working near or within sensitive areas; f) Wastewater management procedures; g) Water usage and conservation; h) Solid waste management procedures; i) Sanitation procedures; and j) Disease prevention. – A record of all environmental awareness training courses undertaken as part of the EMPr must be available; – Educate workers on the dangers of open and/or unattended fires; – A staff attendance register of all staff to have received environmental awareness training must be available.	Client	The training will be done through a qualified environmental person via a visual and audible presentation.	Prior to the commencement of the activity. On a monthly basis during construction.	Client	Monthly	Attendance registers and training records.

– Course material must be available and presented in appropriate languages.						

5.2. Site Establishment development

Impact management outcome: Impacts on the environment are minimized when developing new infrastructure and the development footprint are kept to demarcated development area.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– A method statement must be provided by the contractor prior to any onsite activity that includes the layout of the construction camp in the form of a plan showing the location of key infrastructure and services (where applicable), including but not limited to offices, overnight vehicle parking areas, stores, the workshop, stockpile and lay down areas, hazardous materials storage areas (including fuels), the batching plant (if one is located at the construction camp), designated access routes, equipment cleaning areas and the placement of staff accommodation, cooking and ablution facilities, waste and wastewater management; – Location of camps must be within approved area to ensure that the site does not impact on sensitive areas identified in the environmental assessment or site walk through; – Sites should be located where possible on previously disturbed areas; – The camp must be fenced in accordance with Section 5.5: – Fencing and gate installation; and – The use of existing accommodation for contractor staff, where possible, is encouraged.	Client	Approved method statements.	Prior to the commencement of construction and maintenance works.	Client	Prior to the commencement of the construction or maintenance works. As and when required.	Record keeping of signed method statements.

5.3. No-Go areas

Impact management outcome: Access to No go areas prevented.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Identification of No-Go areas is to be informed by the environmental assessment, site walk through and any additional areas identified during development; – Erect, demarcate and maintain a temporary fence around the perimeter of any No-Go area;	Contractor	Erecting fences and banners. The no-go areas will be included in the	Prior to the commencement of construction, during site preparation to prevent access.	Contractor	Weekly	Training records.

– Fencing of No-Go areas is to be undertaken in accordance with Section 5.5: Fencing and gate installation; and – Unauthorized access and development related activity inside No-Go areas is prohibited.		environmental awareness training.	Prior to the commencement of maintenance works.			

5.4. Access roads

Impact management outcome: Minimize impact to the environment through the planned and restricted movement of vehicles on site.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Access to the servitude and tower positions must be negotiated with the relevant landowner and must fall within the assessed and authorized area; – An access agreement must be formalized and signed by the DPM, Contractor and landowner before commencing with the activities; – The access roads to tower positions must be signposted after access has been negotiated and before the commencement of the activities; – Any access route deviation from that in the written agreement must be closed and re-vegetated immediately, at the contractor's expense; – Maximum use of both existing servitudes and existing roads must be made; – In circumstances where private roads must be used, the condition of the said roads must be recorded in accordance with section 6.9: photographic record; prior to use and the condition thereof agreed by the landowner, the DPM, and the contractor; – All private roads used for access to the servitude must be maintained and upon completion of the works, be left in at least the original condition. As far as possible, access roads must follow the contours in hilly areas, as opposed to winding down steep slopes; – Access is to be established by vehicles passing over the same track on natural ground, multiple tracks are not permitted. – Access roads must only be developed where necessary at watercourses, on steep slopes or where boulders prohibit vehicular traffic; and – Upon completion of development, only roads as indicated by the DPM must be closed.	Contractor	Determine prior to the commencement of construction the roads and servitudes to be used. Identify which roads or access will be used as the project proceeds to make arrangements.	Prior to the commencement of construction.	Contractor	Weekly	Photographic record prior to use.

5.5. Fencing and Gate installation

Impact management outcome: To minimize Impact to the environment and ensure safe and controlled access to the site through the erection of fencing and gates where required.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Use existing gates provided to gain access to all parts of the defined Working Area, where possible; – Existing and new gates to be recorded and documented in accordance with section 6.9: photographic record; – All gates must be fitted with locks and be kept locked at all times during the development phase, unless otherwise agreed with the landowner; – At points where the line crosses a fence in which there is no suitable gate within the extent of the line servitude, on the instruction of the DPM, a gate must be installed at the approval of the landowner; – Care must be taken that the gates must be so erected that there is a gap of no more than 100 mm between the bottom of the gate and the ground; – Where gates are installed in jackal proof fencing, a suitable reinforced concrete sill must be provided beneath the gate; – Original tension must be maintained in the fence wires; – All gates installed in electrified fencing must be re-electrified; – All demarcation fencing and barriers must be maintained in good working order for the duration of overhead transmission and distribution electricity infrastructure development activities; – Fencing must be erected around the camp, batching plants, hazardous storage areas, and all designated no-go areas, where applicable; – All fencing must be developed of high-quality material bearing the SABS mark; – The use of razor wire as fencing must be avoided; – Fenced areas with gate access must remain locked after hours, during weekends and on holidays if staff is away from site. – Site security will be required at all times; – On completion of the development phase all temporary fences are to be removed; – The contractor must ensure that all fence uprights are appropriately removed, ensuring that no uprights are cut at ground level but rather removed completely.	Contractor	The overall project areas and other areas requiring demarcation and fencing must be discussed prior to the commencement of construction.	Prior to the commencement of construction.	Contractor	Monthly As and when required.	Record keeping of the integrity of all fences and gates.

5.6. Water Supply Management

Impact management outcome: Undertake responsible water usage.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All abstraction points or bore holes must be registered with the DWS and suitable water meters installed to ensure that the abstracted volumes are measured on a daily basis; – Should water abstraction be required and the necessary authorisation from DWS and permission from the landowner has been received, the Contractor must ensure the following: a. The vehicle abstracting water from a river does not enter or cross it and does not operate from within the river; b. No damage occurs to the river bed or banks and that the abstraction of water does not entail stream diversion activities; and c. All reasonable measures to limit pollution or sedimentation of the downstream watercourse are implemented. – Ensure water conservation is being practiced by: a. Minimizing water use during cleaning of equipment; b. Undertaking regular audits of water systems; and c. Including a discussion on water usage and conservation during environmental awareness training.	Contractor	Prior to the commencement of construction determine the source of water supply. Ensure all licenses are in order for abstraction from water sources.	Prior to the commencement of construction.	Contractor	Daily	Record keeping of the amounts of water abstracted. Water abstraction log, if required.

5.7. Storm and waste water management

Impact management outcome: Impacts to the environment caused by storm water and wastewater discharges during construction are avoided.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Appropriate pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into watercourses or water bodies must be designed and implemented; – Run off from the cement/ concrete batching areas must be strictly controlled, and contaminated water must be collected, stored and either treated or disposed of off-site, at a location	Contractor	Stormwater Management Plan needs to be implemented. Spillage kits need to be readily available on site.	Prior to the commencement of construction.	Contractor	Weekly	Record keeping of any spills or pollution on site.

approved by the project manager; – All spillage of oil onto concrete surfaces must be controlled by the use of an approved absorbent material and the used absorbent material disposed of at an appropriate waste disposal facility; – Natural storm water runoff not contaminated during the development and clean water can be discharged directly to watercourses and water bodies subject to the Project Manager's approval and support by the ECO; – Water that has been contaminated with suspended solids, such as soils and silt, may be released into watercourses or water bodies only once all suspended solids have been removed from the water by settling out these solids in settlement ponds. The release of settled water back into the environment must be subject to the Project Manager's approval and support by the ECO.		All required licenses from DWS for the discharge into a watercourse or waterbody need to be in place.				

5.8. Solid waste management

Impact management outcome: Wastes are appropriately stored, handled and safely disposed of at a recognized waste facility.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All measures regarding waste management must be undertaken using an integrated waste management approach; – Sufficient, covered waste collection bins (scavenger and weatherproof) must be provided; – A suitably positioned and clearly demarcated waste collection site must be identified and provided; – The waste collection site must be maintained in a clean and orderly manner; – Waste must be segregated into separate bins and clearly marked for each waste type; – Staff must be trained in waste segregation; – Bins must be emptied regularly; – General waste produced onsite must be disposed of at recognized waste disposal sites/ recycling company; – Hazardous waste must be disposed of at a registered waste disposal site; – Certificates of safe disposal for general, hazardous and recycled waste must be maintained.	Contractor	Waste collection bins need to be strategically placed and readily available on site. Clearly marked bins must be placed to recycle the waste. Waste must be collected and removed from site on an, as and when required basis.	Prior to commencement of construction, the bins will need to be strategically placed.	Contractor	Weekly	Certificates of safe disposal. Record keeping of when waste is removed from site.

5.9. **Protection of watercourses**

Impact management outcome: Pollution and contamination of the watercourse environment and erosion are-prevented.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All watercourses must be protected from direct or indirect spills of pollutants such as solid waste, sewage, cement, oils, fuels, chemicals, aggregate tailings, wash and contaminated water or organic material resulting from the Contractor' s activities; – In the event of a spill prompt action must be taken to clear the polluted or affected areas; – Where possible, no development equipment must traverse any seasonal or permanent wetland; – Development of permanent watercourse crossing must only be undertaken where no alternative access to tower position is available; – When working in or near any watercourse or wetland, the following environmental controls and consideration must be taken: a) River levels during the period of construction; b) During the execution of the Works, appropriate measures to prevent pollution and contamination of the riverine environment must be implemented e.g. including ensuring that construction equipment is well maintained; c) Where earthwork is being undertaken in close proximity to any watercourse, slopes must be stabilized using suitable materials, i.e. sandbags or geotextile fabric, to prevent sand and rock from entering the channel; and d) Appropriate rehabilitation and re-vegetation measures for the river banks must be implemented timeously. In this regard, the banks should be appropriately and incrementally stabilized as soon as development allows.	Contractor	All required licenses from DWS for the development of water crossings need to be in place before development of such crossings. Demarcation of a buffer zone around all watercourses to prevent access, where possible.	Prior to the commencement of construction.	Contractor	Daily As and when required.	Record keeping of any spills or pollution into the watercourses.

5.10. **Vegetation clearing**

Impact management outcome: Vegetation clearing is restricted to the authorized development footprint of the proposed infrastructure.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
General: – Indigenous vegetation which does not interfere with the development must be left undisturbed; – Protected or endangered species may occur on or near the development site. Special care should be taken not to damage such species; – Search, rescue and replanting of all protected and endangered species likely to be damaged during project development must be identified by the relevant specialist and completed prior to any development or clearing; – Permits for removal must be obtained from the relevant CA prior to the cutting or clearing of the affected species, and they must be filed; – The Environmental Report must confirm that all identified species have been rescued and replanted; – Trees felled due to construction must be monitored and listed in the Audit Environmental Report; – Rivers and watercourses must be kept clear of felled trees, vegetation cuttings and debris; – Only a registered pest control operator may apply herbicides on a commercial basis and commercial application must be carried out under the supervision of a registered pest control operator, supervision of a registered pest control operator or is appropriately trained; – A daily register must be kept of all relevant details of herbicide usage; – All protected species and sensitive vegetation not removed must be clearly marked and such areas fenced off if required in accordance with No-Go procedure in Section 5.3: No-Go areas. When working in or near any watercourse or wetland, the following environmental controls and consideration shall be taken. **Servitude:** – Vegetation that does not grow high enough to cause interference with overhead transmission and distribution infrastructures, or cause a fire hazard to any plantation, should not be cut or trimmed unless it is growing in the road access	Contractor	All required permits must be obtained from the CA before clearing or cutting of vegetation. All sensitive vegetation needs to be marked and demarcated prior to construction. Maintenance Plan must be implemented.	Prior to the commencement of construction.	Contractor	Weekly As and when required.	Filing of permits from the CA. Report to indicate rescued and replanted species. Record keeping of when herbicide has been sprayed.

area, and then only at the discretion of the Project Manager; – Where clearing for access purposes is essential, the maximum width to be cleared within the servitude must be in accordance to the specifications. – Alien invasive vegetation should be removed according to a plan (in line with relevant municipal and provincial procedures, guidelines and recommendations) and disposed of at a recognized waste disposal facility; – Vegetation should be trimmed where it is likely to intrude on the minimum vegetation clearance distance (MVCD) or will intrude on this distance before the next scheduled clearance. MVCD is determined from SANS 10280; – Debris resulting from clearing and pruning must be disposed of at a recognized waste disposal facility, unless the landowners wish to retain the cut vegetation; – In the case of the development of new overhead transmission and distribution infrastructures, a one metre "trace-line" must be cut through the vegetation for stringing purposes only and no vehicle access must be cleared along the "trace-line". Alternative methods of stringing which limit impact to the environment must always be considered.						

5.11. **Protection of fauna**

Impact management outcome: minimize disturbance to fauna.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– No interference with livestock must occur without the landowner's written consent and with the landowner or a person representing the landowner being present; – The breeding sites of raptors and other wild bird species must be taken into consideration during the planning of the development programme; – Breeding sites must be kept intact and disturbance to breeding birds must be avoided. Special care must be taken where nestlings or fledglings are present; – Nesting sites on existing parallel lines must be documented; – Special recommendations of the avian specialist must be adhered to at all times to prevent unnecessary disturbance of birds; – Bird guards and diverters must be installed on the new line as per the recommendations of the specialist;	Contractor	During the design phase consideration must be given to the breeding sites. Livestock and other animals need to be observed during construction phase to not interfere with the animals. Minimize the fragmentation of habitat for flora, fauna and avifauna.	Prior to the commencement of construction	Contractor	Daily	Incident report must be kept.

– No poaching must be tolerated under any circumstances. All animal dens in close proximity to the works areas must be marked as No-Go areas.						

5.12. **Protection of heritage resources**

Impact management outcome: impact to heritage resources is minimised.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Identify, demarcate and prevent impact to all known sensitive heritage features on site in accordance with the No- Go procedure in Section 5.3: No-Go areas; – Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance; – All work must cease immediately, if any human remains and/or at her archaeological, paleontological and historical material are uncovered. Such material, if exposed, must be reported to the nearest museum, archaeologist/ paleontologist (or the South African Police Services), so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to remove/ collect such material before development recommences.	Contractor	Inspections during the excavations will provide evidence of heritage resources when encountered. All operations must cease if any material of heritage importance are uncovered.	During the construction phase.	Contractor	Daily	Record keeping of inspections done.

5.13. **Safety of the public**

Impact management outcome: all precautions are taken where possible to minimize the risk of injury, harm or complaints.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Identify fire hazards, demarcate and restrict public access to these areas as well as notify the local authority of any potential threats e.g. large brush stockpiles, fuels etc.; – All unattended open excavations must be adequately fenced or demarcated; – Adequate protective measures must be implemented to prevent unauthorized access to and climbing of partly constructed towers and protective scaffolding; – Ensure structures vulnerable to high winds are secured; – Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.	Contractor	Adequate demarcation of high risk areas need to be demarcated to prevent access.	Prior to the commencement of construction. During the construction phase, if the conditions on site change.	Contractor	Daily	Record keeping of any incidents.

5.14. **Sanitation**

Impact management outcome: clean and well maintained toilet facilities are available to all staff in an effort to minimize the risk of disease and impact to the environment.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Mobile chemical toilets are installed onsite if no other ablution facilities are available; – The use of ablution facilities and or mobile toilets must be used at all times and no indiscriminate use of the veld for the purposes of ablutions must be permitted under any circumstances; – Where mobile chemical toilets are required, the following must be ensured: a) Toilets are located no closer than 100 m to any watercourse or water body; b) Toilets are secured to the ground to prevent them from toppling due to wind or any other cause; c) No spillage occurs when the toilets are cleaned or emptied and the contents are managed In accordance with the EMPr; d) Toilets have an external closing mechanism and are closed and secured from the outside when not in use to prevent toilet paper from being blown out; e) Toilets are emptied before long weekends and workers holidays, and must be locked after working hours; f) Toilets are serviced regularly and the ECO must inspect toilets to ensure compliance to health standards; – A copy of the waste disposal certificates must be maintained.	Contractor	Ensure the adequate amount of ablution facilities is available for the workforce. Ensure the ablution facilities are within reasonable distance from the operations.	Prior to the commencement of construction or on the day the construction commences, the ablution facilities must be available.	Contractor	Daily	Record keeping of the servicing of the toilets.

5.15. **Prevention of disease**

Impact management outcome: All necessary precautions linked to the spread of disease are taken.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Undertake environmentally-friendly pest control in the camp area; – Ensure that the workforce is sensitized to the effects of sexually transmitted diseases, especially HIV AIDS; – The Contractor must ensure that information posters on AIDS are displayed in the Contractor Camp area;	Contractor	Informative brochures will be provided to all personnel. Informative posters	Prior to the commencement of construction, the posters will be erected inside the contractor camp.	Contractor	Monthly	Register will be kept and signed when brochure have been received.

– Information and education relating to sexually transmitted diseases to be made available to both construction workers and local community, where applicable; – Free condoms will be made available to all staff on site at central points; – Medical support must be made available; – Provide access to Voluntary HIV Testing and Counselling Services.		will be visual within the contractor camp.				

5.16. **Emergency procedures**

Impact management outcome: emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Compile an Emergency Response Action Plan (ERAP) prior to the commencement of the proposed project; – The Emergency Plan must deal with accidents, potential spillages and fires in line with relevant legislation; – All staff must be made aware of emergency procedures as part of environmental awareness training; – The relevant local authority must be made aware of a fire as – soon as it starts; – In the event of emergency necessary mitigation measures to contain the spill or leak must be implemented (see Hazardous Substances section 5.17).	Contractor	Emergency Response Action Plan need to be implemented. Emergency procedures need to be discussed in the awareness training.	Prior to the commencement of construction.	Contractor	Monthly	Record keeping of emergency incidents. Attendance registers from awareness training.

5.17. **Hazardous substances**

Impact management outcome: safe storage, handling, use and disposal of hazardous substances.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– The use and storage of hazardous substances to be minimized and non-hazardous and non-toxic alternatives substituted where possible; – All hazardous substances will be stored in suitable containers as defined in the Method Statement; – Containers will be clearly marked to indicate contents, quantities and safety requirements; – All storage areas will be bunded. The bunded area will be of	Contractor	The storage area for hazardous materials needs to be demarcated. All Material Safety Data Sheets (MSDS) need to be	Prior to the commencement of construction.	Contractor	Daily	Record keeping of any incidents.

sufficient capacity to contain a spill / leak from the stored containers; – An Alphabetical Hazardous Chemical Substance (HCS) control sheet will be drawn up and kept up to date on a continuous basis; – All hazardous chemicals that will be used on site will have Material Safety Data Sheets (MSDS); – All employees working with HCS will be trained in the safe use of the substance and according to the safety data sheet; – Employees handling hazardous substances/materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment must be made available; – The Contractor must ensure that diesel and other liquid fuel, oil and hydraulic fluid is stored in appropriate storage tanks or in bowsers; – The tanks/bowsers must be situated on a smooth impermeable surface (concrete) with a permanent bund. The impermeable lining must extend to the crest of the bund and the volume inside the bund must be 130% of the total capacity of all the storage tanks/ bowsers (110% statutory requirement plus an allowance for rainfall); – The floor of the bund must be sloped, draining to an oil separator; – Provision must be made for refueling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained; – All empty externally dirty drums must be stored on a drip tray or within a bunded area; – No unauthorized access into the hazardous substances storage areas shall be permitted; – No smoking must be allowed within the vicinity of the hazardous storage areas; – Adequate firefighting equipment must be made available at all hazardous storage areas; – Where refueling away from the dedicated refueling station is required, a mobile refueling unit must be used. Appropriate ground protection such as drip trays must be used; – An appropriately sized spill kit kept onsite relevant to the scale of the activity/s involving the use of hazardous substance must be available at all times; – The responsible operator must have the required training to make use of the spill kit in emergency situations; – In the event of a spill, contaminated soil must be collected in		in place for hazardous chemicals to be used on site. Firefighting equipment and emergency spills kits need to be readily available. All personnel working with HCS will require training in specific handling of such substances.				

containers and stored in a central location and disposed of according to the National Environmental Management: Waste Act 59 of 2008. Refer to Section 5.7 for procedures concerning waste water management and 5.8 for solid waste management.						

5.18. **Workshop, equipment maintenance and storage**

Impact management outcome: Soil, surface water and groundwater contamination is minimized.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Where possible and practical all maintenance of vehicles and equipment must take place in the workshop area; – During servicing of vehicles or equipment, especially where emergency repairs are effected outside the workshop area, a suitable drip tray must be used to prevent spills onto the soil. The relevant local authority must be made aware of a fire as soon as it starts; – Leaking equipment must be repaired immediately or be removed from site to facilitate repair; – Workshop areas must be monitored for oil and fuel spills; – Appropriately sized spill kit kept onsite relevant to the scale of the activity taking place must be available; – The workshop area must have a bunded concrete slab that is sloped to facilitate runoff into a collection sump or suitable oil/water separator where maintenance work on vehicles and equipment can be performed; – Water drainage from the workshop must be contained and managed in accordance Section 5.7: Waste water management.	Contractor	Maintenance of vehicles and equipment need to be scheduled on a routinely basis. Maintenance to take place in the workshop only, unless it is an emergency.	During the construction phase.	Contractor	Daily	Record keeping of all incidents and spills.

5.19. **Batching plants**

Impact management outcome: Minimize spillages and contamination of soil, surface water and groundwater.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Concrete mixing must be carried out on an impermeable surface (such as on boards and/or within a bunded area with an impermeable surface) or make a hard surface and remove	Contractor	Sites for batching plants need to be identified prior to the	Prior to commencement of construction.	Contractor	Daily	Record keeping of all incidents.

when done; – Concrete mixing areas must be fitted with a containment facility for the collection of cement laden water. This facility must be impervious to prevent soil and groundwater contamination; – Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains; – A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted; – Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licensed disposal facility; – Empty cement bags must be secured with adequate binding material if these will be temporarily stored on site; – Sand and aggregates containing cement must be kept damp to prevent the generation of dust (Refer to Section 5.20: Dust emissions) – Any excess sand, stone and cement must be removed or reused from site on completion of construction period and disposed at a registered disposal facility; – Temporary fencing must be erected around batching plants in accordance with Section 5.5: Fencing and gate installation.		commencement of construction and lined with impervious material. Batching plants need to be demarcated to prevent access from unauthorized personnel.				

5.20. **Dust Emissions**

Impact management outcome: dust prevention measures are applied to minimize the generation of dust.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Take all reasonable measures to minimize the generation of dust as a result of project development activities to the satisfaction of the ECO; – Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilized a s soon as ls practically possible; – Excavation, handling and transport of erodible materials must be avoided under high wind conditions or when a visible dust plume is present; – During high wind conditions, the ECO will evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level; – Where possible, soil stockpiles must be located in sheltered	Contractor	Adequate dust suppression measures need to be implemented during times of high dust pollution. Prior to the commencement of construction, high risk areas for dust pollution need to be identified and closely monitored.	During the construction phase, as and when required.	Contractor	Daily	Record keeping of when dust suppression measures have been implemented.

areas where they are not exposed to the erosive effects of the wind; – Where erosion of stockpiles becomes a problem, erosion control measures must be implemented at the discretion of the ECO; – Vehicle speeds must not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas; – Appropriate dust suppression measures must be used when dust generation is unavoidable e.g. Dampening with water; particularly during prolonged periods of dry weather in summer. Such measures must also include the use of temporary stabilizing measures (e.g. chemical soil binders, straw, brush packs, chipping); – Straw stabilization must be applied at a rate of one bale/ 10 m" and harrowed into the top 100 mm of top material, for all completed earthworks; – For significant areas of excavation or exposed ground, spray water or wet areas using trucks to minimize the spread of dust.						

5.21. **Blasting**

Impact management outcome: impact to the environment is minimized through a safe blasting practice.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Any blasting activity must be conducted by a suitably licensed blasting contractor; and – Notification of surrounding landowners, emergency services site personnel of blasting activity 24 hours prior to such activity taking place on Site.	Contractor	Determine and draft a blasting schedule. Notify the surrounding landowners, emergency services and relevant personnel prior to such activity taking place.	During the construction phase.	Contractor	After blasting took place.	Record keeping of blasting and cleaning fly rock from the surrounding areas such as roads, etc. outside the works areas.

5.22. **Noise**

Impact management outcome: To prevent unnecessary noise to the environment by ensuring that noise from development activity is mitigated.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Operating hours as determined by the environmental authorisation are adhered to during the development phase. Where not defined, development must be limited to daylight hours.	Contractor	Implement a working schedule to adhere to and be limited to normal work hours or daylight hours. .	During the construction phase.	Contractor	Daily	Record keeping of working hours.

5.23. **Fire prevention**

Impact management outcome: Prevention of uncontrollable fires.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Designate smoking areas where the fire hazard could be regarded as insignificant; – Firefighting equipment must be available on all vehicles located on site; – The local Fire Protection Agency (FPA) must be informed of construction activities; – Contact numbers for the FPA and emergency services must be communicated in environmental awareness training and displayed at a central location on site; – Two way swap of contact details between ECO and FPA.	Contractor	Fire prevention training during the awareness training. Firefighting equipment need to be readily available.	During the construction phase.	Contractor	Daily	Record keeping of all incidents.

5.24. **Stockpiling and stockpile areas**

Impact management outcome: To reduce erosion and sedimentation as a result of stockpiling						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All material that is excavated during the project development phase (either during piling (if required) or earthworks) must be stored appropriately on site in order to minimize impacts to watercourses, wetlands and water bodies;	Contractor	Demarcate the stockpile areas to prevent unnecessary access.	During the construction phase.	Contractor	Daily	Record keeping of disturbance to the stockpiles or incorrect stockpiling.

– All stockpiled material must be maintained and kept clear of weeds and alien vegetation growth by undertaking regular weeding and control methods; – Stockpiles must not exceed 2 m in height; – During periods of strong winds and heavy rain, the stockpiles should be covered with appropriate material (e.g. cloth, tarpaulin etc.); – Where possible, sandbags (or similar) should be placed at the bases of the stockpiled material in order to prevent erosion of the material.		Stockpiling must take place in such a manner to prevent erosion.				

5.25. **Finalizing tower positions**

Impact management outcome: No environmental degradation occurs as a result of the survey and pegging operations.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– No vegetation clearing must occur during survey and pegging operations; – No new access roads must be developed to facilitate access for survey and pegging purposes; – Project manager, botanical specialist and contractor to agree on final tower positions based on survey within assessed and approved areas; – The surveyor is to demarcate (peg) access roads/tracks in consultation with ECO. No deviations will be allowed without the prior written consent from the ECO.	Contractor	No impacts on the environment are allowed during the finalizing of tower positions. Botanical specialist need to be consulted.	Prior to the commencement of construction.	Contractor	None.	None.

5.26. **Installation of foundations**

Impact management outcome: No environmental degradation occurs a s a result of the survey and pegging operations.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Batching of cement to be undertaken in accordance with Section 5.19: Batching; – Residual cement must be disposed of in accordance with Section 5.8: Solid Waste Management.	Contractor	Implementation methods are as per Section 5.8: Solid Waste Management and Section 5.19: Batching.	As per Section 5.8: Solid Waste Management and Section 5.19: Batching.	Contractor	As per Section 5.8: Solid Waste Management and Section 5.19: Batching.	As per Section 5.8: Solid Waste Management and Section 5.19: Batching.

5.27. **Assembly and erecting towers**

Impact management outcome: No environmental degradation occurs as a result of assembly and erecting of towers.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Prior to erection, assembled towers and tower sections must be stored on elevated surface (suggest wooden blocks) to minimize damage to the underlying vegetation; – In sensitive areas, tower assembly must take place off-site or away from sensitive positions; – The crane used for tower assembly must be operated in a manner which minimizes impact to the environment; – The number of crane trips to each site must be minimized; – Wheeled cranes must be utilized in preference to tracked cranes; – Consideration must be given to erecting towers by helicopter or by hand where it is warranted to limit the extent of environmental impact; – Access to tower positions to be undertaken in accordance with access requirements specified in Section 8.4: Access Roads; – Vegetation clearance to be undertaken in accordance with general vegetation clearance requirements specified in Section 8.10: Vegetation clearing; – No levelling at tower sites must be permitted unless approved by the Development Project Manager or Developer Site Supervisor; – Topsoil must be removed separately and stored for later use during rehabilitation of such tower sites; – Topsoil must be stored in heaps not higher than 2m to prevent destruction of the seed bank within the top soil; – Excavated slopes must be no greater that 1:3, but where this is unavoidable, appropriate measures must be undertaken to stabilize the slopes; – Fly rock from blasting activity must be minimized and any pieces greater than 150 mm falling beyond the Working Area, must be collected and removed; – Only existing disturbed areas are utilized as spoil areas; – Drainage is provided to control groundwater exit gradient with the spill areas such that migration of fines is kept to a minimum; – Surface water runoff is appropriately channeled through or around spoil areas; – During backfilling operations, care must be taken not to dump	Contractor	Identify access to tower positions with the least impact on the environment. Consider equipment which will have minimal impact on the environment. Topsoil to be stockpiled separately and backfilled at the top. Disturbed areas to be used, where possible, for stockpiling, spoil areas and storing of material. Stormwater management plan need to be implemented.	Prior to the assembly and erecting of each tower.	Contractor	Daily	Record keeping of vegetation cleared.

the topsoil at the bottom of the foundation and then put spoil on top of that; – The surface of the spoil is appropriately rehabilitated in – accordance with the requirements specified in Section 5.29: Landscaping and rehabilitation; – The retained topsoil must be spread evenly over areas to be rehabilitated and suitably compacted to effect re- vegetation of such areas to prevent erosion as soon as construction activities on the site is complete. Spreading of topsoil must not be undertaken at the beginning of the dry season.						

5.28. **Stringing**

Impact management outcome: No environmental degradation occurs as a result of stringing						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Where possible, previously disturbed areas must be used for the siting of winch and tensioner stations. In all other instances, the siting of the winch and tensioner must avoid No-Go areas and other sensitive areas; – The winch and tensioner station must be equipped with drip trays in order to contain any fuel , hydraulic fuel or oil spills and leaks; – Refueling of the winch and tensioner stations must be undertaken in accordance with Section 5.17: Hazardous substances; – In the case of the development of overhead transmission and distribution infrastructure, a one metre "trace-line" may be cut through the vegetation for stringing purposes only and no vehicle access must be cleared along "trace-lines". Vegetation clearing must be undertaken by hand, using chainsaws and hand held implements, with vegetation being cut off at ground level. No tracked or wheeled mechanized equipment must be used; – Alternative methods of stringing which limit impact to the environment must always be considered e.g. by hand or by using a helicopter; – Where the stringing operation crosses a public or private road or railway line, the necessary scaffolding/protection measures must be installed to facilitate access. If, for any reason, such access has to be closed for any period's) during development, the persons affected must be given reasonable notice, in	Contractor	Notice to landowners must be provided a minimum of 10 days prior to stringing commences. Drip trays are required for the equipment used. Consider alternative stringing methods which will have minimal impact on the environment.	During the construction phase.	Contractor	During the planning phase for stringing.	Record keeping of vegetation cleared, when and where.

writing; – No services (electrical distribution lines, telephone lines, roads, railways, lines, pipelines, fences, etc.) must be damaged because of stringing operations. Where disruption to services is unavoidable, persons affected must be given reasonable notice, in writing; – Where stringing operations cross cultivated land, damage to crops is restricted to the minimum required to conduct stringing operations, and reasonable notice (10 work days minimum), in writing, must be provided to the landowner; – Necessary scaffolding protection measures must be installed to prevent damage to the structures supporting certain high value agricultural areas such as Vineyards, orchards, nurseries.						

5.29. **Temporary closure of site**

Impact management outcome: Minimize the risk of environmental impact during periods of site closure greater than five days.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– Bunds must be emptied (where applicable); – Hazardous storage areas must be well ventilated; – Fire extinguishers must be serviced and accessible. Service records to be filed and audited at last service; – Emergency and contact details displayed must be displayed; – Security personnel must be briefed and have the facilities to contact or be contacted by relevant management and emergency personnel; – Night hazards such as reflectors, lighting, traffic signage etc. must have been checked; – Fire hazards identified and the local authority must have been notified of any potential threats e.g. large brush stockpiles, fuels etc.; – Structures vulnerable to high winds must be secured; – Wind and dust mitigation must be implemented; – Cement and materials stores must have been secured; – Toilets must have been emptied and secured; – Refuse bins must have been emptied and secured; – Drip trays must have been emptied and secured.	Contractor	Implement a temporary closure plan to ensure all aspects be addressed and accounted for.	Prior to the temporary closure.	Contractor	During closures.	Record keeping of all maintenance and services.

5.30. **Landscaping and rehabilitation**

Impact management outcome: No environmental degradation occurs as a result of the survey and pegging operations.						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for Implementation	Responsible person	Frequency	Evidence of compliance
– All areas disturbed by construction activities must be subject to landscaping and rehabilitation; – All spoil and waste will be disposed to a registered waste site and certificates of disposal provided; – All slopes in excess of 2% (1:50) must be contoured in accordance with the Conservation of Agricultural Resources Act, No 43 of 1983; – All slopes in excess of 12% (1:8.3) must be terraced in accordance with the Conservation of Agricultural Resources Act, No 43 of 1983; – Berms that have been created should have a slope of 1:4 and be replanted with indigenous species and grasses; – Where new access roads have crossed cultivated farmlands, that lands must be rehabilitated by ripping to a minimum depth of 600 mm; – Rehabilitation of tower sites and access roads outside of farmland; – Indigenous species will be used for replanting; – Stockpiled topsoil must be used for rehabilitation (refer to Section 5.23: Stockpiling and stockpiled areas); – Stockpiled topsoil will be evenly spread so as to facilitate seeding and minimize loss of soil due to erosion; – Before placing topsoil, all visible weeds from the placement area and from the topsoil must be removed; – Subsoil must be ripped before topsoil is placed; – The project must be timed so that rehabilitation can take place at the optimal time for vegetation establishment; – Where impacted through construction related activity, all sloped areas must be stabilized to ensure proper rehabilitation is effected and erosion is controlled as per the instruction from the ECO; – Sloped areas stabilized using design structures or vegetation as specified in the design to prevent erosion of embankments. The contract design specifications must be adhered to and implemented strictly; – Where required, re-vegetation can be enhanced using a vegetation seed mixture as described below. A mixture of seed can be used provided the mixture is carefully selected to	Contractor	Rehabilitation plan need to be implemented to ensure the exposed areas due to construction activities are rehabilitated and returned to previous state or better.	After construction has taken place and materials and equipment have been moved. As and when required.	Contractor	Weekly	Photographic evidence of the rehabilitation. Record keeping of when rehabilitation has taken place.

ensure the following: a) Annual mid perennial plants are chosen; b) Pioneer species are included; c) Species chosen must grow in the area feasible to grow; d) Root systems must have a binding effect on the soil; e) The final product should not cause an ecological imbalance in the area.						

6. ENVIRONMENTAL DOCUMENTATION REPORTING AND COMPLIANCE

To ensure accountable and demonstrated implementation of the EMPr, a number of reporting systems, documentation controls and compliance mechanisms must be in place for all overhead electricity transmission and distribution infrastructure projects as a minimum requirement.

6.1. Document control/ Filing system

The holder of the EA/client is solely responsible for the upkeep and management of the EMPr file. At a minimum, all documentation detailed below will be stored in the EMPr file. A hard copy of all documentation shall be tiled, while an electronic copy may be kept where relevant. A duplicate file will be maintained in the office of the DSS (where applicable). This duplicate file will be the responsibility of the ECO's and must remain current and up-to-date. The filing system must be updated and relevant documents added as required. The EMPr file must be made available at all times on request by the CA on terms of NEMA EIA regulation, or other relevant authorities. The EMPr file will form part of any environmental audits undertaken as prescribed in the EIA Regulations.

6.2. Documentation to be available

At the outset of the project the following documents shall be placed in the filing system and be accessible at all times:

- Full copy of the signed EA from the CA in terms of NEMA, granting approval for the development or expansion;
- Copy of the generic and site specific EMPr as well as any amendments thereof;
- Copy of declaration of implementing generic EMPr and subsequent approval of site specific EMPr and amendments thereof;
- All method statements;
- Completed environmental checklists;
- Minutes and attendance register of environmental site meetings;
- An up-to-date environmental incident log;
- A copy of all instructions or directives issued;
- A copy of all corrective actions signed off. The corrective actions must be filed in such a way that a clear reference is made to the non-compliance record;
- Complaints register.

6.3. Weekly Environmental Checklist

The ECO's are required to complete a Weekly Environmental Checklist, the format of which is to be agreed prior to commencement of the activity. The ECOs are required to sign and date the checklist, retain a copy in the EMPr file and submit a copy of the completed checklist to the DSS on a weekly basis.

The checklists will form the basis for the Monthly Environmental Reports. Copies of all completed checklists will be attached as Annexures to the Environmental Audit Report as required in terms of the EIA regulations, 2014.

6.4. Environmental site meetings

Minutes of the environmental site meetings shall be kept. The minutes must include an attendance register and will be attached to the Monthly Report that is distributed to attendees. Each set of minutes must clearly record "Matters for Attention" that will be reviewed at the next meeting.

6.5. Required Method Statements

The method statement will be done in such detail that the ECO's are enabled to assess, whether the contractor's proposal is in accordance with the EMPr.

The method statement shall cover applicable details with regard to:

- Development procedures;
- Materials and equipment to be used;
- Getting the equipment to and from site;
- How the equipment/ material will be moved while on site;
- How and where material will be stored;
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
- Timing and location of activities;
- Compliance / non-compliance with the EMPr; and
- Any other information deemed necessary by the ECOs.

Unless indicated otherwise by the Project Manager, the Contractor shall provide the following method statements to the Project Manager no less than 14 days prior to the commencement date of the activity:

- Site establishment - Camps, Lay-down or storage areas, satellite camps, infrastructure;
- Batch plants;
- Workshop or plant servicing;
- Handling, transport and Storage of Hazardous Chemical Substances;
- Vegetation management - Protected, clearing, aliens, felling;
- Access management - ·Roads, gates, crossings etc.;
- Fire plan;
- Waste management (all waste streams);
- Transport, storage, segregation, classification, disposal
- Social interaction complaints management, compensation claims, access to properties etc.;
- Water use (source, abstraction and disposal) , access and all related information, crossings and mitigation;
- Emergency preparedness - Spills, training, other environmental emergencies;

- Dust and noise management methodologies;
- Fauna interaction and risk management - only if the risk was identified - wildlife interaction especially on game farms; and
- Heritage and paleontology management.

The ECO shall ensure that the contractors perform in accordance with these method statements.

6.6. **Environmental Incident Log (Diary)**

The ECO is required to maintain an up-to-date and current Environmental Incident Log (environmental diary). The Environmental Incident Log is a means to record all environmental incidents and/or all non-compliance notice would not be issued. An environmental incident is defined as:

- Any deviation from the listed impact management actions (listed in this EMPr) that may be addressed immediately by the ECOs. (For example a contractor's staff member littering or a drip tray that has not been emptied);
- Any environmental impact resulting from an action or activity by a contractor in contravention of the environmental .stipulations and guidelines listed in the EMPr Which as a single event would have a minor impact but which if cumulative and continuous would have a significant effect (for example no toilet paper available in the ablutions for an afternoon); and
- General environmental information such as road kills or injured wildlife.

The ECO are to record all environmental incidents in the Environmental Incident Log. All incidents regardless of severity must be reported to the Developer. The Log is to be kept in the EMPr file and at a minimum the following will be recorded for each environmental incident:

- The date and time of the incident;
- Description of the incident;
- The name of the Contractor responsible;
- The incident must be listed as .significant or minor;
- If the incident is listed as significant, a non-compliance notice must be issued, and recorded in the log;
- Remedial or corrective action taken to mitigate the incident; and
- Record of repeat minor offences by the same contractor or staff member.

The Environmental Incident Log will be captured in the EAR.

6.7. **Non-compliance**

A non-compliance notice will be issued to the responsible contractor by the ECO’s via the DSS or Project Manager. The non-compliance notice will be issued in writing; a copy filed in the EMPr file and will at a minimum include the following:

- Time and date of the non-compliance;

- Name of the contractor responsible;
- Nature and description of the non-compliance;
- Recommended/ required corrective action; and
- Date by which the corrective action to be completed.
- The contractors shall act immediately when a notice of non-compliance is received and correct whatever is the cause for the issuing of the notice. Complaints received regarding activities on the development site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. The ECO should be made aware of any complaints. Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed. Failure to redress the cause shall be reported to the relevant CA for them to deal with the transgression, as it deems fit. The contractor is deemed not to have complied with the EMPr if, inter alia, There is a deviation from the environmental conditions, management outcomes and actions activities, as approved in generic and site specific EMPr as relevant as set out in the EMPr, which deviation has, or may cause, an environmental impact.

6.8. **Corrective action records**

For each non-compliance notice issued, a documented corrective action must be recorded. On receiving a non-compliance notice from the Developer's Site Supervisor, the contractor's CEO will ensure that the corrective actions required take place within the stipulated timeframe. On completion of the corrective action the CEO is to issue a Corrective Action Report in writing to the ECOs. If satisfied that the corrective action has been completed, the ECOs are to sign-off on the Corrective Action Report, and attach the report to the non-compliance notice in the EMPr file. A corrective action is considered complete once the report signed off by the ECOs.

6.9. **Photographic record**

A digital photographic record will be kept. The photographic record will be used to show before, during and post rehabilitation evidence of the project as well used in cases of damages claims if they arise. Each image must be dated and a brief description note attached.

The Contractor shall:

1. Allow the ECOs access to take photo graphs of all areas, activities and actions.

The ECO’s shall keep an electronic database of photographic records which will include:

1. Pictures of all areas designated as work areas, camp areas, development sites and storage areas taken before these areas are set up;
2. All bunding and fencing;
3. Road conditions and road verges;
4. Condition of all farm fences;
5. Topsoil storage areas;
6. All areas to be cordoned off during construction;
7. Waste management sites;
8. Ablution facilities (inside and out);
9. Any non-conformances deemed to be "significant";
10. All completed corrective actions for non-compliances;
11. All required signage;
12. All areas before, during and post rehabilitation; and
13. Include relevant photographs in the Final Environmental Audit Report.

6.10. **Complaints register**

The ECOs shall keep a current and up-to-date complaints register. The complaints register is to be a record of all complaints received from communities, stakeholders and individuals. The Complaints Record shall:

1. Record the name and contact details of the complainant;
2. Record the time and date of the complaint;
3. Contain a detailed description of the complaint;
4. Where relevant and appropriate, contain photographic evidence of the complaint or damage (ECOs to take relevant photographs); and
5. Contain a copy of the ECOs written response to each complaint received and keep a record of any further correspondence with the complainant. The ECO’s written response will include a description of any corrective action to be taken and must be signed by the Contract or, ECO and affected party. Where a damage claim is issued by the complainant, the ECOs shall respond as described in (Section 6.11) below.

6.11. **Claims for damages**

In the event that a Claim for Damages is submitted by a community, landowner or individual, the ECOs shall:

1. Record the full detail of the complaint as described in (section 4.10) above;
2. The ECOs will evaluate the claim and associated damage and submit the evaluation to the Senior Site Representative for approval;

3. Following consideration by the DPM, the claim is to be resolved and settled immediately, or the reason for not accepting the claim communicated in writing to the claimant. Should the claimant not accept this, the ECO shall, in writing report the incident to the Developer's negotiator and legal department; and
4. A formal record of the response by the ECOs to the claimant as well as the rectification of the method of making payments not amount will be recorded in the EMPr file.

6.12. Interactions with affected parties

Open, transparent and good relations with affected landowners, communities and regional staff are an essential aspect to the successful management and mitigation of environmental impacts.

The ECOs shall:

1. Ensure that all queries, complaints and claims are dealt within an agreed timeframe;
2. Ensure that any or all agreements are documented, signed by all parties and a record of the agreement kept in the EMPr file;
3. Ensure that a complaints telephone numbers are made available to all landowners and affected parties; and
4. Ensure that contact with affected parties is courteous at all times;

6.13. Environmental audits

Internal Environmental Audits of the activity and implementation of the EMPr will be undertaken by the ECO. The findings and outcomes of these audits will be recorded in the EMPr file. The environmental audits and associated reports must be conducted and submitted to the CA at intervals as indicated in the EA.
The ECOs must prepare a monthly EAR. The report will be tabled as the key point on the agenda of the Environmental Site Meeting. The Report is submitted for acceptance at the meeting and the final report will be circulated to the Project Manager and filed in the EMPr file. At a frequency determined by the Environmental Authorisation, the ECOs shall submit the monthly reports to the Competent Authority in terms of NEMA. At a minimum the Monthly report is to cover the following:

- Weekly Environmental Checklists;
- Deviations and non-compliances with the checklists;
- Non-compliances issued;
- Completed and reported corrective actions;
- Environmental Monitoring;
- General environmental findings and actions; and
- Minutes of the Bi-monthly Environmental Site Meetings.

6.14. **Final environmental audits**

On final completion of the entire activity, the ECOs are required to prepare a final EAR. The report is to be submitted to the CA for acceptance and approval. The environmental report must comply with Appendix 7 of the EIA Regulations, 2014.

- Details of the independent person who prepared the report;
- Details of the expertise of independent person that compiled the report;
- A declaration that the independent auditor is independent in a form as may be specified by the CA;
- An indication of the scope of, and the purpose for which, the environmental audit report was prepared;
- A description of the methodology adopted in preparing the environmental audit report;
- An indication of the ability of the EMPr, and where applicable, the closure plan to.

Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis;

Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and

Ensure compliance with the provisions of EA, EMPr and where applicable, the closure plan;

- A description of any assumptions made, and any uncertainties or gaps in knowledge;
- A description of any consultation process that was undertaken during the course of carrying out the EAR;
- A summary and copies of any comments that were received during any consultation process;
- Any other information requested by the CA.

Submission of the final EAR to the CA will indicate the end of the entire activity.

7. Appendix 1 – Handling of waste

	Waste Type	Disposal method
1.	Asbestos	The management, handling and disposal of asbestos and ACM must be done in accordance with the Asbestos regulation, 2001. (a) All asbestos waste needs to be placed in containers that will prevent the likelihood of exposure during handling. (b) All vehicles, re-usable containers or any other similar articles which have been in contact with asbestos waste are cleaned and decontaminated after use, in such a way that they do not cause a hazard inside or outside the workplace; (c) All asbestos waste which can cause exposure, is disposed of only on sites specifically designated for this and in such a manner that it does not cause a hazard inside or outside the site; (d) All persons involved in the collection, transport and disposal of asbestos waste, who may be exposed to that waste, are provided with personal protective equipment; and (e) Where the services of a contractor for the disposal of asbestos waste are used, a provision is incorporated into the contract stating that the contractor shall also comply with the provisions of the Asbestos Regulations.
2.	Neon lights	The following will be required for disposal of this material: • Neon light tubes need to be broken under controlled condition to render it physically safe and release or recover the mercury containing substances. • Storage of the neon lights in an appropriate container which would need to be removed if and when required. • The lights will need to be crushed and stored within a drum. If the drum reaches full capacity, the drum must be sealed and transported to a hazardous landfill site for safe disposal.
3.	Lead	The management, handling and disposal of lead must be done in accordance with the Lead regulation, 2001. *(a)* Recycle all lead waste, but not into non-lead production processes; *(b)* Ensure that all collected lead waste is placed into containers that will prevent the likelihood of exposure during handling; *(c)* Ensure that all vehicles, re-usable containers and covers which

		have been in contact with lead waste are cleaned and decontaminated after use, in such a way that such vehicles, containers or covers do not cause a hazard inside or outside the premises concerned; *(d)* Ensure that all lead waste that can cause exposure to lead, is disposed of only on sites specifically designated for this purpose in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989) and the National Environmental Management Act,1998 (Act No. 107 of 1998), and in such a manner that it does not cause a hazard inside or outside the site concerned; *(e)* Ensure that all persons involved in the collection, transport and disposal of lead waste and who may be exposed to that waste, are provided with suitable personal protective equipment; and *(f)* Ensure that, in cases where the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor too shall comply with the provisions of these Regulations.
4.	Oil	• Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations. • Collect and reclaim or dispose of material in sealed containers at licensed waste disposal site. • Dispose in accordance with all applicable regulations
5.	Ceramics	• If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations. • This product should be disposed of in suitable landfill sites in accordance with local governmental / municipal regulations.
6.	Steel	• Metal should first be reused or recycled before disposal to landfill is considered. • Waste must be disposed of in accordance with applicable regulations.
7.	Copper	• Metal should first be reused or recycled before disposal to landfill is considered. • If the material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.
8.	Rubber	• Dispose of waste and residues in accordance with applicable requirements.

		• No specific disposal method is required.
9.	Creosote	• Dispose in accordance with all applicable regulations. • Treated wood should not be burned in open fires or in stoves, fireplaces or residential boilers, because toxic chemicals may be produced as part of the smoke and ashes. • Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with regulations.
10.	PVC	• Disposal on registered landfill site in accordance to applicable regulations.

APPROVED BY	SIGNATURE	DATE
NAME: Christelle Greyling		12/10/2018
COMMENTS:		

ANNEX. 3: DRAWINGS

PROJECT : THEMBA KHUBEKA ELECTRIFICATION

CLIENT : METSIMAHOLO LOCAL MUNICIPALITY

PROJECT No : VE9335-7

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	As-Built						Engineer:	M LYON JNR Pr Eng	
	Construction						Design:	M VAN JAARSVELD (M.ENG)	
■	Tender	2021/08/02					Drawn:	M VAN JAARSVELD (M.ENG)	
	Approval						Approved:		
	Information						Date:	02 August 2021	
	Planning								
		Date	Date	REVISIONS	Drawn	Rev. No			

Metsimaholo Municipality

THEMBA KHUBEKA ELECTRIFICATION
COVER SHEET

LYON AND PARTNERS
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PO Box 3925 - VANDERBIJLPARK - 1900

SCALE: NTS (A3)

DRAWING NUMBER: SHEET 01 OF 02
VE9335-7 GNL

REV. NO: 0

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LYON VENNOTE PARTNERS	**Title: Drawing Register**	**Doc No:** QMS 8.3.5.2
	Issued: 3 August 2021	**Rev:** 1
Project Number:	**VE9335-7**	X Symbolises current revision
Project Name:	**THEMBA KHUBEKA ELECTRIFICATION**	- Symbolises previous revisions

Nr	Drawing Number	Description	Size	Latest Rev. Date:	Current Rev.	Information	Planning	Approval	Tender	Construction	As Built	Issued (Y/N)
	GENERAL INFORMATION											
1	VE9335-7-GNL SHEET 01	THEMBA KHUBEKA ELECTRIFICATION - COVER	A3	**2021-08-02**	0		-	-	X			N
2	VE9335-7-GNL SHEET 02	THEMBA KHUBKEA ELECTRIFICATION - INDEX	A3	**2021-08-02**	0		-	-	X			N
3	VE9335-7-LEGEND	THEMBA KHUBEKA ELECTRIFICATION - LEGEND	A3	**2021-08-02**	0		-	-	X			N
4	VE9335-7-ALL LAYOUT	THEMBA KHUBEKA ELECTRIFICATION - RETICULATION LAYOUT ALL	A0	**2021-08-02**	0		-	-	X			N
5	VE9335-7-FEEDER ZONES	THEMBA KHUBEKA ELECTRIFICATION - FEEDER ZONES	A0	**2021-08-02**	0		-	-	X			N
6	VE9335-7-MV LAYOUT	THEMBA KHUBEKA ELECTRIFICATION - MEDIUM VOLTAGE LAYOUT	A0	**2021-08-02**	0		-	-	X			N
7	VE9335-7-LV LAYOUT	THEMBA KHUBEKA ELECTRIFICATION - LOW VOLTAGE LAYOUT	A0	**2021-08-02**	0		-	-	X			N
8	VE9335-7-HSE LAYOUT	THEMBA KHUBEKA ELECTRIFICATION - HOUSE CONNECTION LAYOUT	A0	**2021-08-02**	0		-	-	X			N
9	VE9335-7-SS SITE	THEMBA KHUBEKA ELECTRIFICATION - SWITCHING STATION SITE	A3	**2021-08-02**	0		-	-	X			N
10	VE9335-7-SGR	THEMBA KHUBEKA ELECTRIFICATION - SWITCHGEAR ROOM	A3	**2021-08-02**	0		-	-	X			N
11	VE9335-7-SGS	THEMBA KHUBEKA ELECTRIFICATION - SWITCHGEAR SCHEDULE	A3	**2021-08-02**	0		-	-	X			N
12	VE9335-7-SLD	THEMBA KHUBEKA ELECTRIFICATION - SINGLE LINE DIAGRAM	A0	**2021-08-02**	0		-	-	X			N
13	VE9335-7-PTB	THEMBA KHUBEKA ELECTRIFICATION - POLE TOP BOX	A3	**2021-08-02**	0		-	-	X			N
14	VE9335-7-TRFR STRUC	THEMBA KHUBEKA ELECTRIFICATION - TRANSFORMER STRUCTURE	A3	**2021-08-02**	0		-	-	X			N
15	VE9335-7-LV ASSY	THEMBA KHUBEKA ELECTRIFICATION - LV ASSEMBLY	A3	**2021-08-02**	0		-	-	X			N
16	M.V.8603.1.G1.01	THEMBA KHUBEKA ELECTRIFICATION - ACTOM 22kV SWITCHBOARD	A3	**2021-01-06**	3		-	-	X			N
17	A3SY6154PM1ES002	THEMBA KHUBEKA ELECTRIFICATION - ACTOM RTU / GATEWAY PANEL	A3	**2021-04-06**	4		-	-	X			N

Sign:	
Name:	
Date:	

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Construction						
Tender	2021/08/02					
Approval						
Information						
Planning						
	Date	Date	REVISIONS	Drawn	Rev. No	

Engineer:	M LYON JNR Pr Eng
Design:	M VAN JAARSVELD (M.ENG)
Drawn:	M VAN JAARSVELD (M.ENG)
Approved:	
Date:	02 August 2021

Metsimaholo Municipality

THEMBA KHUBEKA ELECTRIFICATION
COVER SHEET

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SCALE: NTS (A3)

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LEGEND

CODE	DESCRIPTION
A####	POLE, WOOD; 7M LONG (120-139mm TOP)
D####	POLE, WOOD; 9M LONG (140-159mm TOP)
L####	POLE, WOOD; 11M LONG (180-199mm TOP)
#A###	MV-INT (0°)
#E###	MV-STR (0°)
#F###	MV-STR (1-60°)
#H###	MV-STR (60-90°)
#I###	MV-TERM
#J###	MV-T-OFF
##A##	LV-INT
##B##	LV-TERM
##C##	LV-STR
##D##	LV-STR
##F##	LV-T-OFF(INT)
##S##	LV-INT
###A#	1-2 WAY 50A FOR BARE NEUTRAL ABC
###B#	1-4 WAY 50A FOR BARE NEUTRAL ABC
###C#	5-8 WAY 50A FOR BARE NEUTRAL ABC
####I	100kVA 22kV/400V Star P 1861
####F	Section Link
####K	200kVA 22kV/400V Star P 1861
1861	H Pole (In-line) (Refer to drawing VE9335-7-TRFR STRUC)
1730	MV 3 Phase Delta (600mm Stud)
1733	MV 3 Phase Delta / 1.3m Steel x-arm 0° Strain
1734	MV 3 Phase Delta / 1,3m Steel x-arm 1-30 Strain
1735	MV 3 Phase Delta / 1,3m Steel x-arm 30-90 Strain
1736	MV 3 Phase Delta / 1,3m Steel x-arm Terminal
1803	MV 3 Phase Delta 1,3m x-arm T-Off
0384	LV Service Cable Structure
1100	LV ABC 3 Phase Susp 0-30
1120	LV ABC 3 Phase Term
1121	LV ABC 3 Phase Strn 0-60
1122	LV ABC 3 Phase Strn 60-90
1140	LV ABC 3 Phase T from Int
Ⓢ	SLACK SPAN
F	FOX ACSR
35	ABC 35mm
70	ABC 70mm
10	AIRDAC 10mm
→	LV STAY
⊣	LV STRUT
⇉	MV STAY
⊣⊣	MV STRUT

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	Construction						
	Tender	2021/08/02					
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	Information						
	Planning						
		Date	Date	REVISIONS	Drawn	Rev. No	

Engineer:	M LYON Pr Eng
Design:	M VAN JAARSVELD (M.ENG)
Drawn:	M VAN JAARSVELD (M.ENG)
Approved:	
Date:	02 August 2021

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THEMBA KHUBEKA
RETICULATION
LEGEND

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SCALE: NTS (A3)

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	As-Built	DATE:	
	Construction	DATE:	
■	Tender	DATE:	2021/08/02
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

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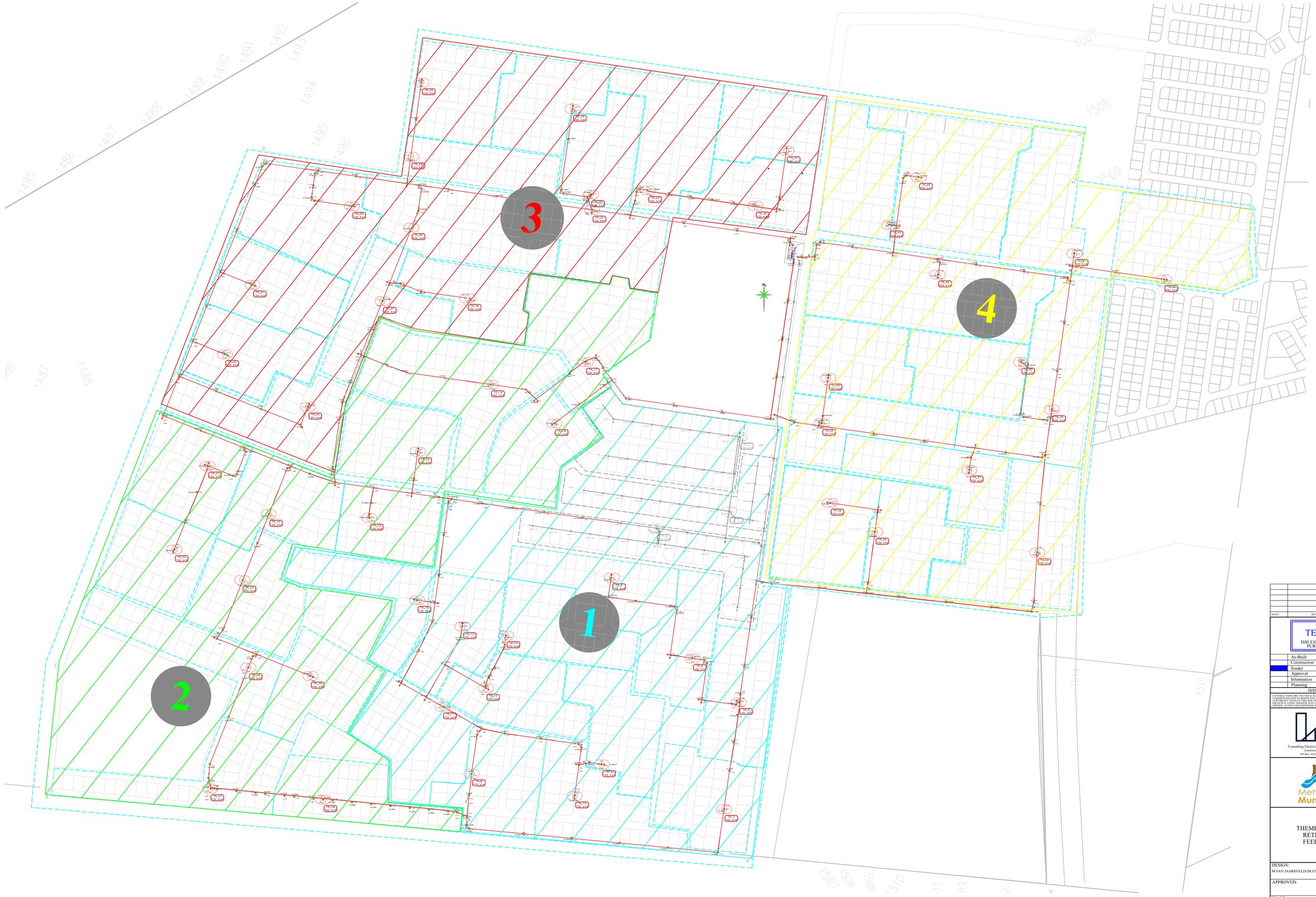
PO Box 3925 - VANDERBIJLPARK - 1900

Metsimaholo Municipality

THEMBA KHUBEKA
RETICULATION
ALL LAYOUT

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: 1 : 2000 (A0)	DATE: 2 AUGUST 2021
DRAWING NUMBER: VE9335-7 ALL — SHEET 01 OF 01	REVISION: 0



DATE:	REVISIONS	DRAWN	REVISION NO

TENDER

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	As-Built	DATE:
	Construction	DATE:
	Tender	DATE: 2021/08/02
	Approval	DATE:
	Information	DATE:
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THEMBA KHUBEKA
RETICULATION
FEEDER ZONES

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: 1 : 2000 (A0)	DATE: 2 AUGUST 2021
DRAWING NUMBER: SHEET 02 OF 04	REVISION:
VE9335-7-FEEDER ZONES	0

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TENDER

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	Tender	DATE:	2021/08/02
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

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Metsimaholo Municipality

THEMBA KHUBEKA RETICULATION MV LAYOUT

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: 1 : 2000 (A0)	DATE: 2 AUGUST 2021
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	REVISION: 0

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	Construction	DATE:	
	Tender	DATE:	2021/08/02
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THEMBA KHUBEKA RETICULATION LV LAYOUT

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: 1 : 2000 (A0)	DATE: 2 AUGUST 2021
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VE9335-7-LV LAYOUT	0

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THEMBA KHUBEKA RETICULATION HOUSE CONNECTIONS LAYOUT

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: 1 : 2000 (A0)	DATE: 2 AUGUST 2021
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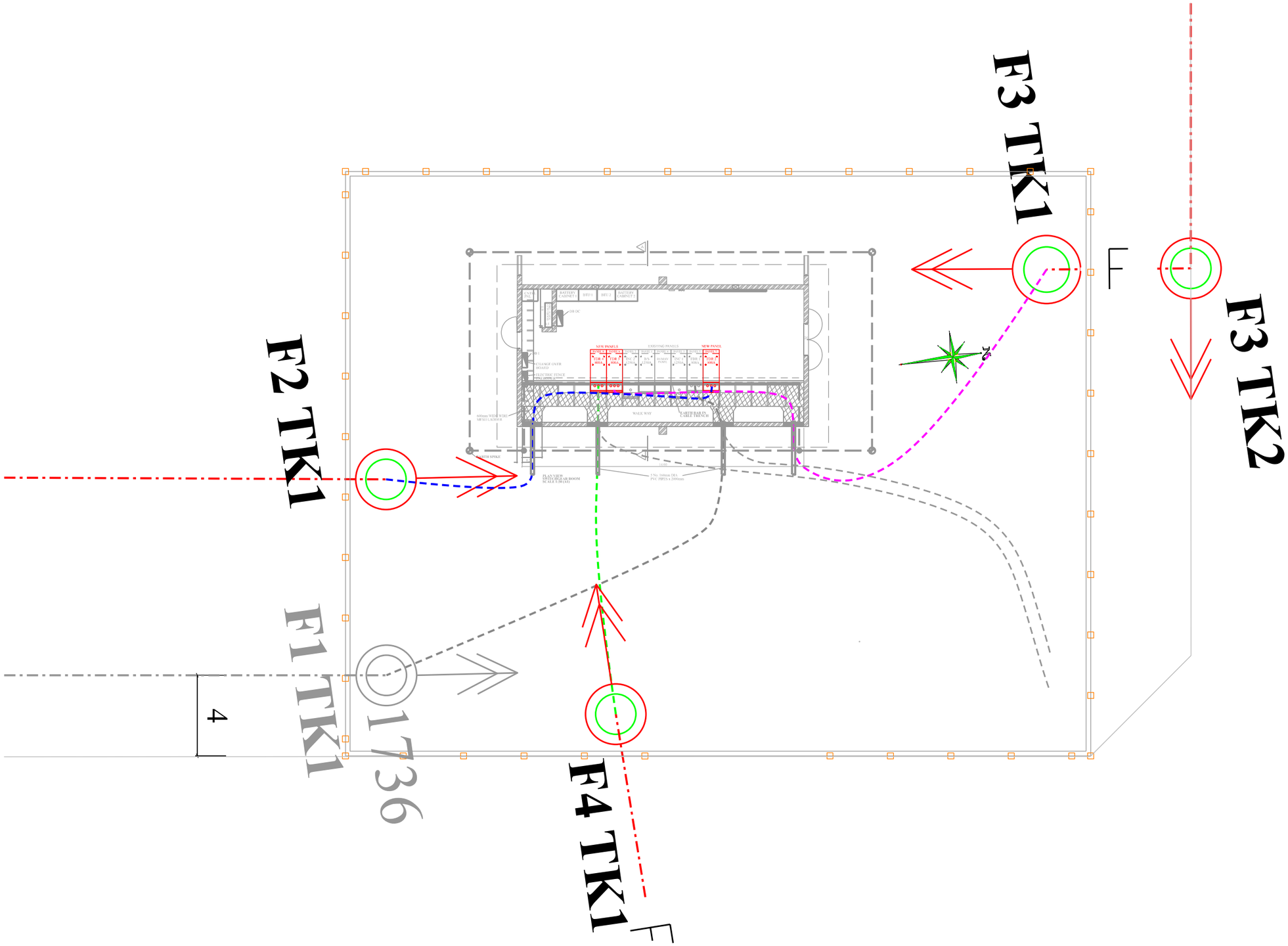

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	Construction				
	Tender	2021/08/02			
	Approval				
	Information				
	Planning				

Engineer:	M LYON Pr Eng
Design:	M VAN JAARSVELD (M.ENG)
Drawn:	M VAN JAARSVELD (M.ENG)
Approved:	
Date:	02 August 2021

Metsimaholo Municipality

THEMBA KHUBEKA
RETICULATION
SWITCHING STATION SITE

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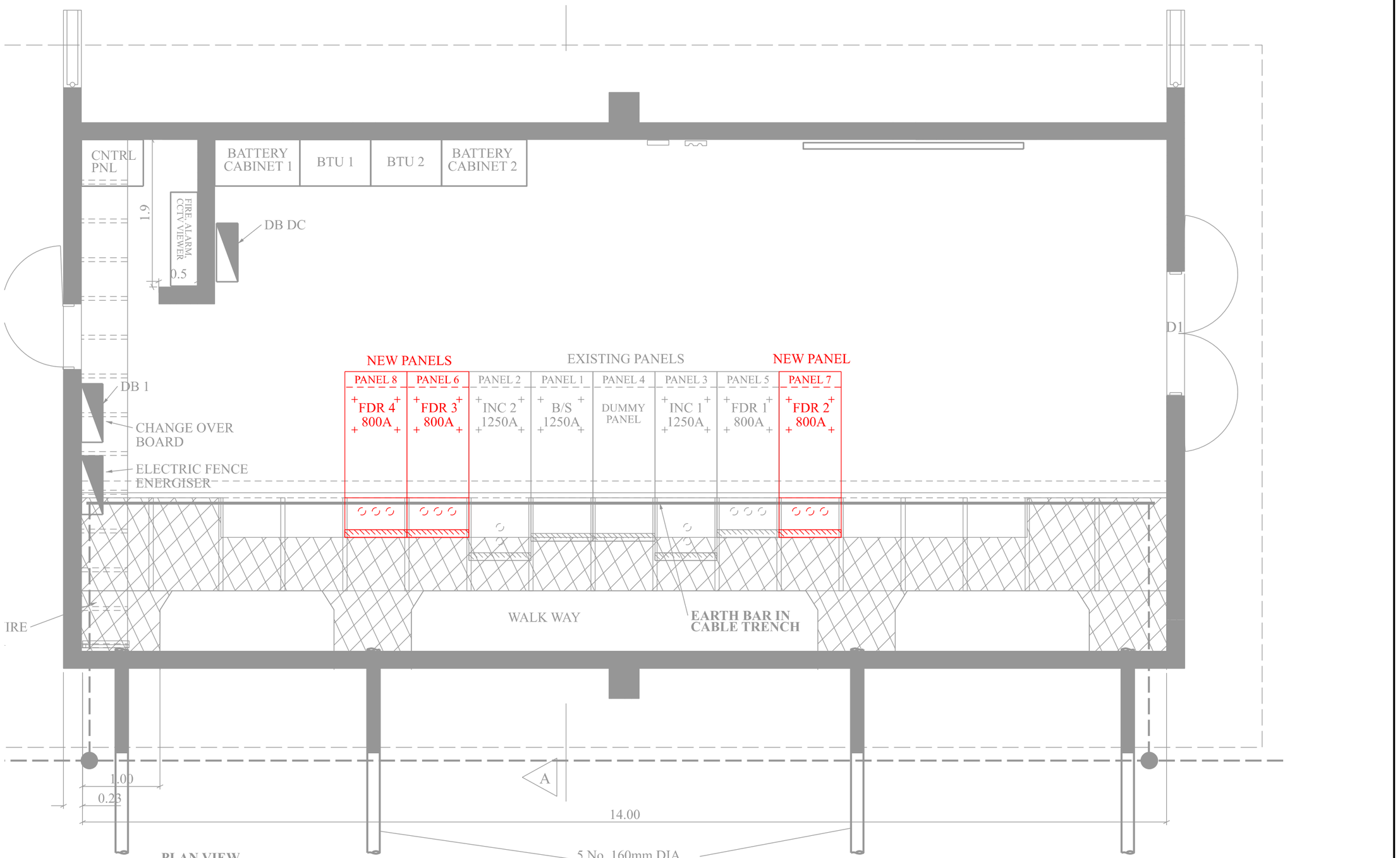
REV. NO: 0



PLAN VIEW
SWITCHGEAR ROOM
SCALE 1:50 (A1)

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■	Tender	2021/08/03					
	Approval						
	Information						
	Planning						
		Date	Date	REVISIONS	Drawn	Rev. No	

Engineer:	M LYON JNR Pr Eng
Design:	M VAN JAARSVELD (M.ENG)
Drawn:	M VAN JAARSVELD (M.ENG)
Approved:	
Date:	03 August 2021

Metsimaholo Municipality

THEMBA KHUBEKA
SWITCHING ROOM LAYOUT

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SCALE: 1 : ? (A3)

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THEMBA KUBHEKA
22 kV SWITCH BOARD

22 kV

LEGEND

1 - TRIP/CLOSE OPERATING FEATURE
1A - LOCAL REMOTE SELECTOR SWITCH
2 - ITT CANNON STAND-OFF TRIP/CLOSE SOCKET
3 - VCB - SEMAPHOR OPEN/CLOSE INDICATION LAMP (SQUARE)
4 - VCB - SEMAPHOR EARTH OPEN/CLOSE INDICATION LAMP (ROUND)
5 - "FAULT TRIP" INDICATION LAMP (AMBER)
6 - MMLG TEST BLOCK - "PROTECTION"
7 - PK-2 TEST BLOCK - "METERING"
8 - PK-2 TEST BLOCK - "INDICATION"
9 - MEASUREMENT - ENERIUM ENERDIS E50
10 - O/C E/F PROTECTION RELAY/BAY CONTROLLER
11 - MVAP22 VOLTAGE SELECTION RELAY
12 - DIR. O/C E/F PROTECTION RELAY / BAY CNTRL
13 - MVAJ 23 MASTER TRIP RELAY
14 - ENERGY METER (3ph, 4 Wire)
15 - DIFF PROTECTION RELAY
16 - ARC PROTECTION RELAY
17 - LIVE INDICATORS (BUSBAR/CABLE)
18 - TRANSFORMER ALARM ANNUNCIATOR PANEL
19 - BATTERY MONITOR
20 - QUALITY OF SUPPLY METER
21 - GPS TIME SYNC & CLOCK
22 - CIRCUIT BREAKER FAIL TRIP (AMBER)
23 - HEATER ON / OFF SWITCH
24 - HEATER HEALTHY LIGHT
25 - N/A - CB CHAMBER LIGHT ON / OFF SWITCH
26 - TRFR PARALLEL TRIP
27 - THERMOSTAT CONTROLLER
28 - DC FAIL INDICATION LIGHT (AMBER)
29 - RELAY NOT HEALTHY LIGHT (AMBER)
30 - TRIP CIRCUIT HEALTHY (PUSH TO TEST)
31 - TRIP CIRCUIT HEALTHY FROM PUSH BUTTON
32 - LAMP TEST (PUSH TO TEST)
33 - CABLE EARTHED
34 - BREAKER OPEN (GREEN)
35 - BREAKER CLOSED (RED)
36 - SPRING CHARGED IND. LED (WHITE)

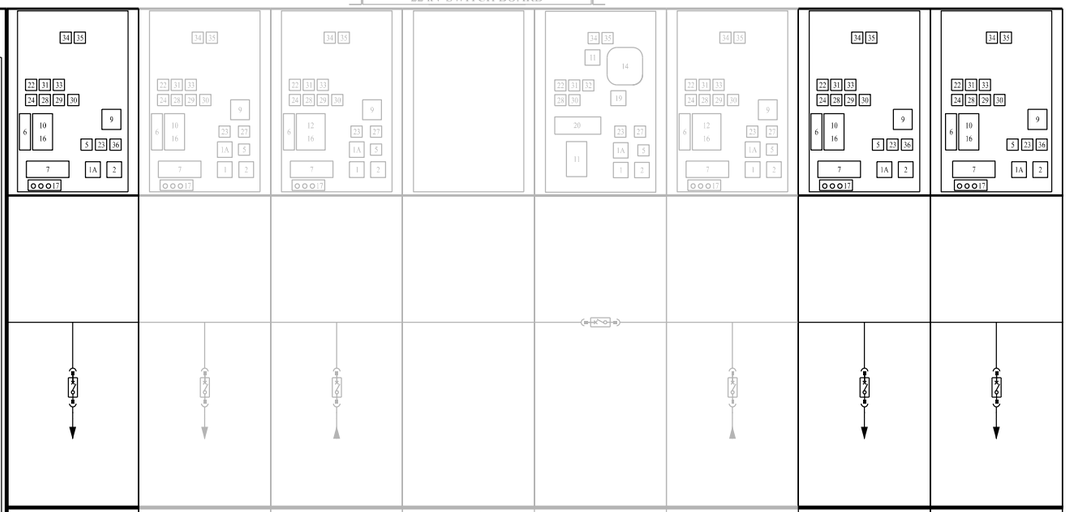
NOTES:

A - 22 000/110V 5 LIMB VT (SPARE FUSES TO BE PROVIDED)
B - ALL PANELS TO BE PROVIDED WITH ARC
C - CIRCUIT BREAKER FAILURE PROTECTION REQUIRED
D - TRIP CIRCUIT SUPERVISION REQUIRED
E - CIRCUIT BREAKER MONITORING AND CONTROL REQUIRED
F - AUTOMATIC CONTROL: SET LATCH TO PREVENT CLOSING OF CIRCUIT BREAKER WITHOUT FAULT ACKNOWLEDGEMENT
G - DIFF, O/C & E/F PROTECTION RELAY LED PROGRAMMED AND LABELED AS FOLLOWS:

O/C & E/F	DIFF, O/C & E/F
LED 5 - O/C I>	LED 5 - DIFF - N/A
LED 6 - O/C I>>	LED 6 - O/C I>
LED 7 - E/F I>	LED 7 - E/F I>
LED 8 - BREAKER FAIL	LED 8 - BREAKER FAIL

H - BATTERY SIZE CALCULATION TO BE ACCORDING TO IEEE 1115. 8 HOURS B/U TIME FOR SECURITY, SCADA & PROTECTION
I - DIFF. PILOT CABLE - N/A
7 CORE, 2.5mm², CU, PVC INSULATED, PVC BEDDING, SWA PVC SHEATHED.
J - TRIP RELAYS:
DIFF. OC/EF TO BE SEPARATE RELAYS EXCEPT INTERCONNECTOR - N/A
ARC AND OC/EF TO BE SEPARATE RELAYS

THERMOSTATIC PROBE TO BE INSTALLED IN THE BUSBAR COMPARIMENT WITH THE CONTROLLER ON THE FRONT DOOR



				NEW	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	NEW	NEW
PANEL No.			1	NO 7	NO 5	NO 3	NO 4	NO 1	NO 2	NO 6	NO 8
NAME PLATE			2	RING FEEDER	RING FEEDER	INCOMER 1	DUMMY PANEL	BUS SECTION	INCOMER 2	RING FEEDER	RING FEEDER
LINE VOLTAGE			3	22 kV	22 kV	22 kV	22 kV	22 kV	22 kV	22 kV	22 kV
BUSBAR RATING			4	1250A	1250A	1250 A	1250 A	1250 A	1250 A	1250A	1250A
BUSBAR ISOLATION			5	AIR	AIR	AIR	AIR	AIR	AIR	AIR	AIR
CIRCUIT BREAKER OR FUSE SWITCH	RATING AMP & TYPE		6	800 A ACTOM TYPE SBV 24L	800 A ACTOM TYPE SBV 24L	1250 A ACTOM TYPE SBV 24L	1250 A ACTOM TYPE SBV 24L	1250 A ACTOM TYPE SBV 24L	1250 A ACTOM TYPE SBV 24L	800 A ACTOM TYPE SBV 24L	800 A ACTOM TYPE SBV 24L
	FAULT LEVEL (kA or MVA)		7	25 kA	25 kA	25 kA	25 kA	25 kA	25 kA	25 kA	25 kA
	OPERATING MECHANISM	MOTOR-CHARGED SPRING RELEASE	8	MWS 110V DC	MWS 110V DC	MWS 110V DC	-	MWS 110V DC	MWS 110V DC	MWS 110V DC	MWS 110V DC
	AUXILIARY CONTACTS (SPARE)		9	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	-	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM	MIN. 3 N/O & 3 N/C, t.b.c. BY OEM
	TRIP COIL		10	110 V DC MAIN & BACK-UP	110 V DC MAIN & BACK-UP	110 V DC MAIN & BACK-UP	-	110 V DC MAIN & BACK-UP	110 V DC MAIN & BACK-UP	110 V DC MAIN & BACK-UP	110 V DC MAIN & BACK-UP
CURRENT TRANSFORMERS	PURPOSE (ALL THREE PHASES)		11	PROTECTION	PROTECTION	PROTECTION	-	METERING	PROTECTION	PROTECTION	PROTECTION
	RATIO		12	3 x 800/600/400/200/1	3 x 800/600/400/200/1	3 x 1200/1000/800/600/400/200/1	-	3 x (1+1)/1	3 x 1200/1000/800/600/400/200/1	3 x 800/600/400/200/1	3 x 800/600/400/200/1
	CLASS & RATING		13	PX	PX	PX	-	SUMMATION	PX	PX	PX
	PURPOSE (ALL THREE PHASES)		14	METERING	METERING	METERING	-	-	METERING	METERING	METERING
	RATIO		15	3 x 800/600/400/200/1	3 x 800/600/400/200/1	3 x 1200/1000/800/600/400/200/1	-	-	3 x 1200/1000/800/600/400/200/1	3 x 800/600/400/200/1	3 x 800/600/400/200/1
	CLASS & RATING		16	5VA CL. 0.5 - 0.2	5VA CL. 0.5 - 0.2	5VA, CL. 0.5 - 0.2	-	-	5VA, CL. 0.5 - 0.2	5VA CL. 0.5 - 0.2	5VA CL. 0.5 - 0.2
	PURPOSE (ALL THREE PHASES)		17	SENSITIVE E/F	SENSITIVE E/F	-	-	-	-	SENSITIVE E/F	SENSITIVE E/F
	RATIO		18	3 x 50/1 CBCT	3 x 50/1 CBCT	-	-	-	-	3 x 50/1 CBCT	3 x 50/1 CBCT
	CLASS & RATING		19	10P10, RING TYPE	10P10, RING TYPE	-	-	-	-	10P10, RING TYPE	10P10, RING TYPE
	PURPOSE (ALL THREE PHASES)		20	-	-	-	-	-	-	-	-
	RATIO		21	-	-	-	-	-	-	-	-
	CLASS & RATING		22	-	-	-	-	-	-	-	-
	PURPOSE (ALL THREE PHASES)		23	-	-	-	-	-	-	-	-
	RATIO		24	-	-	-	-	-	-	-	-
	CLASS & RATING		25	-	-	-	-	-	-	-	-
	PURPOSE (ALL THREE PHASES)		26	-	-	-	-	-	-	-	-
	RATIO		27	-	-	-	-	-	-	-	-
	CLASS & RATING		28	-	-	-	-	-	-	-	-
VOLTAGE TRANSFORMERS	PURPOSE (4 WIRE 3 PHASE)		29	-	-	METERING	-	-	METERING	-	-
	RATIO		30	-	-	(22000/√3) (110/√3)	-	-	(22000/√3) (110/√3)	-	-
	CLASS & RATING		31	-	-	5 LIMB CLASS 0.2 + 50VA	-	-	5 LIMB CLASS 0.2 + 50VA	-	-
	PURPOSE		32	-	-	PROTECTION	-	-	PROTECTION	-	-
	RATIO		33	-	-	(22000/√3) (110/√3)	-	-	(22000/√3) (110/√3)	-	-
	CLASS & RATING		34	-	-	5 LIMB CLASS 3P - 50VA	-	-	5 LIMB CLASS 3P - 50VA	-	-
INTERLOCKING			35	MIN 4 N/O & 4 N/C t.b.c. BY OEM	MIN 4 N/O & 4 N/C t.b.c. BY OEM	MIN 4 N/O & 4 N/C t.b.c. BY OEM	-	MIN 4 N/O & 4 N/C t.b.c. BY OEM	MIN 4 N/O & 4 N/C t.b.c. BY OEM	MIN 4 N/O & 4 N/C t.b.c. BY OEM	MIN 4 N/O & 4 N/C t.b.c. BY OEM
			36	-	-	-	-	-	-	-	-
TRIP RELAYS	PROTECTION IED (MAIN)		37	SEL 751 (5" DISPLAY)	SEL 751 (5" DISPLAY)	SEL 751 (5" DISPLAY)	*	*	SEL 751 (5" DISPLAY)	SEL 751 (5" DISPLAY)	SEL 751 (5" DISPLAY)
	SELECTED RATIO		38	*	*	*	*	*	*	*	*
	CURRENT PLUG SETTING (PS)		39	*	*	*	*	*	*	*	*
	TIME MULTIPLIER SETTING (TMS)		40	*	*	*	*	-	*	*	*
	DIFFERENTIAL		41	*	*	*	*	*	*	*	*
	EARTH FAULT: CURRENT PLUG SETTING (PS)		42	*	*	*	*	*	*	*	*
	EARTH FAULT: TIME MULTIPLIER (TMS)		43	*	*	*	*	*	*	*	*
	SENS. E/F		44	-	-	DC LOW TRIP	-	-	DC LOW TRIP	-	-
	AUX TRIP RELAYS		45	-	-	-	-	-	-	-	-
	ARC DETECTION		46	FROM MAIN IED	FROM MAIN IED	FROM MAIN IED	-	FROM MAIN IED	FROM MAIN IED	FROM MAIN IED	FROM MAIN IED
INDICATION LIGHTS			47	110 V (GREEN-OFF, RED-ON)	110 V (GREEN-OFF, RED-ON)	110 V (GREEN-OFF, RED-ON)	-	110 V (GREEN-OFF, RED-ON)	110 V (GREEN-OFF, RED-ON)	110 V (GREEN-OFF, RED-ON)	110 V (GREEN-OFF, RED-ON)
			48	CABLE - VDS IEC 61243-5	CABLE - VDS IEC 61243-5	CABLE - VDS IEC 61243-5	-	-	CABLE - VDS IEC 61243-5	CABLE - VDS IEC 61243-5	CABLE - VDS IEC 61243-5
AMMETER	TYPE		49	-	-	-	-	-	-	-	-
	SCALE		50	-	-	-	-	-	-	-	-
VOLTMETER	TYPE		51	-	-	-	-	-	-	-	-
	SCALE		52	-	-	-	-	QUALITY OF SUPPLY METER	-	-	-
OTHER INSTRUMENTS			53	ENERIUM ENERDIS E50	ENERIUM ENERDIS E50	ENERIUM ENERDIS E50	-	ELSTER A1700	ENERIUM ENERDIS E50	ENERIUM ENERDIS E50	ENERIUM ENERDIS E50
			54	-	-	-	-	BATTERY MONITOR	-	-	-
OUTGOING CONNECTION			55	3C 95mm² AL	3C 70mm² Cu	3 x SET IN TREFOIL OF 3 SINGLE CORE / PHASE ALUMINIUM, 300 mm², PILC, TRPVC SWA PEPVC E1	-	-	3 x SET IN TREFOIL OF 3 SINGLE CORE / PHASE ALUMINIUM, 300 mm², PILC, TRPVC SWA PEPVC E1	3C 95mm² AL	3C 95mm² AL
			56	PILC	XLPE	PILC	-	-	PILC	PILC	PILC
CABLE BOX TYPE			57	CABLE BOX HEATER & HEATSHRINK	CABLE BOX HEATER & HEATSHRINK	CABLE BOX HEATER & HEATSHRINK	-	-	CABLE BOX HEATER & HEATSHRINK	CABLE BOX HEATER & HEATSHRINK	CABLE BOX HEATER & HEATSHRINK
COLOUR			58	MED SEA GREY G24 TO SANS 1091	MED SEA GREY G24 TO SANS 1091	LIGHT ORANGE B26 TO SANS 1091	LIGHT ORANGE B26 TO SANS 1091	SIGNAL RED A11 TO SANS 1091	LIGHT ORANGE B26 TO SANS 1091	MED SEA GREY G24 TO SANS 1091	MED SEA GREY G24 TO SANS 1091

TENDER
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	As-Built					
	Construction					
	Tender	2021-08-02				
	Approval					
	Information					
	Planning					
		Date	Date	REVISIONS	Drawn	Rev. No

Engineer:	M LYON Pr Eng
Design:	M LYON Pr Eng
Drawn:	M VAN JAARSVELD
Approved:	
Date:	3 August 2021

Metsimaholo Municipality

THEMBA KHUBEKA
SWITCHING STATION:
SWITCHGEAR SCHEDULE

LYON VENNOTE EN PARTNERS
Raadgewende Elektriese Ingenieurs & Projekbestuurders
T. (016) 981 6270 F. (016) 933 0277

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Consulting Electrical Engineers & Project Managers

SCALE: NTS (A3)

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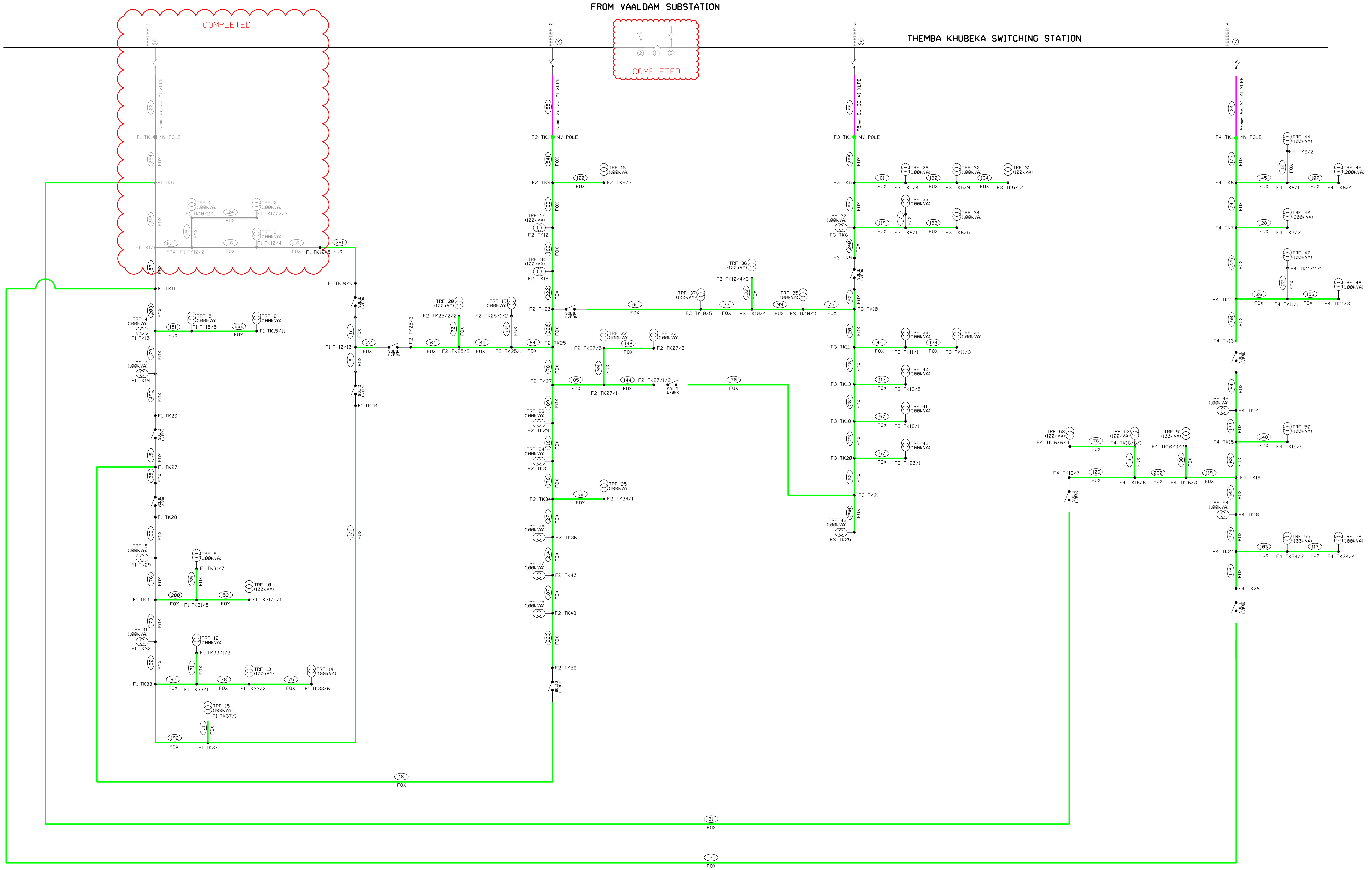

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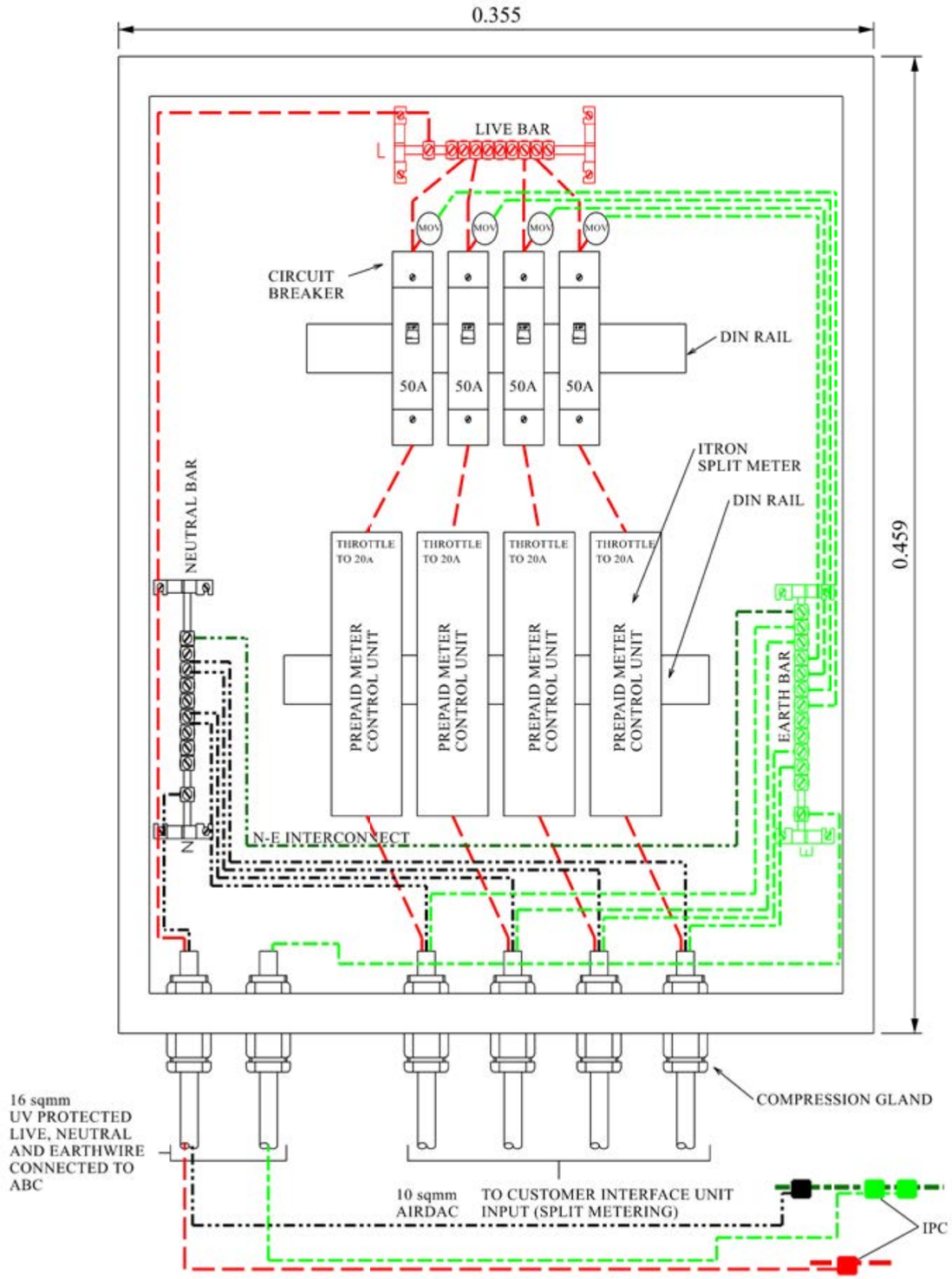
PO Box 3925 - VANDERBIJLPARK - 1900

Metsimaholo Municipality

THEMBA KHUBEKA RETICULATION SINGLE LINE DIAGRAM

DESIGN: M VAN JAARSVELD (M.ENG)	ENGINEER: M LYON JNR Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD (M.ENG)
SCALE: NTS (A1)	DATE: 21 JULY 2021
DRAWING NUMBER: VE9335-7-SLD	SHEET 01 OF 01
REVISION:	A



TENDER
ISSUED FOR TENDER PURPOSES ONLY

	As-Built						Engineer:	M LYON JNR Pr Eng
	Construction						Design:	M VAN JAARSVELD (M.ENG)
	Tender	2021/08/04					Drawn:	M VAN JAARSVELD (M.ENG)
	Approval						Approved:	
	Information						Date:	04 August 2021
	Planning							
	Date		Date	REVISIONS	Drawn	Rev. No		

Metsimaholo Municipality

THEMBA KHUBEKA
ELECTRIFICATION
POLE TOP BOX

LYON AND PARTNERS
Consulting Electrical Engineers & Project Managers

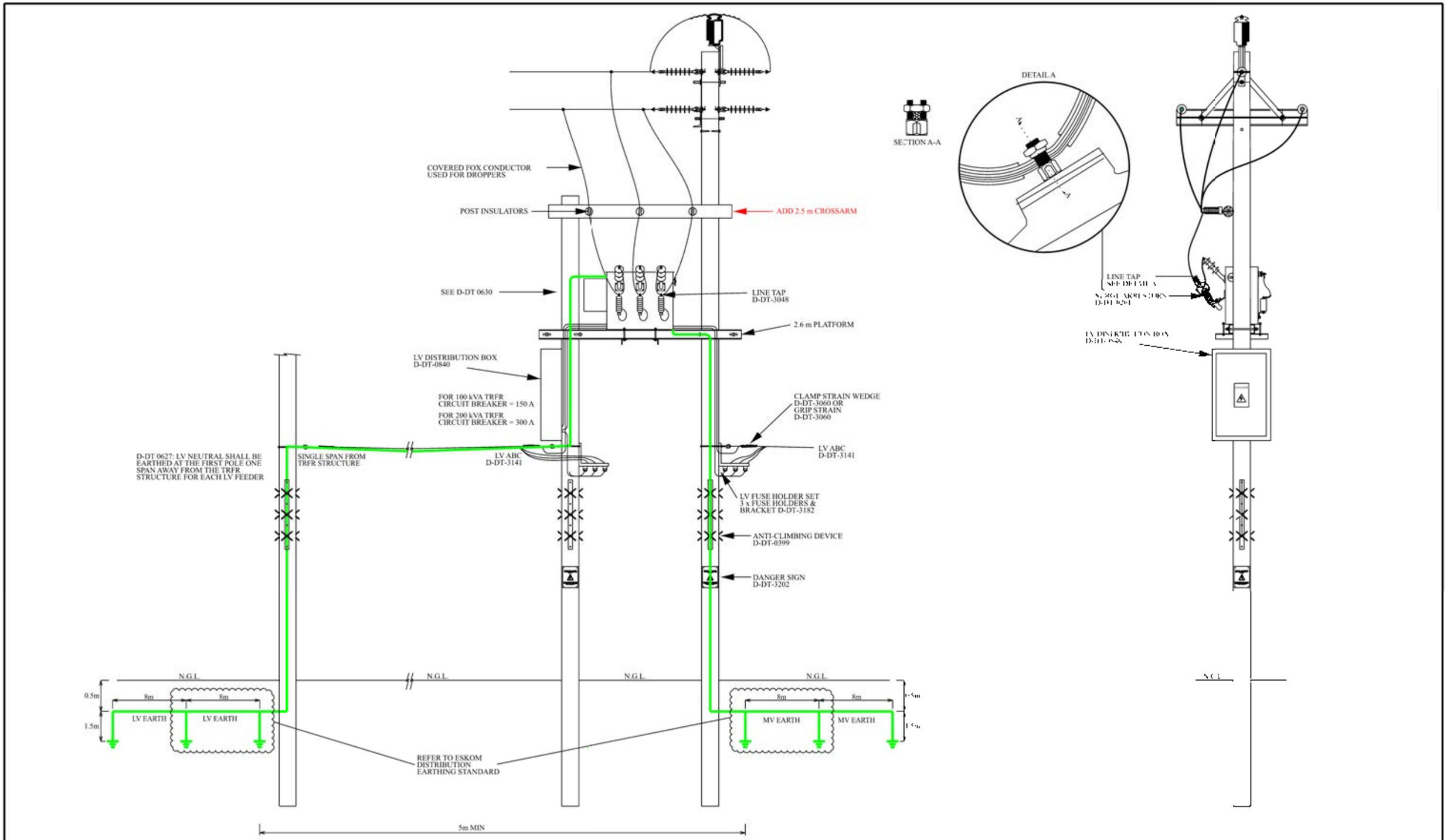
SCALE: NTS (A3)

DRAWING NUMBER: VE9335-7-PTB

SHEET 01 OF 01

REV. NO: 0

CONTRACTORS ARE TO CHECK ALL DIMENSIONS AND LEVELS BEFORE ANY WORK COMMENCES AND TO REFER ANY APPARENT DISCREPANCY TO THE ENGINEER. COPYRIGHT VESTS IN THIS DOCUMENT (DRAWING) AND NO USE OR REPRODUCTION OR DUPLICATION THEREOF MAY OCCUR WITHOUT THE WRITTEN CONSENT OF THE OWNER. LYON AND PARTNERS (PTY) LTD 2021



TENDER
ISSUED FOR TENDER PURPOSES ONLY

As-Built						Engineer:	M LYON JNR Pr Eng
Construction						Design:	M LYON JNR Pr Eng
Tender	2021/08/04					Drawn:	M VAN JAARSVELD (M.ENG)
Approval						Approved:	
Information						Date:	04 August 2021
Planning							
	Date	Date	REVISIONS	Drawn	Rev. No		

CLIENT
Metsimaholo Municipality

THEMBA KHUBEKA
ELECTRIFICATION
TRANSFORMER STRUCTURE

LYON AND PARTNERS
Consulting Electrical Engineers & Project Managers

SCALE:
NTS (A3)

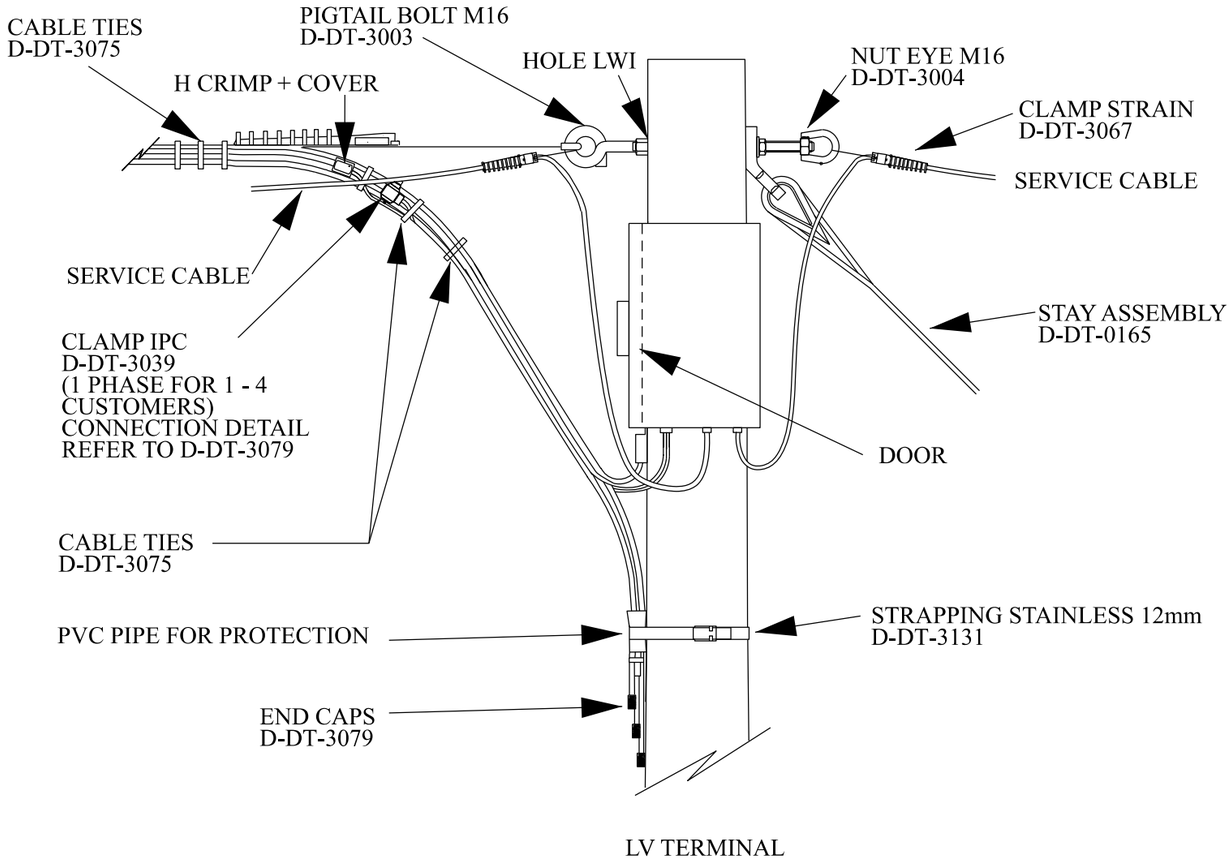
DRAWING NUMBER: SHEET 01 OF 01
VE9335-7-TRFR STRUC

REV. NO:
0

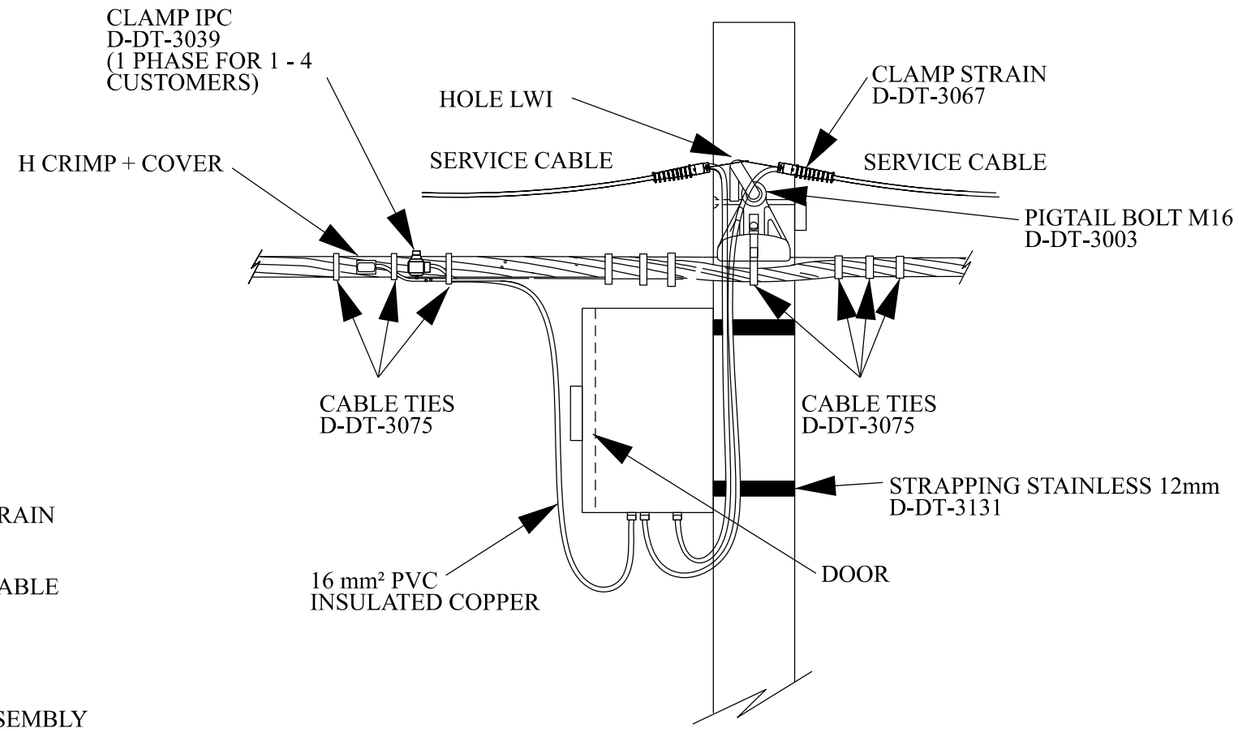
F:_Metsimaholo\VE 9335-7 Themba K Retic\DD - DESIGN DRAWINGS\LYON\3. TENDER DRAWINGS\6. VE9335-5-TRF STRC. REV 1 2021-08-02.dgn

BASED ON D-DT-0180

- SERVICE DISTRIBUTION BOX TO BE INSTALLED BELOW A.B.C.
- SERVICE DISTRIBUTION BOX ACCESS PARALLEL TO ROAD



LV TERMINAL



LV SUSPENSION

TENDER
ISSUED FOR TENDER PURPOSES ONLY

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	As-Built						Engineer:	M LYON JNR Pr Eng
	Construction						Design:	M LYON JNR Pr Eng
	Tender	2021/08/04					Drawn:	M VAN JAARSVELD (M.ENG)
	Approval						Approved:	
	Information							
	Planning						Date:	04 August 2021
		Date	Date	REVISIONS	Drawn	Rev. No		

Metsimaholo Municipality

THEMBA KHUBEKA
ELECTRIFICATION
LV ASSEMBLY

LYON AND PARTNERS
Consulting Electrical Engineers & Project Managers
lyon@lyon.co.za +27 16 981 6270
PO Box 3925 • VANDERBIJLPARK • 1900

SCALE: NTS (A3)

DRAWING NUMBER: SHEET 01 OF 01

VE9335-7-LV ASSY

REV. NO: 0

ACTOM

MV SWITCHGEAR

REV.1
DATE 29/06/20
DRWN F.M
CHK'D
REVISED.
REV.2
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.
REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

CUSTOMER REFERENCES

COMPANY TRACTIONEL ENTERPRISE — CONSULTING ENG. LYON AND PARTNERS — ORDER No. TE37516

PROJECT THEMBEKA KUBHEKA — LOCATION DENEYSVILLE — SUB-LOCATION REFENKGOTSO X5

MAIN PLANT ESKOM VAALDAM S/S — SUB-PLANT THEMBA KHUBEKA SW/S — PLANT SECTION

MAIN SWITCHBOARD DESIGNATION THEMBA KHUBEKA 22kV SWITCHBOARD

TECHNICAL DATA

1 X 3 PANEL TYPE SBV24L SWITCHBOARD

SYSTEM 22000 VOLTS, 3 PHASE, 3 WIRE, 50HZ, EARTHED NEUTRAL — RATED SHORT-TIME WITHSTAND CURRENT (Ik) 25kA — RATED DURATION OF SHORT CIRCUIT (tk) 3s

RATED VOLTAGE (Ur) 24kV — RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE (Up) 125kVip — RATED POWER FREQUENCY WITHSTAND VOLTAGE (Ud) 50kV

RATED NORMAL CURRENT (Ir) BUSBARS 1250A — RATED NORMAL CURRENT (Ir) CIRCUIT (SEE DETAIL SHEET) — IAC IEC 60298 25kA 0.2s

SECONDARY WIRING:- PVC COLOURED — LABELS:- W-B

FINISH:- EXTERIOR: INCOMER:- LIGHT ORANGE (B26) — BUS-SECTION:- SIGNAL RED (A11)

DRAWING DESCRIPTION

GENERAL ARRANGEMENT DRAWING No.:- M.V.8603.1.G1.01 — TOTAL No. OF SHEETS:- 04

DETAIL SHEET No.:- 02 — FRONT VIEW SHEET No.:- 03 — SIDE VIEW SHEET No.:- 04 — FOUNDATION PLAN SHEET No.:- 03

PROFESSIONAL ENGINEER
SIGN.
NUMBER
DATE

LOOSE EQUIPMENT

YES	TOUCH-UP PAINT	YES	RACKING HANDLE	YES	WEAR GAUGE	YES	INTEGRAL EARTH HANDLE	YES	INSULATION MATERIALS
	INSULATING OIL		STEM SPANNER		TEST JUMPER	YES	CARRIAGE RAMP		30V DC B.T.U
	CABLE-BOX COMPOUND		LOCKING RING SPANNER		TEST SPEARS	YES	TOOL RACK	YES	110V DC B.T.U
YES	OPERATING HANDLE		TANK BOLT SPANNER		EARTHING DEVICE	YES	TOOL BOX		

CUSTOMER DRAWING No.

SHT. OF SHTS.

TOTAL No. OF SHEETS

DRAWN		PROJ. ENG.	
TRACED		PROJ. MNG.	
CHECKED		C.M.+E.E.	
CHF. DES.		CHF. ENG.	

TECHNICAL NOTES

1) DUST PROOF DOOR SEALS TO BE PROVIDED.
2) C.T. TERMINALS TO BE SPRING LOADED. ALL OTHERS STANDARD.
3) SMALL WIRING : CLASS TPS C.T.'s & D.C. BUSWIRING = 2.5mm PVC.
C.T.'s + TRIPPING & CLOSING CIRCUITS = 2.5mm PVC.
ALL OTHER CIRCUITS = 1.5mm PVC.
4) DOORS SHALL BE BONDED TO FRAMEWORK BY BRAIDED EARTH STRAP.

ALL GEAR SHOWN IN THE SERVICE, NORMALLY OPEN, RESET OR DE-ENERGISED POSITION

SWITCHBOARD FOUNDATIONS

1) FLOOR TO BE LEVEL TO WITHIN +/- 1mm OVER EACH M^2 THE SWITCHBOARD OCCUPIES , AND TO WITHIN -2mm FOR C.B. WITHDRAWAL.
2) COMMENCE INSTALLATION FROM THE CENTRE PANEL, WORKING OUTWARDS, EACH PANEL BEING ALIGNED AND LEVELLED USING SHIMS, THEN BOLTED DOWN AND TOGETHER.
3) ALIGNMENT AND LEVELLING TO APPLY TO BOTH AXES, ALONG THE SWITCHBOARD AND FROM FRONT TO REAR.
4) AS EACH PANEL IS INSTALLED, THE C.B. SHOULD BE RACKED INTO THE HOUSING TO CHECK FOR EVEN CLEARANCES ALL ROUND, AND IF NOT ADJUST THE SHIMS.
5) FAILURE TO COMPLY WITH THE ABOVE PROCEDURES COULD AFFECT C.B. OPERATION AND MAY INVALIDATE THE GUARANTEE.

RECOMMENDED TORQUES IN Nm FOR GRADE 8.8 BOLTS WITH GRADE 8 NUTS FOR COPPER BUSBAR JOINTS

SIZE	UNPLATED	PLATED
M6	10	7
M8	25	20
M10	50	30
M12	85	55
M16	220	130

(90% OF APPLIED TORQUE IS EMPLOYED IN OVERCOMING FRICTION)

DRG No. M.V.8603.1.G1.01 — REV 3

GENERAL ARRANGEMENT:- 1 X 3 PANELS SBV24L SWITCHBOARD

ORDER No. AM8603.1

SHEET	01	NEXT	02
SCALE	---		
DRAWN	F.M	CHK'D	
DATE	25/11/2019	APP'D	

0 5 10 20 30 40 50 60 70 80 90 100

ACTOM MV SWITCHGEAR

CAD No 86031G11

MAIN BOARD LABEL		THEMBA KHUBEKA 22kV SWITCHBOARD									
ORDER No.		AM8603.1		AM8603.1	AM8603.1						
PANEL REFERENCE		3		1	2						
CIRCUIT LABEL		INCOMER No.1	DUMMY PANEL	BUS–SECTION	INCOMER No.2						
PANEL FUNCTION		INCOMER		BUS–SECTION	INCOMER						
BUSBAR RATING		1250A									
BUSBAR ISOLATION		AIR		AIR	AIR						
CIRCUIT RATING		1250A		1250A	1250A						
CIRCUIT INTERNAL ARRANGEMENT											
CIRCUIT BREAKER RATING		1250A		1250A	1250A						
CIRCUIT BREAKER TYPE		SBV24L	SBV24L	SBV24L	SBV24L						
MECHANISM TYPE		110V DC M.W.S		110V DC M.W.S	110V DC M.W.S						
CLOSING		110V D.C.		110V D.C.	110V D.C.						
TRIPPING – 1st SHUNT		110V D.C.		110V D.C.	110V D.C.						
TRIPPING – 2nd SHUNT		110V D.C.		110V D.C.	110V D.C.						
TRIPPING											
INTEGRAL EARTHING		CABLE			CABLE						
BATTERY MONITORING											
PROTECTION RELAY		SEL 751			SEL 751						
QUALITY OF SUPPLY METER				VECTOR III							
FUSE RATING											
VDS CABLE LIVE		CABLE LIVE			CABLE LIVE						
CURRENT TRANSFORMERS RATIO (PROTECTION)		3x 200/800/1200/1 (M.R.)			3x 200/800/1200/1 (M.R.)						
CURRENT TRANSFORMERS BURDEN+ACCURACY		CLASS PX			CLASS PX						
CURRENT TRANSFORMERS RATIO (METERING)		3x 200/800/1200/1 (M.R.)			3x 200/800/1200/1 (M.R.)						
CURRENT TRANSFORMERS BURDEN+ACCURACY		5VA CLASS 0.5			5VA CLASS 0.5						
CURRENT TRANSFORMERS RATIO (INSTRUMENTATION)		3x 200/800/1200/1 (M.R.)			3x 200/800/1200/1 (M.R.)						
CURRENT TRANSFORMERS BURDEN+ACCURACY		5VA CLASS 0.5			5VA CLASS 0.5						
CURRENT TRANSFORMERS RATIO (SUMMATION)				3x (1+1)/1A							
CURRENT TRANSFORMERS BURDEN+ACCURACY				5VA CLASS 0.5							
CT PRIMARY TURNS											
VOLTAGE TRANSFORMER RATIO											
BURDEN+ACCURACY (BUSBAR)											
VOLTAGE TRANSFORMER RATIO		22000/110/110			22000/110/110						
BURDEN+ACCURACY (CABLE)		50VA CL.0.2/3P			50VA CL.0.2/3P						
AMMETER LOOSE SCALE											
AMMETER SCALE											
VOLTMETER SCALE											
KWH METER MULTIPYING FACTOR		ENERIUM E50		ELSTER A1700	ENERIUM E50						
CABLE ENTRY		BOTTOM			BOTTOM						
MAIN CABLE DETAILS		2x 185mm² 3c PILC			2x 185mm² 3c PILC						
MAIN CABLE TERMINATION		XLPE			XLPE						
SCHEMATIC DIAGRAM No.		AM8603.1.D1.01		AM8603.1.D1.03	AM8603.1.D1.02						
CABLE TYPE		HEATSHRINK			HEATSHRINK						
COLOUR		LIGHT ORANGE(B26)		SIGNAL RED (A11)	LIGHT ORANGE(B26)						
DOOR DRILLING		86031S11		86031S12	86031S11						

REV.1
DATE 29/06/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.3
DATE 25/09/20
DRWN F.M
CHK'D
IMPEDO DUO REPLACED BY VECTOR III.

REV.4
DATE 15/10/20
DRWN F.M
CHK'D
DUMMY PANEL ADDED.

REV.5
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.G1.01 | REV 5 | SHEET 02 NEXT 03 | SCALE ———

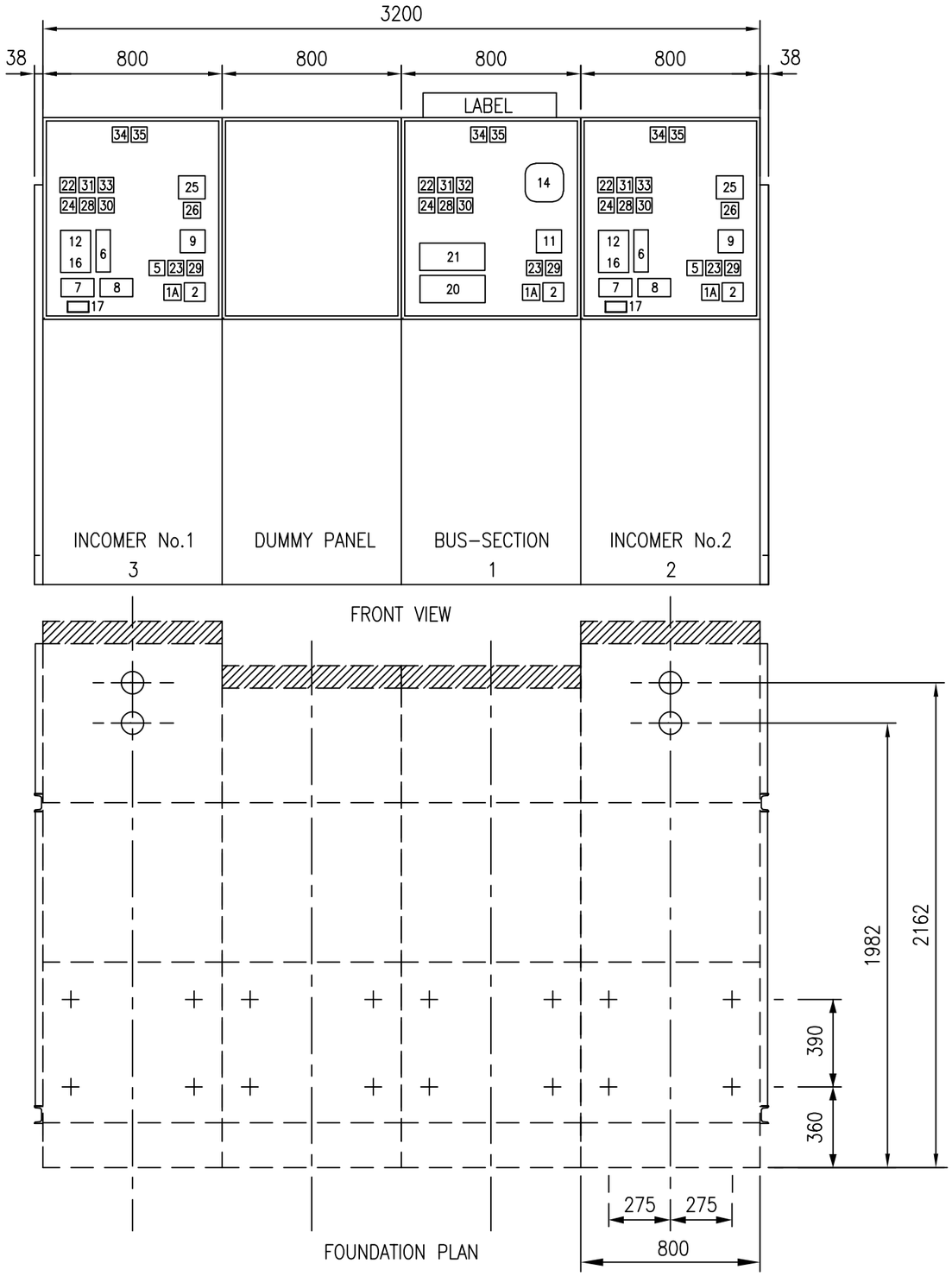
GENERAL ARRANGEMENT:-1 X 3 PANELS SBV24L SWITCHBOARD | DRAWN F.M | CHK'D

ORDER No. AM8603.1 | DATE 25/11/2019 | APP'D

ACTOM
MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031G12



✳ RECOMMENDED DIMENSIONS ⌖ MAIN CABLE POSITIONS ▨ AUX CABLE POSITIONS ⌖ 14⌀ FOUNDATION CENTRES

37		
36		
35	"V.C.B. CLOSED" INDICATION LED – (RED)	H55
34	"V.C.B. OPEN" INDICATION LED – (GREEN)	H54
33	"CABLE EARTHED" INDICATION LED – (WHITE)	H59
32	LAMP TEST PUSHBUTTON – (BLACK)	S59
31	"TRIP CIRCUIT NOT HEALTHY" IND. LED – (AMBER)	H63
30	"TRIP CIRCUIT HEALTHY" IND. LAMP & P/B – (WHITE)	H58/S58
29	"SPRING CHARGED" IND. LED – (WHITE)	H52
28	"DC FAIL" INDICATION LED – (AMBER)	H61
27	THERMOSTAT CONTROLLER	B20
26	VOLTMETER SELECTOR SWITCH	S60
25	VOLTMETER TYPE FV96 0–13kV	P60
24	HEATER HEALTHY LIGHT	H65
23	HEATER OFF/ON SELECTOR SWITCH	S56
22	"CB FAIL TRIP" INDICATION LED – (AMBER)	H57
21	VECTOR III – QUALITY OF SUPPLY METER (ZONE 2)	P81
20	VECTOR III – QUALITY OF SUPPLY METER (ZONE 1)	P80
19		
18		
17	VDS – "CABLE" LIVE INDICATORS	H51
16	ARC PROTECTION	
15		
14	ELSTER A1700 – POWER METER	P70
13		
12	SEL–751 DIR. O/C & E/F PROTECTION RELAY	F51
11	RF4/RD2 – VOLTAGE SELECTION RELAY	P57
10		
9	ENERIUM E50 – MEASUREMENT METER	P58
8	PK2 4 WAY TEST BLOCK – (INSTRUMENTATION)	X53
7	PK2 4 WAY TEST BLOCK – (METERING)	X52
6	MMLG TEST BLOCK – (PROTECTION)	X51
5	"FAULT TRIP" INDICATION LED – (AMBER)	H56
4		
3		
2	ITT CANNON STAND–OFF TRIP/CLOSE SOCKET	S70/X57
1A	LOCAL/REMOTE SELECTOR SWITCH	S53
1		
G.A. REF.	INSTRUMENT PANEL EQUIPMENT	S.D. REF

REV.1	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED.	
REV.2	
DATE	25/09/20
DRWN	F.M
CHK'D	
IMPED DUO REPLACED BY VECTOR III & BA300 REMOVED	
REV.3	
DATE	15/10/20
DRWN	F.M
CHK'D	
DUMMY PANEL ADDED & SPRING CHARGED LED.	
REV.4	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

DRG No. M.V.8603.1.G1.01 REV 4

SHEET 03 NEXT 04

SCALE 1:25

GENERAL ARRANGEMENT:– 1 X 3 PANELS SBV24L SWITCHBOARD

DRAWN F.M CHK'D

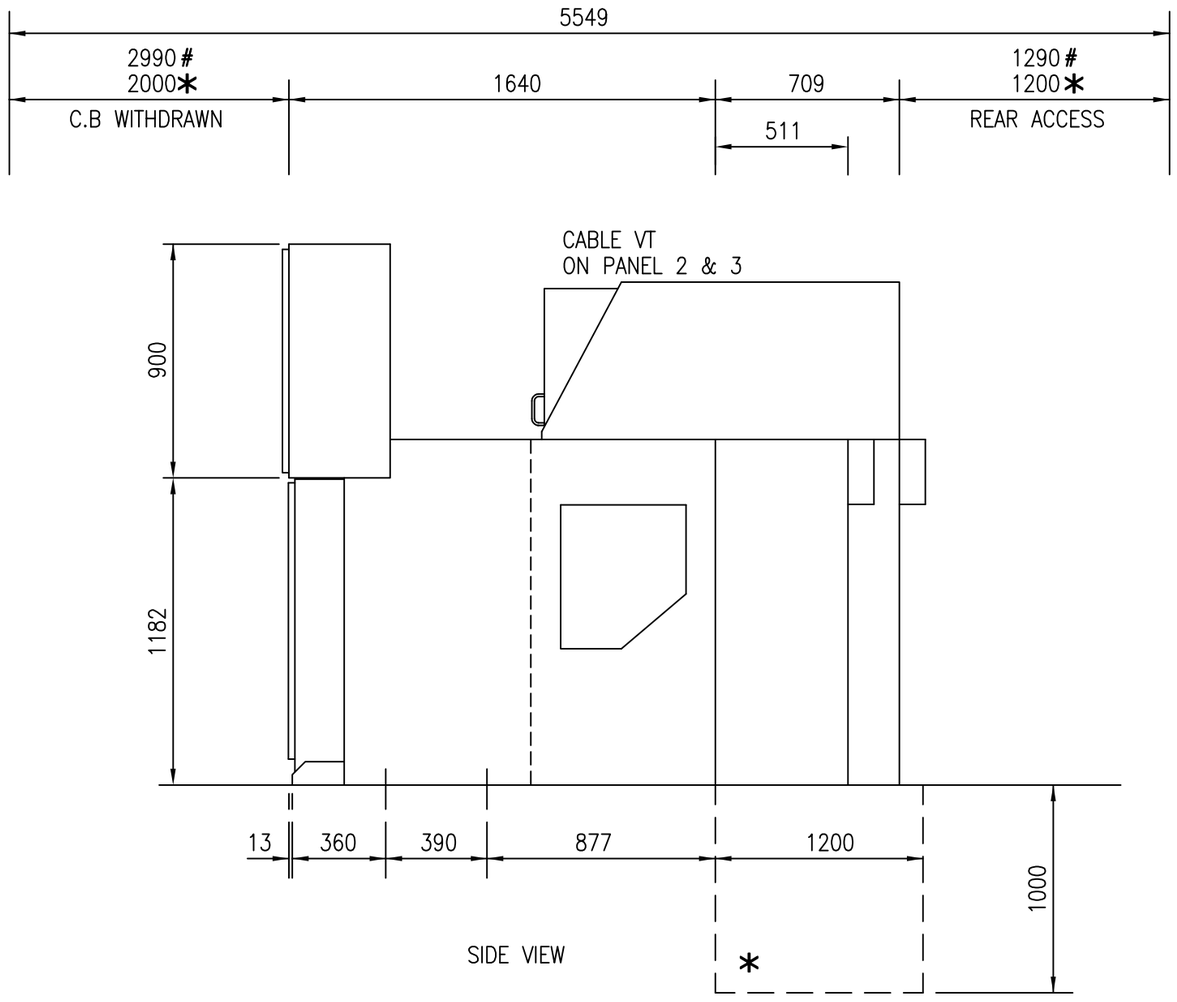
ORDER No. AM8603.1

DATE 25/11/2019 APP'D

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031G13

ACTOM
MV SWITCHGEAR



ACTUAL DIMENSIONS

* RECOMMENDED DIMENSIONS ⊕ MAIN CABLE POSITIONS ▨ AUX CABLE POSITIONS + 14Ø FOUNDATION CENTRES

REV.1	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED.	
REV.2	
DATE	25/09/20
DRWN	F.M
CHK'D	
REVISED.	
REV.3	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

DRG No.	M.V.8603.1.G1.01	REV 3	SHEET	04	NEXT --
			SCALE	1:25	
GENERAL ARRANGEMENT:- 1 X 3 PANELS SBV24L SWITCHBOARD			DRAWN	F.M	CHK'D
ORDER No.	AM8603.1		DATE	25/11/2019	APP'D

ACTOM
MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031G14

514 4567

1250A BUSBARS
R W B

1250A Q

P1 P1 P1

CORE 1
PROTECTION C.T.'s
M.R. 200/800/1200/1A
CLASS PX

T77 T77 T77

1S1 1S2 1S3 1S4

R W B

TO SHEET 02

C11-R2.5 C12-R2.5 C14-R2.5 C31-W2.5 C32-W2.5 C34-W2.5 C51-B2.5 C52-B2.5 C54-B2.5

PT 1 2 5 6 9 10

PT 3 4 7 8 11 12

C13-R2.5 C33-W2.5 C53-B2.5 C70-BK2.5 90-GY2.5

13

PT E

X51 21 23 25 27

22 24 26 28

C15-R2.5 C35-W2.5 C55-B2.5 C71-BK2.5

Z01 Z03 Z05 Z08

F51 IA IB IC IN

Z02 Z04 Z06 Z07

C72-BK2.5

12 M 07–17
11 L 07–18
10 K 05–8
9 J
8 H 08–19
7 G 08–18
6 F 08–17
5 E 08–16
4 D 07–9
3 C 07–8
2 B 05–7
1 QS A 06–11

S1
1B 3B 2B 07–4
1A 3A 2A 07–10

NOTE:– SPECIFICATION OF PROTECTIVE CT's

TAPPING	RATIO	CLASS	MIN Vk	Max Ie	Max R at 75 °C
S1–S2	1/200T	PX	83,3V	300mA	1 Ohm
S3–S4	1/400T	PX	167V	150mA	2 Ohms
S2–S3	1/600T	PX	250V	100mA	3 Ohms
S1–S3	1/800T	PX	333V	75mA	4 Ohms
S2–S4	1/1000T	PX	417V	60mA	5 Ohms
S1–S4	1/1200T	PX	500V	50mA	6 Ohms

F51

T1	TYPE	T2	REF
Z01	P	Z02	01–13
Z03	P	Z04	01–14
Z05	P	Z06	01–15
Z07	P	Z08	01–16
A03	–/	A04	05–7
A05	–/	A06	06–12
A07	–/	A09	04–3
A11		A10	05–17
		A12	05–18
C01	–/	C02	05–5
C03	–/	C04	05–6
C05	–/	C06	06–4
C07	–/	C08	07–17
C09		C10	07–8
C11		C12	07–9
C13		C14	07–10
C15		C16	07–11
D01	–/	D02	07–2
D03	–/	D04	07–3
D05	–/	D06	06–2
D07	–/	D08	08–12
D09		D10	07–20
D11		D12	06–18
D13		D14	06–20
D15		D16	06–2
E03	V–BAT	E04	05–2

VACUUM CIRCUIT BREAKER

O/C & E/F PROTECTION CIRCUIT

QS– V.C.B. AUX. CONTACTS | T77– PROTECTION CT's (CORE 1) | F51– SEL–751 O/C & E/F PROTECTION RELAY

Q– VACUUM CIRCUIT BREAKER | S1– RACKING SWITCH (SHOT BOLT) | X51– MMLG TEST BLOCK – "PROTECTION"

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⌖ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 29/06/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CT CHANGES.

REV.3
DATE 21/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S REQUEST.

REV.4
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.01
REV 4
SHEET 01 NEXT 02
PNL No 3
SCHEMATIC DIA:– INCOMER 1
DRAWN F.M CHK'D
ORDER No. AM8603.1
DATE 29/11/2019 APP'D

ACTOM
MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D11

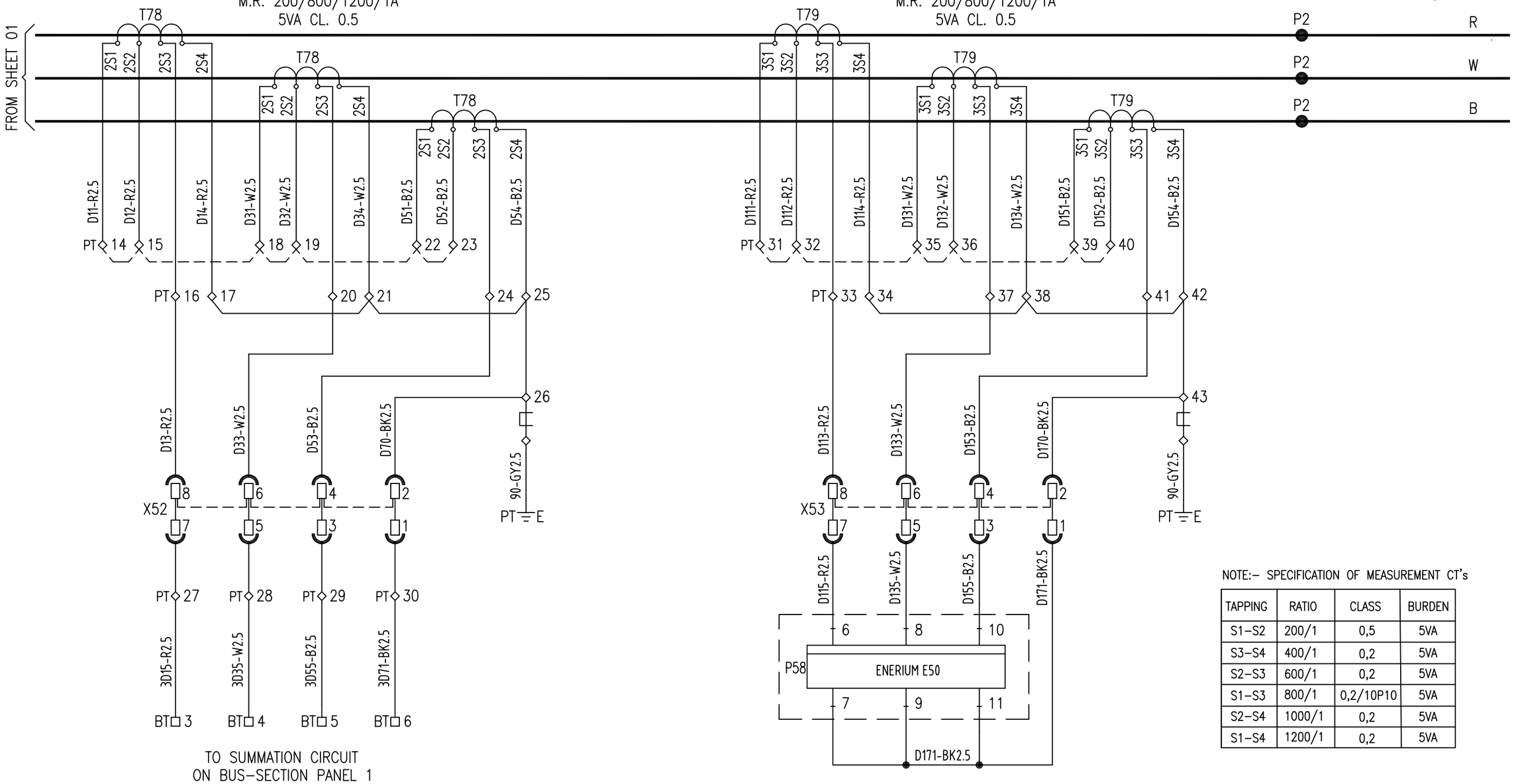
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

CORE 1
METERING C.T.'s
M.R. 200/800/1200/1A
5VA CL. 0.5

CORE 1
INSTRUMENTATION C.T.'s
M.R. 200/800/1200/1A
5VA CL. 0.5

FROM SHEET 01

TO SHEET 03



NOTE:- SPECIFICATION OF MEASUREMENT CT's

TAPPING	RATIO	CLASS	BURDEN
S1-S2	200/1	0,5	5VA
S3-S4	400/1	0,2	5VA
S2-S3	600/1	0,2	5VA
S1-S3	800/1	0,2/10P10	5VA
S2-S4	1000/1	0,2	5VA
S1-S4	1200/1	0,2	5VA

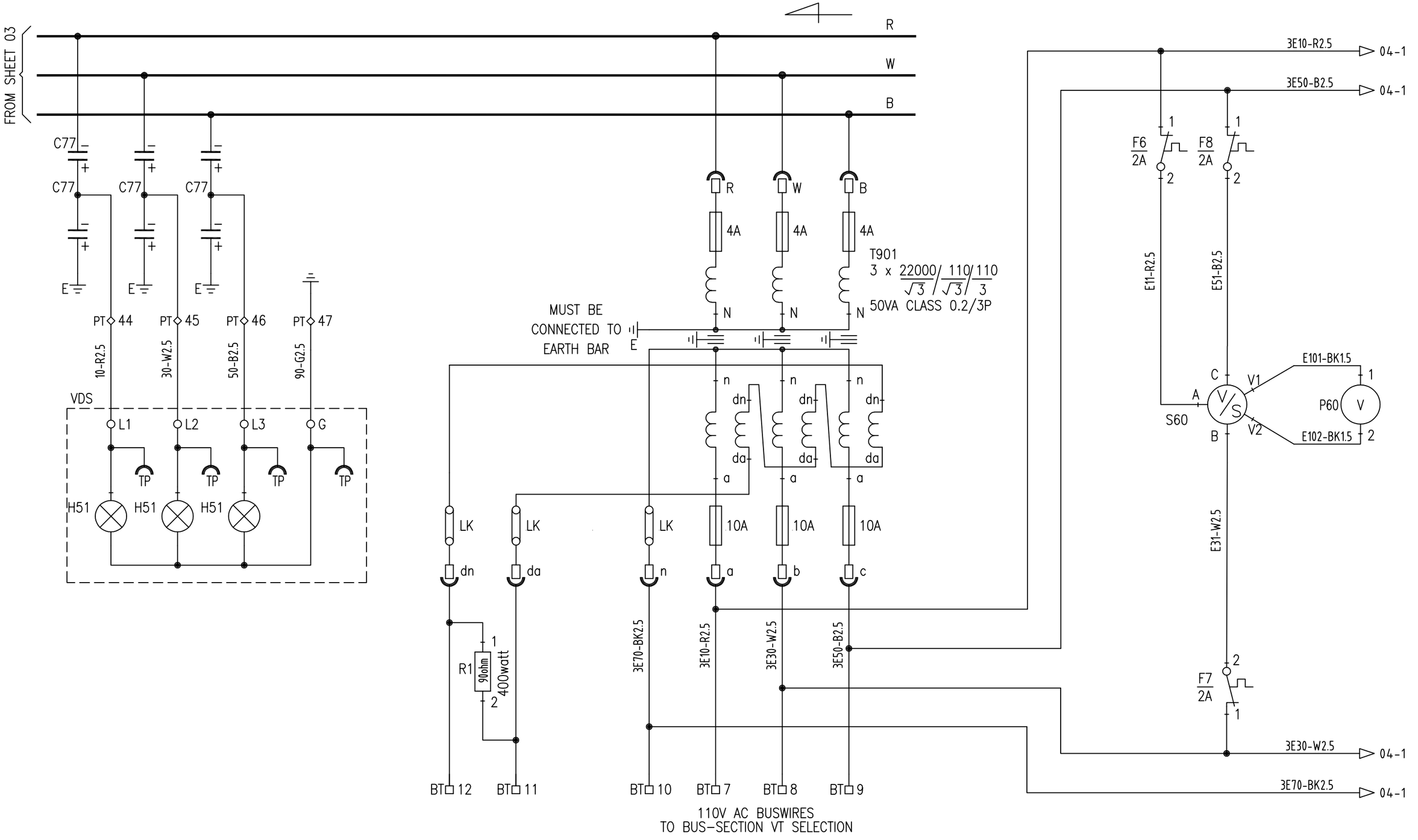
METERING CIRCUIT			INSTRUMENTATION CIRCUIT
T78- METERING CT's (CORE 2)	T79- INSTRUMENTATION CT's (CORE 3)	X52- PK2 4 WAY TEST BLOCK - "METERING"	
X53- PK2 4 WAY TEST BLOCK - "INSTRUMENTATION"	P58- ENERIUM E50 MDI MEASUREMENT CENTER METER		
△-GLAND TERMINALS	⚠-TEST POSITION	□-BUSWIRING TERMINALS	◇-PANEL TERMINALS	⊣⊢-LINKED TERMINALS	⏚-EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1	REV.2	REV.3	REV.4
DATE 29/06/20	DATE 02/09/20	DATE 21/09/20	DATE 06/01/21
DRWN F.M	DRWN F.M	DRWN F.M	DRWN F.M
CHK'D	CHK'D	CHK'D	CHK'D
REVISED.	REVISED AS PER CUSTOMER'S CT CHANGES.	REVISED.	AS TESTED.

DRG No. M.V.8603.1.D1.01	REV 4	SHEET 02	NEXT 03	ACTOM MV SWITCHGEAR
		PNL No 3		
SCHEMATIC DIA:- INCOMER 1		DRAWN F.M	CHK'D	
ORDER No. AM8603.1		DATE 29/11/2019	APP'D	

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D12

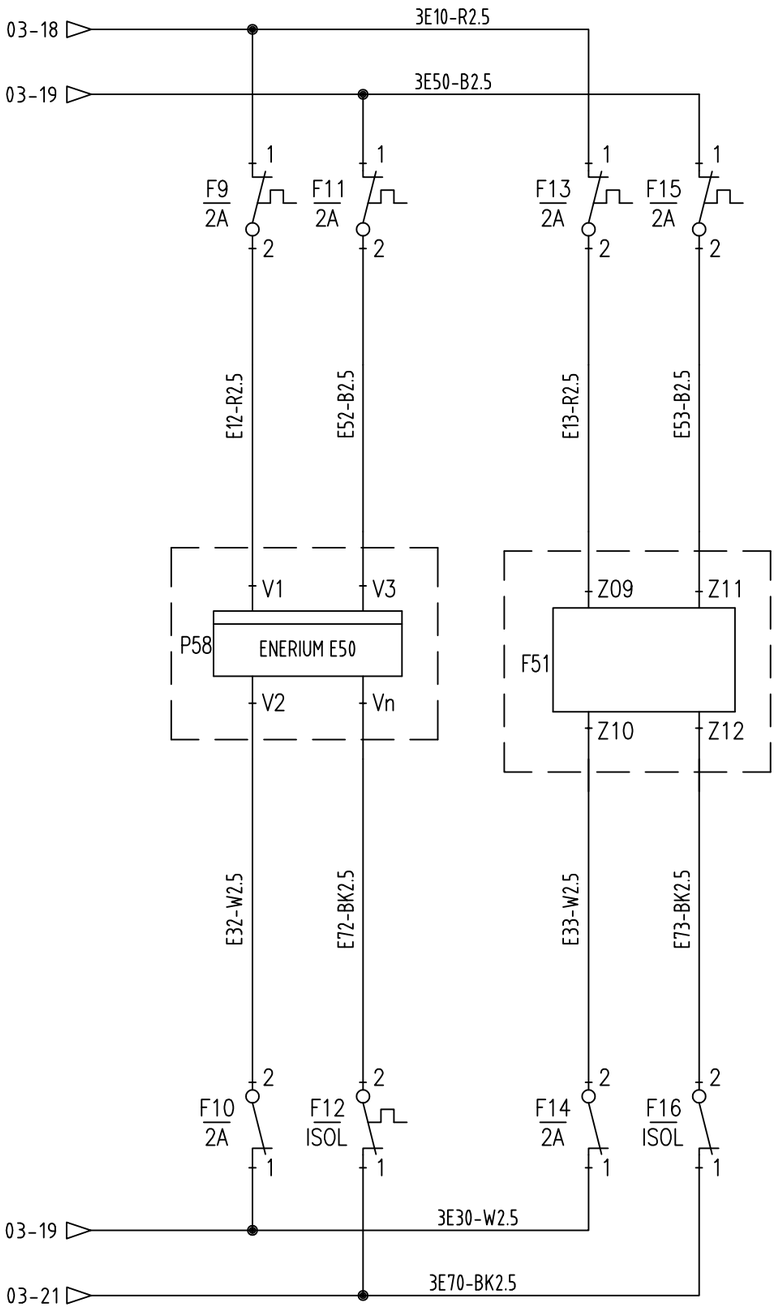


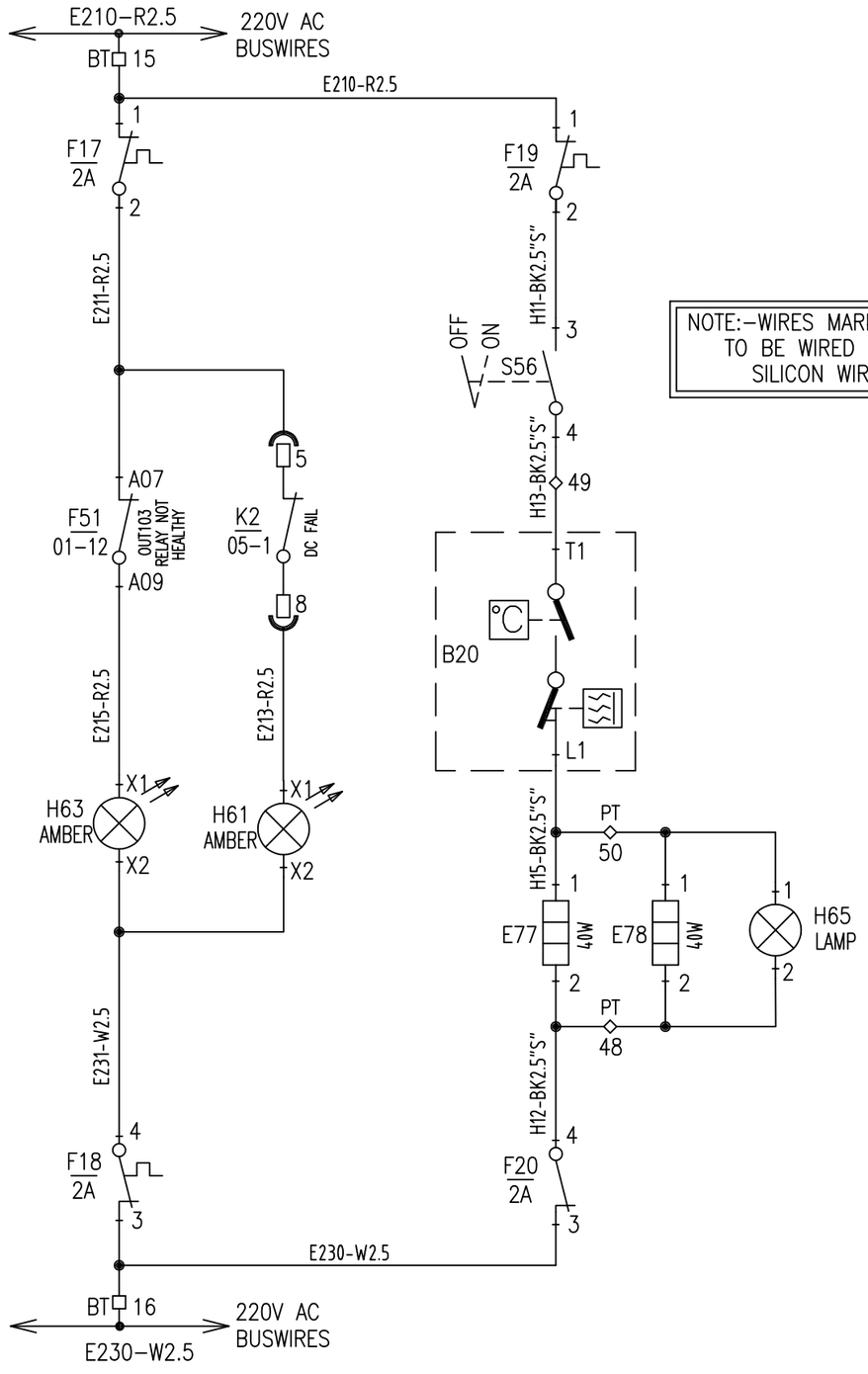
REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.
REV.2
DATE 21/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S REQUEST.
REV.3
DATE 04/11/20
DRWN F.M
CHK'D
VT CHANGED.
REV.4
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

VDS CABLE LIVE CIRCUIT		CABLE VOLTAGE TRANSFORMER CIRCUIT		VOLTMETER CIRCUIT 110V AC
P60– VOLTMETER TYPE Fv96 "BUSBAR VOLTS"	C77– CAPACITOR DIVIDERS	R1– RESISTOR 400W, 90ohms		
T901– CABLE VOLTAGE TRANSFORMER	H51– VDS CABLE LIVE INDICATION	S60– VOLTMETER SELECTOR SWITCH		
△–GLAND TERMINALS	⚠–TEST POSITION	□–BUSWIRING TERMINALS	◇–PANEL TERMINALS	⊣⊢–LINKED TERMINALS	⊕–EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.01	REV 4	SHEET 03	NEXT 04	ACTOM MV SWITCHGEAR
			PNL No 3		
SCHEMATIC DIA:– INCOMER 1			DRAWN F.M	CHK'D	
ORDER No. AM8603.1			DATE 29/11/2019	APP'D	

CAD No 86031D13





NOTE:–WIRES MARKED "S" TO BE WIRED WITH SILICON WIRE

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.
REV.2
DATE 21/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S REQUEST.
REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

110V AC METERING CIRCUIT 110V AC RELAY VT CIRCUIT 220V AC PROTECTION IND. CIRCUIT 220V AC CB HEATER CIRCUIT

F51– SEL–751 O/C & E/F PROTECTION RELAY	S56– HEATER ON/OFF SELECTOR SWITCH	H65– "HEATER HEALTHY" LAMP	E77– CT CHAMBER HEATER	P58– ENERIUM E50 MESUREMENTS METER
H61– "D.C FAIL" AMBER LED	H63– "RELAY NOT HEALTHY" AMBER LED	B20– THERMOSTAT TYPE HONEYWELL T498A1927	E78– BUSBAR CHAMBER HEATER	

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⊕ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.01	REV	3	SHEET 04	NEXT 05
				PNL No	3
SCHEMATIC DIA:– INCOMER 1				DRAWN F.M	CHK'D
ORDER No.	AM8603.1			DATE 29/11/2019	APP'D

ACTOM MV SWITCHGEAR

CAD No 86031D14

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

J1-GY4 (+ve) 110V DC BUSWIRES

BT 1

J1-GY4 ... J1-GY4 ... 06-1

F1 10A

PT 51

×K1-GY2.5

@@@

GT 1 REMOTE TRIP

GT 2

×K3A-GY2.5

F51 01-12 OUT301 OC/EF TRIP — C01 C02

F51 01-12 OUT302 ARC TRIP — C03 C04

F51 01-12 OUT101 CNTRL TRIP — A03 A04

X51 — K1A-GY2.5 — K1B-GY2.5

X57 D — S70 — X57 C

K1 05-3 TRIP RE-INFORCE — K5-GY2.5 — K1 05-3 TRIP RE-INFORCE

L R S53 — B1 B2 — K9-GY2.5

S58 — K11-GY2.5 — L9-GY2.5 07-5

H58 WHITE

F51 T.C.S A11 A10 A12

K13-GY2.5 K15-GY2.5

V4 V3 V1 V2

×K3-GY2.5 K7-GY2.5

P58 POWER SUPPLY 13 14

F51 POWER SUPPLY A01 A02

F51 V-BAT E03 E04

K2 DC FAIL 2 7

K1 1st SHUNT TRIP RE-INFORCE 2 7

J1-GY4 J2-GY4 J2-GY4

K2-GY2.5

X1 X33 — S14 I.E — QS 01-6 — X23 X55 — K

QY1 01-6 — X2 X34

NOTE:
S14 OPENS WHEN INTEGRAL EARTH IS SELECTED.

F1 10A

J2-GY4 BT 2 (−ve) 110V DC BUSWIRES

J2-GY4 ... 06-1

K1			
T1	TYPE	T2	REF
2	P	7	05−3
3	−/	1	05−11
6	−/	8	05−11

K2			
T1	TYPE	T2	REF
2	P	7	05−1
5	−/	8	04−4
3	−/	1	

NOTE:−WIRES MARKED * TO BE PREFIXED WITH PANEL No.

NOTE:−WIRES MARKED @@@ TO BE THE LAST CONNECTION IN THE CIRCUITS

1st SHUNT TRIPPING CIRCUIT 110V DC

QS− V.C.B. AUX. SWITCHES | F51− SEL−751 O/C & E/F PROTECTION RELAY | S70/X57− ITT CANNON STAND−OFF TRIP/CLOSE SOCKET | X51− MMLG TEST BLOCK − "PROTECTION" | K2− D.C FAIL AUX. RELAY TYPE FINDER 60.12

QY1− 110V D.C. SHUNT TRIP COIL | S14− INTERGRAL EARTHING SWITCH | H58/S58− TRIP CIRCUIT HEALTHY PB & LAMP | K1− 1st SHUNT TRIP RE−INFORCE AUX. RELAY TYPE 60.12 | K5− REMOTE TRIP AUX. RELAY TYPE FINDER 60.12

△−GLAND TERMINALS | ⚠−TEST POSITION | □−BUSWIRING TERMINALS | ◇−PANEL TERMINALS | −LINKED TERMINALS | ⊕−EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

S53− LOCAL/REMOTE SELECTOR SWITCH | V1,V2,V3,V4− AVALANCHE BLOCKING DIODE | P58− ENERIUM E50 MESUREMENTS METER

S52− TRIP/NEUTRAL/CLOSE SEL. SWITCH

DRG No.	M.V.8603.1.D1.01	REV	2	SHEET 05	NEXT 06
				PNL No	3
SCHEMATIC DIA:− INCOMER 1				DRAWN F.M	CHK'D
ORDER No.	AM8603.1			DATE 29/11/2019	APP'D

ACTOM MV SWITCHGEAR

CAD No 86031D15

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

05-21 ▷ J1-GY4

F21 2A: 1 → 2 → ×K121-GY2.5 → BT 19

F2 10A: 1 → 2 → ×K41-GY2.5

NOTE:-WIRES MARKED * TO BE PREFIXED WITH PANEL No.

×K41-GY2.5:
- X57 L1 → 3 → S70 → 4 → X57 L2 → K43-GY2.5 → A1
- K3 06-12 (CLOSE RE-INFORCE): 3 → 1 → K45-GY2.5 → 6 → K3 06-12 (CLOSE RE-INFORCE) → 8 → K47-GY2.5
- K6 08-4 (REMOTE CLOSE): 3 → 1
- GT 5 → REMOTE CLOSE → GT 6
- F52 01-12 (OUT102 CNTRL CLOSE): A05 → A06

BT 20 → ×K123-GY2.5 → D15 → F51 LIGHT SIGNAL IN404 → D16 → K122-GY2.5 → 4 → F21 2A → 3 → 05-21 ▷ J2-GY4

L / R S53: A1 → 1 → K49-GY2.5 → C05 → F51 01-12 (OUT303 CLOSE BLOCK) → C06 → K51-GY2.5

K51-GY2.5 → PT 54 → X3 X35 → 11

V14 (+ / −) on K43-GY2.5

K47-GY2.5 → A2

13 → 1 → 7 K11 2 → 4 → 12 → 2 → 3 S11 1 → 6 → 11

15 → 8 → 16

QS 01-6: A → 1 → 14 → 1 → QY2 → 2

×K53-GY2.5 → 2 K3 CLOSE RE-INFORCE 7 → X4 X36 → K42-GY2.5 → 4 → F2 10A → 3

F3 2A: 1 → 2 → M1-GY2.5 → X37 X5

M3-GY2.5: X8 X40 → 24 → 2 3 S12 1 → 21 → 22 → M → 23 → X38 X6

K7 SPRING CHARGED: 2 → 7

M2-GY2.5 → 4 → F3 2A → 3

F22 2A: 1 → 2 → P1-GY2.5 → BT 21 ↔ P1-GY2.5 BREAKER FAIL/BLOCKING BUSWIRES

P3-GY2.5 → BT 22 ↔ P3-GY2.5 BREAKER FAIL BUSWIRES → D11 → F51 CB FAIL IN402 → D12

P5-GY2.5 → BT 23 ↔ P5-GY2.5 BLOCKING BUSWIRES → D13 → F51 BLOCKING IN403 → D14

P2-GY2.5 → 4 → F22 2A → 3

J1-GY4 ▷ 07-1

J2-GY4 ▷ 07-1

K7			
T1	TYPE	T2	REF
2	P	7	06-17
3	—/—	1	07-5
6	—/—	8	08-9

K3			
T1	TYPE	T2	REF
2	P	7	06-12
3	—/—	1	06-6
6	—/—	8	06-6

REV.1	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED AS PER CUSTOMER'S CHANGES.	

REV.2	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED AS PER CUSTOMER'S REQUEST.	

REV.3	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED AS PER CUSTOMER'S REQUEST.	

REV.4	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

LIGHT TRANSFER 110V DC | CLOSING CIRCUIT 110V DC | MOTOR CIRCUIT 110V DC | CB FAIL\BLOCKING CIRCUIT 110V DC

QS- V.C.B. AUX SWITCH | K3- CLOSE RE-INFORCE RELAY TYPE FINDER 60.12 | QY2- 110V DC CLOSING COIL | S11/S12- SPRING CHARGE MICRO SWITCHES | S52 - TRIP/NEUTRAL/CLOSE SEL. SWITCH | K7- SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

X57,S70- ITT CANNON STAND-OFF TRIP/CLOSE SOCKET | F51- SEL 751 O/C & E/F PROTECTION RELAY | S53 - LOCAL/REMOTE SEL. SWITCH | K11- ANTI PUMPING RELAY | K6- REMOTE CLOSE AUX. RELAY TYPE FINDER 60.12

△ -GLAND TERMINALS | ⚠ -TEST POSITION | □ -BUSWIRING TERMINALS | ◇-PANEL TERMINALS | -LINKED TERMINALS | ⌖ -EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.01	REV	4	SHEET 06 NEXT 07
				PNL No 3
SCHEMATIC DIA:- INCOMER 1				DRAWN F.M CHK'D
ORDER No.	AM8603.1			DATE 29/11/2019 APP'D

ACTOM MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D16

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

06-21 ▷ J1-GY4

F4 2A: 1 → 2

NOTE:-WIRES MARKED × TO BE PREFIXED WITH PANEL No.

PT 56 L1-GY2.5

L1-GY2.5 → DO1 F51 01-12 OUT401 FAULT TRIP → DO2

L1-GY2.5 → DO3 F51 01-12 OUT402 CB FAIL → DO4

X7 SERVICE → L11-GY2.5 → X8 → X21 (36) → 3 S17 I.E. 1 → X22 (37) → L7-GY2.5 ◇57

K7 06-17 SPRING CHARGED: 3 → 1

L9-GY2.5 ◇05-16

LAMP TEST BUSWIRES BT 22

X41 X9 C (51) QS 01-6 (52) 3 X10 X42

X43 X11 D (53) QS 01-6 (54) 4 X12 X44

X43 SERVICE X44 → L19-GY2.5 → PT ◇60

X31 (31) 3 S16 I.E. 1 (32) X32 → L21-GY2.5 → PT ◇61

L3-GY2.5 L5-GY2.5 L13-GY2.5 L15-GY2.5 L17-GY2.5

PT ◇58 PT ◇59

V8 V9 V10 V11 V12 V13

H56 AMBER X1 X2

H59 WHITE X1 X2

H55 RED X1 X2

H57 AMBER X1 X2

H52 WHITE X1 X2

H54 GREEN X1 X2

L2-GY2.5

PT 55 L2-GY2.5

F51 IN401 T.C.S → D09 → D10

F51	C09	C11	C13	C15
	V.C.B OPEN IN301	V.C.B CLOSED IN302	V.C.B IN SERVICE POSITION IN303	CABLE EARTHED IN304
	C10	C12	C14	C16

×K111-GY2.5

F5 10A: 1 → 2 ×K111-GY2.5 → GT 3 REMOTE TRIP

PT ◇62

X51 5 → K111A-GY2.5 → 6 C07 F51 01-12 OUT304 OC/EF TRIP C08 → K111B-GY2.5 → 8 X51 7

K4 07-14 TRIP RE-INFORCE: 3 → 1 → K115-GY2.5 → 6 → 8

@@@ → D09 → D10 → @@@ → K117-GY2.5 → V5 → V6 → K119-GY2.5

GT 4 ×K113A-GY2.5 → V7

PT ◇63 K113-GY2.5

@@ PT ◇64

×K113A-GY2.5 → 2 K4 2nd SHUNT TRIP RE-INFORCE 7

K113-GY2.5 → X59 X27

S15 I.E.: 3 → 1, 2 → 6

QS 01-6: M → 12 → 7 → 1 QY7 2 → 8 X60 X28

QS 01-6: 7 → 11

X57 X25 67 L

K112-GY2.5

F5 10A: 4 → 3

K4			
T1	TYPE	T2	REF
2	P	7	07-14
3	–⁄–	1	07-19
6	–⁄–	8	07-19

F4 2A: 4 → 3

06-21 ▷ J2-GY4

INDICATION CIRCUIT 110V DC

2nd SHUNT TRIPPING CIRCUIT 110V DC

QS– V.C.B. AUX SWITCH | F51– SEL 751 O/C & E/F PROTECTION RELAY | H54– GREEN LED LAMP–"V.C.B. OPEN" | H55– RED LED LAMP–"V.C.B. CLOSED" | H56– AMBER LED –"FAULT TRIP" | QY7– 110V D.C. SHUNT TRIP COIL

H59– WHITE LED LAMP–"V.C.B. CABLE EARTHED" | X51– MMLG TEST BLOCK – "PROTECTION" | K4– 2nd SHUNT TRIP RE-INFORCE AUX. RELAY TYPE FINDER 60.12 | S16,S17– INTERGRAL EARTHING SWITCH | V5–V13 – AVALANCHE BLOCKING DIODE

△ –GLAND TERMINALS | ⧋ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⊕ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

H57– AMBER LED LAMP–"CB FAIL" | H52– WHITE LED LAMP–"SPRING CHARGED" | K7– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 04/11/20
DRWN F.M
CHK'D
SPRING CHARGED LED ADDED.

REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.01 REV 3

SHEET 07 NEXT 08

PNL No 3

SCHEMATIC DIA:– INCOMER 1

ORDER No. AM8603.1

DRAWN F.M CHK'D

DATE 29/11/2019 APP'D

ACTOM MV SWITCHGEAR

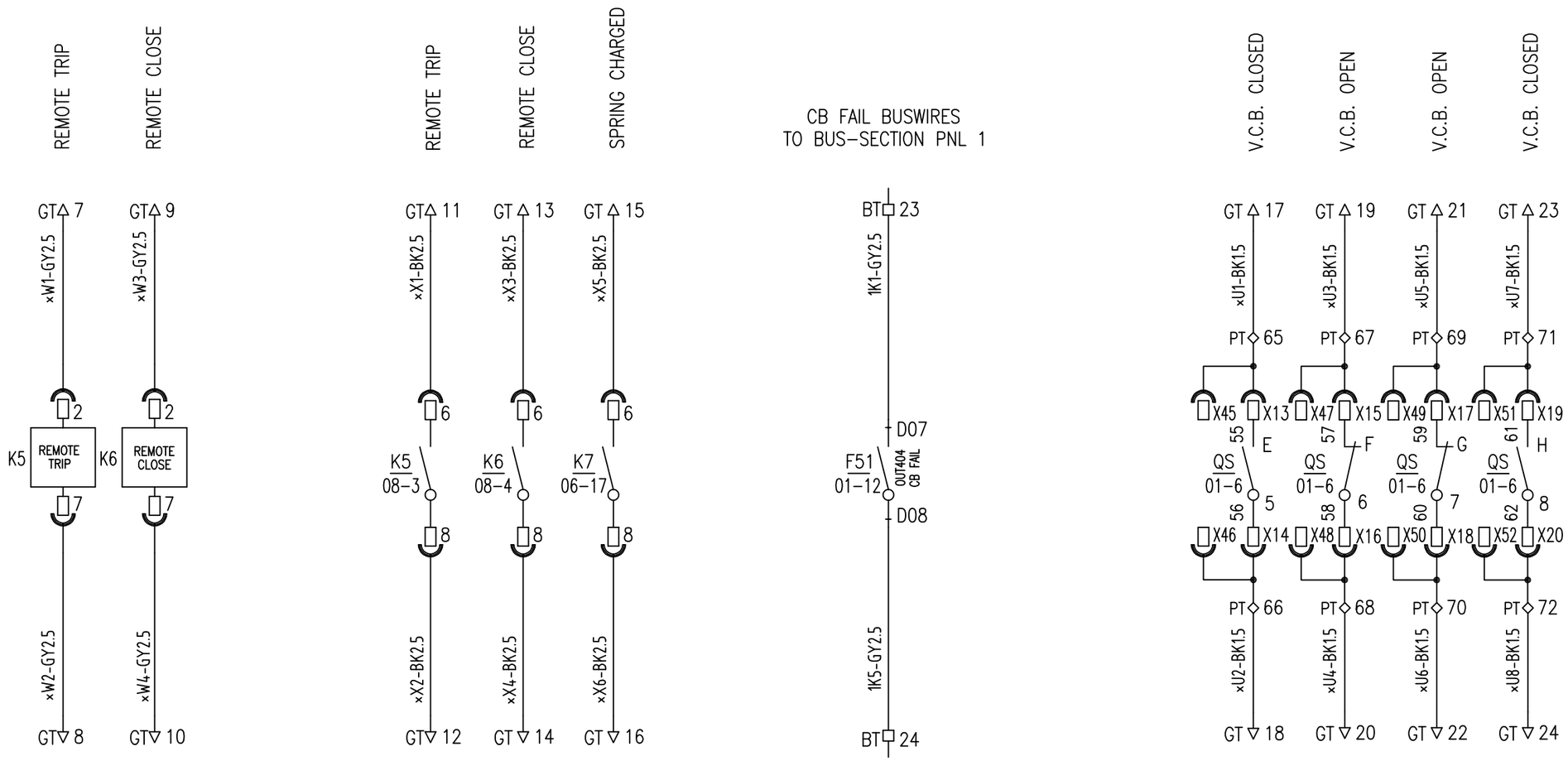
0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D17

K5			
T1	TYPE	T2	REF
2	P	7	08–3
3	–/–	1	05–14
6	–/–	8	08–7

K6			
T1	TYPE	T2	REF
2	P	7	08–4
3	–/–	1	06–7
6	–/–	8	08–8

NOTE:–WIRES MARKED * TO BE PREFIXED WITH PANEL No.



24V DC REMOTE CIRCUITS		ALARM CIRCUITS	CB FAIL CIRCUITS	SPARE V.C.B. AUX. CONTACTS
QS– V.C.B. AUX. SWITCHES	K2– D.C FAIL AUX. RELAY TYPE FINDER 60.12	F51– SEL–751 O/C & E/F PROTECTION RELAY		
K5– REMOTE TRIP AUX. RELAY TYPE FINDER 60.12	K6– REMOTE CLOSE AUX. RELAY TYPE FINDER 60.12	K7– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12		
△ –GLAND TERMINALS	⚠–TEST POSITION	□ –BUSWIRING TERMINALS	◇–PANEL TERMINALS	⊣⊢ –LINKED TERMINALS	⌖ –EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.01 REV 2

SCHEMATIC DIA:– INCOMER 1

ORDER No. AM8603.1

SHEET 08	NEXT ––		
PNL No	3		
DRAWN	F.M	CHK'D	
DATE	29/11/2019	APP'D	

ACTOM MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D18

522 4567

1250A BUSBARS R W B

1250A Q

P1 P1 P1

CORE 1 PROTECTION C.T.'s M.R. 200/800/1200/1A CLASS PX

T77 T77 T77

1S1 1S2 1S3 1S4

R W B

TO SHEET 02

C11-R2.5 C12-R2.5 C14-R2.5 C31-W2.5 C32-W2.5 C34-W2.5 C51-B2.5 C52-B2.5 C54-B2.5

PT 1 2 5 6 9 10

PT 3 4 7 8 11 12

C13-R2.5 C33-W2.5 C53-B2.5 C70-BK2.5

13

90-GY2.5

PT E

X51 21 22 23 24 25 26 27 28

C15-R2.5 C35-W2.5 C55-B2.5 C71-BK2.5

Z01 Z03 Z05 Z08

F51 IA IB IC IN

Z02 Z04 Z06 Z07

C72-BK2.5

NOTE:– SPECIFICATION OF PROTECTIVE CT's

TAPPING	RATIO	CLASS	MIN Vk	Max Ie	Max R at 75 °C
S1–S2	1/200T	PX	83,3V	300mA	1 Ohm
S3–S4	1/400T	PX	167V	150mA	2 Ohms
S2–S3	1/600T	PX	250V	100mA	3 Ohms
S1–S3	1/800T	PX	333V	75mA	4 Ohms
S2–S4	1/1000T	PX	417V	60mA	5 Ohms
S1–S4	1/1200T	PX	500V	50mA	6 Ohms

12 M 07–17
11 L 07–18
10 K 05–8
9 J
8 H 08–19
7 G 08–18
6 F 08–17
5 E 08–16
4 D 07–9
3 C 07–8
2 B 05–7
1 QS A 06–11

S1
1B 3B 07–4 2B
1A 3A 07–10 2A

F51			
T1	TYPE	T2	REF
Z01	P	Z02	01–13
Z03	P	Z04	01–14
Z05	P	Z06	01–15
Z07	P	Z08	01–16
A03	–⌒–	A04	05–7
A05	–⌒–	A06	06–12
A07	–⌒–	A09	04–3
A11		A10	05–17
		A12	05–18
C01	–⌒–	C02	05–5
C03	–⌒–	C04	05–6
C05	–⌒–	C06	06–4
C07	–⌒–	C08	07–17
C09		C10	07–8
C11		C12	07–9
C13		C14	07–10
C15		C16	07–11
D01	–⌒–	D02	07–2
D03	–⌒–	D04	07–3
D05	–⌒–	D06	06–2
D07	–⌒–	D08	08–12
D09		D10	07–20
D11		D12	06–18
D13		D14	06–20
D15		D16	06–2
E03	V–BAT	E04	05–2

VACUUM CIRCUIT BREAKER

O/C & E/F PROTECTION CIRCUIT

QS– V.C.B. AUX. CONTACTS | T77– PROTECTION CT's (CORE 1) | F51– SEL–751 O/C & E/F PROTECTION RELAY

Q– VACUUM CIRCUIT BREAKER | S1– RACKING SWITCH (SHOT BOLT) | X51– MMLG TEST BLOCK – "PROTECTION"

△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⫩–LINKED TERMINALS | ⌖–EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 29/06/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CT CHANGES.

REV.3
DATE 21/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S REQUEST.

REV.4
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.02 | REV 4 | SHEET 01 NEXT 02 | PNL No 2

SCHEMATIC DIA:– INCOMER 2 | DRAWN F.M | CHK'D

ORDER No. AM8603.1 | DATE 29/11/2019 | APP'D

ACTOM MV SWITCHGEAR

CAD No 86031D21

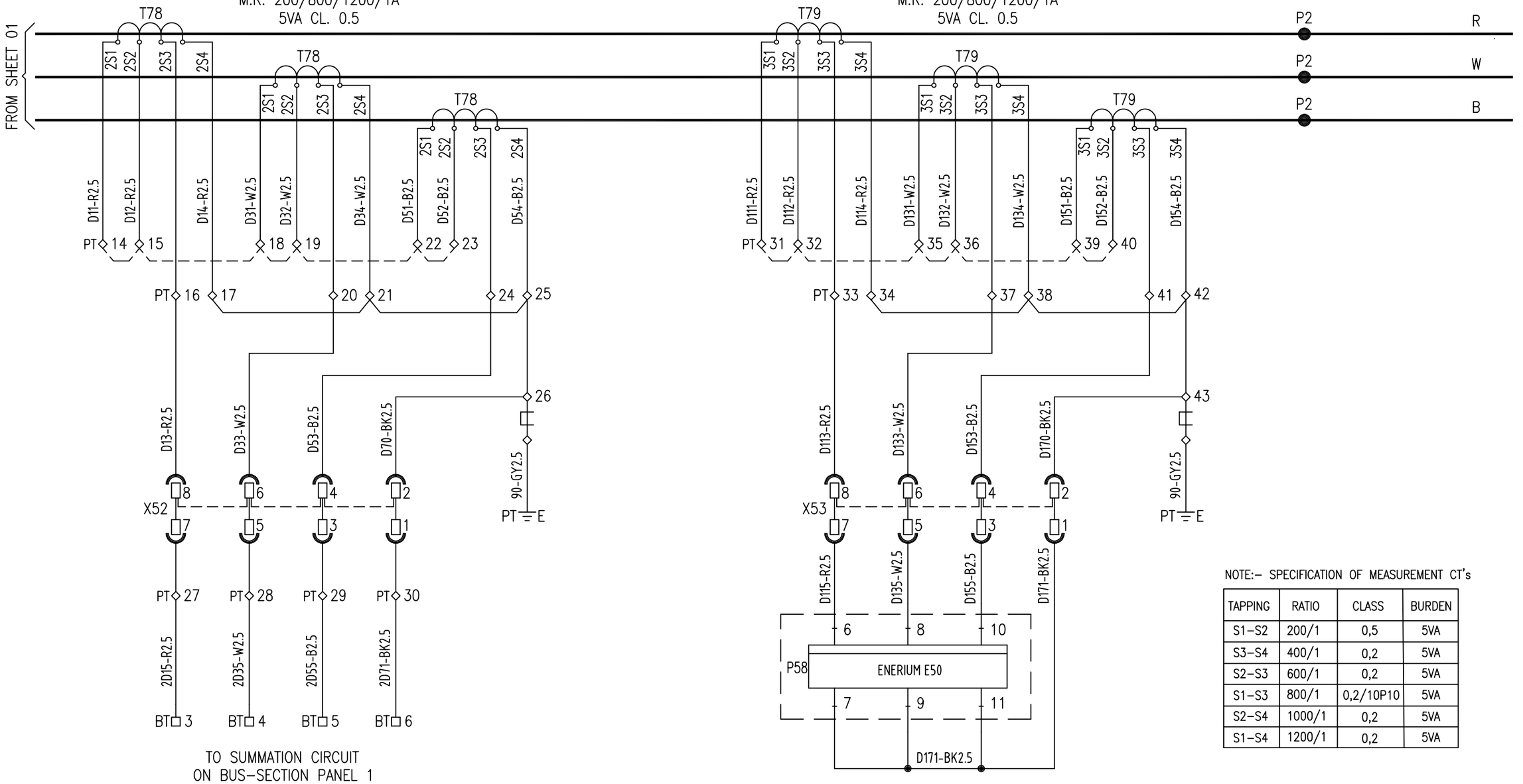
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

CORE 1
METERING C.T.'s
M.R. 200/800/1200/1A
5VA CL. 0.5

CORE 1
INSTRUMENTATION C.T.'s
M.R. 200/800/1200/1A
5VA CL. 0.5

FROM SHEET 01

TO SHEET 03



TO SUMMATION CIRCUIT
ON BUS-SECTION PANEL 1

NOTE:- SPECIFICATION OF MEASUREMENT CT's

TAPPING	RATIO	CLASS	BURDEN
S1-S2	200/1	0,5	5VA
S3-S4	400/1	0,2	5VA
S2-S3	600/1	0,2	5VA
S1-S3	800/1	0,2/10P10	5VA
S2-S4	1000/1	0,2	5VA
S1-S4	1200/1	0,2	5VA

METERING CIRCUIT | INSTRUMENTATION CIRCUIT

T78- METERING CT's (CORE 2) | T79- INSTRUMENTATION CT's (CORE 3) | X52- PK2 4 WAY TEST BLOCK - "METERING"

X53- PK2 4 WAY TEST BLOCK - "INSTRUMENTATION" | P58- ENERIUM E50 MDI MEASUREMENT CENTER METER

△-GLAND TERMINALS | ⚠-TEST POSITION | □-BUSWIRING TERMINALS | ◇-PANEL TERMINALS | -LINKED TERMINALS | -EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 29/06/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CT CHANGES.

REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.02 | REV 3

SHEET 01 NEXT 02

PNL No 2

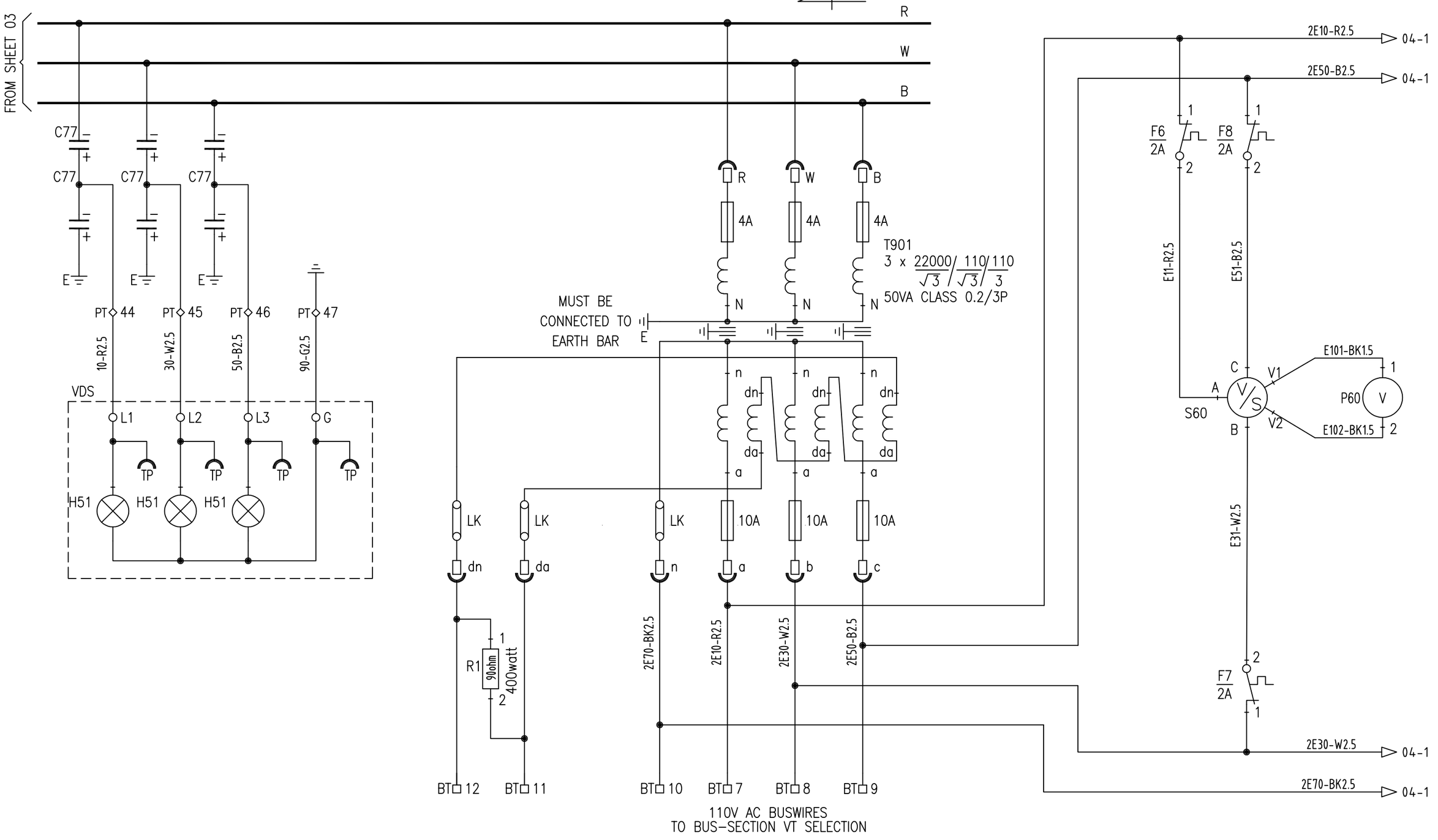
SCHEMATIC DIA:- INCOMER 2 | DRAWN F.M | CHK'D

ORDER No. AM8603.1 | DATE 29/11/2019 | APP'D

ACTOM
MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D22



REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.
REV.2
DATE 21/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S REQUEST.
REV.3
DATE 04/11/20
DRWN F.M
CHK'D
VT CHANGED.
REV.4
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

VDS CABLE LIVE CIRCUIT | CABLE VOLTAGE TRANSFORMER CIRCUIT | VOLTMETER CIRCUIT 110V AC

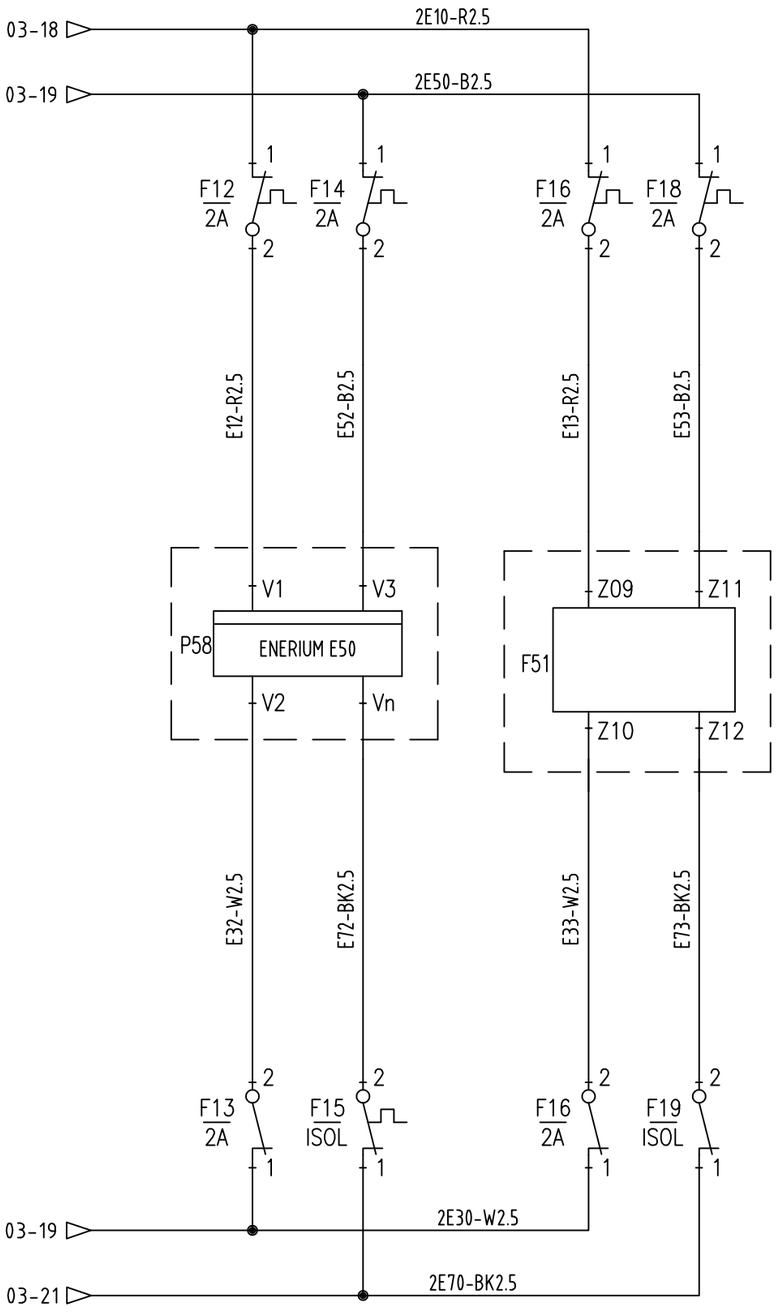
P60– VOLTMETER TYPE Fv96 "BUSBAR VOLTS" | C77– CAPACITOR DIVIDERS | R1– RESISTOR 400W, 90ohms

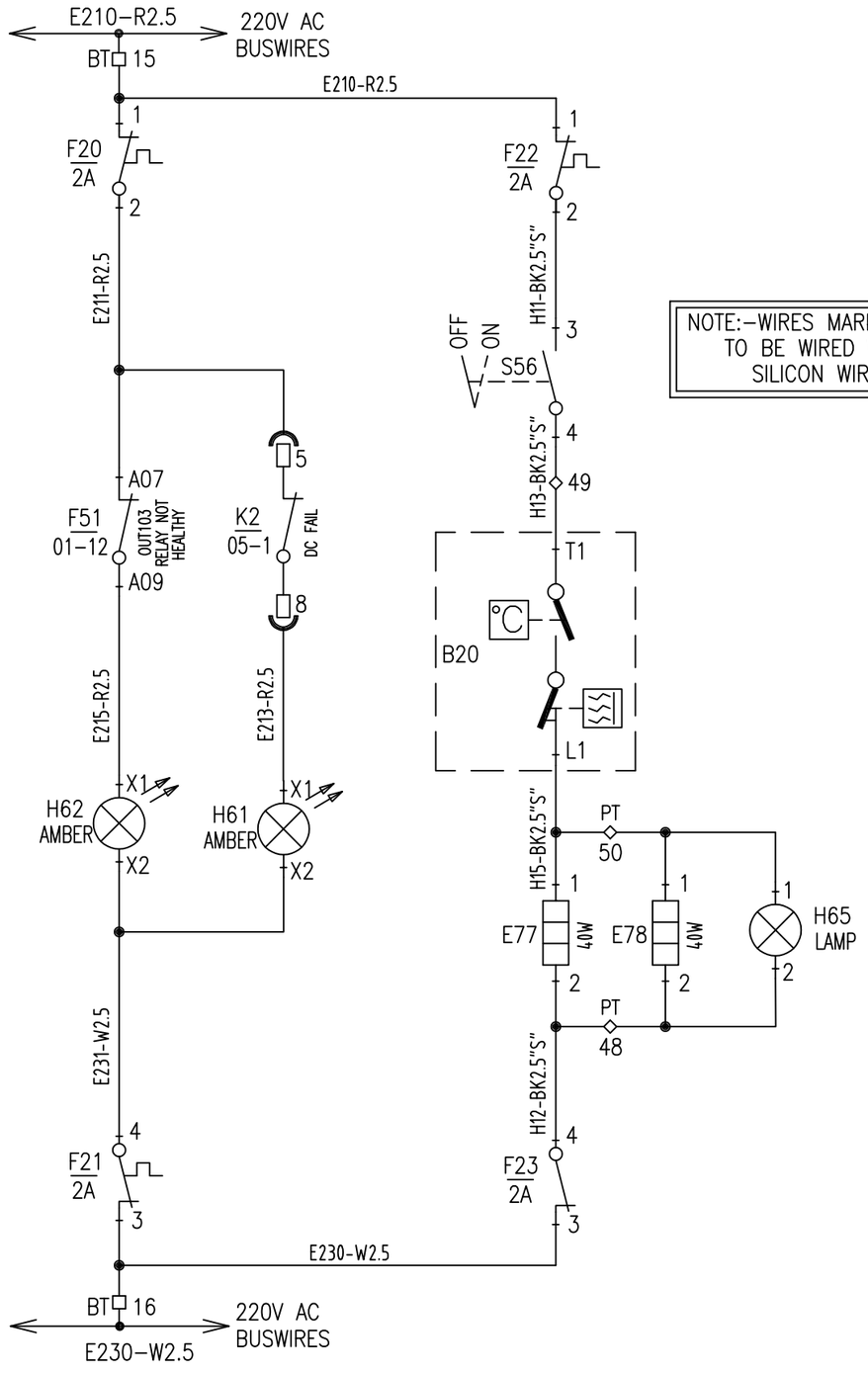
T901– CABLE VOLTAGE TRANSFORMER | H51– VDS CABLE LIVE INDICATION | S60– VOLTMETER SELECTOR SWITCH

△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢–LINKED TERMINALS | ⊕–EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No. M.V.8603.1.D1.02	REV 4	SHEET 03	NEXT 04	ACTOM MV SWITCHGEAR
		PNL No 2		
SCHEMATIC DIA:– INCOMER 2		DRAWN F.M	CHK'D	
ORDER No. AM8603.1		DATE 29/11/2019	APP'D	

CAD No 86031D23





NOTE:–WIRES MARKED "S" TO BE WIRED WITH SILICON WIRE

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.
REV.2
DATE 21/09/20
DRWN F.M
CHK'D
REVISED
REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

110V AC METERING CIRCUIT 110V AC RELAY VT CIRCUIT 220V AC PROTECTION IND. CIRCUIT 220V AC CB HEATER CIRCUIT

F51– SEL–751 O/C & E/F PROTECTION RELAY	S56– HEATER ON/OFF SELECTOR SWITCH	H65– "HEATER HEALTHY" LAMP	E77– CT CHAMBER HEATER	P58– ENERIUM E50 MESUREMENTS METER
H61– "D.C FAIL" AMBER LED	H62– "RELAY NOT HEALTHY" AMBER LED	B20– THERMOSTAT TYPE HONEYWELL T498A1927	E78– BUSBAR CHAMBER HEATER	

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⊕ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.02	REV 3	SHEET 04	NEXT 05	ACTOM MV SWITCHGEAR
			PNL No 2		
SCHEMATIC DIA:– INCOMER 2			DRAWN F.M	CHK'D	
ORDER No. AM8603.1			DATE 29/11/2019	APP'D	

CAD No 86031D24

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

J1-GY4 (+ve) 110V DC BUSWIRES

BT 1

J1-GY4 → 06-1

F1 10A

PT 51

×K1-GY2.5

@@@

GT 1 REMOTE TRIP

GT 2

×K3A-GY2.5

F51 01-12 OUT301 OC/EF TRIP — C01 C02

F51 01-12 OUT302 ARC TRIP — C03 C04

F51 01-12 OUT101 CNTRL TRIP — A03 A04

X51 — K1A-GY2.5 — K1B-GY2.5

X57 D — S70 — X57 C

K1 05-3 TRIP RE-INFORCE — K5-GY2.5 — K1 05-3 TRIP RE-INFORCE

L R S53 — B1 B2 — K9-GY2.5

K5 08-2 REMOTE TRIP

S58 — K11-GY2.5 — L9-GY2.5 — 07-5

H58 WHITE

V4

F51 T.C.S A11 A10 A12

K13-GY2.5 K15-GY2.5

E03 F51 V-BAT E04

V3

PT 52 ×K3-GY2.5

PT 53 @@ K7-GY2.5

V1 V2

×K3-GY2.5

P58 POWER SUPPLY 13 14

F51 POWER SUPPLY A01 A02

K2 DC FAIL 2 7

K1 1st SHUNT TRIP RE-INFORCE 2 7

J2-GY4 J1-GY4 J2-GY4

K2-GY2.5

X1 X33 X23 X55 X2 X34

S14 I.E

QS 01-6

QY1 01-6

NOTE:
S14 OPENS WHEN INTEGRAL EARTH IS SELECTED.

K1			
T1	TYPE	T2	REF
2	P	7	05-3
3	–/–	1	05-11
6	–/–	8	05-11

K2			
T1	TYPE	T2	REF
2	P	7	05-1
5	–/–	8	04-4
3	–/–	1	

NOTE:–WIRES MARKED * TO BE PREFIXED WITH PANEL No.

NOTE:–WIRES MARKED @@@ TO BE THE LAST CONNECTION IN THE CIRCUITS

F1 10A

J2-GY4 BT 2 (–ve) 110V DC BUSWIRES

J2-GY4 → 06-1

1st SHUNT TRIPPING CIRCUIT 110V DC

QS– V.C.B. AUX. SWITCHES	F51– SEL–751 O/C & E/F PROTECTION RELAY	S70/X57– ITT CANNON STAND–OFF TRIP/CLOSE SOCKET	X51– MMLG TEST BLOCK – "PROTECTION"	K2– D.C FAIL AUX. RELAY TYPE FINDER 60.12		
QY1– 110V D.C. SHUNT TRIP COIL	S14– INTERGRAL EARTHING SWITCH	H58/S58– TRIP CIRCUIT HEALTHY PB & LAMP	K1– 1st SHUNT TRIP RE–INFORCE AUX. RELAY TYPE 60.12	K5– REMOTE TRIP AUX. RELAY TYPE FINDER 60.12		
△ –GLAND TERMINALS	⚠–TEST POSITION	□ –BUSWIRING TERMINALS	◇–PANEL TERMINALS	⊣⊢ –LINKED TERMINALS	⊕ –EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR
S53– LOCAL/REMOTE SELECTOR SWITCH	V1,V2,V3,V4– AVALANCHE BLOCKING DIODE	P58– ENERIUM E50 MESUREMENTS METER				
S52– TRIP/NEUTRAL/CLOSE SEL. SWITCH						

DRG No.	M.V.8603.1.D1.02	REV 2	SHEET 05	NEXT 06	
			PNL No 2		
SCHEMATIC DIA:– INCOMER 2			DRAWN	F.M	CHK'D
ORDER No.	AM8603.1		DATE	29/11/2019	APP'D

ACTOM MV SWITCHGEAR

CAD No 86031D25

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

05-21 ▷ J1-GY4 ▷ 07-1

F21 2A — 1 — 2 — ×K121-GY2.5 — BT 17

F2 10A — 1 — 2 — ×K41-GY2.5

NOTE:-WIRES MARKED * TO BE PREFIXED WITH PANEL No.

X57 L1 — 3 — S70 — 4 — X57 L2 — K43-GY2.5 — A1

K3 06-12 CLOSE RE-INFORCE — 3 / 1 — K45-GY2.5 — 6 — K3 06-12 CLOSE RE-INFORCE — 8 — K47-GY2.5

K6 08-4 REMOTE CLOSE — 3 / 1

GT 5 — REMOTE CLOSE — GT 6

F52 01-12 OUT102 CNTRL CLOSE — A05 / A06

BT 18 — ×K123-GY2.5 — D15

F51 LIGHT SIGNAL IN404 — D16 — K122-GY2.5 — 4 — F21 2A — 3 — J2-GY4 ▷ 05-21

L R S53 — A1 / A2 — 1 — K49-GY2.5 — C05 — F51 01-12 OUT303 CLOSE BLOCK — C06 — K51-GY2.5

K51-GY2.5 — PT 54 — X3 X35 — 11

13 — 1 — K11 — 7 — 4 — 15 — 2 — 3 — 8 — 12 — S11 — 1 — 6

QS 01-6 — A — 1 — 14 — 1 — QY2 — 2 — 16

K3 CLOSE RE-INFORCE — 2 / 7 — ×K53-GY2.5

X4 X36 — K42-GY2.5 — F2 10A — 4 — 3

F3 2A — 1 — 2 — M1-GY2.5 — X37 X5

M3-GY2.5 — X8 X40 — 24 — 2 — 3 — S12 — 1 — 21 — 22

M — K7 SPRING CHARGED — 2 / 7 — 23 — X38 X6 — M2-GY2.5 — F3 2A — 4 — 3

F22 2A — 1 — 2 — P1-GY2.5 — BT 19 — P1-GY2.5 — BREAKER FAIL/BLOCKING BUSWIRES

P3-GY2.5 — BREAKER FAIL BUSWIRES — BT 20 — P3-GY2.5 — D11 — F51 CB FAIL IN402 — D12 — P2-GY2.5 — 4 — F22 2A — 3 — J2-GY4 ▷ 07-1

P5-GY2.5 — BLOCKING BUSWIRES — BT 21 — P5-GY2.5 — D13 — F51 BLOCKING IN403 — D14

K7			
T1	TYPE	T2	REF
2	P	7	06-17
3	—/	1	07-5
6	—/	8	08-9

K3			
T1	TYPE	T2	REF
2	P	7	06-12
3	—/	1	06-6
6	—/	8	06-6

REV.1	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED AS PER CUSTOMER'S CHANGES.	

REV.2	
DATE	21/09/20
DRWN	F.M
CHK'D	
REVISED	

REV.3	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED AS PER CUSTOMER'S REQUEST.	

REV.4	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

LIGHT TRANSFER 110V DC | CLOSING CIRCUIT 110V DC | MOTOR CIRCUIT 110V DC | CB FAIL\BLOCKING CIRCUIT 110V DC

QS- V.C.B. AUX SWITCH | K3- CLOSE RE-INFORCE RELAY TYPE FINDER 60.12 | QY2- 110V DC CLOSING COIL | S11/S12- SPRING CHARGE MICRO SWITCHES | S52 - TRIP/NEUTRAL/CLOSE SEL. SWITCH | K7- SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

X57,S70- ITT CANNON STAND-OFF TRIP/CLOSE SOCKET | F51- SEL 751 O/C & E/F PROTECTION RELAY | S53 - LOCAL/REMOTE SEL. SWITCH | K11- ANTI PUMPING RELAY | K6- REMOTE CLOSE AUX. RELAY TYPE FINDER 60.12

△ -GLAND TERMINALS | ⚠ -TEST POSITION | □ -BUSWIRING TERMINALS | ◇-PANEL TERMINALS | ⊣⊢ -LINKED TERMINALS | ⊕ -EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No. M.V.8603.1.D1.02 | REV 4 | SHEET 06 NEXT 07 | PNL No 2

SCHEMATIC DIA:- INCOMER 2 | DRAWN F.M | CHK'D

ORDER No. AM8603.1 | DATE 29/11/2019 | APP'D

ACTOM MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D26

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

06-21 ▷ J1-GY4

F4 2A: 1 → 2

PT 56 — L1-GY2.5

NOTE:-WIRES MARKED × TO BE PREFIXED WITH PANEL No.

L1-GY2.5: DO1, DO3

F51 01-12 OUT401 FAULT TRIP: DO1 → DO2

F51 01-12 OUT402 CB FAIL: DO3 → DO4

SERVICE: X7, X8

L11-GY2.5: X8 → X21 (36) → 3 → S17 I.E. → 1 → X22 (37) → L7-GY2.5 ◇57

K7 06-17 SPRING CHARGED: 3 → 1

L13-GY2.5

05-16 — L9-GY2.5

LAMP TEST BUSWIRES: BT 22

QS 01-6: X41, X9 (51, C), X43, X11 (53, D); 52 → 3 → X42, X10; 54 → 4 → X44, X12

SERVICE: X29, X30

X31 → 31 → 3 → S16 I.E. → 1 → 32 → X32

L15-GY2.5 → PT ◇58

L17-GY2.5 → PT ◇59

L19-GY2.5 → PT ◇60

L21-GY2.5 → PT ◇61

V8 V9 V10 V11 V12 V13

H56 AMBER, H59 WHITE, H55 RED, H57 AMBER, H52 WHITE, H54 GREEN — X1 / X2

F51: C09 V.C.B OPEN IN301 — C11 V.C.B CLOSED IN302 — C13 V.C.B IN SERVICE POSITION IN303 — C15 CABLE EARTHED IN304; C10 C12 C14 C16

L2-GY2.5 — PT 55

F4 2A: 4 → 3

06-21 ▷ J2-GY4

F5 10A: 1 → 2

PT ◇62 — ×K111-GY2.5

GT ▽3 — REMOTE TRIP — GT △4

×K113A-GY2.5

V7

PT ◇63 — K113-GY2.5

PT ◇64

X51: 5 → K111A-GY2.5 → C07; F51 01-12 OUT304 OC/EF TRIP; C08 → 8 → K111B-GY2.5 → X51 7

K4 07-14 TRIP RE-INFORCE: 3 → 1 → K115-GY2.5 → 6 → 8

@@@ — F51 T.C.S IN401 — D09 → D10 — @@@

K117-GY2.5 → V5 → V6 → K119-GY2.5

@@ — X57 X25 — 67 — L

QS 01-6: 6 → M; 12 → 7 → 11

S15 I.E.: 3 → 2; 1

K4 2nd SHUNT TRIP RE-INFORCE: 2 → 7

X59 X27 — 5

QY7: 1 → 2

60 X28

K112-GY2.5

F5 10A: 4 → 3

K4			
T1	TYPE	T2	REF
2	P	7	07–14
3	–/–	1	07–19
6	–/–	8	07–19

INDICATION CIRCUIT 110V DC

2nd SHUNT TRIPPING CIRCUIT 110V DC

QS– V.C.B. AUX SWITCH | F51– SEL 751 O/C & E/F PROTECTION RELAY | H54– GREEN LED LAMP–"V.C.B. OPEN" | H55– RED LED LAMP–"V.C.B. CLOSED" | H56– AMBER LED –"FAULT TRIP" | QY7– 110V D.C. SHUNT TRIP COIL

H59– WHITE LED LAMP–"V.C.B. CABLE EARTHED" | X51– MMLG TEST BLOCK – "PROTECTION" | K4– 2nd SHUNT TRIP RE-INFORCE AUX. RELAY TYPE FINDER 60.12 | S16,S17– INTERGRAL EARTHING SWITCH | V5–V13 – AVALANCHE BLOCKING DIODE

△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢–LINKED TERMINALS | ⌖–EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

H57– AMBER LED LAMP–"CB FAIL" | H52– WHITE LED LAMP–"SPRING CHARGED" | K7– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 04/11/20
DRWN F.M
CHK'D
SPRING CHARGED LED ADDED.

REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.02 REV 3

SHEET 07 NEXT 08

PNL No 2

SCHEMATIC DIA:– INCOMER 2

DRAWN F.M CHK'D

ORDER No. AM8603.1

DATE 29/11/2019 APP'D

0 5 10 20 30 40 50 60 70 80 90 100

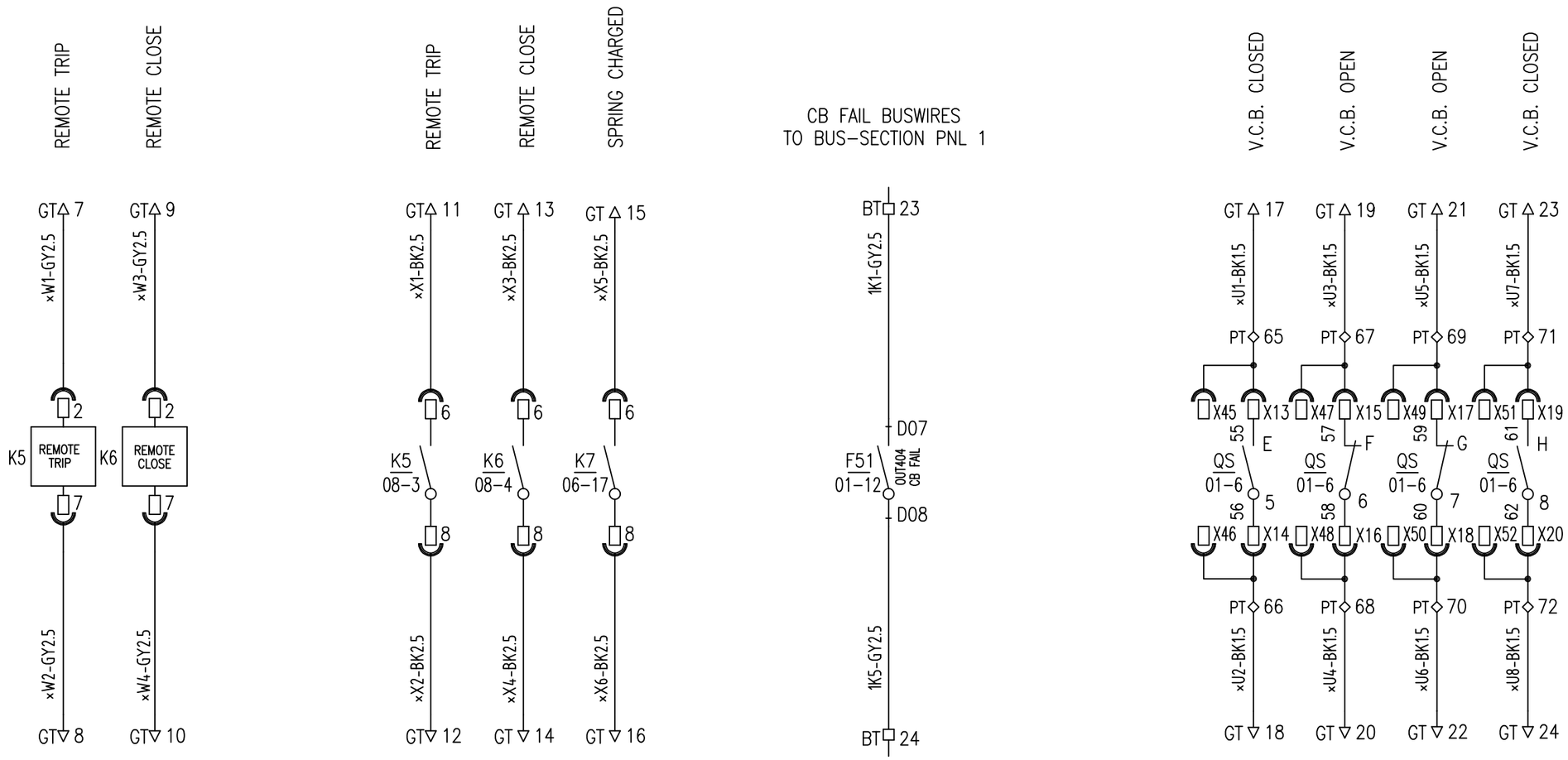
ACTOM MV SWITCHGEAR

CAD No 86031D27

K5			
T1	TYPE	T2	REF
2	P	7	08–3
3	–/–	1	05–14
6	–/–	8	08–7

K6			
T1	TYPE	T2	REF
2	P	7	08–4
3	–/–	1	06–7
6	–/–	8	08–8

NOTE:–WIRES MARKED * TO BE PREFIXED WITH PANEL No.



REMOTE CIRCUITS		ALARM CIRCUITS	CB FAIL CIRCUITS	SPARE V.C.B. AUX. CONTACTS
QS– V.C.B. AUX. SWITCHES	K2– D.C FAIL AUX. RELAY TYPE FINDER 60.12	F51– SEL–751 O/C & E/F PROTECTION RELAY		
K5– REMOTE TRIP AUX. RELAY TYPE FINDER 60.12	K6– REMOTE CLOSE AUX. RELAY TYPE FINDER 60.12	K7– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12		
△ –GLAND TERMINALS	⚠–TEST POSITION	□ –BUSWIRING TERMINALS	◇–PANEL TERMINALS	⫟⫟ –LINKED TERMINALS	⌖ –EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED AS PER CUSTOMER'S CHANGES.

REV.2
DATE 04/11/20
DRWN F.M
CHK'D
SPRING CHARGED ADDED.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.02	REV 3	SHEET 08	NEXT --	
		PNL No 2		
SCHEMATIC DIA:– INCOMER 2		DRAWN F.M	CHK'D	
ORDER No. AM8603.1		DATE 29/11/2019	APP'D	

ACTOM
MV SWITCHGEAR

CAD No 86031D28

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

LEFTHAND BUSBARS 1250A
R W B

1250A
Q

R W B
RIGHTHAND BUSBARS 1250A

12 — M — 07–16
11 — L — 07–18
10 — K — 05–5
9 — J — 09–21
8 — H — 09–20
7 — G — 09–19
6 — F — 09–18
5 — E — 09–16
4 — D — 07–4
3 — C — 07–3
2 — B — 05–4
1 — A — 06–15
QS

V.C.B. AUX. SWITCH

Q– VACUUM CIRCUIT BREAKER | QS– V.C.B. AUXILIARY CONTACTS

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⊕ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.03
REV 1
SHEET 01 NEXT 02
PNL No 1
SCHEMATIC DIA:– BUS–SECTION
DRAWN F.M CHK'D
ORDER No. AM8603.1
DATE 26/11/2019 APP'D

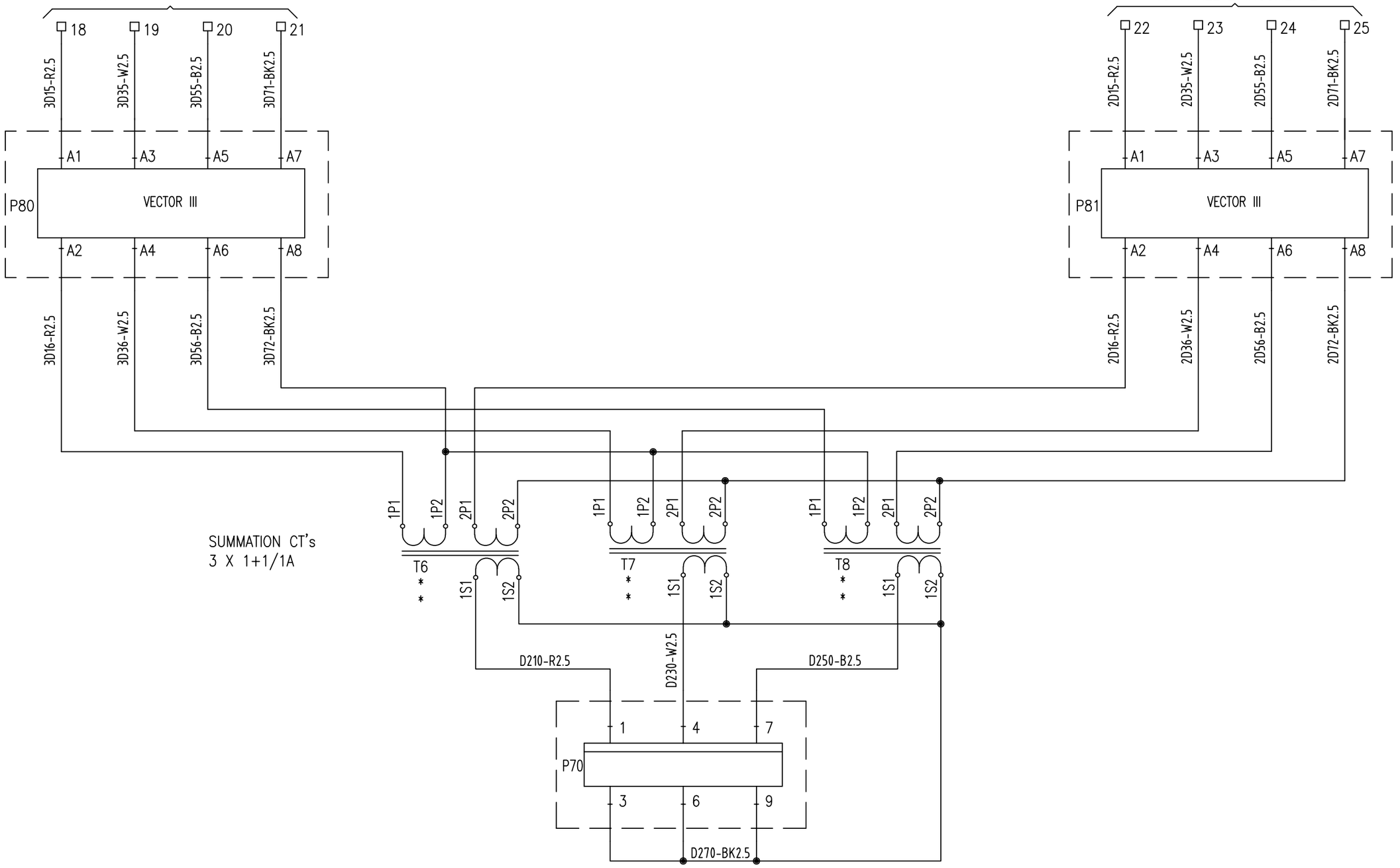
ACTOM
MV SWITCHGEAR

0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D31

110V AC CURRENT BUSWIRES
TO PANEL 3 INCOMER 1

110V AC CURRENT BUSWIRES
TO PANEL 2 INCOMER 2



SUMMATION CT's
3 X 1+1/1A

T6,T7,T8– SUMMATION CT's | P70– ELSTER A1700 ENERGY METER | SUMMATION CIRCUIT

P80/P81– VECTOR III POWER RECORDER

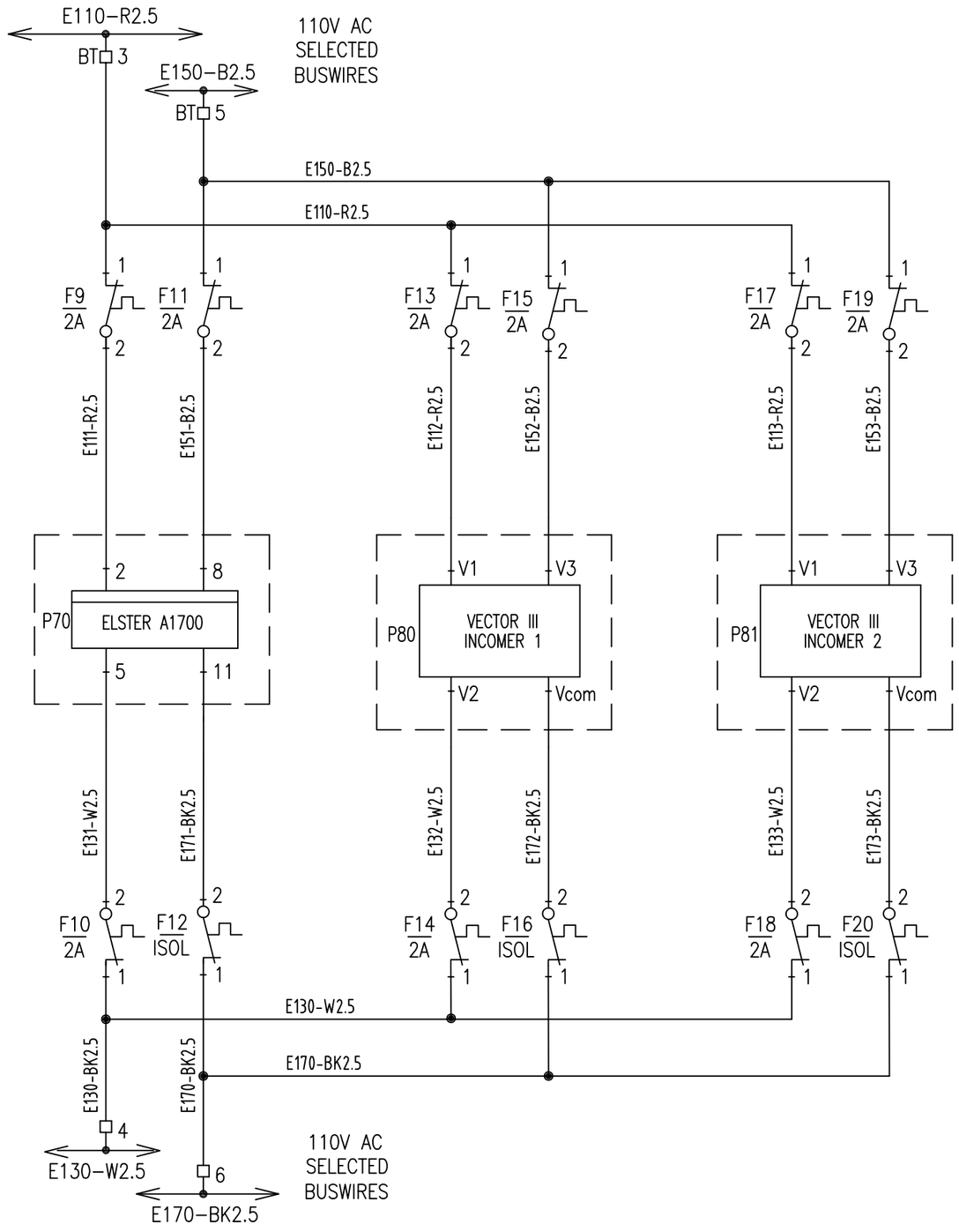
△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | –LINKED TERMINALS | –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1	
DATE	02/09/20
DRWN	F.M
CHK'D	
REVISED.	
REV.2	
DATE	21/09/20
DRWN	F.M
CHK'D	
REVISED.	
REV.3	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

DRG No.	M.V.8603.1.D1.03	REV 3	SHEET	02	NEXT 03
			PNL No	1	
SCHEMATIC DIA:– BUS–SECTION			DRAWN	F.M	CHK'D
ORDER No.	AM8603.1		DATE	26/11/2019	APP'D

ACTOM
MV SWITCHGEAR

CAD No 86031D32



METERING VOLTAGE CIRCUIT 110V AC | INC 1 QUALITY VOLTAGE CIRCUIT 110V AC | INC 2 QUALITY VOLTAGE CIRCUIT 110V AC

P70– ELSTER A1700 ENERGY METER | P80,P81– VECTOR III POWER RECORDER

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⊕ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2.5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

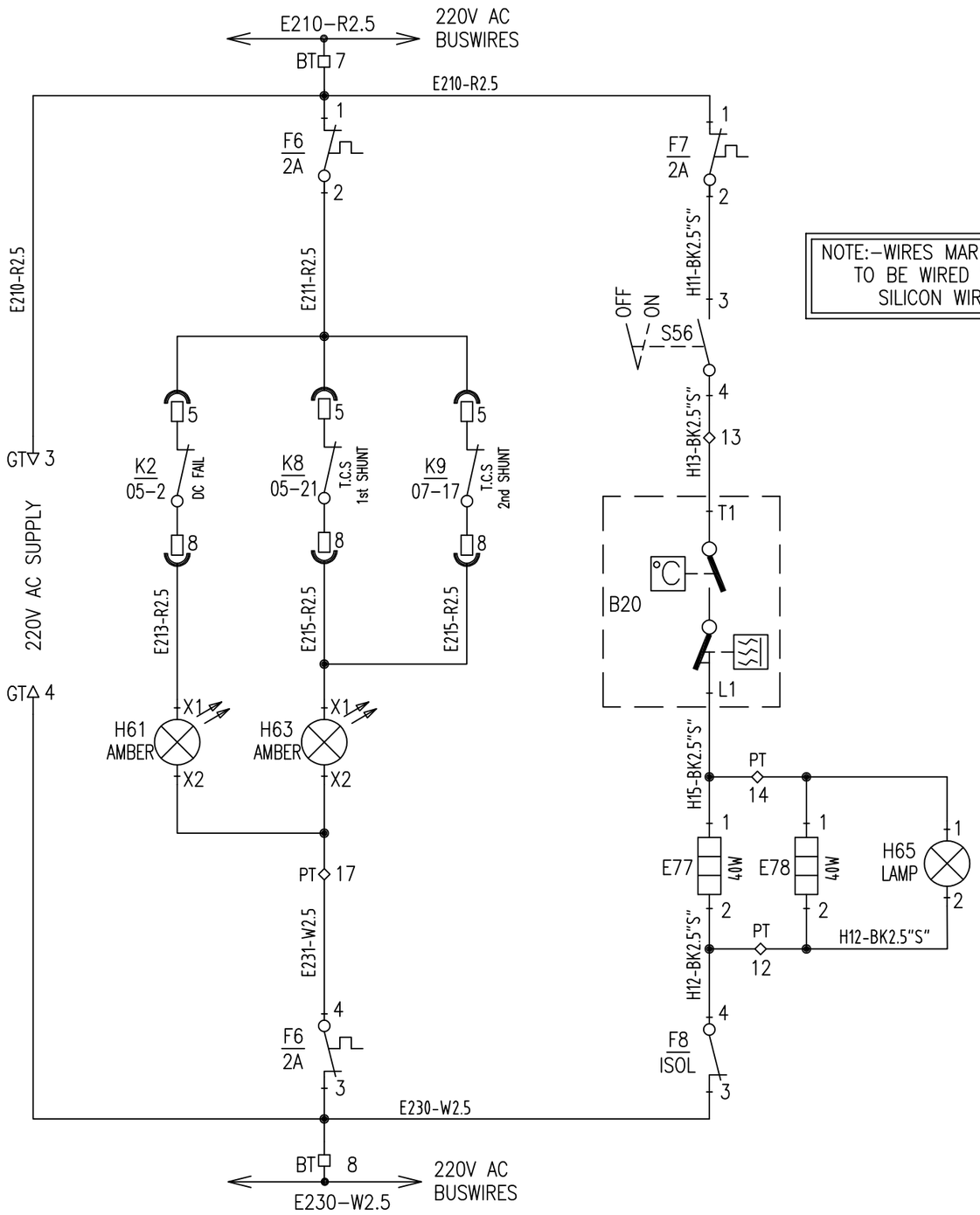
DRG No. M.V.8603.1.D1.03	REV 2	SHEET 03	NEXT 04		
		PNL No 1			
SCHEMATIC DIA:– BUS–SECTION		DRAWN F.M	CHK'D		
ORDER No. AM8603.1		DATE 26/11/2019	APP'D		

ACTOM
MV SWITCHGEAR

CAD No 86031D33

REV.1
DATE 21/09/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.



220V AC PROTECTION IND. CIRCUIT			220V AC HEATER CIRCUIT	
S56– HEATER OFF/ON SELECTOR SWITCH	K2– D.C FAIL AUX. RELAY	H65– "HEATER HEALTHY" LAMP	H61– "D.C FAIL" AMBER LED	H63– "TRIP CIRCUIT SUP. NOT HEALTHY" AMBER LED
E77– CT CHAMBER HEATER	E78– BUSBAR CHAMBER HEATER	B20– THERMOSTAT TYPE HONEYWELL T498A1927	K8– 1st SHUNT T.C.S AUX. RELAY TYPE FINDER 60.12	K9– 2nd SHUNT T.C.S AUX. RELAY TYPE FINDER 60.12
△–GLAND TERMINALS	⚠–TEST POSITION	□–BUSWIRING TERMINALS	◇–PANEL TERMINALS	⊣⊢–LINKED TERMINALS	⊕–EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2.5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

REV.1
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.D1.01	REV 1	SHEET 04	NEXT 05		
		PNL No 1			
SCHEMATIC DIA:– BUS–SECTION		DRAWN	F.M	CHK'D	
ORDER No. AM8603.1		DATE	26/11/2019	APP'D	

ACTOM
MV SWITCHGEAR

CAD No 86031D34

REV.1
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

J1-GY4 (+ve) 110V DC BUSWIRES

BT 1

J1-GY4 ... 06-1

F1 10A

×K1-GY2.5

PT 1 2 3 4 5

BT 9 10 11 12 13 14 15 16

REMOTE TRIP

D07 F51 OUT404 CB FAIL/ARC INCOMER 1 D08

D07 F51 OUT404 CB FAIL/ARC INCOMER 2 D08

X57 D E

S70

K1 04-4 TRIP RE-INFORCE

K9-GY2.5

L R S53 A1 A2

K11-GY2.5

K6 09-2 REMOTE TRIP

S58

K13-GY2.5

07-8 L9-GY2.5 V4

H58 WHITE X1 X2

K8 T.C.S.

V1 V2 V3 V5

K3-GY2.5 K5-GY2.5 K7-GY2.5 K15-GY2.5

×K3A-GY2.5

110V DC B.T.U. SUPPLY

K2 DC FAIL

K1 TRIP RE-INFORCE

K4 CB FAIL

QS 01-6

QY1 01-6

X1 X23 X2

K2-GY2.5

J2-GY4

F1 10A

BT 2 (−ve) 110V DC BUSWIRES

K1			
T1	TYPE	T2	REF
2	P	2	05-6
3	−/	1	05-15
6	−/	8	05-15

K2			
T1	TYPE	T2	REF
2	P	7	05-2
5	/−	8	04-3

K4			
T1	TYPE	T2	REF
2	P	7	05-7
3	−/	1	07-7

K8			
T1	TYPE	T2	REF
2	P	7	05-21
5	/−	8	04-5

NOTE:−WIRES MARKED @@ TO BE THE 2nd LAST CONN. IN THE CIRCUITS

NOTE:−WIRES MARKED @@@ TO BE THE LAST CONNECTION IN THE CIRCUITS

NOTE:−WIRES MARKED * TO BE PREFIXED WITH PANEL No.

110V DC 1st SHUNT TRIPPING CIRCUIT

QS− V.C.B. AUX. SWITCHES | S70/X57− CANNON TRIP/CLOSE SOCKET | X51− MMLG TEST BLOCK − "PROTECTION" | K2− D.C FAIL AUX. RELAY TYPE FINDER 60.12 | K1− 1st SHUNT TRIP RE-INFORCE AUX. RELAY TYPE FINDER 60.12

QY1− 110V D.C. SHUNT TRIP COIL | K6− REMOTE TRIP AUX. RELAY TYPE FINDER 60.12 | K8− MAIN T.C.S AUX. RELAY TYPE FINDER 60.12 | S53− LOCAL/REMOTE SELECTOR SWITCH | V1,V2,V3,V4,V5− AVALANCHE BLOCKING DIODE

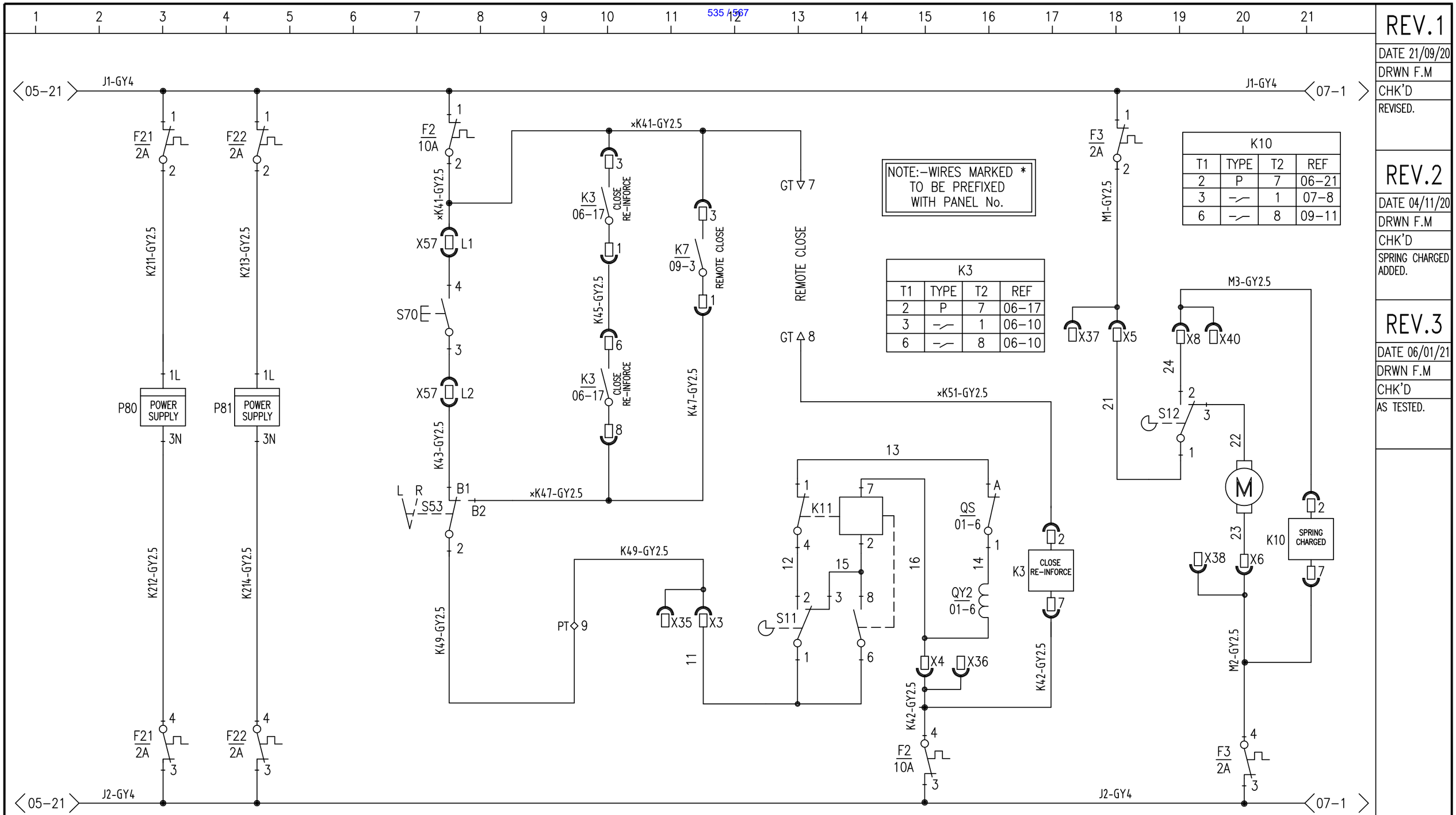
△−GLAND TERMINALS | ⚠−TEST POSITION | □−BUSWIRING TERMINALS | ◇−PANEL TERMINALS | −⊓⊓− −LINKED TERMINALS | ⊕ −EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2.5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

H58/S58− TRIP CIRCUIT HEALTHY PB & LAMP | K4− CB FAIL AUX. RELAY TYPE FINDER 60.12

DRG No.	M.V.8603.1.D1.03	REV 1	SHEET 05	NEXT 06	
			PNL No 1		
SCHEMATIC DIA:− BUS-SECTION			DRAWN F.M	CHK'D	
ORDER No. AM8603.1			DATE 26/11/2019	APP'D	

ACTOM MV SWITCHGEAR

CAD No 86031D35



NOTE:–WIRES MARKED * TO BE PREFIXED WITH PANEL No.

K3			
T1	TYPE	T2	REF
2	P	7	06–17
3	–⁄–	1	06–10
6	–⁄–	8	06–10

K10			
T1	TYPE	T2	REF
2	P	7	06–21
3	–⁄–	1	07–8
6	–⁄–	8	09–11

REV.1
DATE 21/09/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 04/11/20
DRWN F.M
CHK'D
SPRING CHARGED ADDED.

REV.3
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

110V DC POWER RECORDER CIRCUIT (INC 1)	110V DC POWER RECORDER CIRCUIT (INC 2)	CLOSING CIRCUIT 110V DC	110V DC MOTOR CIRCUIT

P80– VECTOR III POWER RECORDER (NICOMER 1)	P81– VECTOR III POWER RECORDER (NICOMER 2)	QS– V.C.B. AUX. SWITCHES	S53– LOCAL/REMOTE SELECTOR SWITCH	S70/X57– CANNON TRIP/CLOSE SOCKET	

QY2– 110V D.C. CLOSING COIL	K11– FINDER ANTI–PUMPING AUX. RELAY	K3– 'CLOSE RE–INFORCE' AUX. RELAY	K7– 'REMOTE CLOSE' AUX. RELAY	S12– SPRING CHARGE LIMIT SWITCH	K10– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

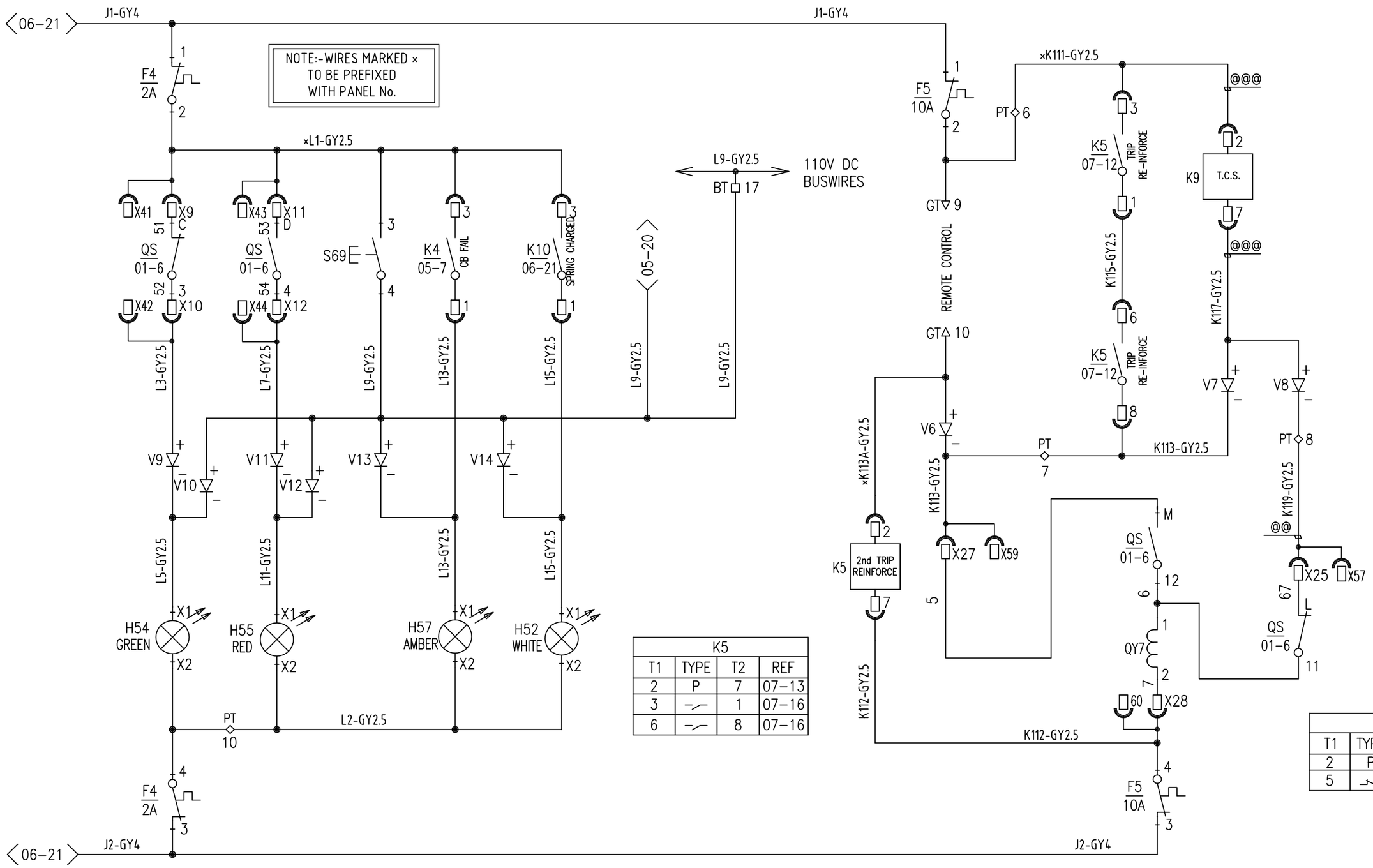
△–GLAND TERMINALS	⚠–TEST POSITION	□–BUSWIRING TERMINALS	◇–PANEL TERMINALS	⊣⊢–LINKED TERMINALS	⊕–EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.03	REV	3	SHEET 06	NEXT 07
				PNL No 1	
SCHEMATIC DIA:– BUS–SECTION				DRAWN F.M	CHK'D
ORDER No. AM8603.1				DATE 26/11/2019	APP'D

ACTOM
MV SWITCHGEAR

CAD No 86031D36

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21



K5			
T1	TYPE	T2	REF
2	P	7	07–13
3	–/	1	07–16
6	–/	8	07–16

K9			
T1	TYPE	T2	REF
2	P	7	07–18
5	–/	8	04–6

INDICATION CIRCUIT 110V DC

110V DC 2nd SHUNT TRIP CIRCUIT

QS– V.C.B. AUX. SWITCHES | H54– GREEN LED "V.C.B. OPEN" | H55– RED LED "V.C.B. CLOSED" | H57– AMBER LED "CB FAIL" | QY7– 110V D.C. 2nd SHUNT TRIP COIL | K10– SPRING CHARGED AUX. RELAY TYPE FINDER 60.12

S69– LAMP TEST PUSHBUTTON (BLACK) | V6,7,8,9,10,11,12,13,14– BLOCKING DIODE | S15– INTERGRAL EARTHING SWITCH | K9– 2nd SHUNT T.C.S AUX. RELAY | K5– 2nd SHUNT TRIP RE-INFORCE AUX. RELAY TYPE FINDER 60.12

△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | –LINKED TERMINALS | ⊕–EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

H52– WHITE LED LAMP–"SPRING CHARGED"

REV.1
DATE 04/11/20
DRWN F.M
CHK'D
SPRING CHARGED LED ADDED.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No.	M.V.8603.1.D1.03	REV	2	SHEET 07	NEXT 08
				PNL No	1
SCHEMATIC DIA:– BUS–SECTION				DRAWN F.M	CHK'D
ORDER No. AM8603.1				DATE 26/11/2019	APP'D

ACTOM
MV SWITCHGEAR

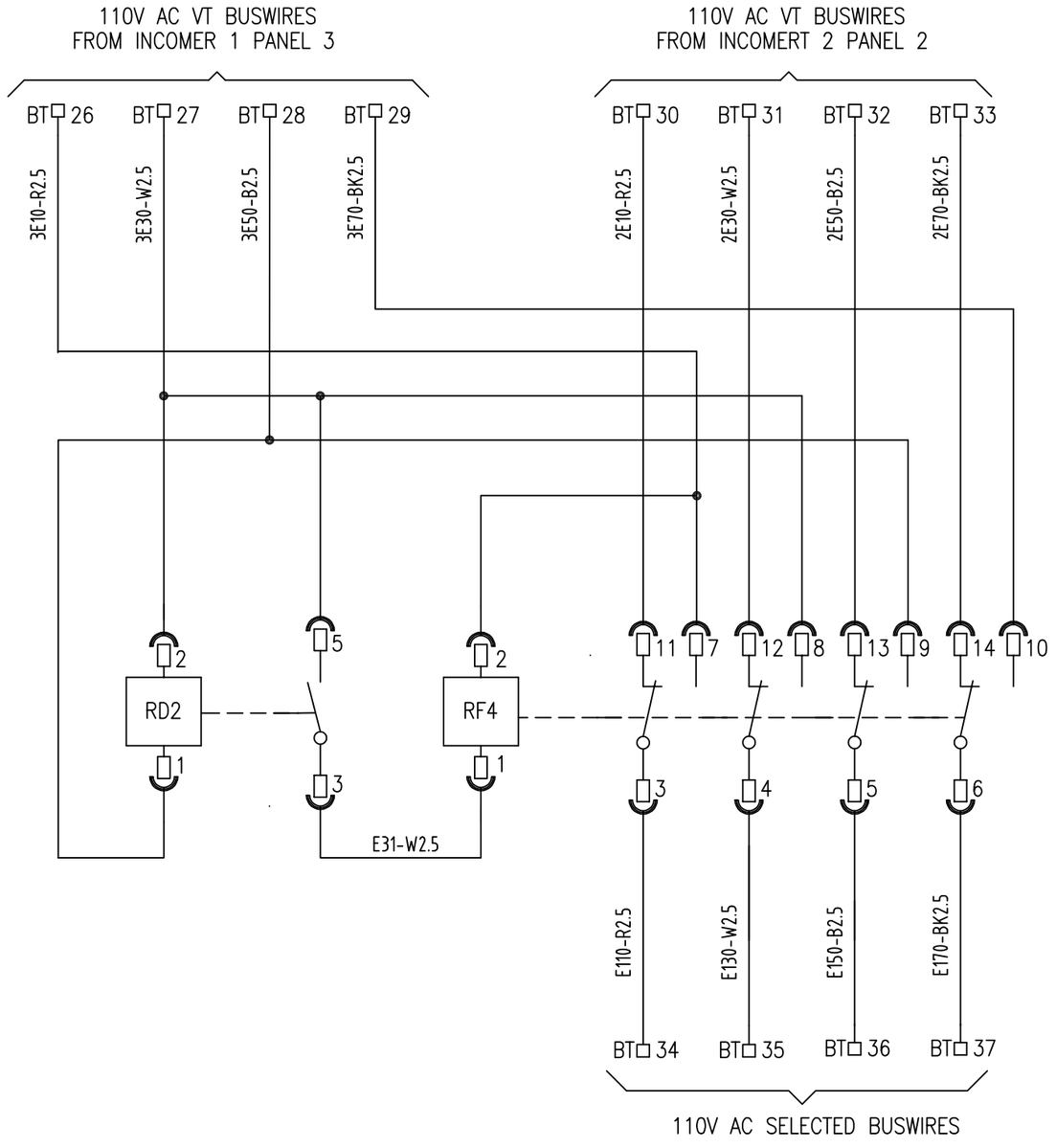
0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D37

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

REV.1
DATE 02/09/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.



VOLTAGE SELECTION CIRCUIT

RF4/RD2– VOLTAGE SELECTION RELAY

△–GLAND TERMINALS | ⚠–TEST POSITION | □–BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢–LINKED TERMINALS | ⊕–EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES | WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No. M.V.8603.1.D1.03	REV 2	SHEET 08	NEXT 09		ACTOM MV SWITCHGEAR
		PNL No 1			
SCHEMATIC DIA:– BUS–SECTION		DRAWN F.M	CHK'D		
ORDER No. AM8603.1		DATE 26/11/2019	APP'D		

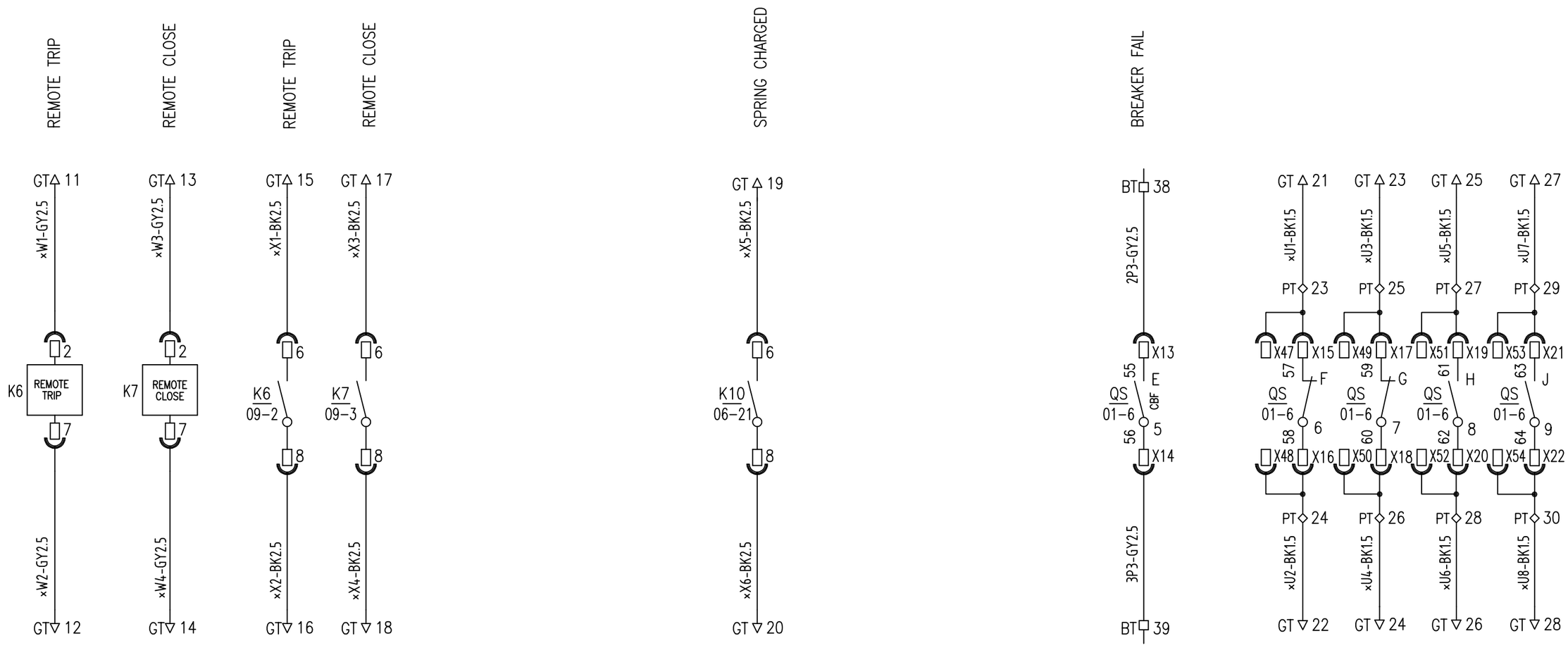
0 5 10 20 30 40 50 60 70 80 90 100

CAD No 86031D38

K6			
T1	TYPE	T2	REF
2	P	7	09-2
3	-/-	1	05-17
6	-/-	8	09-5

K7			
T1	TYPE	T2	REF
2	P	7	09-3
3	-/-	1	06-11
6	-/-	8	09-6

NOTE:-WIRES MARKED * TO BE PREFIXED WITH PANEL No.



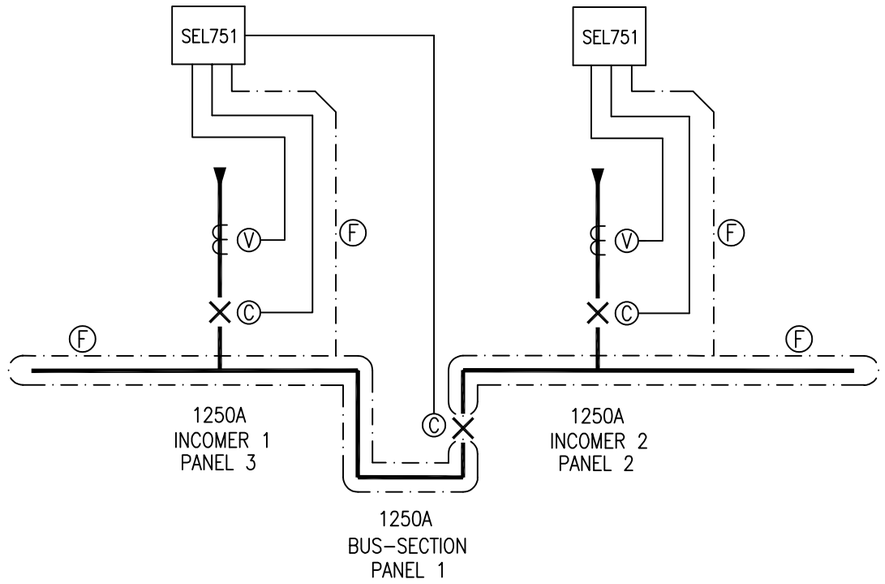
24V DC REMOTE CIRCUITS		ALARM CIRCUITS	BREAKER FAIL CIRCUIT	SPARE V.C.B. AUX. CONTACTS
QS- V.C.B. AUX. SWITCHES	F51- SEL-751 O/C & E/F PROTECTION RELAY	P80- IMPEDO DUO POWER RECORDER		
K6- REMOTE TRIP AUX. RELAY TYPE FINDER 60.12	K7- REMOTE CLOSE AUX. RELAY TYPE FINDER 60.12	K10- SPRING CHARGED AUX. RELAY TYPE FINDER 60.12		
△-GLAND TERMINALS	⚠-TEST POSITION	□-BUSWIRING TERMINALS	◇-PANEL TERMINALS	⊣⊢-LINKED TERMINALS	⊕-EARTH POSITION	SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES	WIRE 2,5mm² UNLESS NUMERAL DENOTING WIRE SIZE FOLLOWS COLOUR

DRG No.	M.V.8603.1.D1.03	REV	1	SHEET 09	NEXT --
				PNL No	1
SCHEMATIC DIA:- BUS-SECTION				DRAWN F.M	CHK'D
ORDER No.	AM8603.1			DATE 26/11/2019	APP'D

ACTOM
MV SWITCHGEAR

CAD No 86031D39

REV.1
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.



	SEL 751 (MOUNTED ON PANEL 3)		
PANEL No.	SENSOR LOCATION	SENSOR WIRE No.	TERML. No.
3	C.T. CHAMBER	CT3S1	E07
3	C.B. CHAMBER	CB3S2	E08
3	B.B. LOOP	BB3S3	E09
1	C.B. CHAMBER	CB1S4	E10

	SEL 751 (MOUNTED ON PANEL 2)		
PANEL No.	SENSOR LOCATION	SENSOR WIRE No.	TERML. No.
2	C.T. CHAMBER	CT2S1	E07
2	C.B. CHAMBER	CB2S2	E08
2	B.B. LOOP	BB2S3	E09
	SPARE	--	E10

Ⓑ BUSBAR CHAMBER ARC SENSOR

Ⓥ C.T. / CABLE CHAMBER ARC SENSOR

Ⓒ CIRCUIT BREAKER CHAMBER ARC SENSOR

Ⓕ FIBER LOOP BUSBAR SENSOR (— · —

ARC PROTECTION SCHEME SENSOR INSTALLATION DETAILS

△ –GLAND TERMINALS | ⚠ –TEST POSITION | □ –BUSWIRING TERMINALS | ◇–PANEL TERMINALS | ⊣⊢ –LINKED TERMINALS | ⌖ –EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES

DRG No.	M.V.8603.1.AP.01	REV 2	SHEET 01	NEXT --	
			PNL No	1–3	
SCHEMATIC DIA:– ARC PROTECTION			DRAWN	F.M	CHK'D
ORDER No.	AM8603.1		DATE	02/09/2020	APP'D

ACTOM
MV SWITCHGEAR

CAD No 86031AP1

REV.1	
DATE	21/09/20
DRWN	F.M
CHK'D	
REVISED.	

REV.2	
DATE	06/01/21
DRWN	F.M
CHK'D	
AS TESTED.	

SEL-751 O/C E/F PROTECTION

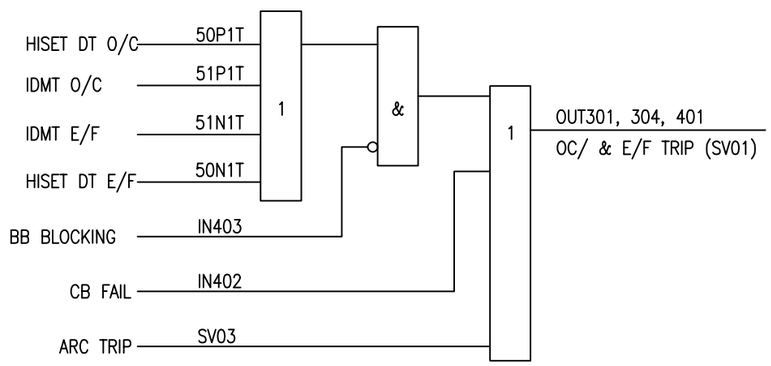
INPUT	FUNCTION
101	TCS 52A
102	TCS 52B
103	–
301	VCB CLOSED
302	VCB OPEN
303	VCB IN SERVICE
304	CABLE EARTHED
401	TCS 2ND TRIP
402	CB FAIL TRIP-EXT
403	BB BLOCKING
404	L>SIGNAL-ARC

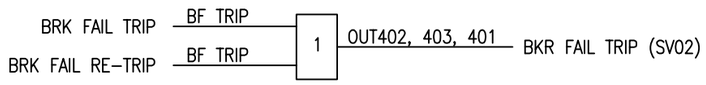
OUTPUT	FUNCTION
101	CONTROL TRIP
102	CONTROL CLOSE
103	RELAY NOT HEALTHY
301	O/C & E/F TRIP
302	ARC TRIP
303	CLOSE BLOCK
304	O/C & E/F TRIP
401	FAULT TRIP
402	CB FAIL TRIP
404	CB FAIL TRIP

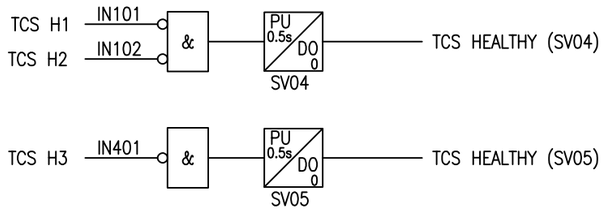
LED	FUNCTION
1 ORED50T	INSTATENOUS O/C
2 ORED51T	TIME PHASE O/C
3 51N1T/50N1T	EARTH FAULT
4 SV03	ARC PROT. TRIP
5 SV02	CB FAIL TRIP
6 NOT (SV04/05)	TRIP CCT. FAIL

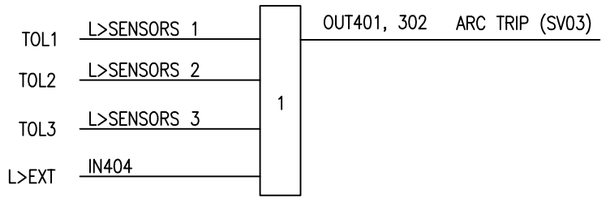
PB LED	FUNCTION
1 IN302	CB OPEN
2 IN301	CB CLOSED
3 IN303 (LT01)	CT ARC TRIP
4 IN304 (LT02)	CB ARC TRIP
5 IN402 (LT04)	BB ARC TRIP
6	

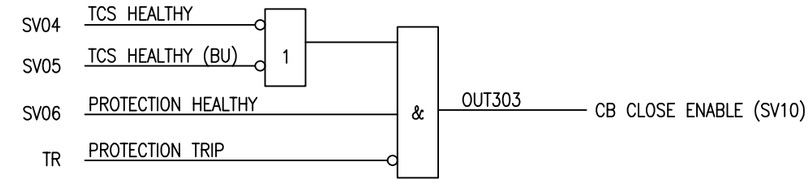
PROTECTION & CONTROL LOGICS

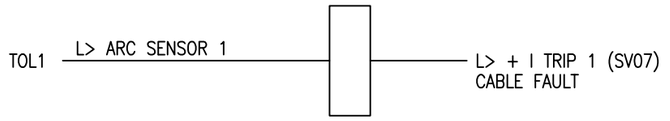


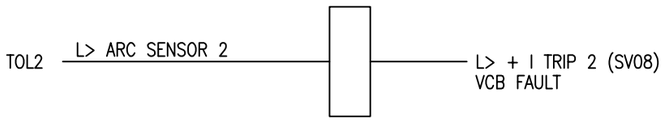


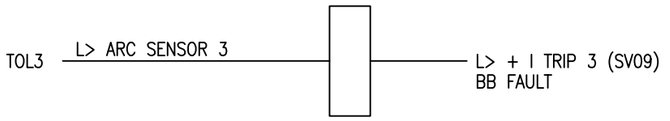


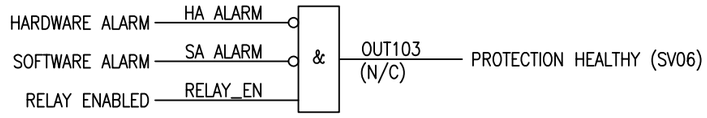


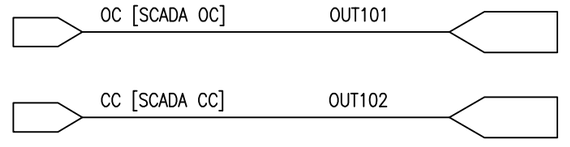












IED LOGICS FOR SEL-751

F51- SEL-751 O/C & E/F PROTECTION RELAY

△-GLAND TERMINALS | ⚠-TEST POSITION | □-BUSWIRING TERMINALS | ◇-PANEL TERMINALS | -LINKED TERMINALS | -EARTH POSITION | SEE GENERAL ARRANGEMENT SHEET 1 FOR NOTES

REV.1
DATE 22/10/20
DRWN F.M
CHK'D
REVISED.

REV.2
DATE 06/01/21
DRWN F.M
CHK'D
AS TESTED.

DRG No. M.V.8603.1.L1.01
REV 2
SHEET 01 NEXT --
PNL No 1-3
SCHEMATIC DIA:- RELAY LOGICS
DRAWN F.M CHK'D
ORDER No. AM8603.1
DATE 16/10/2020 APP'D

ACTOM
MV SWITCHGEAR

CAD No 86031L11

THEMBA KHUBEKA SWITCHING STATION – RTU/GATEWAY PANEL

DRAWING No.	SHEET No.	DESCRIPTION	REVISION
A3SY6154PM1ES002	00	INDEX SHEET	4
	01	PANEL LAYOUT AND LEGEND	4
	02	SYMBOLS AND ACRONYMS	4
	03	FUNCTION BLOCK DIAGRAM	4
	04	AC SUPPLIES	4
	05	DIGITAL INPUTS (I/O 1A)	4
	06	DIGITAL INPUTS (I/O 1B)	4
	07	DIGITAL INPUTS (I/O 1C)	4
	08	DIGITAL INPUTS AND OUTPUTS (ORIONLXm)	4
	09	TRIPPING AND REMOTE CONTROL	4
	10	TRIPPING AND REMOTE CONTROL	4
	11	CLOSING AND REMOTE CONTROL	4
	12	CLOSING AND REMOTE CONTROL	4
	13	DIGITAL INPUTS (I/O 2A)	4
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	15	TERMINAL LIST	4

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE-SUBMISSION	N.M	S.M	17/09/20					
2	THIRD ISSUE	N.M	S.M	02/09/20					
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CUSTOMER: TRACTIONAL ENTRPRISE | CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D		DATE	
PROJN		SCALE	DO NOT SCALE

TITLE: THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
INDEX SHEET

CAD REF. 6154_02_00 | SHEET: 00 | NEXT: 01 | DRG. NO. A3SY6154PM1ES002 | A3

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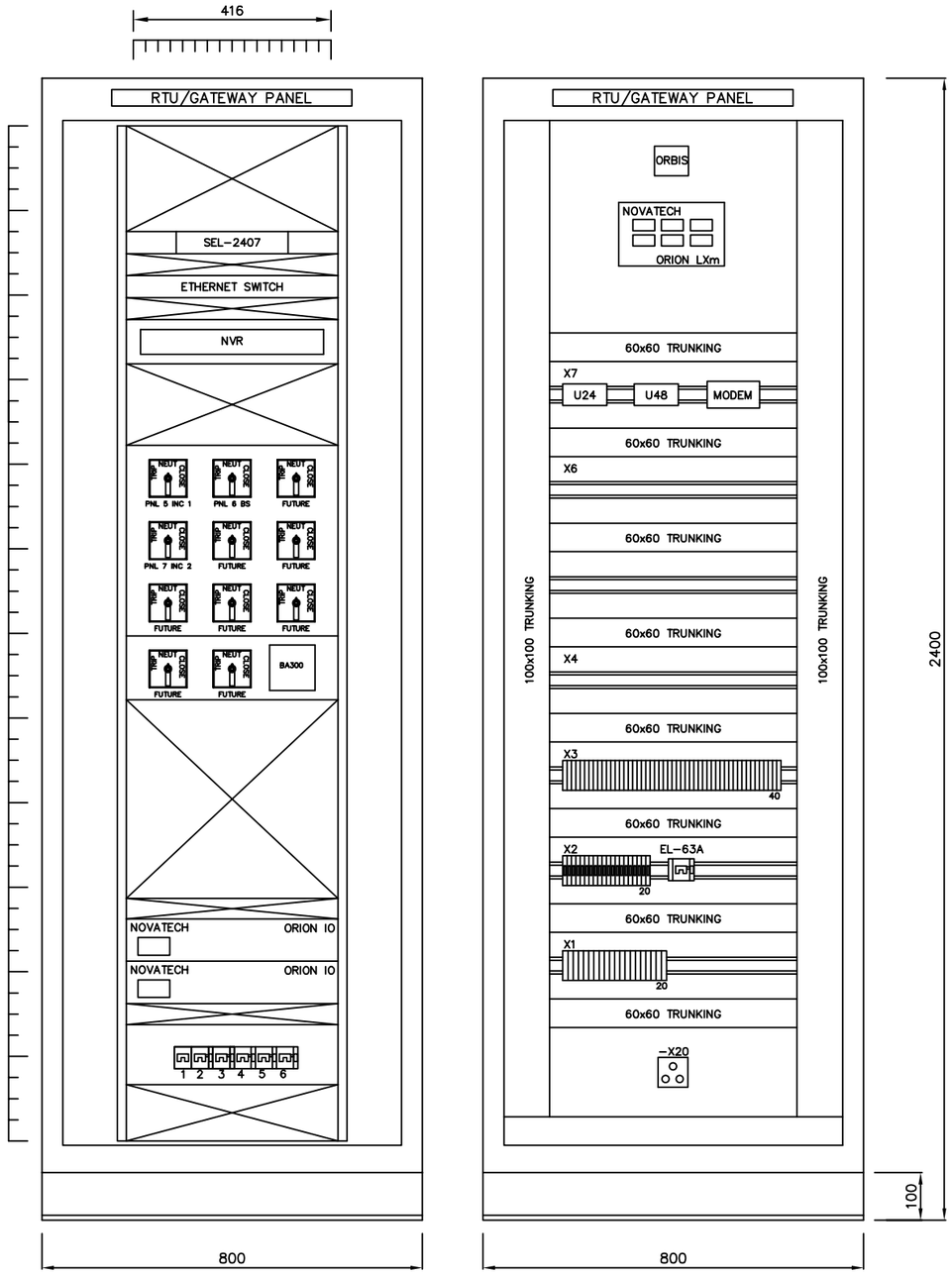

FRONT VIEW

INTERNAL VIEW

DESIGNATION	RELAY REFERENCE	RELAY/EQUIPMENT/ DESCRIPTION/FUNCTION	SUPPLIER
MOXA	PT-7728-R-HV-HV	ETHERNET SWITCH	RJ CONNECT
CLOCK	SEL-2407	SATELLITE-SYNCHRONISED CLOCK	SCHWEITZER ENG. LABS
BATTERY MONITOR	BA300	SUBSTATION BATTERY MONITORING	GE
MCB/1	G102C16 (AC)	230V AC SUPPLY: THERMOSTAT, PLUG POINT & PANEL-LAMP	GE
MCB/2	EP102UCC2 (DC)	POE INJECTOR RADIO LINK	GE
MCB/3	EP102UCC2 (DC)	ORIONLXM & IO ORION	GE
MCB/4	EP102UCC6 (DC)	SEL3622	GE
MCB/5	EP102UCC6 (DC)	GPS CLOCK & ETHERNET SWITCH	GE
MCB/6	EP102UCC6 (DC)	BA300	GE
MCB/7	G101C06 (AC)	NVR	GE
TNC	3-POS / 3-WAFER	CIRCUIT BREAKER CONTROL SWITCH	ACTOM
ORION IO	ORION	I/O-SX-2E-111X-SD-WR-98	NOVATECH
ORION IO	ORION	I/O-SX-2E-000X-SD-WR-98	NOVATECH
NVR	-	NVR FOR CCTV	-

OTHER/INTERNAL EQUIPMENT

-X20, -S20, -H20, -R20	..	STD PANEL ANCILLARIES: PLUG, DOOR SWITCH, LAMP, HEATER	ACTOM
X1	KULT 6	KULT6 - SPRING LOADED TERMINAL (6mm)	ACTOM (ELMEX)
X2	KUTSD6	DIGITAL INPUT / OUTPUT TERMINAL RAILS (SLIDING LINK)	ACTOM (ELMEX)
X3-X8	KULT 1	KULT1 - SPRING LOADED TERMINAL (10mm)	GE
ORBIS	MLW	THERMOSTAT	CLIMA
EL-63A AC	-	230V AC SUPPLY EARTH LEAKAGE (63A)	GE
ORIONLXM	ORIONLXM	OrionLXm-XXX-2EXX-1HV-WR-PANL-01-103-44-57-95-07-101	NOVATECH
PSU	PSU	110V - 24V DC POWER SUPPLY	WHEANWELL
MODEM	-	CELLULAR MODEM	-
FIREWALL	SEL-3622	SECURITY GATEWAY	SCHWEITZER ENG. LABS
U24	110 : 24V DC	DC-DC CONVERTOR - 24V OUTPUT TO FIREWALL	WINDS
U48	110 : 48V DC	DC-DC CONVERTOR - 48V OUTPUT TO BA300	WINDS

NOTES:

1. PANEL TYPE : FIXED SWING FRAME, FRONT, ACCESS, TOP CABLE ENTRY
2. PANEL COLOUR : RAL 7035 TO SABS 1091
   TEXTURED FINISH
3. PANEL RATING : IP40
4. ALL 230V AC WIRING: 2.5 SQMM SILICONE
5. ALL DC CONTROL WIRING: 1.5 SQMM MULTI-STRAND GREY
6. RS-485 CABLING: SHIELDED TWISTED PAIR

NOTE:

* FIREWALL IS MOUNTED ON THE INSIDE VIEW OF THE PANEL

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
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CUSTOMER: TRACTIONAL ENTERPRISE | CUST. REF. : _____

DRN	N.M	DATE	05/01/20
CHD	H.M	DATE	05/01/20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE: THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
PANEL LAYOUT AND LEGEND

CAD REF. 6154_02_01 | SHEET: 01 | NEXT: 02 | DRG. NO. A3SY6154PM1ES002 | A3

0 10 20 30 40 50 100 150 200

ISOLATOR		MAKE CONTACT LIMIT SWITCH		CONNECTION POINT
CIRCUIT BREAKER		BREAK CONTACT LIMIT SWITCH		TERMINAL
PLUG AND SOCKET		RELAY COIL		FUSE
MAKE CONTACT		RELAY COIL WITH FLAG INDICATOR		LINK
BREAK CONTACT		RELAY COIL OF A MECHANICALLY LATCHED RELAY		DIODE
BREAK CONTACT WITH NON AUTOMATIC RETURN		RELAY COIL OF A SLOW OPERATING RELAY		RESISTOR
MAKE CONTACT WITH NON AUTOMATIC RETURN		RELAY COIL OF A SLOW RELEASING RELAY		VARIABLE RESISTOR
CHANGE OVER CONTACT		LATCHING RELAY WITH CUT-THROAT CONTACT		METROSIL
DELAY ON PICKUP		TRIP RELAY WITH FLAG INDICATION		HEATER
DELAY ON DROP OFF		ALARM RELAY WITH FLAG INDICATION		LAMP
TEST BLOCK (PK2)	PSU	RELAY POWER SUPPLY COIL		STATUS INDICATION / SEMAPHORE (LED TYPE)
TEST BLOCK (MMLG)		AC/DC POWER SUPPLY		EARTH
MINIATURE CIRCUIT BREAKER		DC/DC POWER SUPPLY		SURGE ARRESTOR
2 POSITION TURN SWITCH		AC TO DC TRANSDUCER		CURRENT TRANSFORMER
3 POSITION TURN SWITCH		OPTO-ISOLATED LOGIC INPUT (1)	A	AMMETER
PUSHBUTTON		OPTO-ISOLATED LOGIC INPUT (2)	V	VOLTMETER
KEY SWITCH		CHAMBERLAIN + HOOK METERING TESTBLOCK		ARC SENSOR

NOMENCLATURE/DESIGNATIONS

Protective Device	
Code	Function
12	Overspeed device
13	Synchronous speed device
14	Underspeed device
21	Distance protection
23	Temperature control device
24	Volts per Hertz relay
25	Synchronism check device
27	Undervoltage protection
30	Annunciator relay
31	Separate excitation device
32	Reverse power protection
37	Undercurrent (power) protection
38	Bearing protective device
40	Loss of excitation protection (field relay)
45	Atmospheric condition monitor
46	Negative sequence protection
47	Phase sequence voltage protection
48	Incomplete sequence relay
49	Transformer thermal protection
50	Instantaneous overcurrent protection
51	Time delay overcurrent protection
55	Power factor control
56	Field application device
59	Overvoltage protection
60	Voltage or current balance protection
61	Density switch or sensor
62	Time delay stopping or opening relay
63	Pressure supervision device
64	Ground detector relay (for E/F use 51N)
67	Directional overcurrent protection
68	Blocking relay
71	Level supervision device
74	Alarm relay
76	DC overcurrent device
77	Telemetering device
78	Phase angle measuring device
79	Auto reclose
80	Flow supervision device
81	Frequency supervision device
85	Pilot wire protection device
86	Lockout relay
87	Differential protection
90	Regulating device (Automatic voltage control)
91	Voltage directional device
92	Power directional device
94	Tripping or trip free relay
95	-Spare-
96	-Spare-
16	Digital Communications Device
52	Circuit Breaker Auxiliary Contact
89	Isolator / Earth Switch Auxiliary Contact

Equipment Location/Description	
Item	Designation
AC	Alternating Current
BYC	Bay Controller
CTJB	Current Transformer Junction Box
CB	Circuit Breaker
DC	Direct Current
DTT	Direct Transfer Trip
ES-x	Earth Switch <Plant Type>
Fnn	Function <Numerical>
HV	High Voltage / 88kV
ISOL	Isolator
LV	Low Voltage
MTR	Master Trip Relay
MCB	Miniature Circuit Breaker
MV	Medium Voltage / 11kV
PQ	Power Quality
RP	Relay Panel
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SMP	Statistical Metering Panel
TMP	Tariff Metering Panel
TMK	Transformer Marshalling Kiosk
VT	Voltage Transformer
VTS	Voltage Transformer Selection
YMK	Yard Marshalling Kiosk
ZMK	NEC/R/Aux Marshalling Kiosk

Wiring Prefixes	
Prefix	Circuit Description
A/A1	Main / Unit Protection CT Circuits
B	Busbar Protection CT Circuits
C/C1	Backup Protection / Auxiliary CT Circuits
D/D1	Metering / Measurements CT Circuits
E	VT Circuits
H	230V AC Circuits
J	110/220V DC Supplies
K1	Main DC Control Circuits
K3	Backup DC Control Circuits
K5	Close DC Control Circuits
L	Indication Circuits
M	Motor (Spring Rewind or Isolator) Circuits
N	Tapchange Control Circuits
P	Busbar Protection DC Circuits
S	Transducer Output Circuits
X	Hardwired SCADA Circuits

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CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D		DATE	
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
SYMBOLS AND ACRONYMS

CAD REF. 6154_02_02
SHEET: 02
NEXT: 03
DRG. NO. A3SY6154PM1ES002
A3

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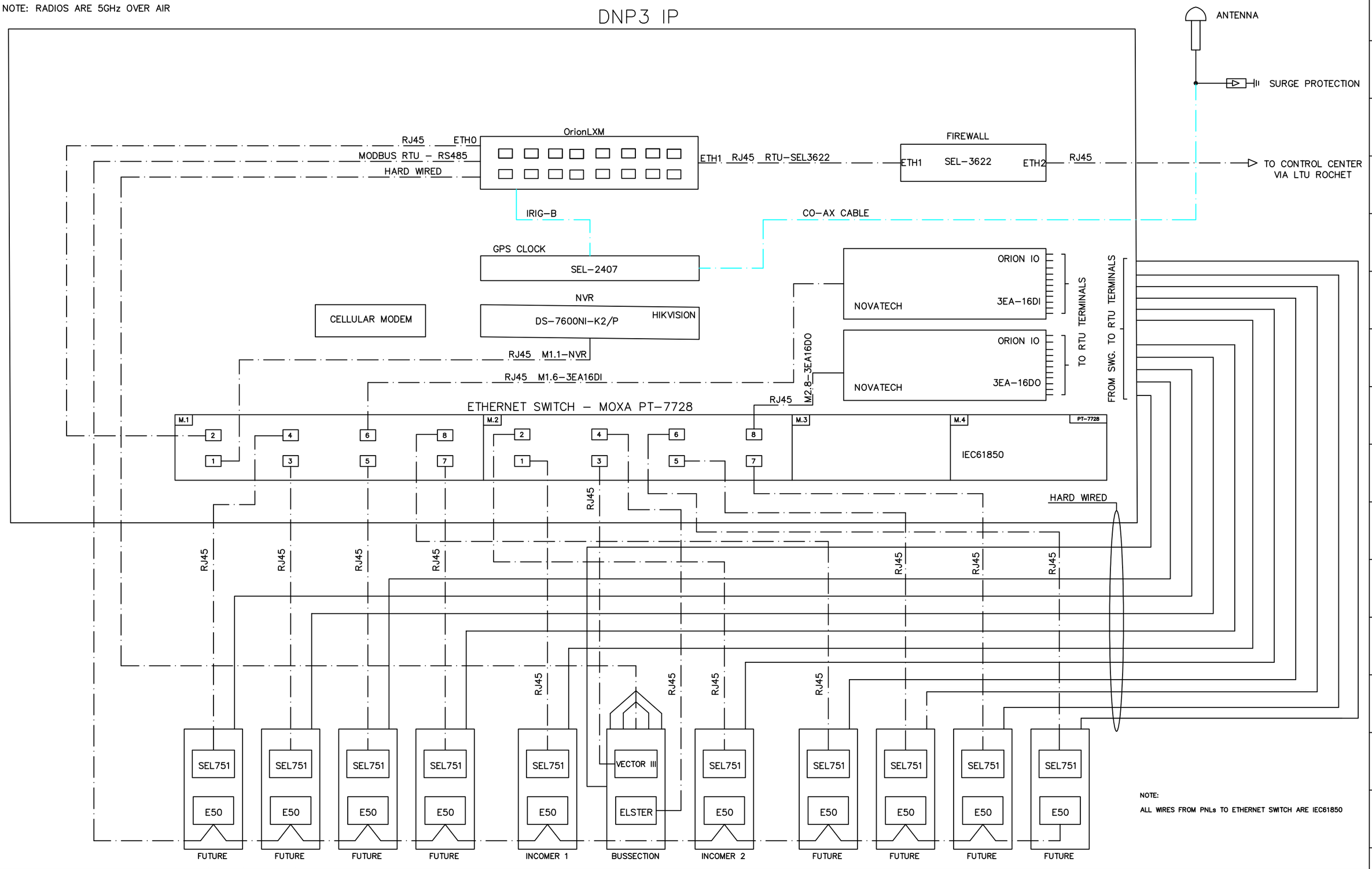
NOTE: RADIOS ARE 5GHz OVER AIR

DNP3 IP



NOTE:

ALL WIRES FROM PNLs TO ETHERNET SWITCH ARE IEC61850

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
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2	THIRD ISSUE	N.M	S.M	02/09/20					
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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D		DATE	
PROJN		SCALE	DO NOT SCALE

TITLE: THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
FUNCTIONAL BLOCK DIAGRAM

CAD REF. 6154_02_03 | SHEET: 03 | NEXT: 04 | DRG. NO. A3SY6154PM1ES002 | A3

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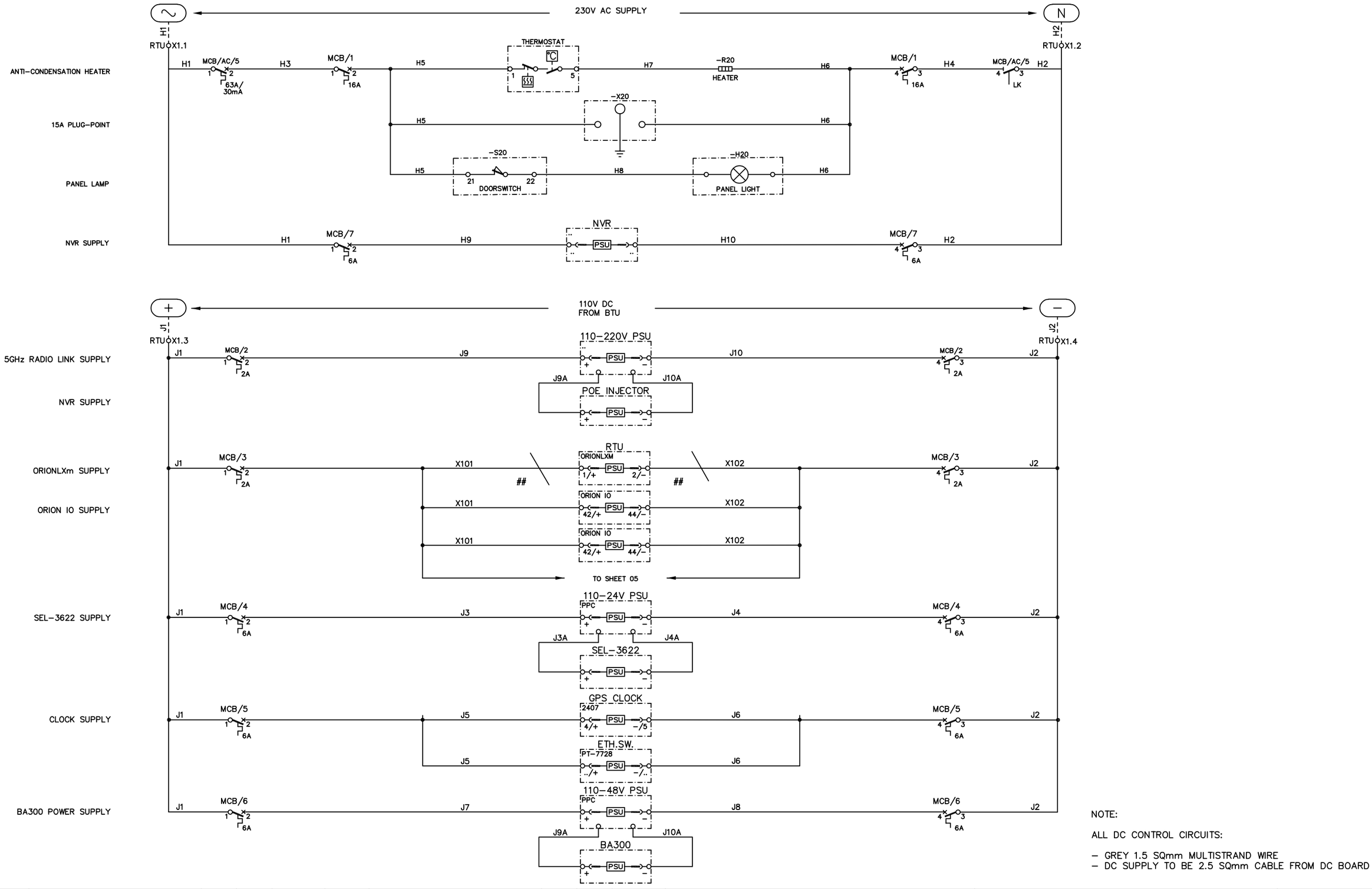

NOTE:

ALL DC CONTROL CIRCUITS:

- GREY 1.5 SQmm MULTISTRAND WIRE
- DC SUPPLY TO BE 2.5 SQmm CABLE FROM DC BOARD

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	H.M	06/04/21					
3	RE-SUBMISSION	N.M	H.M	17/09/20					
2	ORION IO POWER SUPPLY	N.M	H.M	07/09/20					
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0	FIRST ISSUE	N.M	H.M	05/02/20					

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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D		DATE	
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
AC SUPPLIES

CAD REF. 6202_02_04 | SHEET: 04 | NEXT: 05 | DRG. NO. A3SY6202PM1ES001 | A3

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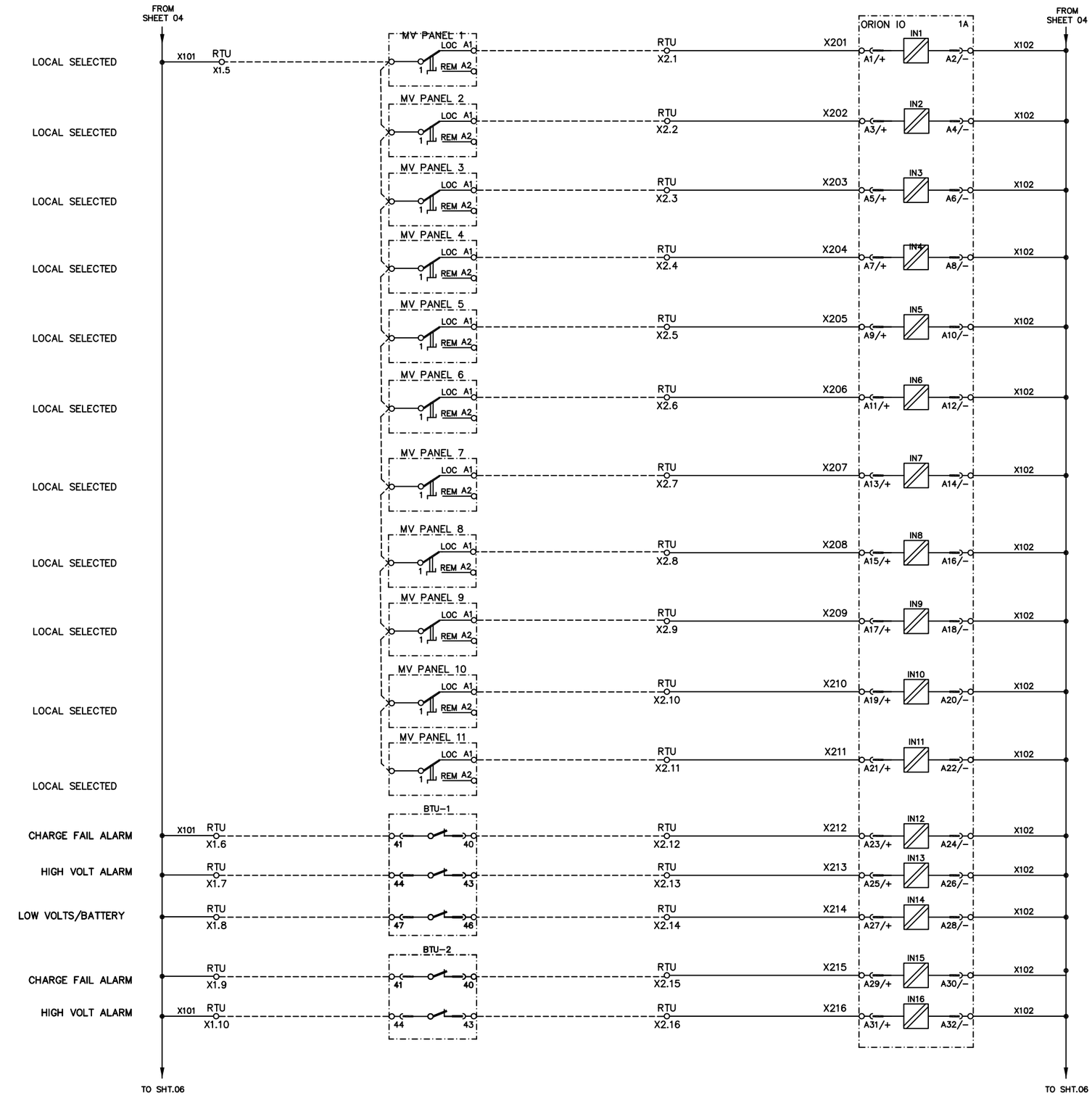

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4	REVISED	N.M	S.M	06/04/21					
3	RE−SUBMISSION	N.M	S.M	17/09/20					
2	ORION IO	N.M	S.M	02/09/20					
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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL INPUTS (I/O 1A)

CAD REF. 6154_02_05
SHEET: 05
NEXT: 06
DRG. NO. A3SE6154PM1ES002
A3

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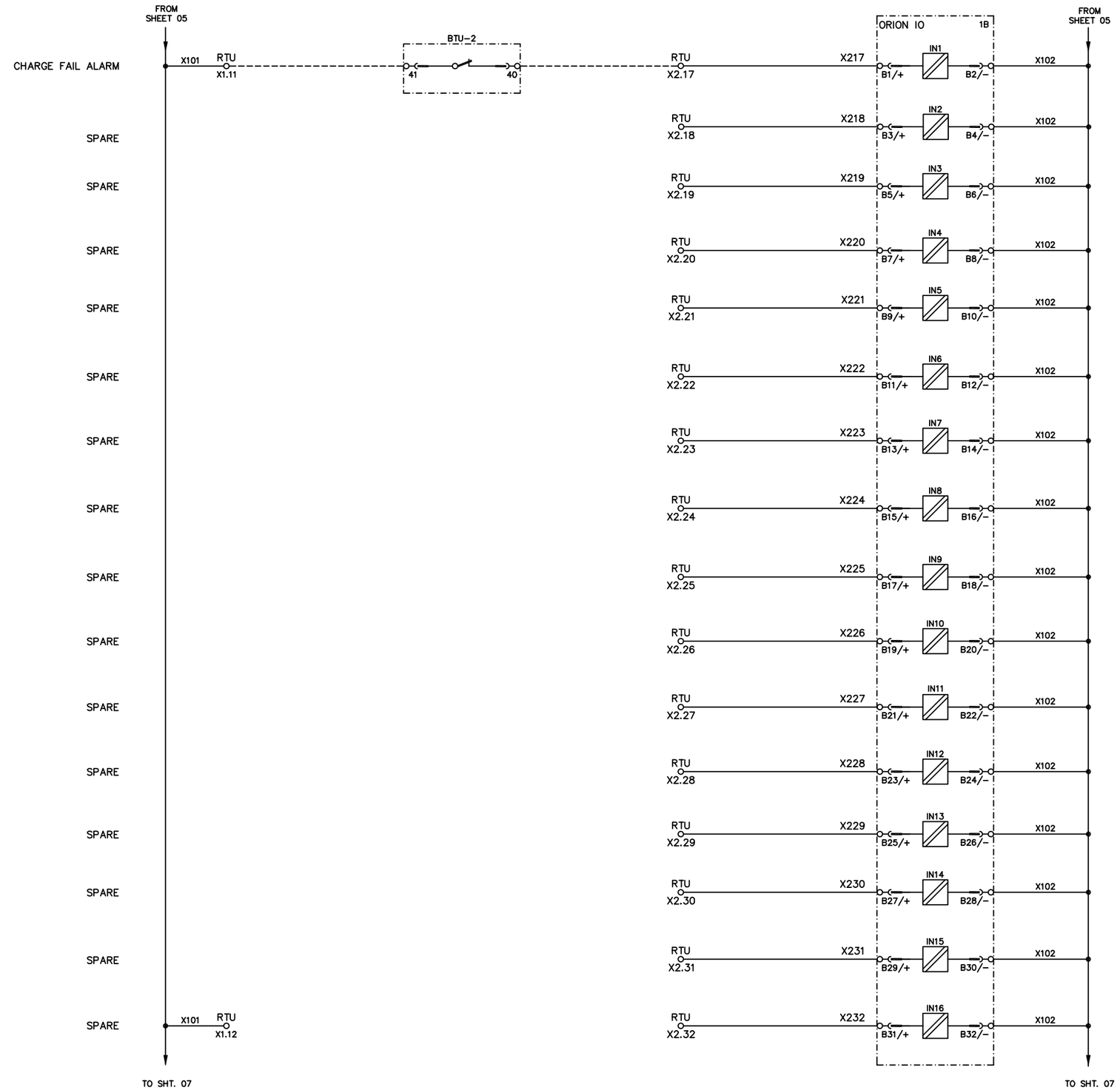

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4	REVISED	N.M	S.M	06/04/21					
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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE
CAD REF.	6154_02_06	SHEET:	06
		NEXT:	07

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL INPUTS (I/O 1B)

DRG. NO. A3SE6154PM1ES002 A3

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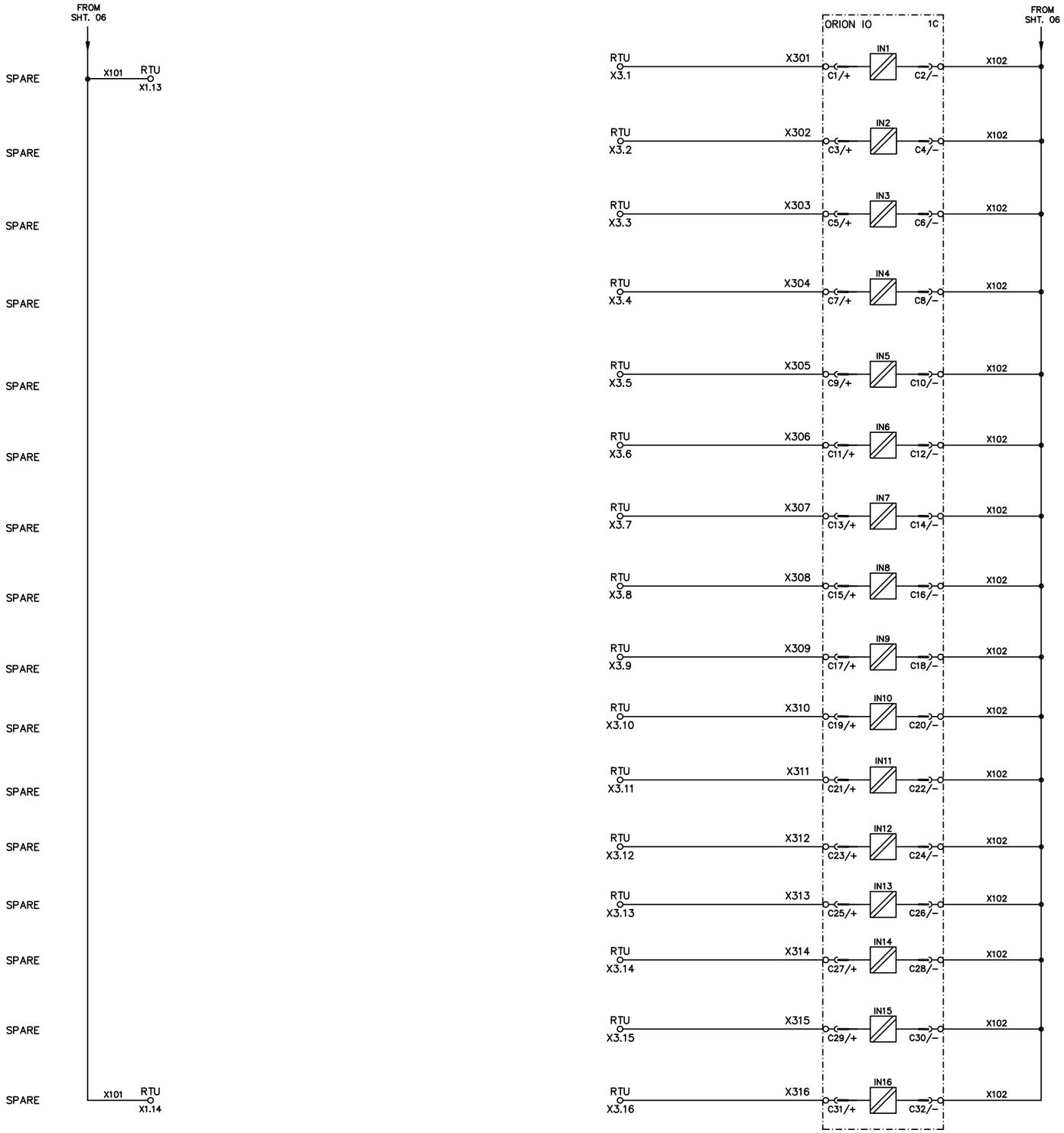

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4	REVISED	N.M	S.M	06/04/21					
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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE
CAD REF.	6154_02_07	SHEET:	07
		NEXT:	08

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL INPUTS (I/O 1C)

DRG. NO. A3SE6154PM1ES002 A3

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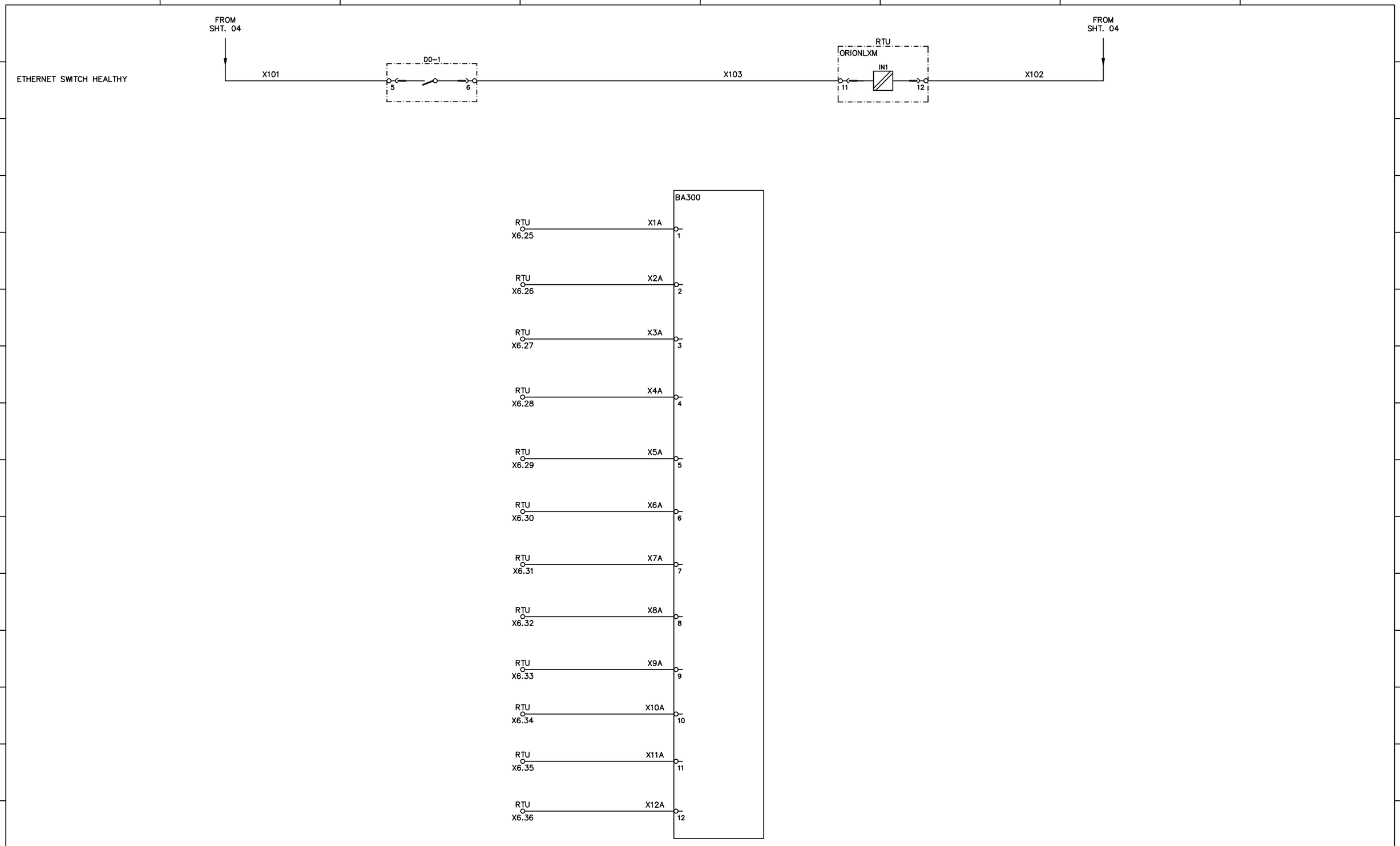

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4	REVISED	N.M	S.M	06/04/21					
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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL INPUTS (ORIONLXm & BA300)

CAD REF. 6154_02_08
SHEET: 08
NEXT: 09
DRG. NO. A3SY6154PM1ES002
A3

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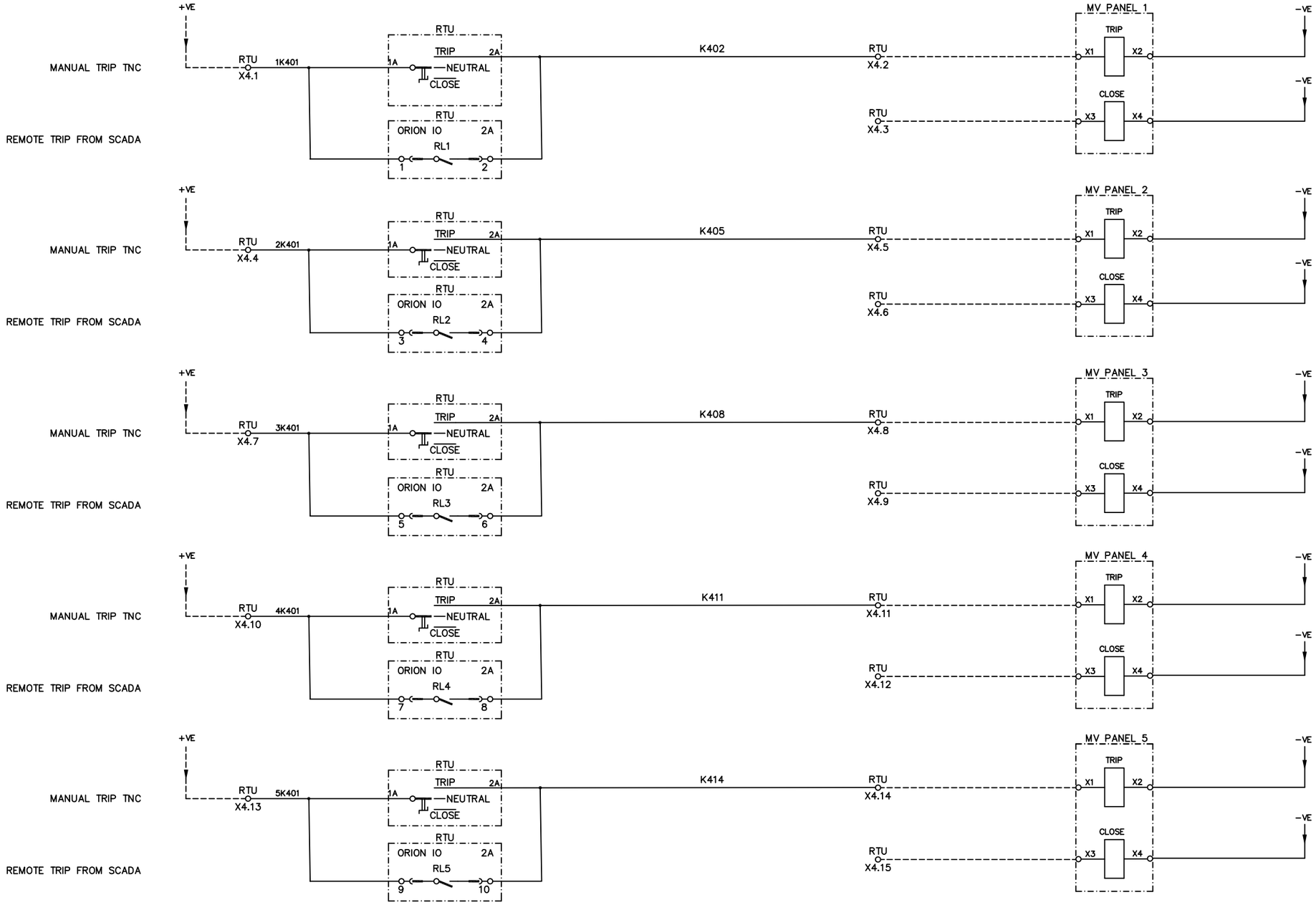

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DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	.. ..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
TRIPPING & REMOTE CONTROL

CAD REF. 6154_02_09
SHEET: 09
NEXT: 10
DRG. NO. A3SE6034PM1ES002
A3

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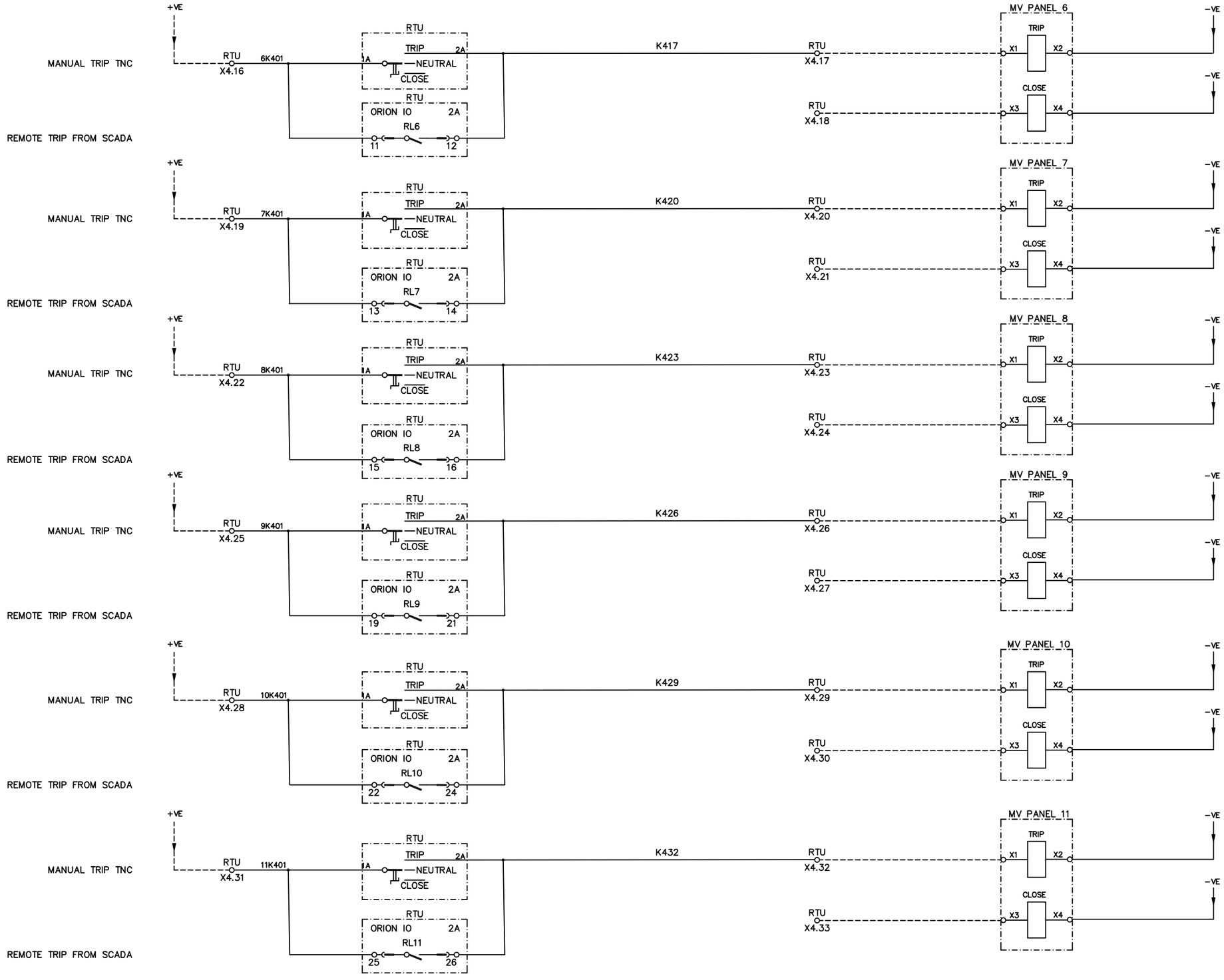

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE-SUBMISSION	N.M	S.M	17/09/20					
2	THIRD ISSUE	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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Tel: (011) 820-5111 Fax: (011) 820-5323

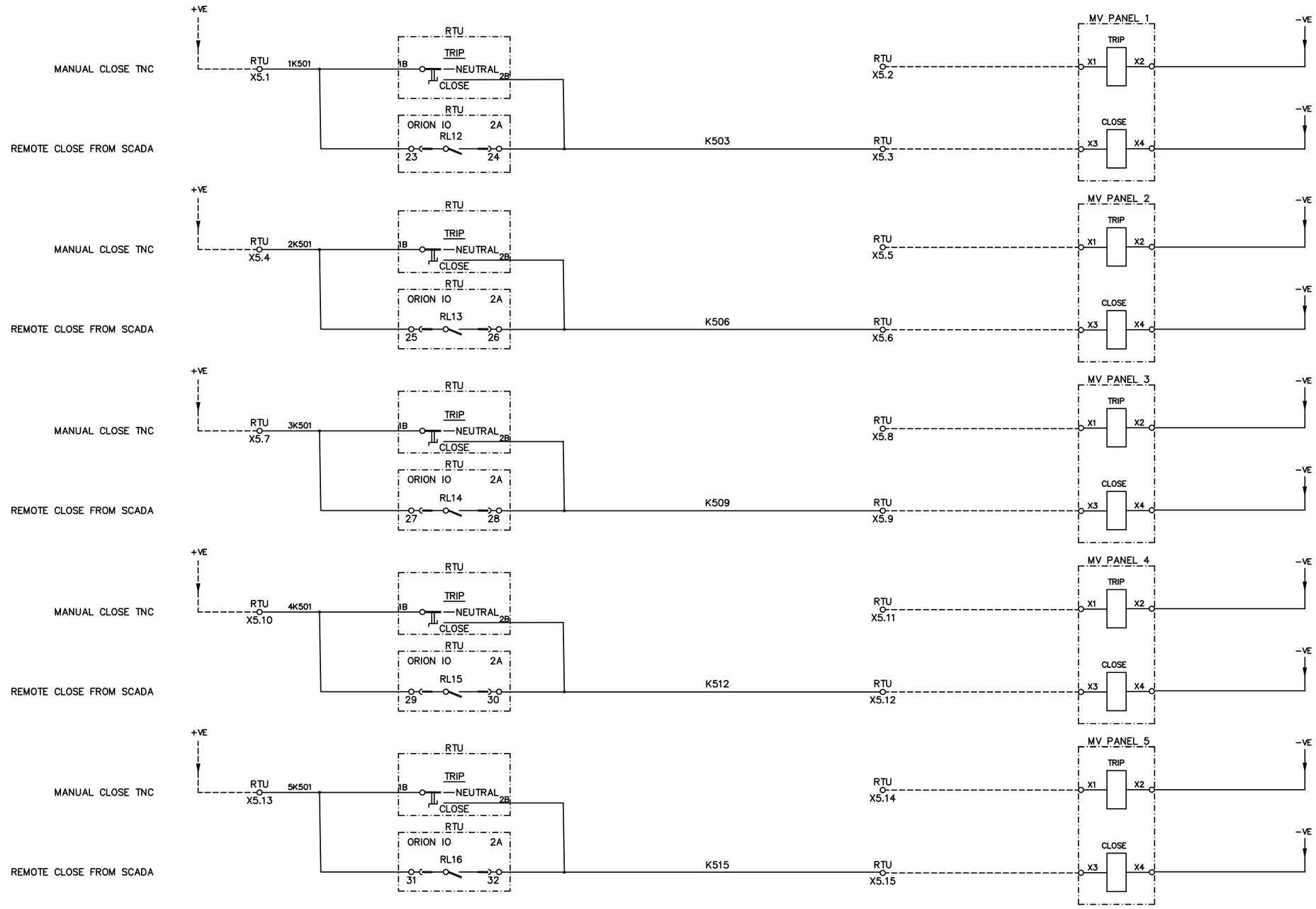
CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	.. ..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
TRIPPING & REMOTE CONTROL

CAD REF. 6154_02_08
SHEET: 10
NEXT: 11
DRG. NO. A3SE6154PM1ES002
A3

0 10 20 30 40 50 100 150 200



REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE-SUBMISSION	N.M	S.M	17/09/20					
2	THIRD ISSUE	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	.. ..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
CLOSING & REMOTE CONTROL

CAD REF. 6154_02_11
SHEET: 11
NEXT: 12
DRG. NO. A3SE6154PM1ES002
A3

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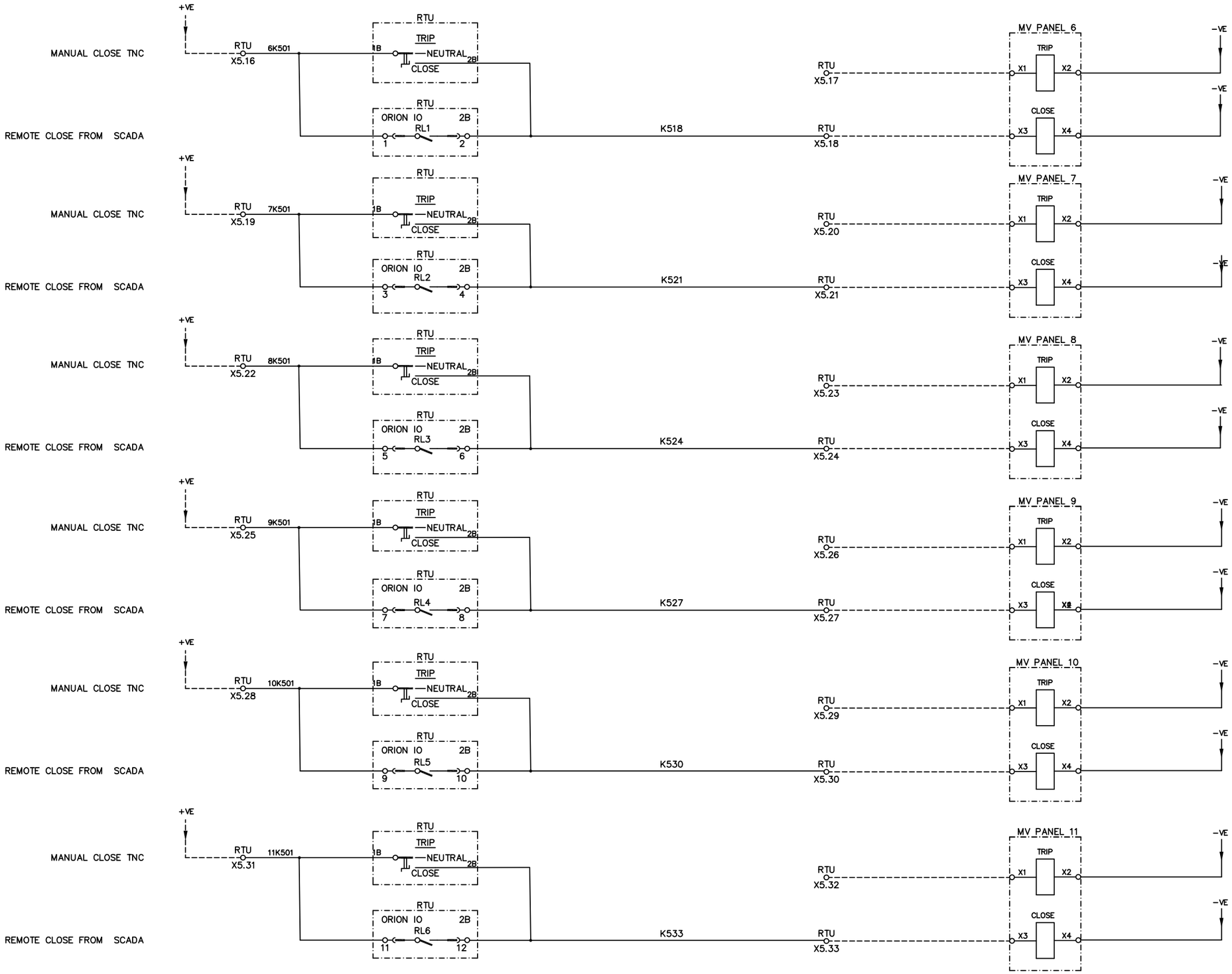

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE-SUBMISSION	N.M	S.M	17/09/20					
2	THIRD ISSUE	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	.. ..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
CLOSING & REMOTE CONTROL

CAD REF. 6154_02_12
SHEET: 12
NEXT: 13
DRG. NO. A3SE6154PM1ES002
A3

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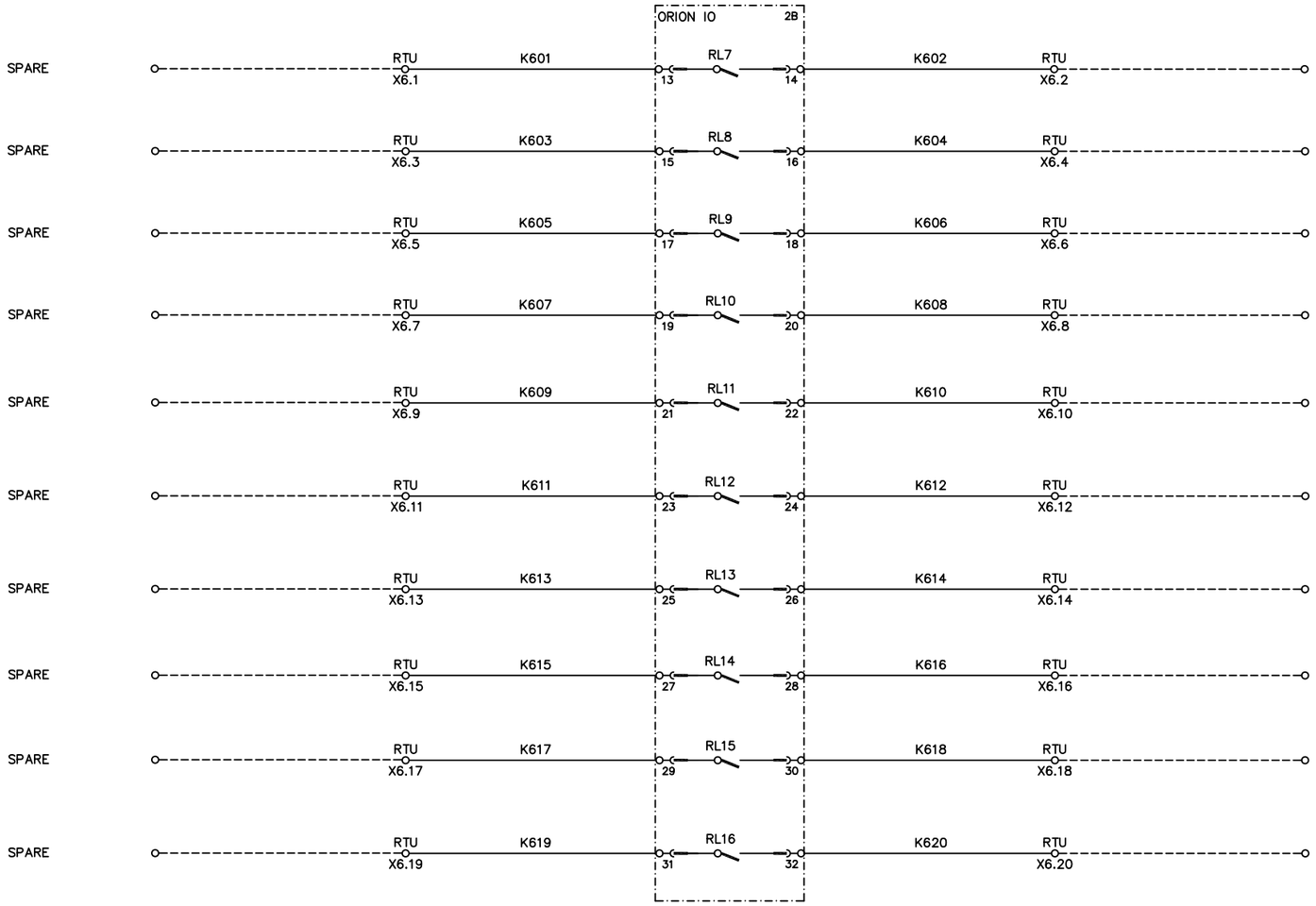

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE–SUBMISSION	N.M	S.M	17/09/20					
2	ORION IO	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL OUTPUTS

CAD REF. 6154_02_13
SHEET: 13
NEXT: 14
DRG. NO. A3SE6154PM1ES002
A3

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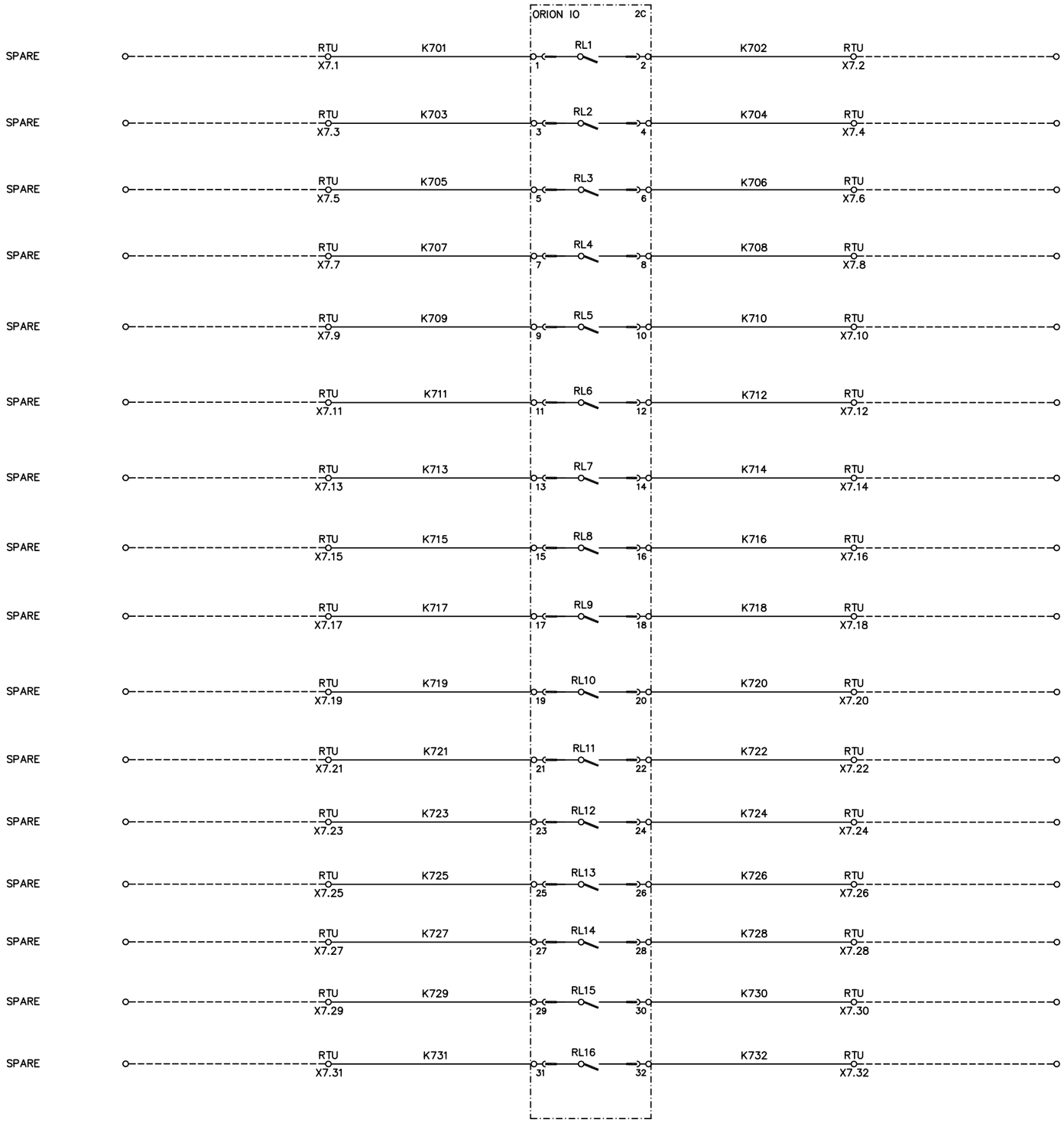

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE–SUBMISSION	N.M	S.M	17/09/20					
2	ORION IO	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
DIGITAL OUTPUTS

CAD REF. 6154_02_14
SHEET: 14
NEXT: 15
DRG. NO. A3SE6154PM1ES002
A3

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X1	
NO.	WIRE NO.
1	H1
2	H2
3	J1
4	J2
5	X101
6	X101
7	X101
8	X101
9	X101
10	X101
11	X101
12	X101
13	X101
14	X101
15	X103
16	SPARE
17	SPARE
18	SPARE
19	SPARE
20	SPARE
21	SPARE
22	SPARE
23	SPARE
24	SPARE
25	SPARE
26	SPARE
27	SPARE
28	SPARE
29	SPARE
30	SPARE
31	SPARE
32	SPARE
33	SPARE
34	SPARE
35	SPARE

X2	
NO.	WIRE NO.
1	X201
2	X202
3	X203
4	X204
5	X205
6	X206
7	X207
8	X208
9	X209
10	X210
11	X211
12	X212
13	X213
14	X214
15	X215
16	X216
17	X217
18	X218
19	X219
20	X220
21	X221
22	X222
23	X223
24	X224
25	X225
26	X226
27	X227
28	X228
29	X229
30	X230
31	X231
32	X232
33	SPARE
34	SPARE
35	SPARE

X3	
NO.	WIRE NO.
1	X301
2	X302
3	X303
4	X304
5	X305
6	X306
7	X307
8	X308
9	X309
10	X310
11	X311
12	X312
13	X313
14	X314
15	X315
16	X316
17	SPARE
18	SPARE
19	SPARE
20	SPARE
21	SPARE
22	SPARE
23	SPARE
24	SPARE
25	SPARE
26	SPARE
27	SPARE
28	SPARE
29	SPARE
30	SPARE
31	SPARE
32	SPARE
33	SPARE
34	SPARE
35	SPARE

X4	
NO.	WIRE NO.
1	K401
2	K402
3	
4	K401
5	K405
6	
7	K401
8	K408
9	
10	K401
11	K411
12	
13	K401
14	K414
15	
16	K401
17	K417
18	
19	K401
20	K420
21	
22	K401
23	K423
24	
25	K401
26	K426
27	
28	K401
29	K429
30	
31	K401
32	K432
33	
34	SPARE
35	SPARE

X5	
NO.	WIRE NO.
1	K501
2	
3	K503
4	K501
5	
6	K506
7	K501
8	
9	K509
10	K501
11	
12	K512
13	K501
14	
15	K515
16	K501
17	
18	K518
19	K501
20	
21	K521
22	K501
23	
24	K524
25	K501
26	
27	K527
28	K501
29	
30	K530
31	K501
32	
33	K533
34	SPARE
35	SPARE

X6	
NO.	WIRE NO.
1	X601
2	X602
3	X603
4	X604
5	X605
6	X606
7	X607
8	X608
9	X609
10	X610
11	X611
12	X612
13	X613
14	X614
15	X615
16	X616
17	X617
18	X618
19	X619
20	X620
21	SPARE
22	SPARE
23	SPARE
24	SPARE
25	X1A
26	X2A
27	X3A
28	X4A
29	X5A
30	X6A
31	X7A
32	X8A
33	X9A
34	X10A
35	X11A
36	X12A

X7	
NO.	WIRE NO.
1	K701
2	K702
3	K703
4	K704
5	K705
6	K706
7	K707
8	K708
9	K709
10	K710
11	K711
12	K712
13	K713
14	K714
15	K715
16	K716
17	K717
18	K718
19	K719
20	K720
21	K721
22	K722
23	K723
24	K724
25	K725
26	K726
27	K727
28	K728
29	K729
30	K730
31	K731
32	K732
33	SPARE
34	SPARE
35	SPARE

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
4	REVISED	N.M	S.M	06/04/21					
3	RE-SUBMISSION	N.M	S.M	17/09/20					
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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05.02.20
CHD	H.M	DATE	05.02.20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE

TITLE:
THEMBA KHUBEKA SWITCHING STATION
RTU/GATEWAY PANEL
TERMINAL LIST

CAD REF. 6154_02_15
SHEET: 15
NEXT: –
DRG. NO. A3SY6154PM1ES002
A3

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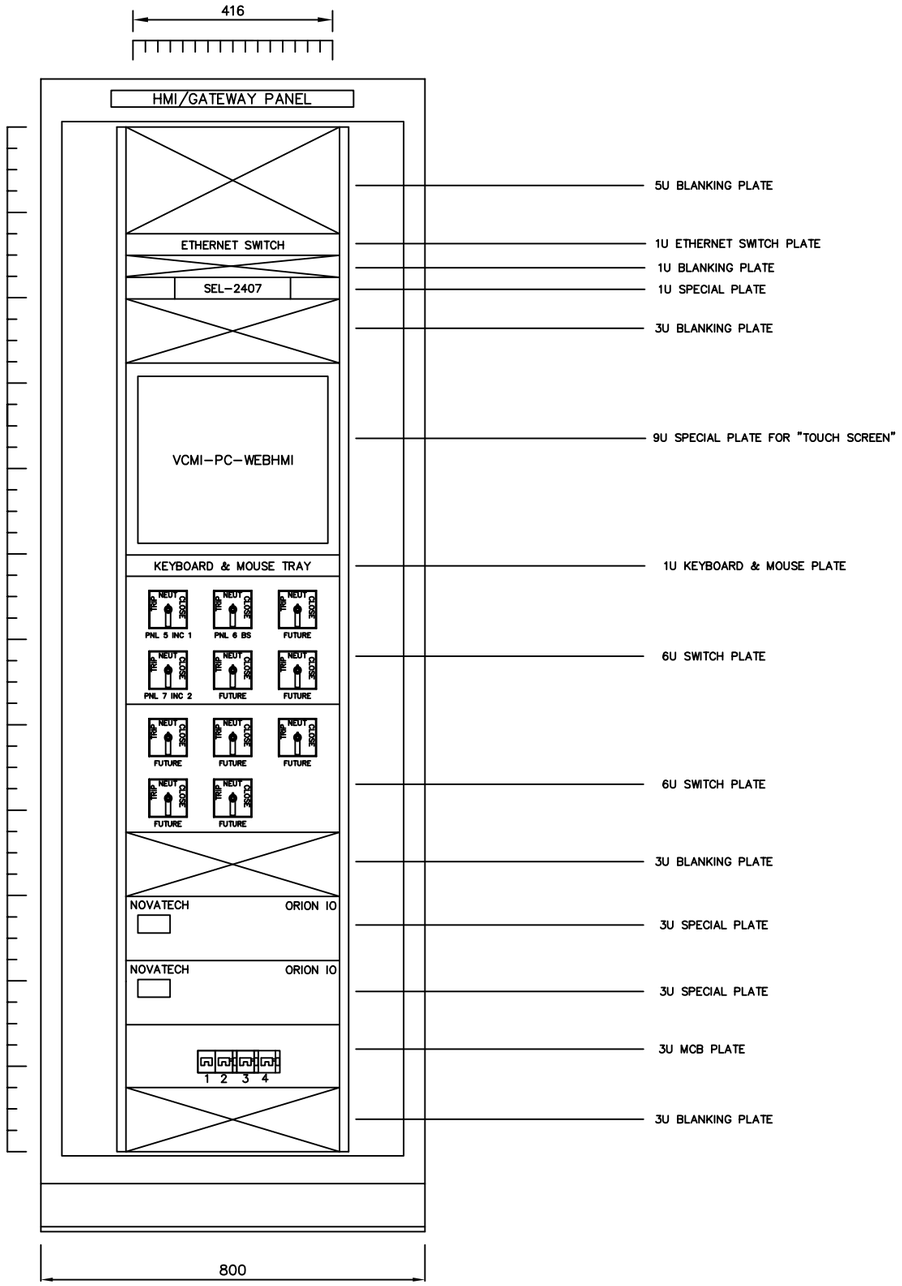

FRONT VIEW

REVISION	DESCRIPTION	DRAWN	APP'D	DATE	REVISION	DESCRIPTION	DRAWN	APP'D	DATE
2	THIRD ISSUE	N.M	S.M	02/09/20					
1	SECOND ISSUE	N.M	H.M	03/07/20					
0	FIRST ISSUE	N.M	H.M	05/02/20					

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CUSTOMER: TRACTIONAL ENTERPRISE
CUST. REF. : _____

DRN	N.M	DATE	05/01/20
CHD	H.M	DATE	05/01/20
APP'D	..	DATE	..
PROJN		SCALE	DO NOT SCALE
CAD REF.	6154_02_16	SHEET:	16
		NEXT:	--

TITLE:
THEMBA KHUBEHA SWITCHING STATION
RTU/GATEWAY PANEL
PANEL LAYOUT AND LEGEND

DRG. NO. A3SY6154PM1ES002 A3

0 10 20 30 40 50 100 150 200

PROJECT : VAALDAM SUBSTATION EXTENSION

CLIENT : METSIMAHOLO LOCAL MUNICIPALITY

PROJECT No : VE9335-6

TENDER
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	As-Built						Engineer:	M LYON JNR Pr Eng
	Construction						Design:	M VAN JAARSVELD (M.ENG)
	Tender	2021-07-05					Drawn:	M VAN JAARSVELD (M.ENG)
	Approval						Approved:	
	Information						Date:	05 JULY 2021
	Planning							
		Date	Date	REVISIONS	Drawn	Rev. No		

Metsimaholo Municipality

VAALDAM SUBSTATION EXTENSION
COVER SHEET

LYON AND PARTNERS
Consulting Electrical Engineers & Project Managers
lyon@lyon.co.za +27 16 981 6270
PO Box 3925 - VANDERBIJLPARK - 1900

SCALE: NTS (A3)

DRAWING NUMBER: SHEET 01 OF 02
VE9335-6-GNL

REV. NO: 0

F:_Metsimaholo\VE 9335-6 Vaaldam Substation\DD - DESIGN DRAWINGS\LYON DRAWINGS\3. TENDER DRAWINGS\1. VE9335-6-GNL.dgn

LYON VENNOTE PARTNERS	**Title: Drawing Register**	**Doc No:** QMS 8.3.5.2
	Issued: 3 August 2021	**Rev:** 1

Project Number:	**VE9335-6**
Project Name:	**VAALDAM SUBSTATION EXTENSION**

X Symbolises current revision

- Symbolises previous revisions

Nr	Drawing Number	Description	Size	Latest Rev. Date:	Current Rev.	Information	Planning	Approval	Tender	Construction	As Built	Issued (Y/N)
	GENERAL INFORMATION											
1	VE9335-6-GNL SHEET 01	VAALDAM SUBSTATION EXTENSION - COVER	A3	**2021-07-05**	0		-	-	X			N
2	VE9335-6-GNL SHEET 02	VAALDAM SUBSTATION EXTENSION - INDEX	A3	**2021-07-05**	0		-	-	X			N
3.a	VE9335-6-SITE	VAALDAM SUBSTATION EXTENSION - SITE LAYOUT	A1	**2021-07-05**	0		-	-	X			N
3.b	VE9335-6-GA	VAALDAM SUBSTATION EXTENSION - GENERAL ARRANGEMENT	A1	**2021-07-05**	0		-	-	X			N
3.c	VE9335-6-FDN	VAALDAM SUBSTATION EXTENSION - FOUNDATION LAYOUT	A1	**2021-07-05**	0		-	-	X			N
3.d	VE9335-6-STL	VAALDAM SUBSTATION EXTENSION - STEELWORK LAYOUT	A1	**2021-07-05**	0		-	-	X			N
3.e	VE9335-6-EARTH	VAALDAM SUBSTATION EXTENSION - EARTH GRID LAYOUT	A1	**2021-07-05**	0		-	-	X			N
3.f	VE9335-6-EQP	VAALDAM SUBSTATION EXTENSION - EQUIPMENT LAYOUT	A1	**2021-07-05**	0		-	-	X			N
4	VE9335-6-SED	VAALDAM SUBSTATION EXTENSION - STATION ELECTRIC DIAGRAM	A3	**2021-07-05**	0		-	-	X			N
5	VE9335-6- VAALDAM SS - CR	VAALDAM SUBSTATION EXTENSION - CONTROL ROOM	A3	**2021-07-05**	0		-	-	X			N

Sign:	
Name:	
Date:	

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	As-Built							Engineer:	M LYON JNR Pr Eng	
	Construction							Design:	M VAN JAARSVELD (M.ENG)	
	Tender	2021-07-05						Drawn:	M VAN JAARSVELD (M.ENG)	
	Approval							Approved:		
	Information							Date:	05 JULY 2021	
	Planning									
		Date	Date	REVISIONS	Drawn	Rev. No				

Metsimaholo Municipality

VAALDAM SUBSTATION EXTENSION
COVER SHEET

LYON AND PARTNERS
Consulting Electrical Engineers & Project Managers
lyon@lyon.co.za +27 16 981 6270
PO Box 3925 - VANDERBIJLPARK - 1900

SCALE: NTS (A3)

DRAWING NUMBER: VE9335-6-GNL SHEET 02 OF 02

REV. NO: 0

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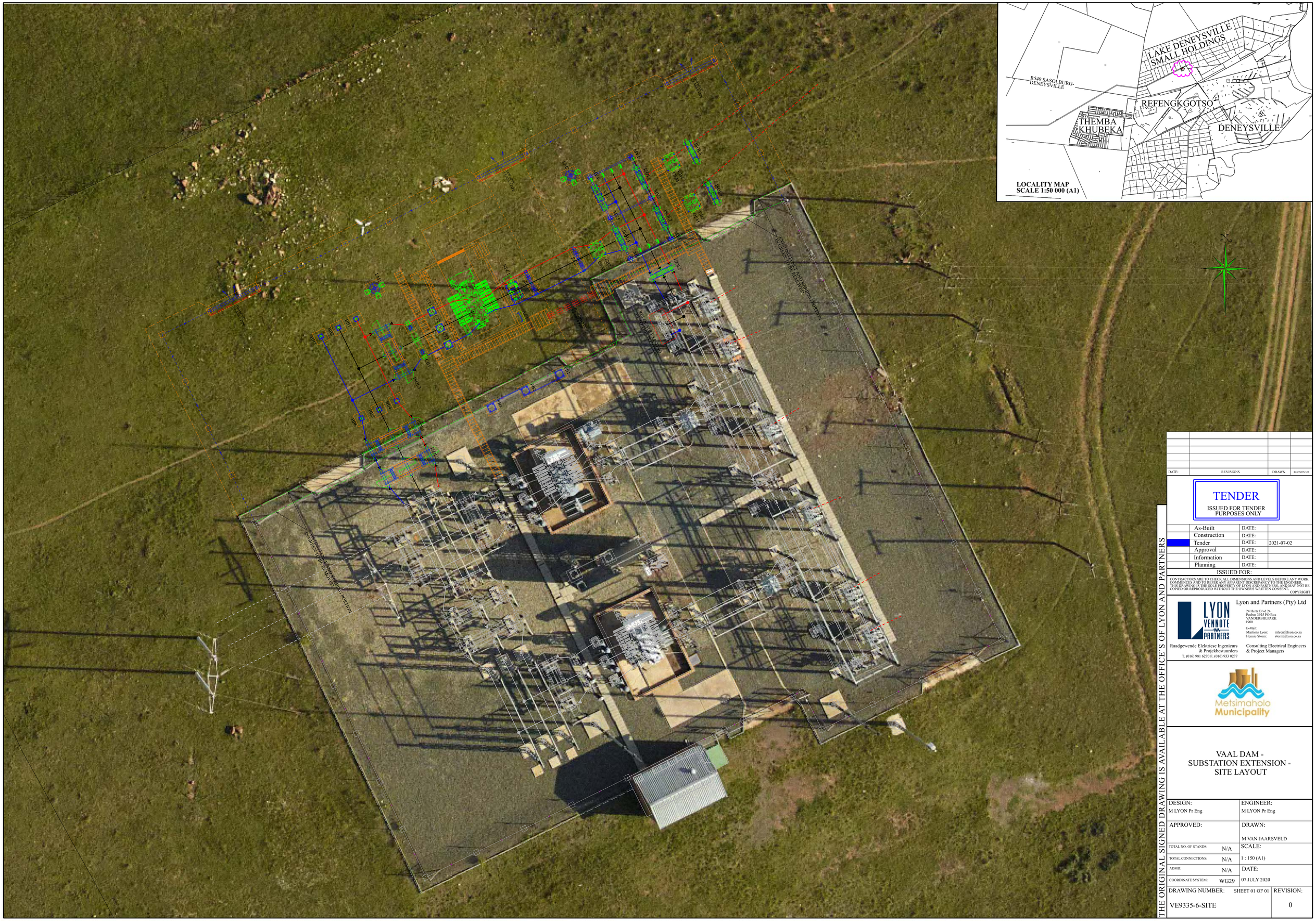
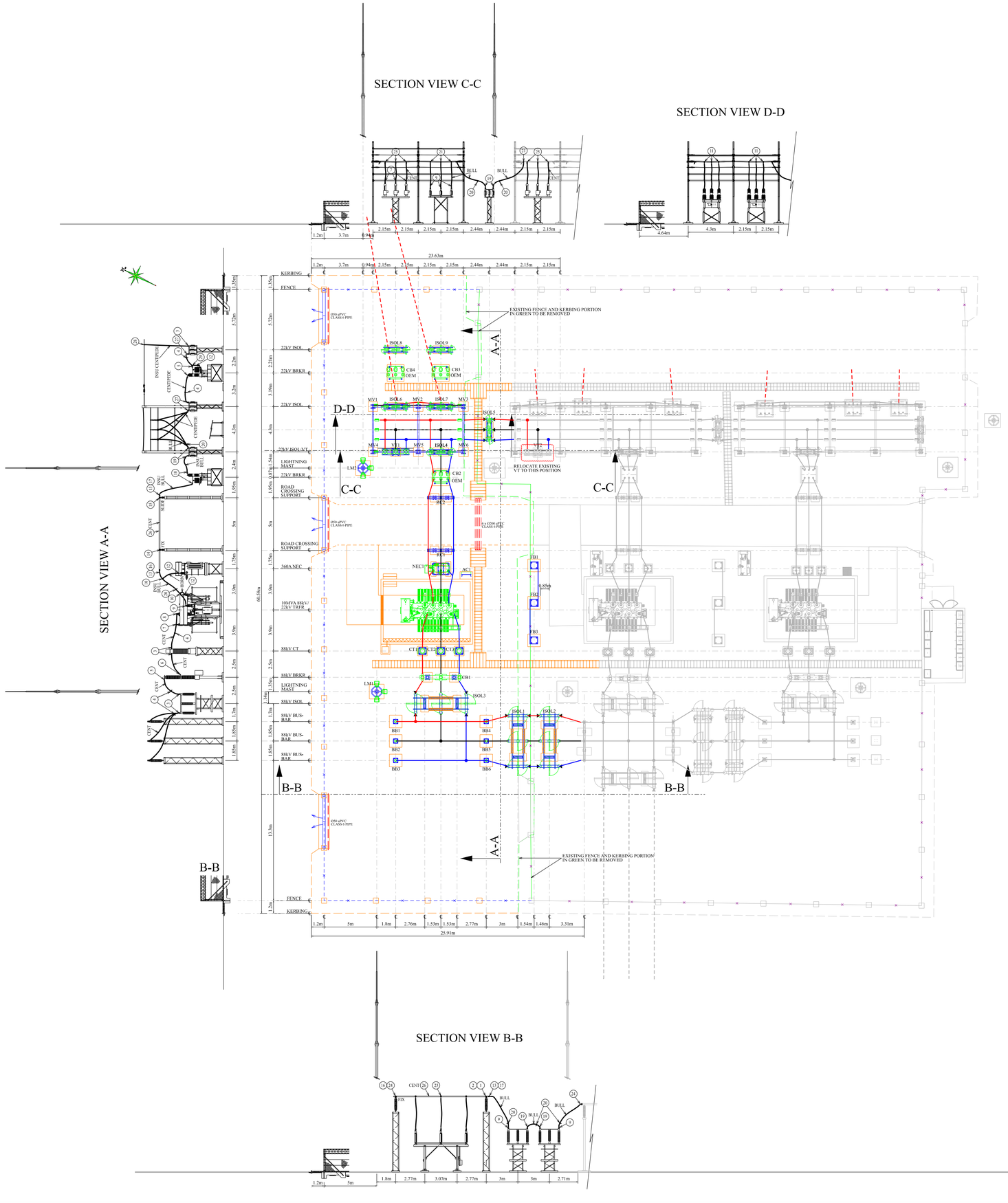

EXISTING 132kV LINE
EXISTING 132kV LINE
EXISTING 132kV LINE

ITEM NO	DESCRIPTION	D-DT No	QTY
1	CLAMP, TUBE TBSS 120/127	6118s1	3
2	CLAMP, TUBE TBC 120/120	6116	3
3	CLAMP B/COMP 26.5mm-38mm 0DG EXC-B (KC2)	6006s2	18
4	CLAMP PEG AL CENT 26.5mm EPC-26	6115s1	18
5	CLAMP B/COMP 26.5mm PALM 0DG EPC-A	6018	15
6	CLAMP B/COMP 26.5mm PALM 45DG EPC-B	6018	3
7	CLAMP CROSS 26.5mm - 26mm K2 EX-B	6002s2	6
8	CLAMP B/COMP 26.5mm-26mm 0DG EXC-A (KC1)	6006s1	3
9	CLAMP B/COMP 38.3mm-38mm 0DG EXC-C (KC3)	6006s3	9
10	CLAMP CROSS 16.3mm - 38mm K3 EX-C	6002s3	6
11	CLAMP T/COMP 26.5mm - 38.3mm 0DG	6010s4	6
12	LUG AL HORNET 1B M12 0DG	3074s1	6
13	CLAMP T S/COMP TBCT-120/38C1 0DG	6090	9
14	CLAMP BUS COUPLER TBFC120-76	6086s1	3
15	CLAMP BUS COUPLER TBSC120-76	6086s2	3
16	END CAP TBEC 120 WITH F/CLAMP	6040s2	6
17	END CAP TBEC 120 PLAIN NO F/CLAMP	6040s1	6
18	CLAMP B/COMP 38.3mm PALM 0DG EPC-D	6018s3	6
19	CLAMP B/COMP 38.3mm - 38mm 45DG EXC-E (KC4)	6006s4	18
20	CLAMP PEG AL BULL 38.3mm EPC 38	6115	18
21	CLAMP T/COMP 38.3mm - 38.3mm 0DG TC10	6010s2	6
22	CLAMP TUB TAP-OFF TBTC120/C1-26	6119	6
23	CLAMP BUS COUPLER TBFC 120-127	6086s2	6
24	CLAMP T S/COMP TBCT-80/38C1 45DG	6090s2	3
25	CLAMP CROSS 26.5mm - 38mm K4 EX-C	6002s3	6
26	TUBE AL 120mm OD x 4mm W THK	6000s1	52
27	CLAMP B/COMP 26.5mm-38mm 45DG EXC-H	6006s3	18
28	CLAMP EUT-C 18.8mm - 26.5mm (CHICADEE-CENTIPEDE)	6099	6
29	CLAMP EUT-D 26.5mm - 18.1mm (CENTIPEDE-HORNET)	6099	6
HORN	COND. AAC HORNET 16.25D UNGRS	3136s7	26
CENT	COND. AAC CENTIPEDE 26.45D UNGRS	3136s7	104
INSU CERT	COND. AAC CENTIPEDE 26.45D INSU UNGRS	3136s7	82
BULL	COND. AAC BULL 38.25D UNGRS	3136s7	98
INSU BULL	COND. AAC BULL 38.25D INSU UNGRS	3136s8	32



DATE:	REVISIONS	DRAWN	REVISION NO

TENDER

ISSUED FOR TENDER PURPOSES ONLY

	As-Built	DATE:	
	Construction	DATE:	
	Tender	DATE:	2021-07-02
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

ISSUED FOR:

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Raadgewende Elektriese Ingenieurs & Projekbestuurders
T. (016) 981 6270 F. (016) 933 0277
Consulting Electrical Engineers & Project Managers

Metsimaholo Municipality

VAAL DAM - SUBSTATION EXTENSION - GENERAL ARRANGEMENT

DESIGN: M LYON Pr Eng	ENGINEER: M LYON Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD
TOTAL NO. OF STANDS: N/A	SCALE: 1 : 200 (A1)
TOTAL CONNECTIONS: N/A	
ADMD: N/A	DATE: 01 JULY 2021
COORDINATE SYSTEM: WG29	

DRAWING NUMBER: VE9335-6-GA — SHEET 01 OF 01 — REVISION: 0

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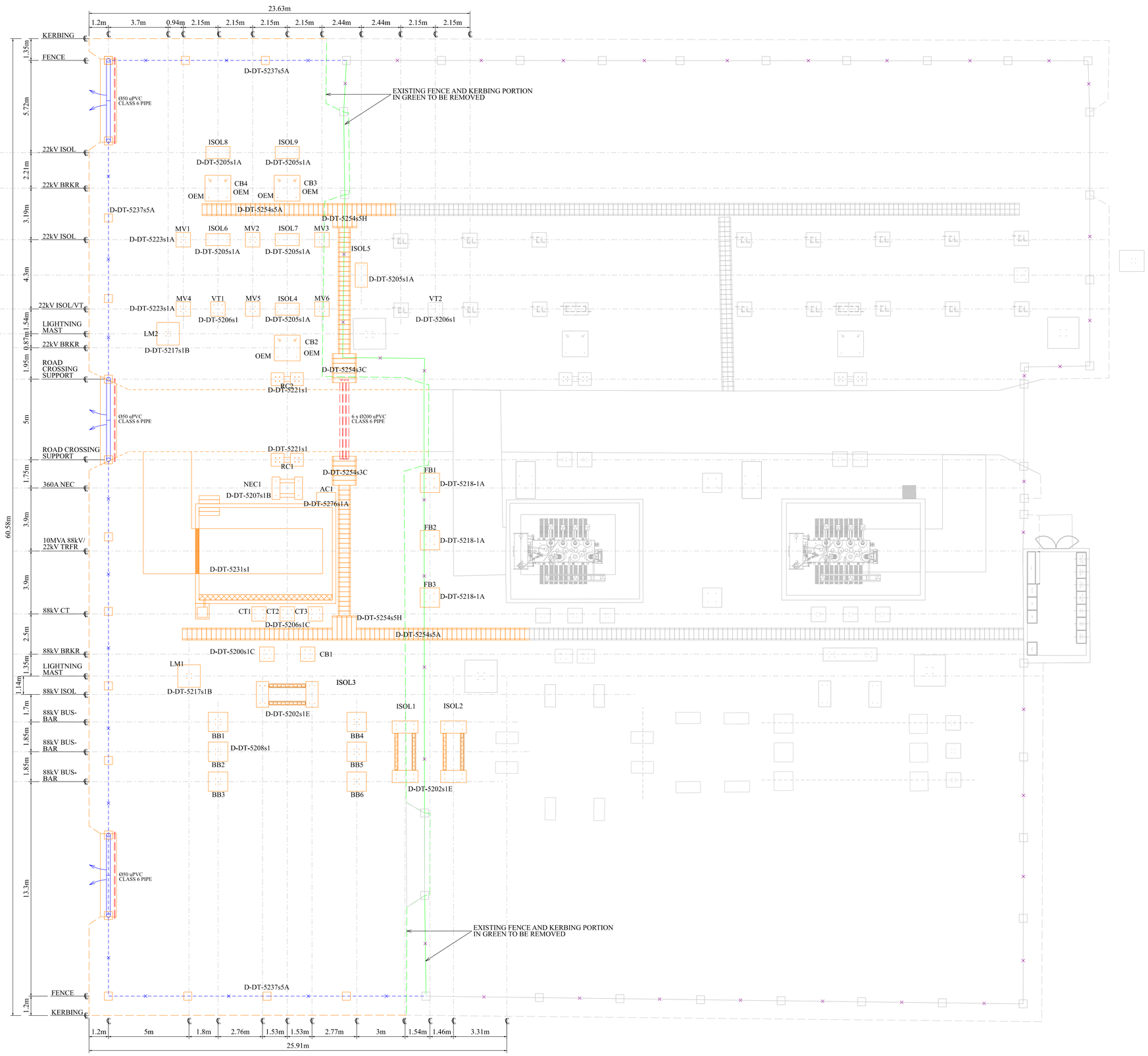

PLATFORM WORK:

- TOP LAYER OF 25MM STONE DOLOMITE OR GRANITE 150MM THICK
- 150MM THICK LAYER OF G5 MATERIAL MODIFIED WITH 3% OPC COMPACTED TO 98% MOD AASHTO DENSITY (C4)
- 150MM THICK LAYER OF G5 MATERIAL COMPACTED TO 96% MOD AASHTO DENSITY
- 150MM THICK LAYER OF G6 MATERIAL COMPACTED TO 93% MOD AASHTO DENSITY
- 150MM THICK RIP AND RECOMPACT INSITU MATERIAL TO 90% MOD AASHTO DENSITY

GRAVEL ROAD:

- TOP LAYER OF 25MM STONE DOLOMITE OR GRANITE 150MM THICK (INTERNAL SITE ONLY)
- 150MM THICK GRAVEL WEARING COURSE G3 BASE LAYER COMPACTED TO 98% MOD AASHTO DENSITY
- 150MM THICK SUBBASE LAYER OF G5 MATERIAL COMPACTED TO 96% MOD AASHTO DENSITY
- 150MM THICK UPPER SELECTED LAYER OF G5 MATERIAL COMPACTED TO 96% MOD AASHTO DENSITY
- 150MM THICK RIP AND RECOMPACT INSITU MATERIAL TO 90% MOD AASHTO DENSITY

DATE:	REVISIONS	DRAWN	REVISION NO

TENDER

ISSUED FOR TENDER PURPOSES ONLY

	As-Built	DATE:	
	Construction	DATE:	
	Tender	DATE:	2021-07-05
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

ISSUED FOR:

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Metsimaholo Municipality

VAAL DAM - SUBSTATION EXTENSION - FOUNDATION LAYOUT

DESIGN: M LYON Pr Eng		ENGINEER: M LYON Pr Eng	
APPROVED:		DRAWN: M VAN JAARSVELD	
TOTAL NO. OF STANDS:	N/A	SCALE: 1 : 125 (A1)	
TOTAL CONNECTIONS:	N/A		
ADMD:	N/A	DATE: 07 JULY 2020	
COORDINATE SYSTEM:	WG29		
DRAWING NUMBER: VE9335-6-FDN		SHEET 01 OF 01	REVISION: 0

LEGEND

	EXISTING FENCE LINE
	EXISTING CURB LINE
	NEW FENCE LINE

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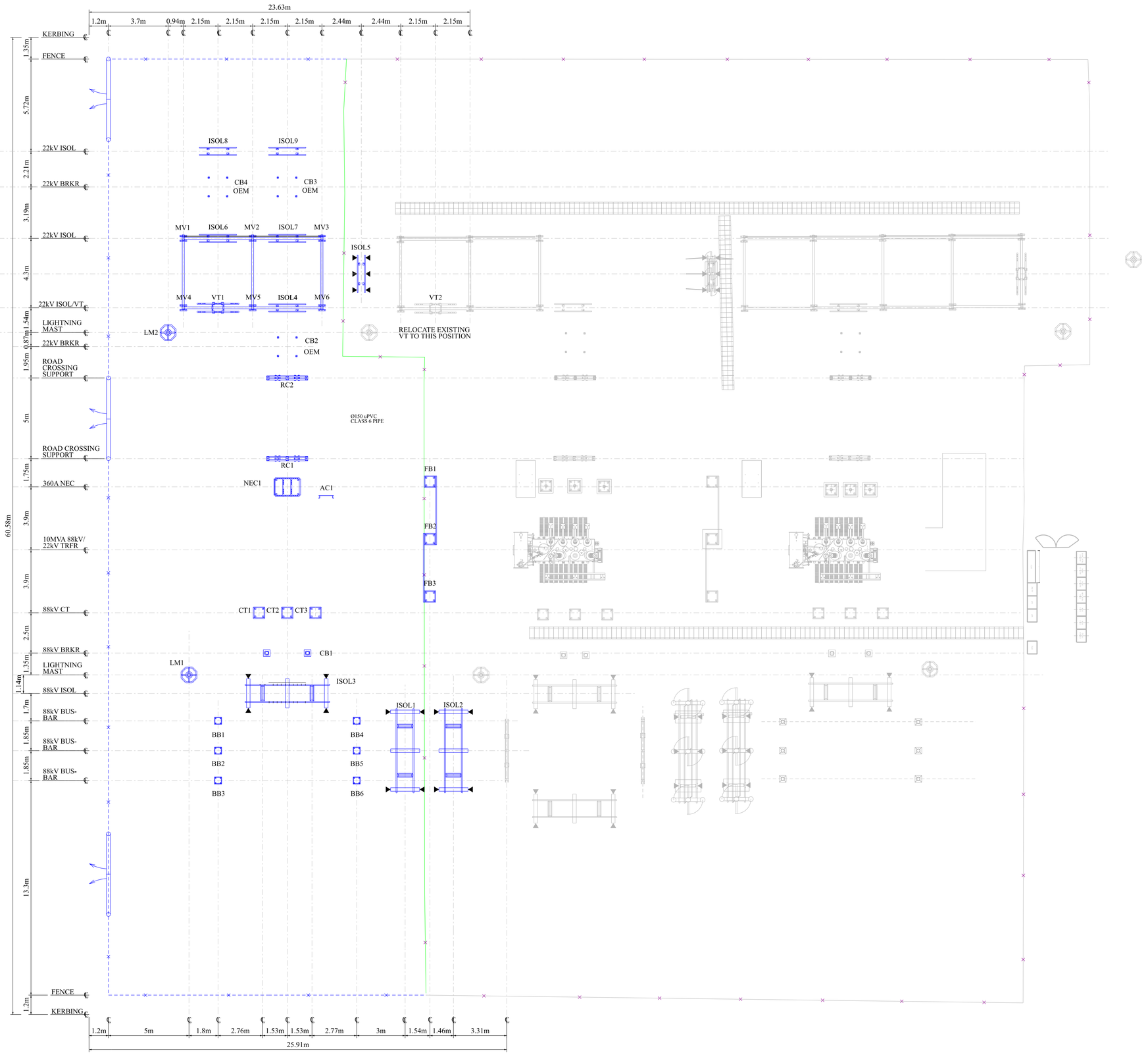

DATE:	REVISIONS	DRAWN	REVISION NO

TENDER

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	As-Built	DATE:	
	Construction	DATE:	
	Tender	DATE:	2021-07-05
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

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VAAL DAM - SUBSTATION EXTENSION - STEELWORK LAYOUT

DESIGN: M LYON Pr Eng	ENGINEER: M LYON Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD
TOTAL NO. OF STANDS: N/A	SCALE: 1 : 125 (A1)
TOTAL CONNECTIONS: N/A	
ADMD: N/A	DATE: 07 JULY 2020
COORDINATE SYSTEM: WG29	

DRAWING NUMBER: VE9335-6-STL

SHEET 01 OF 01

REVISION: 0

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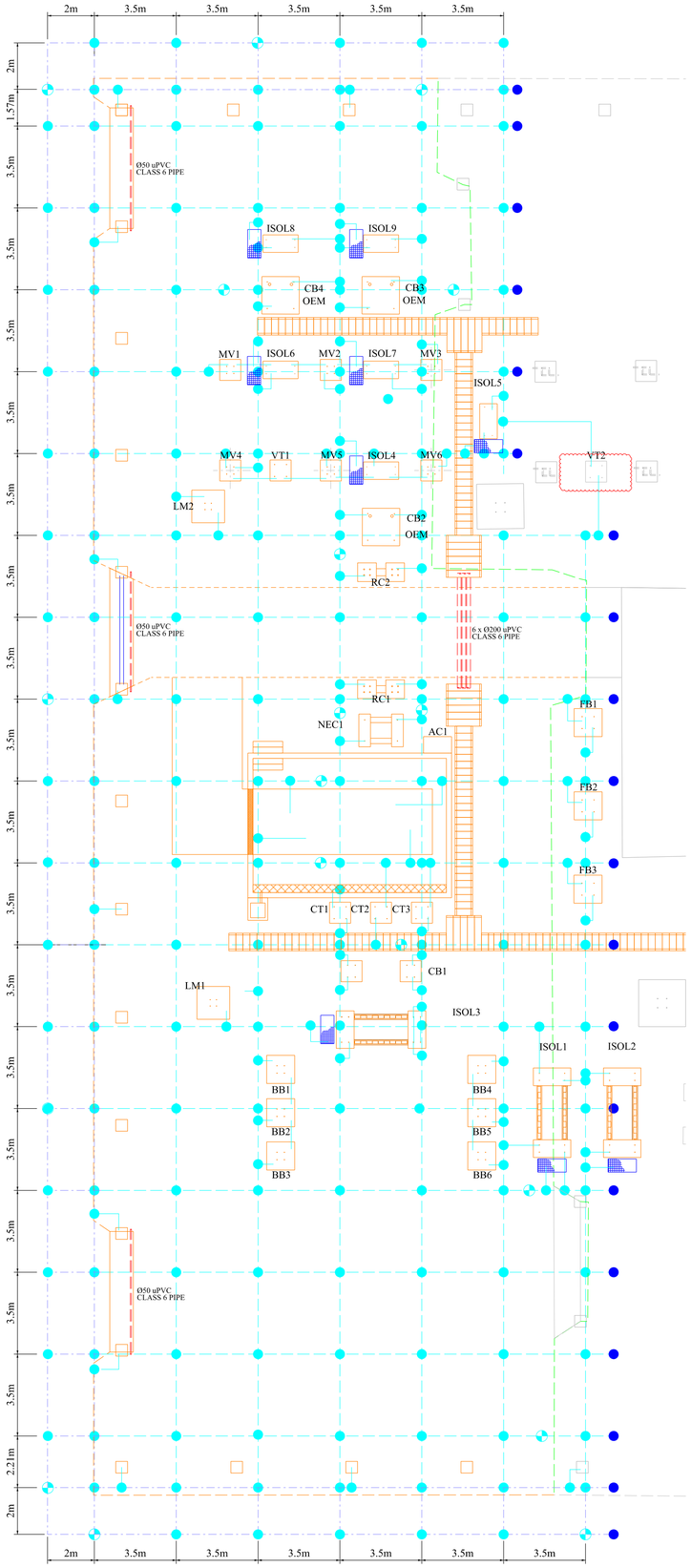
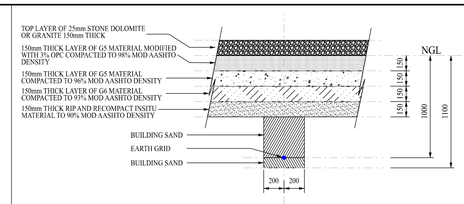
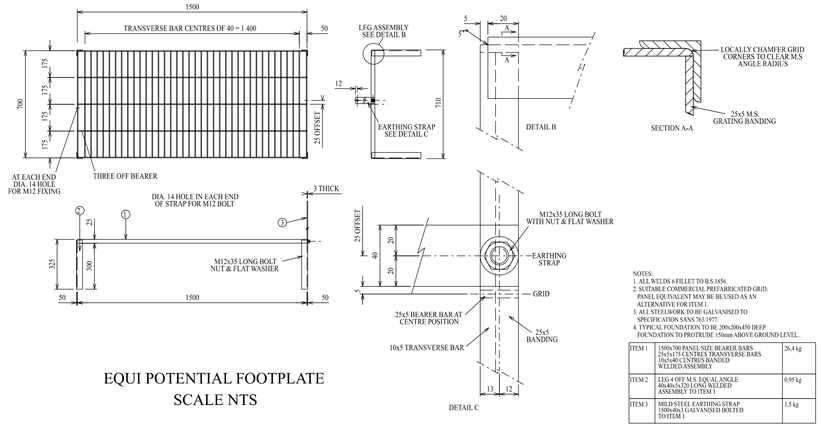




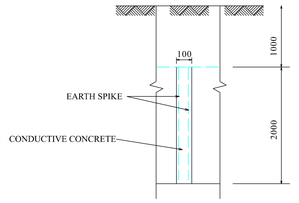
EARTH GRID DETAIL



EQUI POTENTIAL FOOTPLATE
SCALE NTS

NOTES:
1. ALL WELDS 6 FILLET TO B.S.1856.
2. SUITABLE COMMERCIAL PREFABRICATED GRID. PANEL EQUIVALENT MAY BE BE USED AS AN ALTERNATIVE FOR ITEM 1.
3. ALL STEELWORK TO BE GALVANISED TO SPECIFICATION SANS 763:1977.
4. TYPICAL FOUNDATION TO BE 200x200x450 DEEP FOUNDATION TO PROTRUDE 150mm ABOVE GROUND LEVEL.

ITEM 1	1500x700 PANEL SIZE BEARER BARS 25x5x175 CENTRES TRANSVERSE BARS 10x5x40 CENTRES BANDED WELDED ASSEMBLY	26,4 kg
ITEM 2	LEG 4 OFF M.S. EQUAL ANGLE 40x40x5x220 LONG WELDED ASSEMBLY TO ITEM 1	0,95 kg
ITEM 3	MILD STEEL EARTHING STRAP 1500x40x3 GALVANISED BOLTED TO ITEM 1	1,5 kg



EARTH SPIKE DETAIL
SCALE NTS

NOTES:
1. FOR STANDARD EARTHING SPEC. SEE DRAWING D-DT-5240 LATEST REVISION (NO CRIMPING IS ALLOWED TO BE USED).
2. ALL TINNED COPPER MUST BE TREATED AS DESCRIBED PRIOR TO MAKING A CONNECTION:
   A) WASH AND BRUSH TINNED AREA IN WATER,
   B) APPLY THIN LAYER OF NON OXIDE GREASE ONLY TO TINNED AREAS FACING GALVANIZED STEELWORK.
3. WHERE CONNECTION IS MADE TO GALVANIZED STEELWORK THE SURFACE SHALL BE COATED WITH PETROLEUM JELLY PRIOR TO BOLTING.
4. ALL GATES & REMOVABLE PANELS TO BE BRIDGED WITH AN EARTH CONNECTION VIA THE SHORTEST POSSIBLE ROUTE.
5. FENCE EARTH CONNECTIONS TO POSTS, BOTH SIDES OF ANY GATE AND REMOVABLE PANEL NOT TO EXCEED 20m.
6. COPPER QUANTITIES EXCLUDE FOUNDATION H.D. BOLTS EARTHING. COPPER IN FOUNDATION FORMS PART OF FOUNDATION.
7. ALL RE-INFORCED MESH TO BE CONNECTED TO MAIN EARTH GRID.

	DESCRIPTION
	10mm ROUND COPPER MAIN EARTH GRID (1m BELOW GROUND LEVEL)
	50mm x 3mm FLAT COPPER FOR EARTH TAILS TO THE FOUNDATIONS.
	50mm x 3mm FLAT COPPER FOR EARTH-TAILS TO THE FENCE AND FENCE CORNER GATE POST (CGP)
	50mm x 3mm FLAT COPPER FOR EARTHING AND EARTH-TAILS FOR BUILDING EARTHING OF PANELS.
	CCS CAMO EQUIVALENT TO 10mm COPPER (CLOSING SPAN & OUTSIDE FENCE PERIMETER)
	80mm x 6mm GALVANIZED STEEL (TRFR)
	JOINTS BRAZED - TO BE OXY-ACETYLENE BRAZED USING DIA 3mm SILBRALLOY BRAZING RODS. NO CRIMPING ALLOWED.
	MAIN EARTH GRID BONDING 10mm ROUND TO 10mm ROUND
	MAIN EARTH BONDING TO EARTH TAILS DIAMETER 10mm TO 50mm x 3mm FLAT
	FLAT TAIL BONDING 50mm x 3mm TO 50mm x 3mm (FOUNDATIONS)
	FLAT TAIL BONDING 50mm x 3mm TO EQUAL POTENTIAL FOOT PLATES
	FLAT TAIL BONDING 50mm x 3mm TO CORNER GATE POST.
	TRANSFORMER PLINTH EARTH 50mm x 3mm
	REINFORCING EARTH CONNECTIONS
	INSULATED EARTH WIRE (MAIN TO SUB EARTH BAR THROUGH ROXTEC)
SA	SACRIFICIAL EARTH ANODE D-DT-5240s11.
	EARTH SPIKES (PROVISION ONLY)
	ISOLATOR FOOT PLATE
	BONDING TO EXISTING SUBSTATION EARTH GRID

DATE:	REVISIONS	DRAWN	REVISION NO

TENDER
ISSUED FOR TENDER PURPOSES ONLY

	As-Built	DATE:	
	Construction	DATE:	
	Tender	DATE:	2021-07-05
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

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Metsimaholo Municipality

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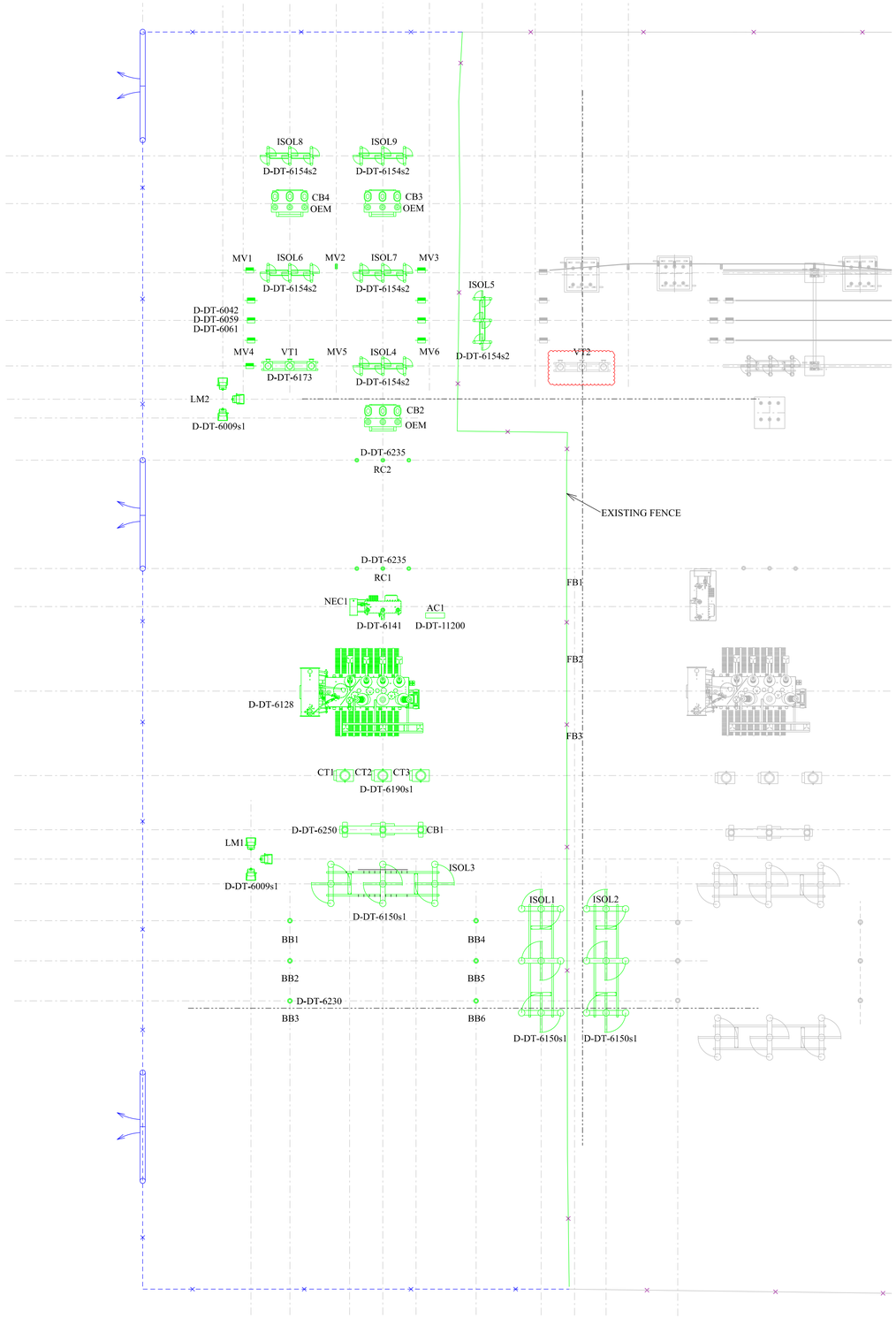
VAAL DAM - SUBSTATION EXTENSION - EARTH GRID LAYOUT

DESIGN: M LYON Pr Eng	ENGINEER: M LYON Pr Eng
APPROVED:	DRAWN: M VAN JAARSVELD
TOTAL NO. OF STANDS: N/A	SCALE: 1 : 125 (A1)
TOTAL CONNECTIONS: N/A	
ADMD: N/A	DATE: 07 JULY 2020
COORDINATE SYSTEM: WG29	
DRAWING NUMBER: VE9335-6-EARTH	SHEET 01 OF 01
REVISION: 0	

LEGEND	
	EXISTING FENCE LINE
	EXISTING CURB LINE
	NEW FENCE LINE



DATE:	REVISIONS	DRAWN	REVISION NO:

TENDER

ISSUED FOR TENDER PURPOSES ONLY

	As-Built	DATE:	
	Construction	DATE:	
	Tender	DATE:	2021-07-05
	Approval	DATE:	
	Information	DATE:	
	Planning	DATE:	

ISSUED FOR:

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Metsimaholo Municipality

VAAL DAM - SUBSTATION EXTENSION - EQUIPMENT LAYOUT

DESIGN: M LYON Pr Eng		ENGINEER: M LYON Pr Eng	
APPROVED:		DRAWN: M VAN JAARSVELD	
TOTAL NO. OF STANDS:	N/A	SCALE:	1 : 125 (A1)
TOTAL CONNECTIONS:	N/A		
ADMD:	N/A	DATE:	07 JULY 2020
COORDINATE SYSTEM:	WG29		

DRAWING NUMBER:	SHEET 01 OF 01	REVISION:
VE9335-6-EQP		0

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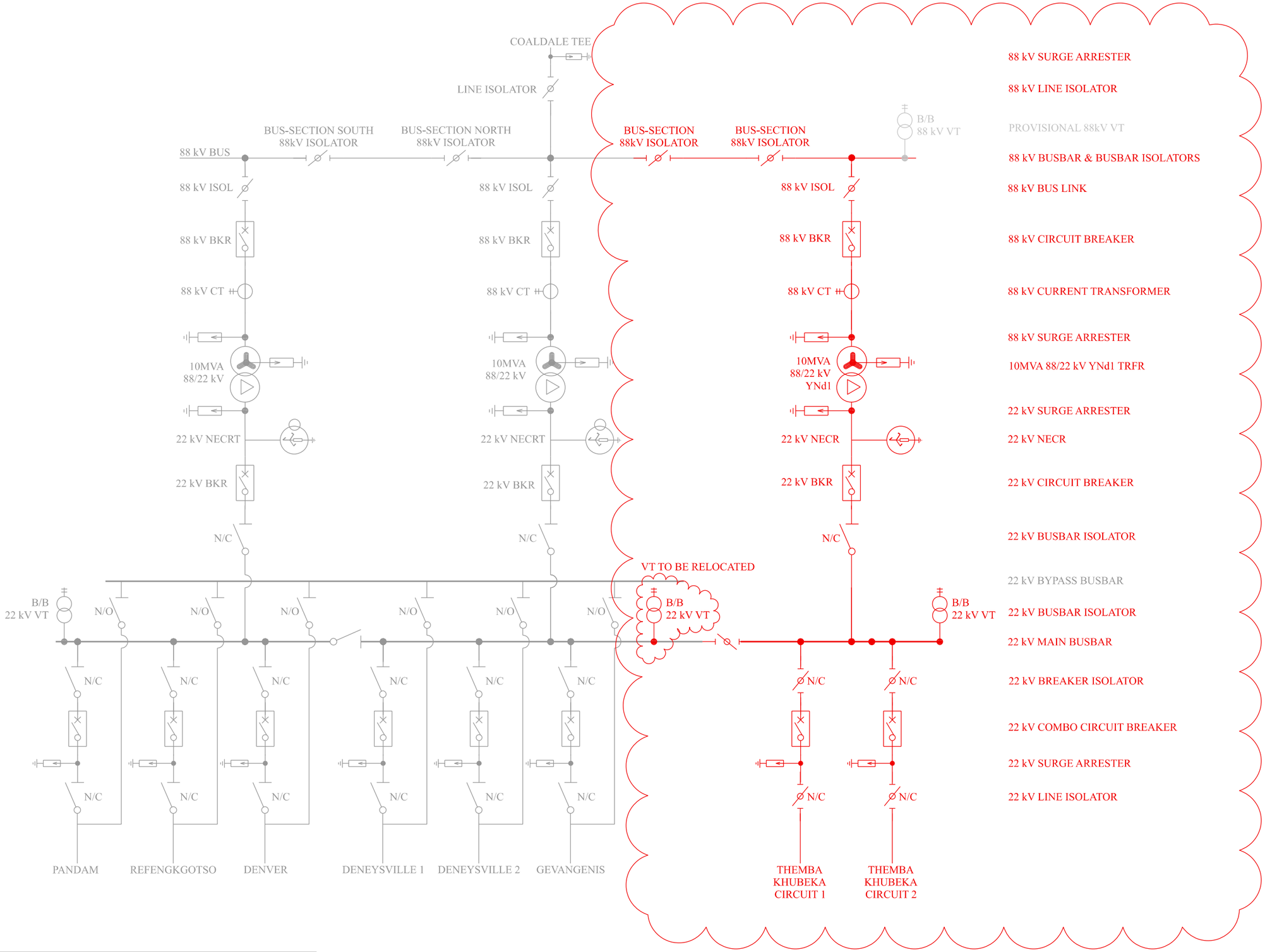

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	As-Built						Engineer: M LYON JNR Pr Eng
	Construction						Design: M LYON JNR Pr Eng
	Tender	2020-07-05					Drawn: M VAN JAARSVELD
	Approval						Approved:
	Information						
	Planning						Date: 20 JANUARY 2021
		Date	Date	REVISIONS	Drawn	Rev. No	

Metsimaholo Municipality

VAAL DAM SUBSTATION
88/22 kV EXTENSION
STATION ELECTRIC DIAGRAM

LYON VENNOTE EN PARTNERS
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PO Box 1901 Vanderbijlpark 1900

SCALE: NTS (A3)

DRAWING NUMBER: VE9335-6-SED SHEET 01 OF 01

REV. NO: 0

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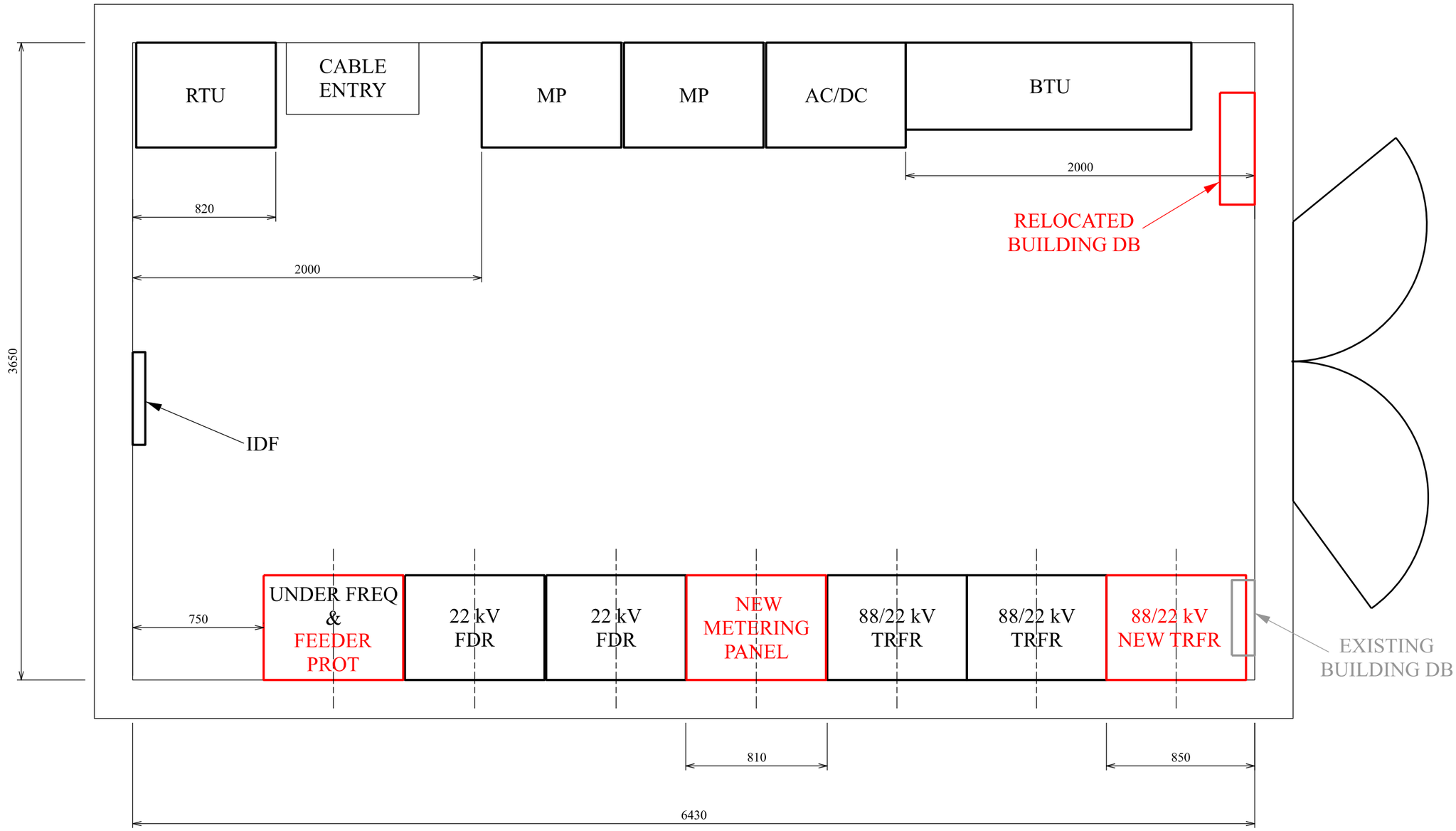

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	As-Built						
	Construction						
	Tender	2021-07-05					
	Approval						
	Information						
	Planning						
		Date	Date	REVISIONS	Drawn	Rev. No	

Engineer:	M LYON Pr Eng
Design:	M LYON Pr Eng
Drawn:	M VAN JAARSVELD
Approved:	
Date:	10 JULY 2020

Metsimaholo Municipality

VAALDAM -
SUBSTATION EXTENSION -
CONTROL ROOM

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Consulting Electrical Engineers & Project Managers

SCALE: 1:25 (A3)

DRAWING NUMBER: VE9335-6 - VAALDAM SS - CR

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REV. NO: 0

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