Project Name	:	Transnet Saldanha NMD Upgrade - New Ystervark S/S
Project ID	:	153272156
Job Name	:	Ystervark 66 - 132 kV Substation
Job ID	:	153272156-00003

Final Design Package: Book 1

Prepared for

TRANSNET GROUP CAPITAL

Prepared by

Brian Homann

In association with

AECOM Technical Team

2020-04-24

AECOM AGILITY
CLIENTS
EMPLOYEES
EXCELLENCE
INNOVATION
INTEGRITY
PROFITABLE GROWTH
SAFETY

Quality Information

Document	Final Design Package: Ystervark 66 - 132 kV Substation - Book 1		
Ref	Eskom Job Number: 153272156-00003	Date	2020-04-24
Prepared by	Brian Homann	Reviewed by	Colin Pym
Document Number	1924701-2-300-E-RPT-0006		

ISSUED FOR USE

Revision History

Revision	Revision Date	Details	Authorized Name/Position	Signature	Date
			Practice Line Lead, Electrical, Africa		30 April 2020
Rev 02	2020-04-24	Issued for Use	Colin Pym		

Additional Signatories for Transnet SOC Ltd

Revision	Revision Date	Details	Authorized Name/Position	Signature	Date
			Richard Shandu Senior Engineering Manager		23/04/2020
Rev 02	2020-04-24	Issued for Use	Richard Shandu (Transnet Group Capital)		

Revision	Revision Date	Details	Authorized Name/Position	Signature	Date
					23/04/2020
Rev 02	2020-04-24	Issued for Use	Tonny Mhondiwa (Transnet Port Terminals)		

Revision	Revision Date	Details	Authorized Name/Position	Signature	Date
					23/04/2020
Rev 02	2020-04-24	Issued for Use	Jabulani Nkanyani (Transnet National Ports Authority)		

Table of Contents

1. Abbreviations

The abbreviations as listed below shall be applicable throughout this document.

Abbreviation	Meaning Given to the Abbreviation
A	Ampere
AAC	All Aluminium Conductor
AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
ADSS	All-dielectric Self-supporting
AF	Air Forced
Al	Aluminium
AMSL	Above Mean Sea Level
AWB	Asymmetrical Wide Beam
BB or B/B	Busbar
BIL	Basic Insulation Level
BoM	Bill of Materials
BoQ	Bill of Quantities
BTU	Battery Terminal Unit
CAD	Computer Aided Design
CCTV	Close Circuit Television
CD	Compact Disc
CDEGS	Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis
CIJB	Customer Interface Junction Box
CPU	Central Processing Unit
CT	Current Transformers
Cu	Copper
dB	Decibel
DB	Distribution Board
DBPC	Ditertiary Butyl Para-Cresol
DC	Direct Current

Abbreviation	Meaning Given to the Abbreviation
DCI	Direct Current Isolator Switch
DP MCB	Double Pole Miniature Circuit Breaker
DTF	Distance to Fault
DT	Definite Time
E/F	Earth Fault
FAT	Factory Acceptance Tests
FDP	Final Design Package
FO	Fibre Optic
ECSA	Engineering Council of South Africa
ENC	Eskom National Contract
GPR	Ground Potential Rise
GPS	Global Positioning System
HAZOP	Hazard and Operability Study
HIRA	Hazard Identification & Risk Assessment
Hz	Hertz
HMI	Human-machine Interface
HVAC	Heating, Ventilation, Air-Conditioning
HV	High Voltage
ICEW	Insulated Copper Earth Wire
ICT	Information and Communication Technology
IDMT	Inverse Definite Minimum Time
IEC	Independent Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronic Engineers
In	Nominal Current Rating
I/O	Input - Output
IP	Ingress Protection
IP	Internet Protocol
IR	Infra-Red
ISO	International Standards Organisation

Abbreviation	Meaning Given to the Abbreviation
JB	Junction Box
kA	Kilo Ampere
K	Kelvin
KIPTS	Koeberg Insulator Pollution Test Station
kPa	Kilo Pascal
kVA	Kilo Volt Ampere
kV	Kilo Volt
LAN	Local Area Network
LAP	List of Accepted Products
LC	Lucent Connector
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LHMI	Local Human-machine Interface
LOR	Local/Off/Remote Switch
LPL	Lightning Protection Level
LPS	Lightning Protection System
LPZ	Lightning Protection Zone
LSC	Loss of Service Continuity
LV	Low Voltage
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MH	Mounting Height
MIB	Marshalling Interface Box
mm	Millimetre
MPa	Mega Pascal
ms	Milliseconds
MS	Microsoft
MTS	Main Transmission Substation
MTTR	Mean Time To Repair
MV	Medium Voltage

Abbreviation	Meaning Given to the Abbreviation
MVA	Mega Volt Ampere
MW	Mega Watt
Native	Original electronic file format of documentation
NC	Normally Closed
NECRT	Neutral electro-magnetic coupler (NEC) with neutral earthing resistor (NER) and auxiliary transformer
NEC	Neutral Electro-Magnetic Coupler
NER	Neutral Earthing Resistor
NiCad	Nickel Cadmium
Nm	Newton meter
NMD	Notified Maximum Demand
NO	Normally Open
NTP	Network Time Protocol
OEM	Original Equipment Manufacturer
O/C	Overcurrent
OHL	Overhead Line
OHS	Occupational Health and Safety
O&M	Operating and Maintenance
OPGW	Optical Ground Wire
OTI	Oil Temperature Indicator
ºC	Degree Celsius
PB	Plug Box
PC	Personal Computer
pC	Pico Coulomb
PCB	Polychlorinated Biphenyls
PCD	Pitch Circle Diameter
PCS	Process Control System
PFC	Power Factor Correction
PLC	Programmable Logic Controller
PPS	Pulse Per Second

Abbreviation	Meaning Given to the Abbreviation
PTP	Precision Timing Protocol
p.u.	Per Unit
PVC	Polyvinyl Chloride
QA	Quality Assurance
QoS	Quality of Supply
RAM	Random Access Memory
RE/F	Restricted Earth Fault
RIO	Remote Input Output device
RIV	Radio Influence Voltage
r.m.s	Route-Mean Square
RTC	Real Time Clock
s	seconds
SA	Surge Arrestor
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Tests
SCADA	Supervisory Control and Data Acquisition
SEA	Sacrificial Earth Anode
SED	Station Electric Diagram
SEF	Sensitive Earth Fault
SF_6	Sulphur Hexafluoride
SHE	Safety, Health and Environment
SHEQ	Safety, Health and Environment and Quality
SLD	Single Line Diagram
SNTP	Simple Network Timing Protocol
SOC	State Owned Company
SWA	Steel Wire Armour
SWB	Symmetrical Wide Beam
TTL	Transistor-Transistor Logic
UPS	Uninterruptable Power Supply

Abbreviation	Meaning Given to the Abbreviation
USB	Universal Serial Bus
USCD	Unified Specific Creepage Distance
uPVC	Unplasticized Polyvinyl Chloride
UV	Ultra-violet
V	Volt
VA	Volt Ampere
VLF	Very Low Frequency
VT	Voltage Transformer
VTJB	Voltage Transformer Junction Box
W	Watt
kWhr	Kilowatt Hours
XLPE	Cross Linked Polyethylene
Z_nO	Zinc Oxide

2. Volume 3 Documentation Checklist

The Eskom standard Substation FDP template was used for the order creation of this document, with certain alterations made to the layout to suit the FDP application where applicable. The checklist below is the aforementioned template in order to confirm the information included, and those not included due to applicability.

BOOK 1

Item	Description	Applicable and Included	Not Applicable
1.	Technical Team	✓	
2.	Additional Notes	✓	
3.	Scope of Works	✓	
4.	Execution Plan	✓	
5.	Credit Bill of Materials		✓
6.	Existing Network Diagram	✓	
7.	Proposed Network Diagram	✓	
8.	Civil: *Specifications*	✓	
9.	Geotechnical Report	✓	
10.	Civil: *Bill of Schedules*	✓	
11.	Civil: *Detailed Drawings*	✓	
12.	Architectural: *Specifications*	✓	
13.	Architectural: *Detailed Drawings*	✓	
14.	Power Plant: *Specifications*	✓	
15.	Power Plant: *Long Lead Time Bill of Materials*	✓	
16.	Power Plant: *Final Bill of Materials*	✓	
17.	Power Plant: *Final Bill of Quantities*	✓	
18.	Power Plant: *Label Schedule*	✓	

19.	Power Plant: *Detailed Drawings*	✓	
20.	Power Plant: *Non-Standard Material Specifications*		✓
21.	Control Plant: *Specifications*	✓	
22.	Control Plant: *Long Lead Time Bill of Materials*	✓	
23.	Control Plant: *Final Bill of Materials*	✓	
24.	Control Plant: *Final Bill of Quantities*	✓	
25.	Control Plant: *Detailed Drawings*	✓	
26.	Control Plant: *Non-Standard Material Specifications*		✓
27.	Execution Plan and Temporary Arrangements: *Specifications*	✓	
28.	Execution Plan and Temporary Arrangements: *Bill of Materials*		✓
29.	Execution Plan and Temporary Arrangements: *Bill of Quantities*		✓
30.	Execution Plan and Temporary Arrangements: *Detailed Drawings*		✓
31.	Execution Plan and Temporary Arrangements: *Non-Standard Material Specifications*		✓
32.	HV Lines: *Design Philosophy*		✓
33.	HV Lines: *Templated Profile*		✓
34.	HV Lines: *Staking Table*		✓
35.	HV Lines: *Bill of Materials and Quantities*		✓
36.	HV Lines: *Structure Drawings*		✓
37.	HV Lines: *Hardware Assembly Drawings*		✓
38.	HV Lines: *Foundations*		✓
39.	HV Lines: *Stringing Charts*		✓
40.	HV Lines: *Buy Out Specification*		✓

41.	HV Lines: *Construction Checklist*		✓
42.	MV Lines: *Specifications*		✓
43.	MV Lines: *Network Overview*		✓
44.	MV Lines: *Bill of Materials*		✓
45.	MV Lines: *Bill of Quantities*		✓
46.	MV Lines: *Structural Drawings*		✓
47.	MV Lines: *Sag & Tension Tables*		✓

3. Technical Team

ESKOM

	Name	Telephone
Project Initiator:	Sicelo Ngxonono	021 980 3445
Project Engineer:	Garth van Heerden	021 980 3369
Project Co-ordinator:	Aldrey Africa	021 980 3688
Programme Manager:	Shantal Gordon	021 983 4247
Electricity Delivery:	Llewellyn Floris	
Field Services:	Beryl Swano Ryan Ali	
Plant:	Laurence Myburgh Hennie Mostert	
Project Engineering:	Masturah Barodien	
Land Development:	Owen Peters Justine Wyngaardt	
MEW	Marlyn Hendriks	
Network Operations:	Nwabisa Mijoli Elsje Basson	
Network Planning:	Ahilan Kailasanathan	
Technology & Quality:	TBC	

Control Plant Key Role Players

Name	Discipline
Llewellyn Floris	Protection
Christine Van Schalkwyk	DC
Juan Atkinson	Metering
Albertus Hendriks	Security
Tertius Hyman	Substation Automation
Gregory Pieterse	Tele-control
Zeyaad Pandey	Telecomms

AECOM

	Name	Telephone
Project Manager:	Barto van der Merwe	021 950 7500
Practice Area Lead (Electrical):	Colin Pym	021 950 7500
Lead Project Engineer:	Brian Homann	021 950 7500
Associate Electrical Engineer:	Ndumiso Mabuza	012 421 3703
Senior Electrical Engineer:	Lize-Mari Botha	021 950 7500
Senior Electrical Technologist:	Amanda Marais	021 950 7500
Senior Electrical Technologist:	Ludaan Kohrs	021 950 7500
Practice Area Lead (Architecture):	Peet Kok	021 950 7500
Architectural Technologist:	Ruché Uys	021 950 7500
Practice Area Lead (Structural):	Schalk Marais	021 950 7500
Structural Engineer:	Claire Kleynhans	021 950 7500
Civil Engineer (Associate):	Francois Ricketts	021 950 7500
Civil Engineer:	Francois van Loon	021 950 7500
Practice Area Lead (Mechanical):	Wouter Seevinck	021 950 7500
Mechanical Engineer:	Johan Jooste	021 950 7500
Geotechnical Engineer (Senior):	Ross Dold	021 950 7500
Geotechnical Engineer:	Wilhelm Wessels	021 950 7500
Document Controls Lead:	Dino O’Brien	021 950 7500
Quantity Surveyor:	Graham Munnik	021 950 7500

TRANSNET

	Name	Telephone
Senior Project Manager:	Lehlohonolo Tsotetsi	022 703 2470
Senior Manager:	Richard Shandu	083 242 7546
Senior Electrical Engineer:	Bonga Ntshangase	078 861 6686
Senior Manager – Structures & Bridges	Dyke Ramokotjo	
Senior Engineer – Civil & Perway	Motebang Malapane	076 975 8428
Candidate Structural Engineer	Lesiba Baloyi	
C&I Engineer	Lonwabo Mgushelo	083 762 7078
Document Controls Lead:	Adrian Ford	022 703 2460
Document Controller:	Rolivhuwa Nemakonde	022 703 2460

4. Assumptions, Agreements, Acceptances and Additional Notes

The following should be noted with regards to the submission of this FDP document:

1.) This FDP submission should be viewed on the basis that the Contractor is already on-site, which typically would not have been the case for a project of this nature i.e. the FDP submission & acceptance thereof would have been concluded prior to the Contractor being appointed & commencing with construction activities.

2.) It should be noted that an amendment to the current EA & EMPr is underway. The amendment required relates to additional works to by undertaken on the 66 kV Branch Line works (refer to Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines - Book 1, Eskom Job Number: 153272156-00001, Report Number: 1924701-2-300-E-RPT-0004). The Ystervark Substation works is already covered under the current EA & EMPr (see FDP Ystervark 66 - 132 kV Substation - Book 2).

3.) The Contractor has been appointed by Transnet on a re-measurable contract, hence the BoM BoQ quantities may not reflect the final quantities installed. The Contractor shall, as part of the final as-built handover pack, provide a comprehensive & detailed list of all new installed equipment / material.

4.) To date not all wayleave applications have been received from the respective utilities / stakeholders. This shall be provided to Eskom upon receipt.

5.) In the original TEF submission, the 132 kV Control Building would have had a store room, allocated to be a future battery room, with the batteries to be located within the control room. However subsequent detailed designs have resulted in the batteries not being able to be installed in the control room, as the amount of batteries required results in the room being a hazardous area.

   Hence there will be no store room, only a battery room & will be classified as a Zone 2 hazardous area (refer to the rational fire design report contained in FDP document Ystervark 66 - 132 kV Substation - Book 2, as well as Section 8 of this document).

6.) The Council submission for the 132 kV Control Building will be done once Eskom has approved the FDP document.

5. Project Details

5.1. Introduction

Transnet SOC Ltd is undertaking a major programme of projects in Cape Town, Saldanha and Postmasburg to upgrade and expand the capacity of their infrastructure, as part of their Market Demand Strategy.

The purpose of the Tippler 3 project at the Port of Saldanha is to sustain the materials handling capacity at the Port of Saldanha by the addition of a third tippler. As part of the Tippler 3 project, new bulk electrical supply infrastructure is to be provided to increase the capacity of the existing power supply to meet current and future demands at the Port of Saldanha.

In order to facilitate the abovementioned increase in capacity, there is a requirement for the provision of new infrastructure for Eskom, including upgrades & modifications to their existing 66 kV supply network in the region. The works has been registered with Eskom as a self-build project and subdivided into four jobs respectively, which are as follows:

Project Name	**Project ID**
Transnet Saldanha NMD Upgrade - New Ystervark S/S	153272156
Job Name	**Job ID**
Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines	153272156-00001
Blouwater Substation - Ystervark Feeder Control Plant	153272156-00002
Ystervark 66 - 132 kV Substation	153272156-00003
Iscor 66 kV Breakers & Protection Upgrade	153272156-00004

This final design package covers the design principles and approach for the new Ystervark 66 - 132 kV Substation.

This document must be read in conjunction with the other abovementioned projects' FDPs. ***Each FDP document consists of three books respectively.***

Figure 1 overleaf depicts the location of the new Ystervark Substation.

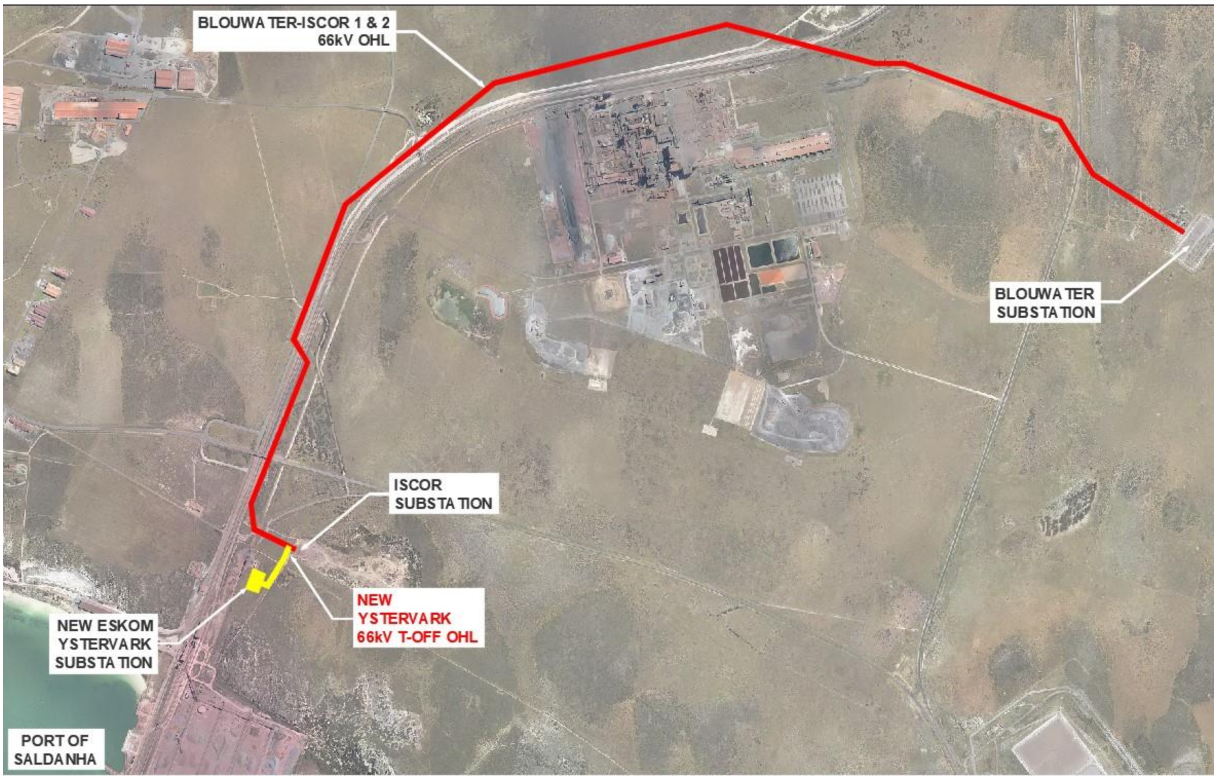


Figure 1: Ystervark Substation Location

5.2. Scope of Works

The current Notified Maximum Demand (NMD) for the supply of electrical power to the Port of Saldanha, as per existing agreements between Transnet and Eskom, is 25 MVA, which is provided from Eskom's Iscor 66/11 kV Substation. Eskom have also committed themselves to an NMD of 2 MVA for the Sunrise Energy facilities adjacent to the Port, which is also supplied from Iscor Substation.

With the introduction of the new Tippler 3, including associated conveyors and associated infrastructure, an additional estimated 8.8 MVA supply will be required. It is to be noted that once the new Tippler 3, with associated infrastructure is operational, the existing Tippler 1 will be decommissioned as it has reached its end of life. Hence it is envisaged that a saving in demand of ± 2.3 MVA will arise (actual Tippler 1 load only which is in the region of ~ 2.3 MVA). Further reference is made to the table below depicting the estimated overall Port peak demand, once the new Tippler 3 and associated infrastructure is operational.

Table 1: Port Net Demand: Tippler 3 Operational

Maximum peak demand at Port (January 2014), without power factor correction taken into account	22.9 MVA
Total demand for Tippler 3, including associated infrastructure	8.8 MVA
Total demand	31.7 MVA
Deduct estimated Tippler 1 demand (once Tippler 3 is in operation)	2.3 MVA
Net Demand with Tippler 3 in Operation (Tippler 1 out of service) - Without power factor correction	**29.4 MVA**

It should be noted that in 2014, a PFC facility was commissioned at the Port, which if in operation will further reduce the above peak demand. Seeing as Iscor Substation can only supply a theoretical maximum of 23.8 MVA (11 kV indoor switchgear side), new bulk electrical infrastructure is required to supply the Port's current, medium and long-term power demands. Reference is to be made to Section 5.5 detailing the existing bulk electrical network arrangement.

As part of the new bulk infrastructure, a new 132-66/11 kV Substation is required, with the intended works being summarised as follows:

Two new substations will be built back to back. One, a new 132-66/11 kV ± 80 MVA (N-1) Transnet Substation called 'Main Intake Substation'. The other a 66-132kV Eskom Substation called 'Ystervark'. The boundary between the two substations will be demarcated by fence lines around and within the sites (refer to Figure 2 and Figure 3 overleaf). The complete platform area will cover an area of approximately 17,461 m² (146 m by 120 m), with Ystervark Substation covering an area of approximately 9,957 m². The Eskom substation has been issued the name classification 'Ystervark Substation'.

Ystervark Substation will be undertaken by Transnet as part of a self-build project, which will include the design, procurement, construction and handover to Eskom, all in accordance with Eskom's standards, requirements and National Contract Schemes (ENCs). The "cold" commissioning of all Ystervark Substation equipment will be undertaken Transnet, "hot" commissioning and telecoms to be done by Eskom.

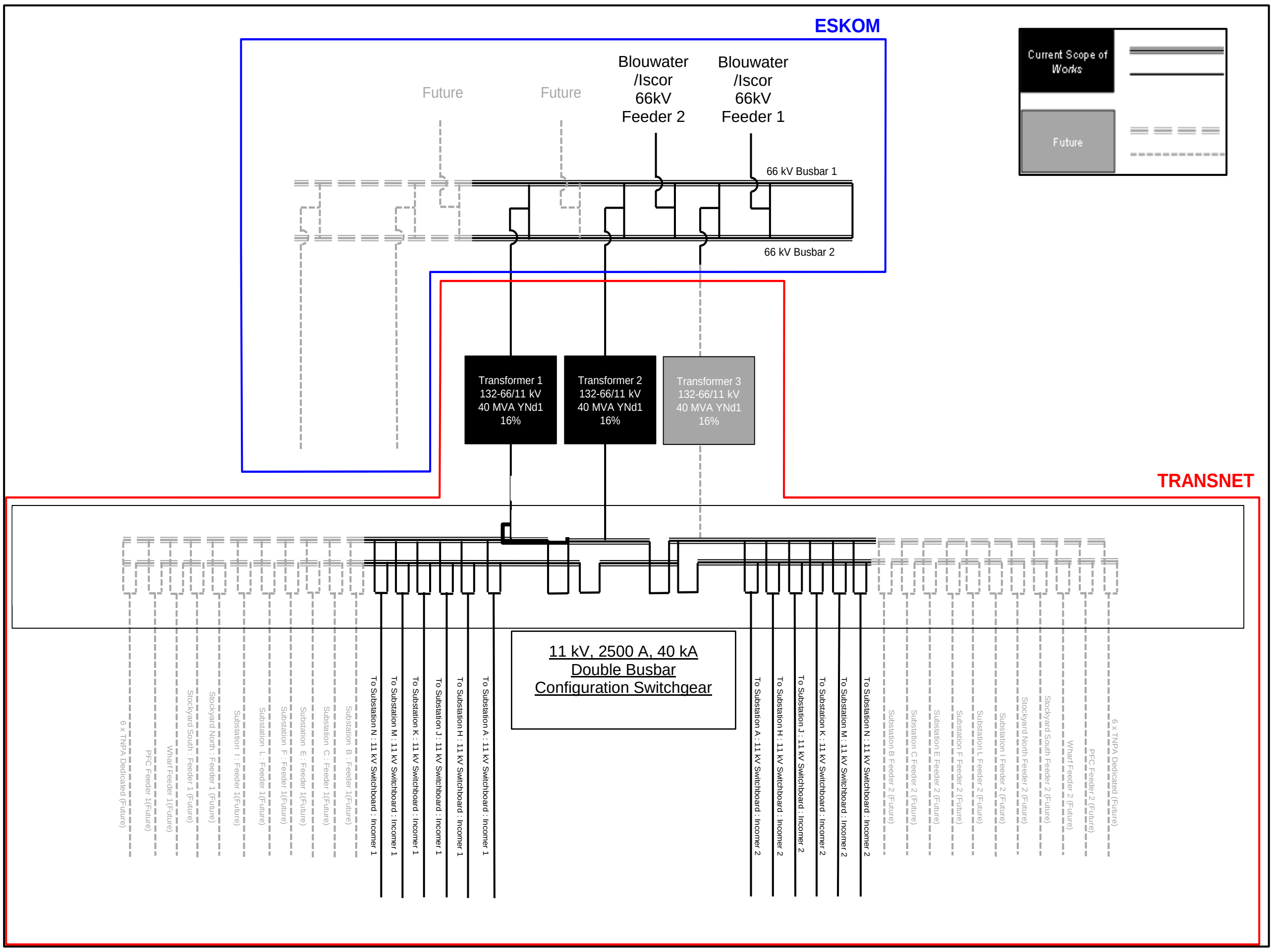


Figure 2: High Level SLD: HV and MV Systems: Main Intake and Ystervark Substation

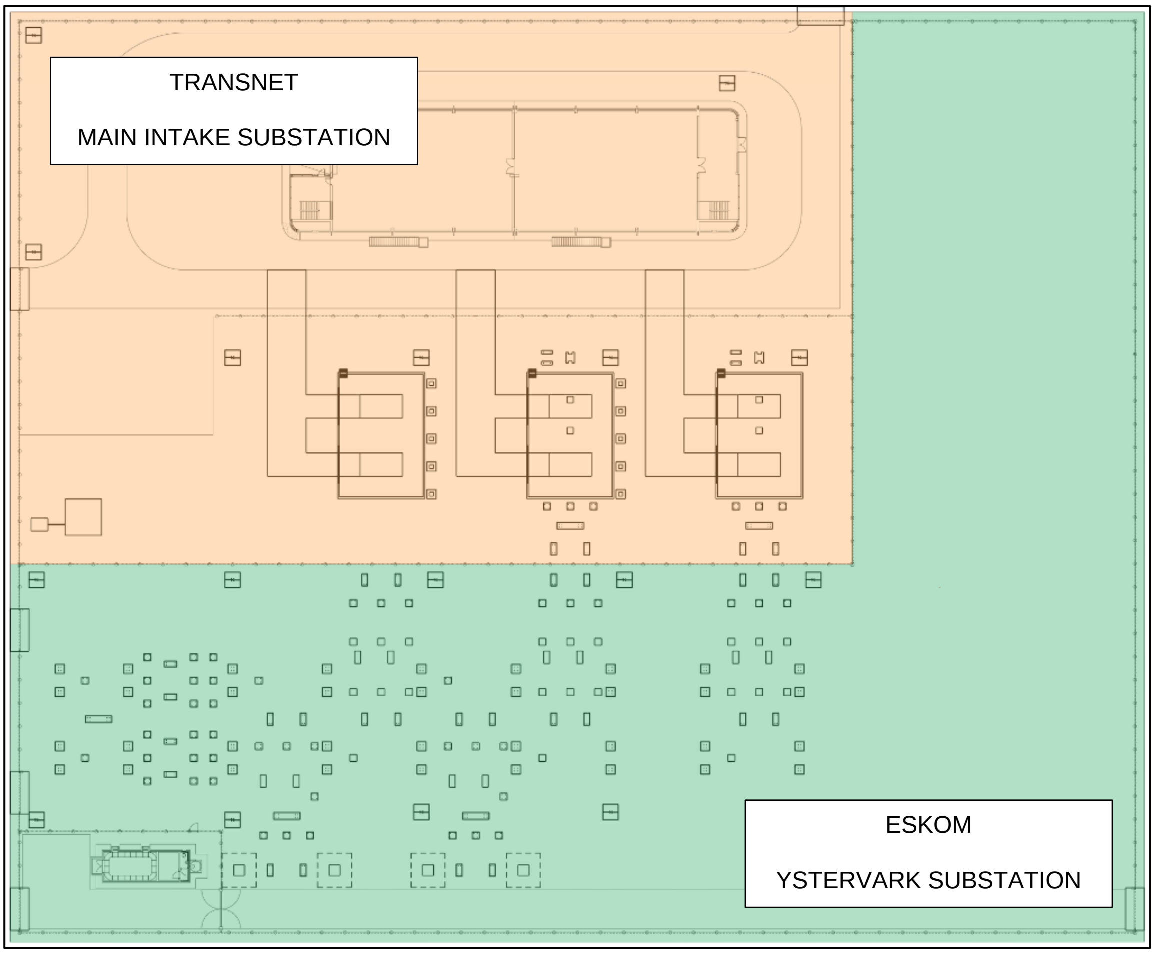


Figure 3: Ystervark/Main Intake Substation Demarcation Area

The Ystervark Substation will initially be supplied at 66 kV from the existing Blouwater-Iscor 66 kV overhead lines, via a branch line of approximately 300 m in length, taken immediately before Iscor Substation. In future Eskom will upgrade the 66 kV network in the region to 132 kV. Hence, given the aforementioned all HV equipment inside Ystervark Substation has been rated to a voltage level of 132 kV, except for the voltage transformers and surge arrestors, which will have to be upgraded when the incoming voltage is changed from 66 kV to 132 kV. All applicable outdoor equipment shall have a 31 mm/kV creepage distance where applicable.

The initial phase of Ystervark Substation will consist of two equipped 132 kV feeder bays (initially supplied at 66 kV), three 132 kV transformer bays and a relay house, with space allocation for two future 132 kV feeder bays, two 132 kV transformer bays (up to 40 MVA each) as well as a switch house. The Transnet and Eskom portions will be separated by means of isolators on either side of the boundary fence, with an interface junction box, installed at each feeder bay, to allow for control cabling between the two Substations.

Further reference is made to Section 5.6 for the proposed new electrical network configuration and Section 9 detailing the power plant accordingly.

5.3. Site/Environmental Conditions

Referencing Figure 1, the site for Ystervark Substation will be located within Transnet's property near the Port, to the East of the incoming rail lines and roads to the Port area. The Northern side of the Substation site will extend up to the boundary of the adjoining Sunrise Energy property. The coordinates for the Substation are 32°59'46.19" S and 18°0'7.15" E. Access routes to the Substation are described in Section 6.2.5.

The existing site terrain slopes broadly from East to West, with an elevation difference of approximately 10 m. A detailed survey of the site was conducted with the topography of the site indicated in Figure 4 below.

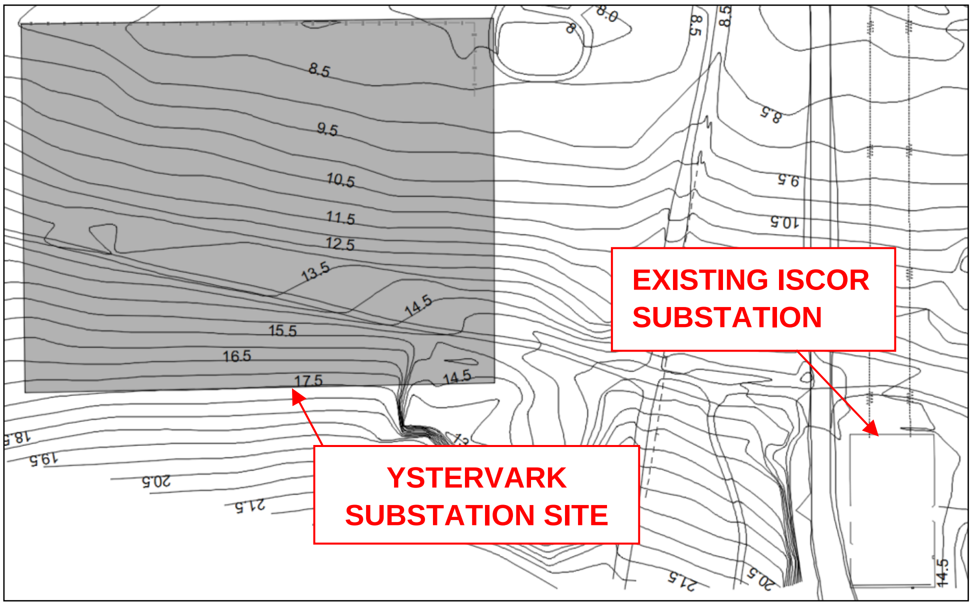


Figure 4: Site Topography

A geotechnical Investigation was carried out by AECOM of which all the relevant findings and test results are contained in the Geotechnical Report no. 1924701-2-300-H-PRT-001 Rev 00 (refer to FDP document 'Ystervark 66 - 132 kV Substation - Book 2, Job no. 153272156-00003'). The regional geological conditions have been well documented in previous geotechnical reports undertaken at Saldanha. A summary of the regional geology encountered at the site is presented in the table below:

Table 2: Regional Geological Stratigraphy

Group	Formation	Age
Sandveld Group	Langebaan Formation	Pleistocene
Hoedjiesbaai	Cape Granite	Pre-Cambrian

The site where Ystervark Substation will be located has been subjected to different periods of marine transgression and a range of weathering processes during regression. This has resulted in the formation of a highly variable interbedded sequence of marine and alluvial sediments and dune sands.

The formation of extensive calcrete has occurred in the dune sands because of near-surface evaporation of groundwater supersaturated with calcium carbonate. The variation with depth and the discontinuous nature of calcrete formation (calcretisation) reflects past fluctuations in the level of the groundwater table. The dominant geological formation that will be encountered during the distribution line development will be the ***Langebaan Formation***.

The trial hole investigation revealed a fairly consistent soil profile. Loose becoming medium dense to dense calcareous silty sandy transported soils were generally underlain by strongly to very strongly cemented pedogenic (calcrete) material. The Southern area of the Main Intake/Ystervark Substation location is covered by a thin layer of transported soil.

The Northern area is covered by a transported layer of 0.50 to 0.80 meters thick. The underlying calcrete layers encountered in the trial holes were discontinuous and interlayered with a calcareous silty sand layer. The very strongly cemented (hardpan) calcrete lenses ranged from 200 mm to greater than 350 mm in thickness. A summary of the different soil layers encountered during the investigation and the depths they were encountered (meters below existing ground level) are provided in Table 3 below.

The soil horizons as described in Table 3 below were classified according to the Eskom standard 'Transmission Line Towers and Line Construction' document (TRMSCAAC1, latest revision) and the relevant "Soil Type" identified and indicated for each soil horizon.

Table 3: Soil Layers on Site

Trial hole No.	**FILL** Stiff to very stiff slightly sandy gravelly SILT	**TRANSPORTED** Very loose to loose slightly silty SAND with occasional strongly to very strongly cemented Calcrete gravel	**TRANSPORTED/ PEDOGENIC** Firm to stiff becoming very stiff with depth calcareous gravelly SILT or slightly sand gravelly SILT with minor cobbles and boulders	**PEDOGENIC** Stiff to very stiff calcareous SILT which is cemented in places becoming Cemented Calcrete with depth	**REFUSAL** Very strongly cemented Calcrete
P14	-	0 – 0.50	-	0.50 – 1.05	+1.05
P15	-	0 – 0.30	0.30 – 0.60	0.60 – 1.40	+1.50
P16	0 – 0.20	-	0.20 – 0.80	0.80 – 1.00	+1.00
P17	-	0.00 – 0.15	0.15 – 0.62	0.62 – 1.35	+1.35
ESKOM SOIL TYPE[1]	2	3	2	1	1

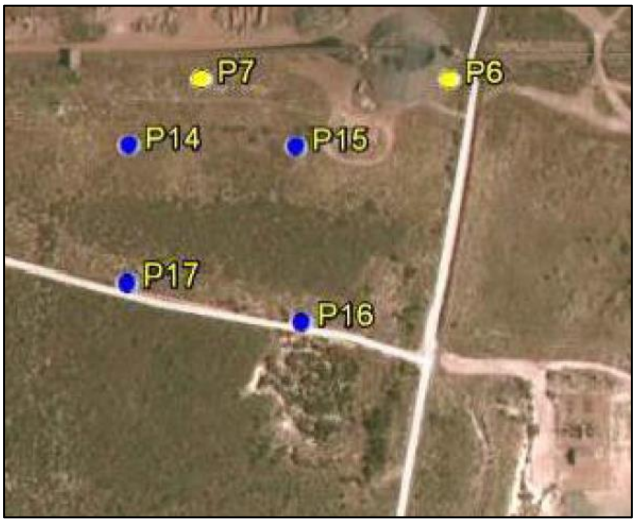


Figure 5: Trial Hole Positions

The climate in the area is defined as semi-arid Mediterranean, which is strongly influenced by the cold Benguela current and coastal berg wind conditions. The table below summarizes the climatic conditions on site:

Table 4: Site Climatic Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45°C Maximum; -5°C Minimum
Equipment Surface Temperature (from sun)	60°C Maximum
Relative Humidity	50% Minimum; 85% Maximum; 60% Average
Air Quality	Coastal salt-laden air with high concentration of iron ore dust
Air Pressure	101.3kPa

Table 5 below indicates the average monthly precipitation for the Saldanha area. Figure 6 indicates the seasonal wind speeds and directions.

Table 5: Average Monthly Precipitation (mm): Saldanha

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	12	24	36	39	39	27	24	12	4	12

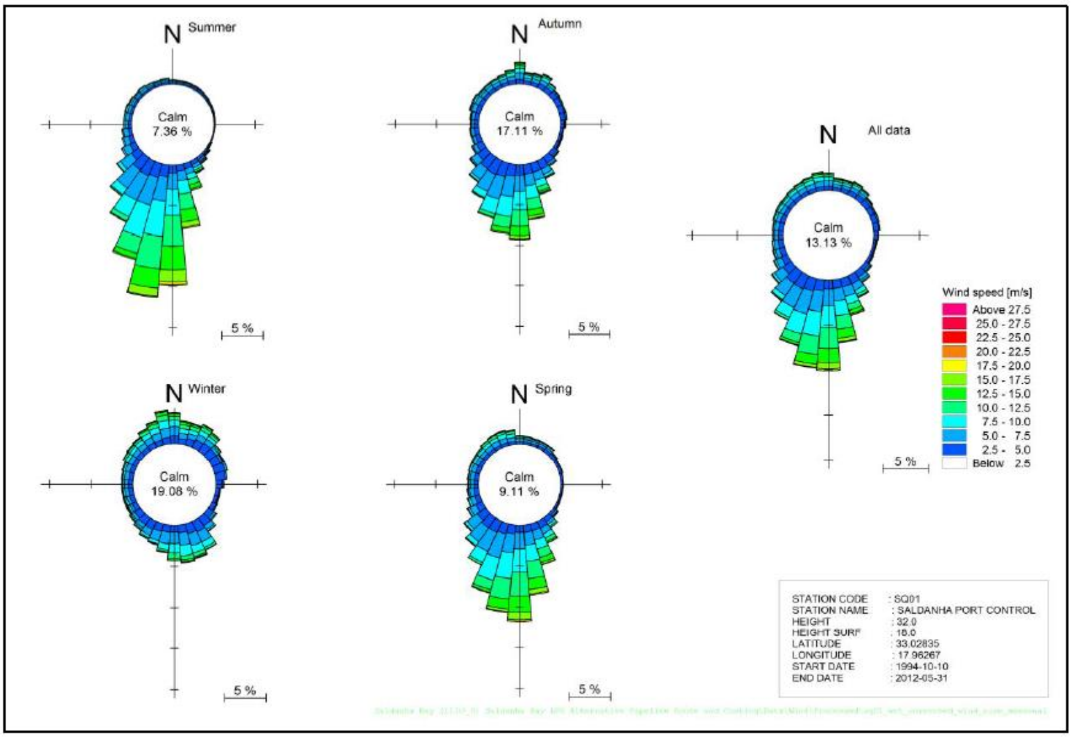


Figure 6: Seasonal Wind Roses for the Port of Saldanha

With regards to pollution levels and lightning activity in the area of the site, the following two figures below have been used to guide the designer. The site has a high pollution level as a result of iron ore export activities at the Port, and heavy salt-laden air. All outdoor equipment shall have a 31 mm/kV creepage distance where applicable. The lightning activity in the area is minimal, with a ground flash density of less than 1 flash/km²/annum.

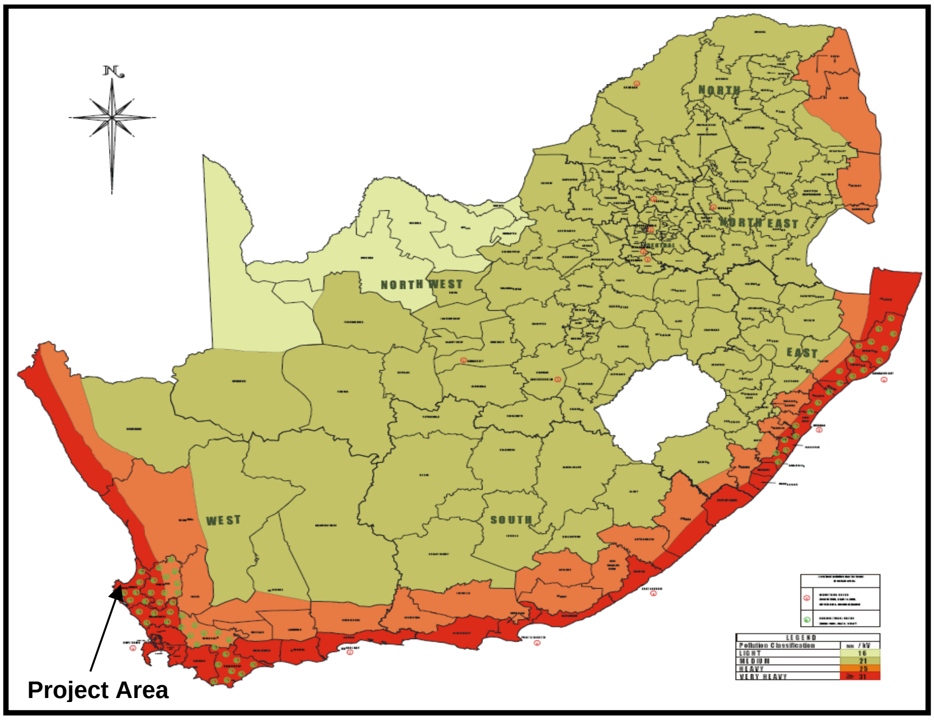


Figure 7: Pollution Map

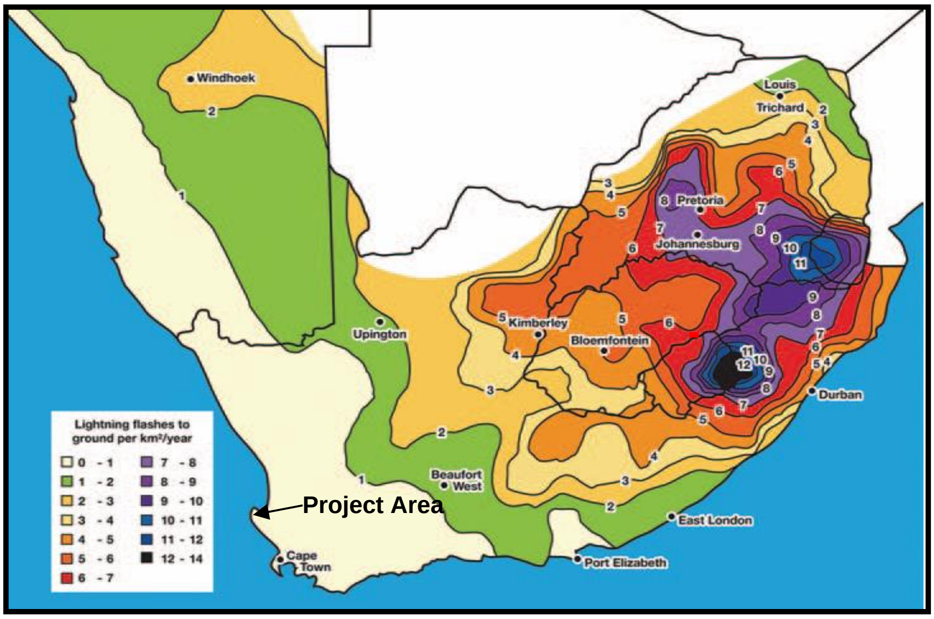


Figure 8: Lightning Ground Flash Density Map

The figure below depicts the environmental study layout map of project components conducted for the Transnet bulk power upgrade project (includes Ystervark Substation) at the Port of Saldanha **(*Note: Lighting forms part of a different package on the Tippler 3 project*)**.

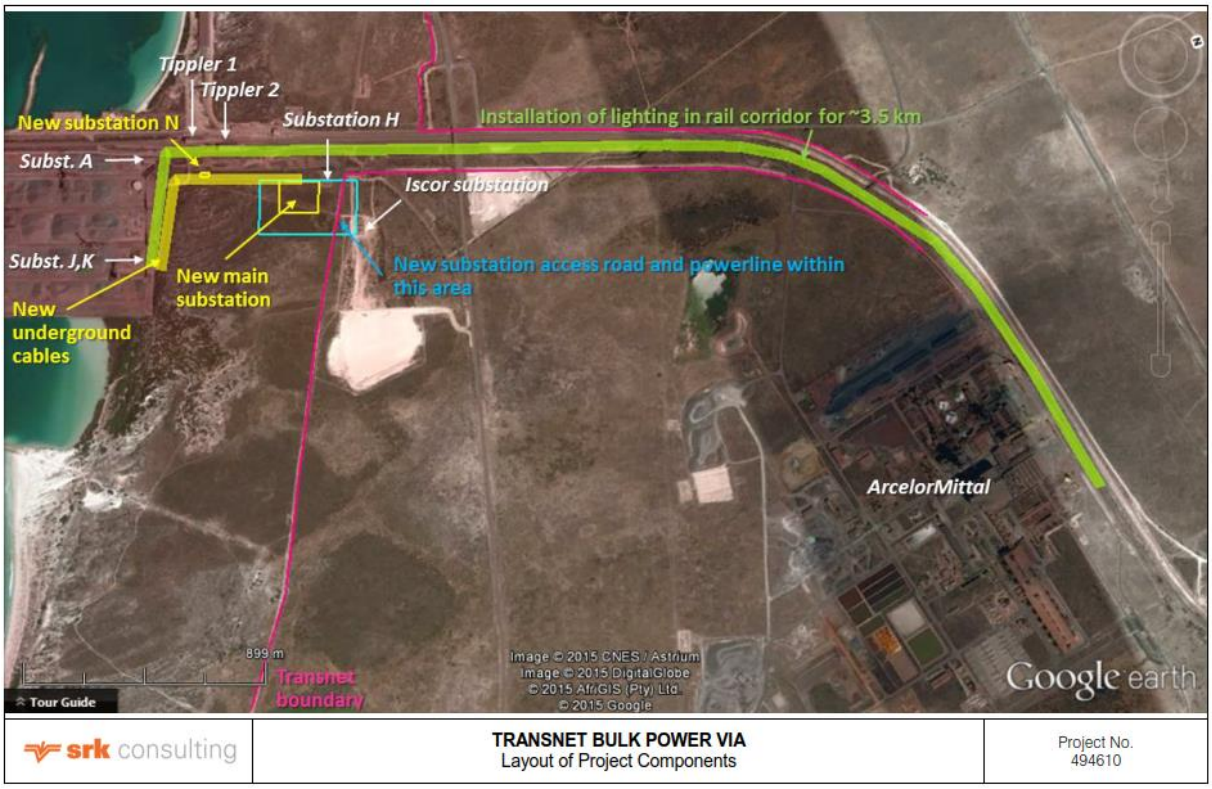


Figure 9: Environmental Study Layout Map of Project Components

According to the project EMPr (refer to FDP document 'Ystervark 66 - 132 kV Substation - Book 2, Job no. 153272156-00003' for further details and associated environmental documentation), the following findings relates to Heritage, Vegetation, Aquatic Ecosystems and Avifauna:

Heritage

"No archaeological heritage was encountered during a field assessment undertaken on 21 October 2015. Buried archaeological material may occur on top of the calcrete or in crevices below the wind-blown surface sands in the core footprint area. Early and Middle Stone Age artefacts and associated fossil bones are sometimes found within and below the capping of calcrete that underlines the aelion sands in the core footprint area. Extinct terrestrial snail fossils (Trigonephrus) and fossil root stems were noted by the specialist in the soft limestone sediments in the old quarry near the proposed project area, as well as in the limestone cuttings alongside the Iscor Substation."

Vegetation

"The project is located in an area with sensitive calcrete vegetation that forms part of the Saldanha Strandveld vegetation. Calcrete shrublands are considered of conservation importance and are only formally protected in the West Coast National Park.
Although degraded to some extent throughout the area as a result of previous grazing and/or clearing, the vegetation is deemed to be of medium to good quality east of the existing track bisecting the main new substation study area, while West of the track towards the railway line the vegetation is in poor to medium condition (see Figure 1-2)." ***Note: This figure is Figure 10 in this document.***

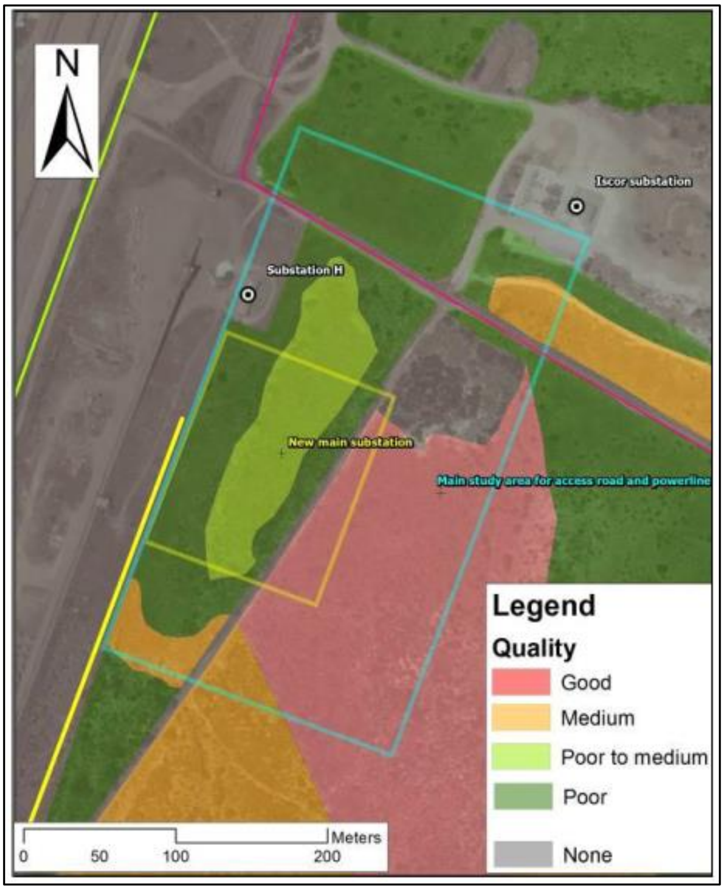


Figure 10: Vegetation Quality at the Main Intake Substation

Prior to commencement of any clearing and grubbing on site (site clearance), a nominated and suitably qualified/specialist subcontractor will undertake search and rescue activities of key plant species in the construction footprint where necessary. The rescued plant species shall be maintained and propagated in a nursery for the duration of construction, where after these shall be planted within areas identified by Transnet for rehabilitation. Areas rehabilitated shall provide for homogenous representativity of the surrounding vegetation.

Aquatic Ecosystems

"Two freshwater features were identified in the study area (see Figure 1 - Figure 3):

- Previous infrastructure development and surcharge from the adjacent sewage pump station have created an artificial wetland to the East of the gravel road. Habitat integrity is largely modified and provides few ecosystem goods and services. The Ecological Importance and Sensitivity rating for the wetland is low; and
- A stormwater drain is located adjacent and parallel to the railway line. The stormwater feature is not considered to be ecologically significant and only serves the purpose of conveying stormwater.

No freshwater features occur within the main study area for the access road, powerline, substation and underground cables. There are no ***Freshwater Ecosystem Priority Areas or Critical Biodiversity Areas in the development footprint." Note: Figure 1-3 is Figure 11 in this document.***

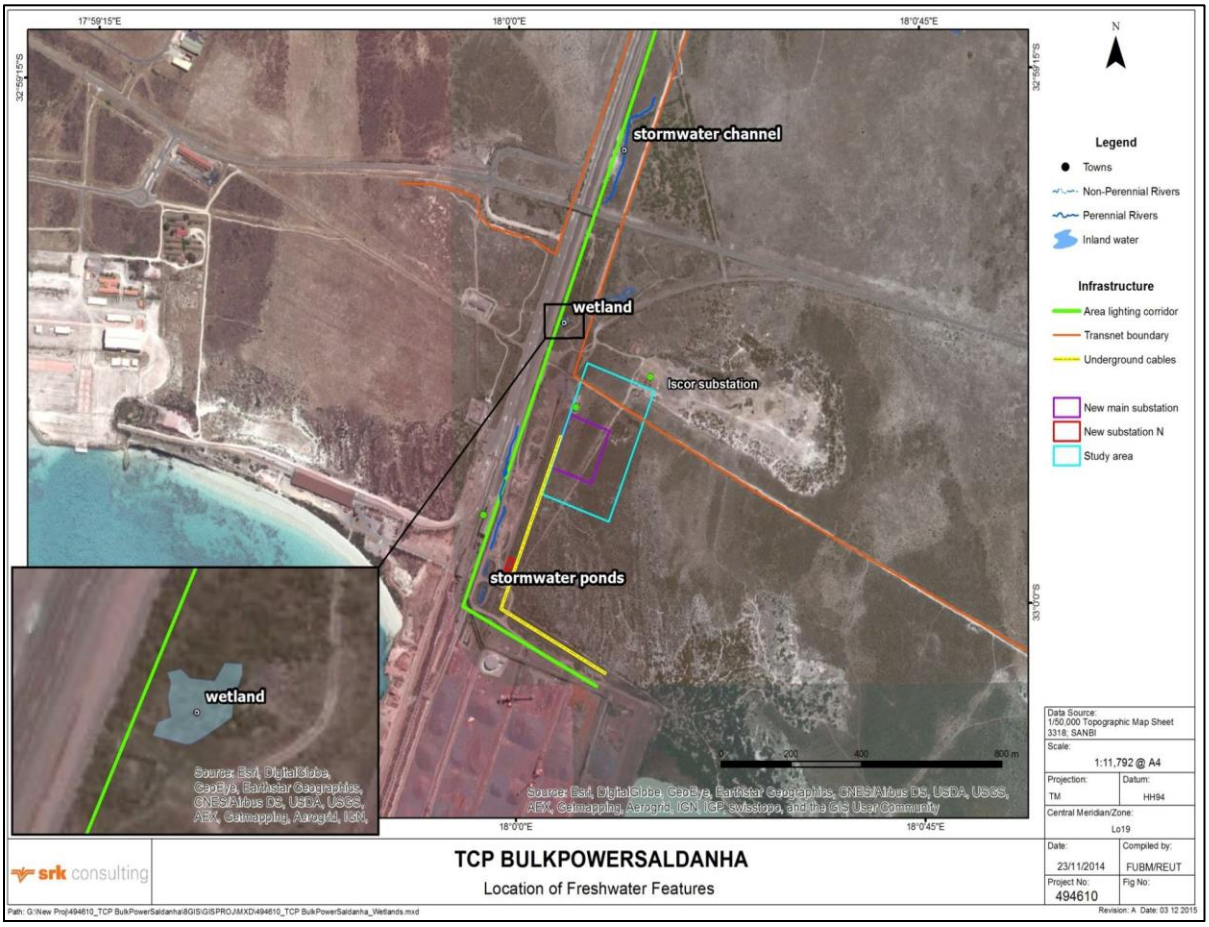


Figure 11: Location of Freshwater Features

Avifauna

"The project site is located near Important Bird Areas: the Langebaan Lagoon, Saldanha Bay Islands and Berg River Estuary. The close proximity of the study area to the West Coast National Park and Saldanha Bay Islands means that some Red Data species could potentially occur within the study area, including globally threatened species such as Cape Cormorant, Bank Cormorant, Crowned Cormorant, Black Harrier and Southern Black Korhaan and regionally threatened species such as Caspian Tern, African Marsh Harrier and Lanner Falcon. However, the main flight path of birds between these areas is expected to lie East of the study area."

5.4. Credit Bill of Material

Not Applicable

5.5. Existing Network Configuration

The existing bulk electrical supply to the Port of Saldanha is fed from Iscor 66/11 kV Substation. This Substation includes 2 x 20 MVA transformers, which in turn is fed by 2 x single-circuit 66 kV overhead lines from Blouwater Substation, with each line terminating separately onto the transformers. There is no busbar interconnecting the incoming feeds with the transformers. The current firm capacity of Iscor Substation is 20 MVA, equating to the rating of a single transformer.

On the 11 kV side the network consists of indoor type switchgear inside the control building, which supplies the Port's existing main supply Substations A and H, with an allocated 20 MVA NMD to Sub A and 5 MVA to Sub H respectively, providing a total allocated NMD of 25 MVA to the Port. All 11 kV indoor switchgear panels within Iscor Substation are fully allocated with no spare panels available to provide the additional loads required at the Port, including Tippler 3. There is also no space within the control building to add new switchgear.

The maximum power rating of the 11 kV switchgear is 1250 A, i.e. 23.8 MVA, which is the ultimate final maximum load that Iscor Substation can supply. Adding new switchgear will thus not resolve the upper limit of power supply. Figure 12 overleaf shows the existing electrical network configuration, Figure 13 the SED for Iscor Substation at present and Figure 14 the associated existing layout of Iscor Substation.

The firm supply at Iscor Substation has on occasion been lost in the past. Since the introduction of the previously mentioned 10.5 MVAr PFC facility in 2014 (refer to Section 5.2), it has facilitated an average of ± 2 MVA peak power demand reduction.

This has resulted in the firm supply at Iscor Substation being restored. However, with the connection of Sunrise Energy to Iscor Substation (allocated 2 MVA NMD), and assuming worst case scenario with the PFC out of operation, the firm supply at Iscor Substation could be lost again and also possibly cause the 11 kV indoor switchgear panels to trip as a result of overloading. This worst case scenario will mean total power loss to the Port and Sunrise Energy.

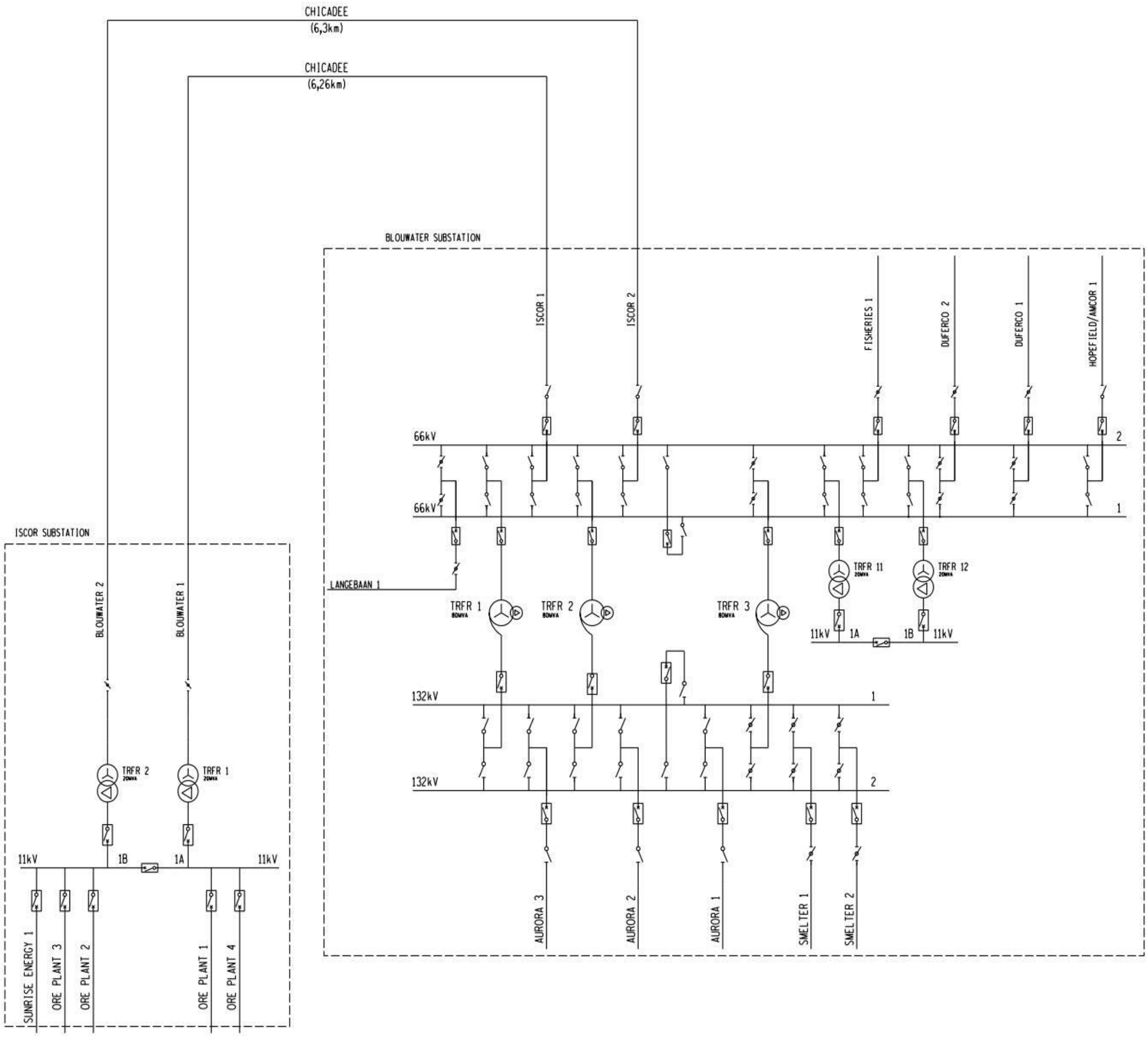


Figure 12: Existing Electrical Network Configuration - Blouwater to Iscor Substation

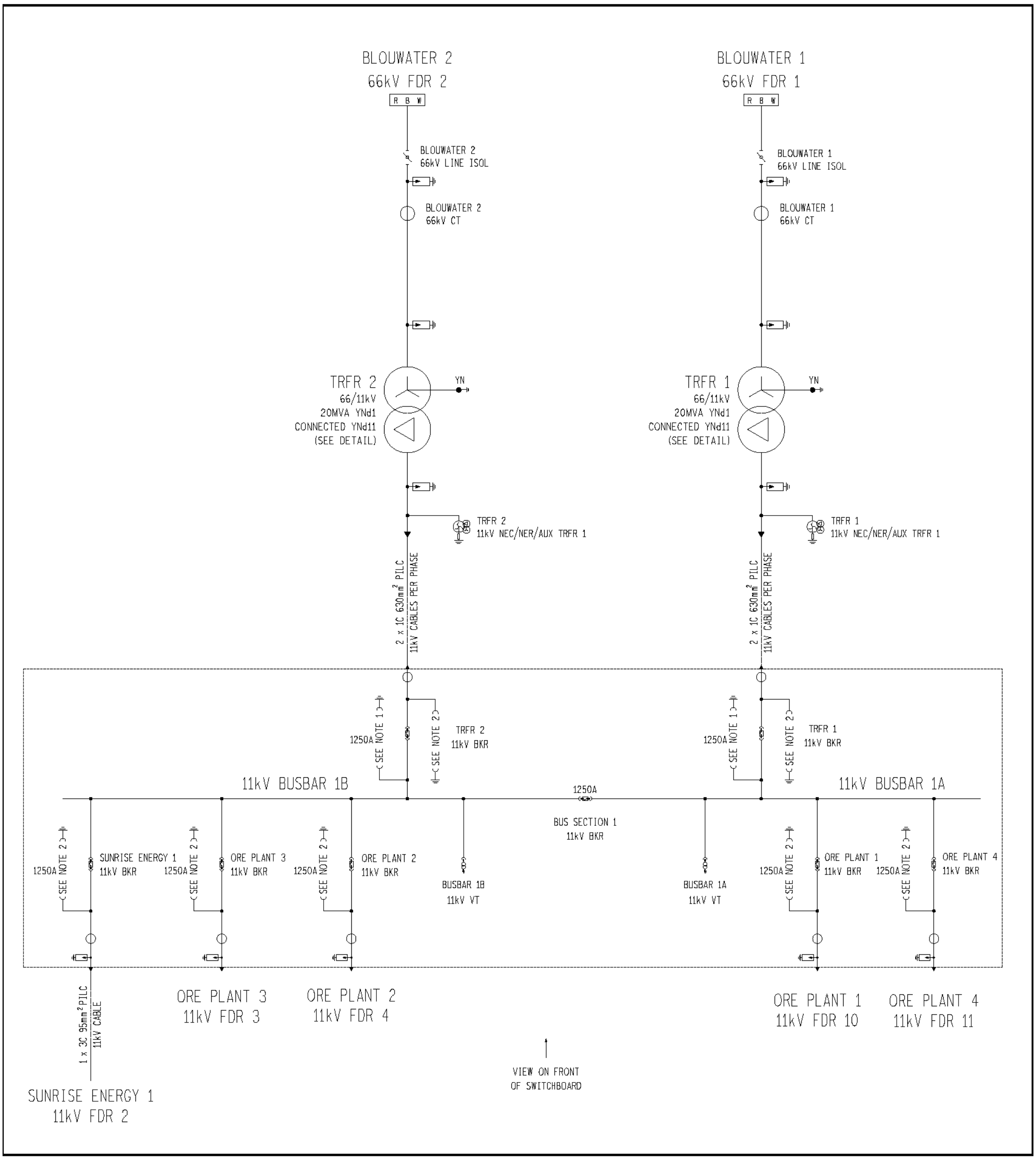


Figure 13: SED - Iscor 66/11kV Substation (Existing)

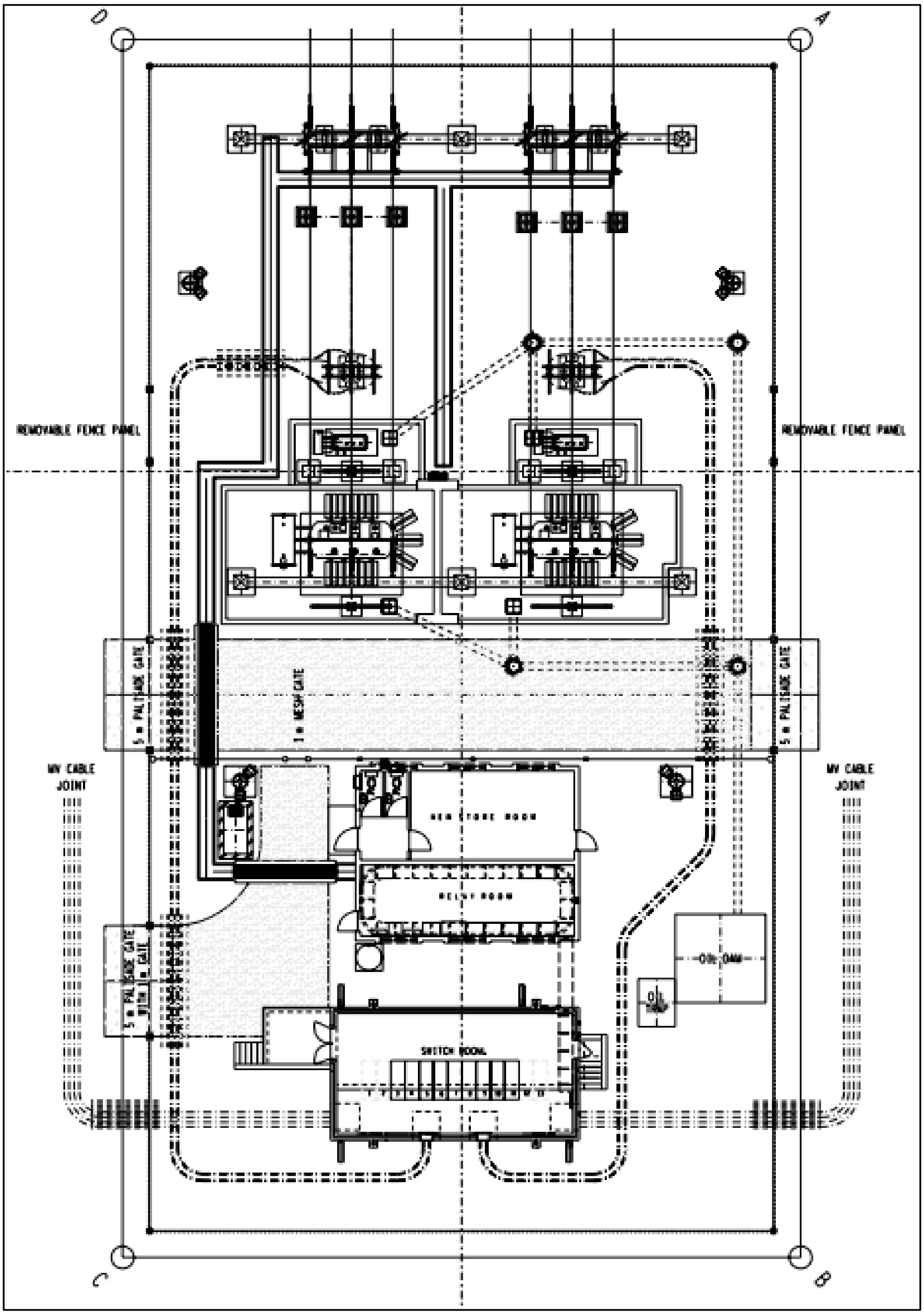


Figure 14: Layout - Iscor 66/11kV Substation (Existing)

5.6. Proposed Network Configuration

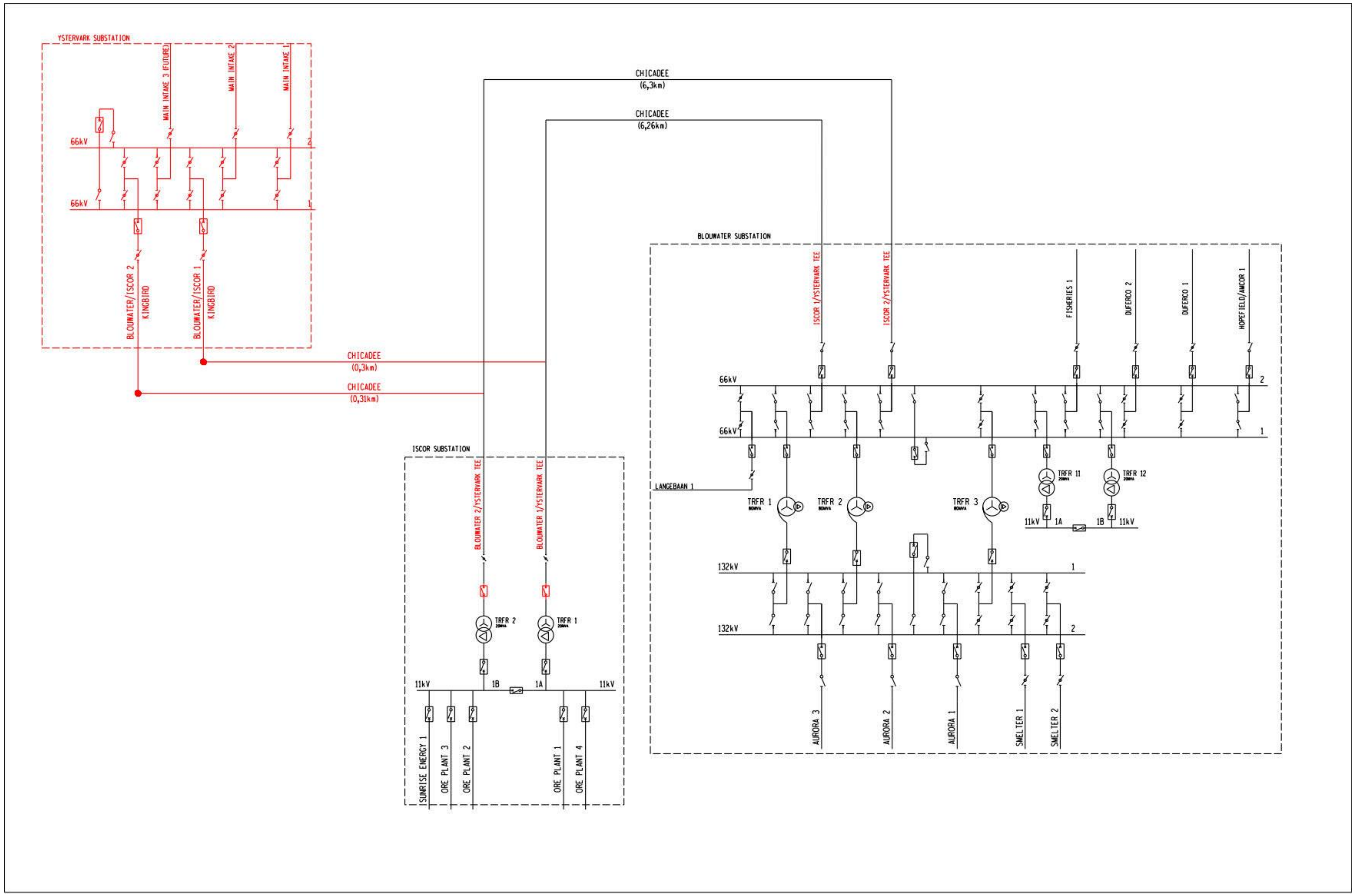


Figure 15: Proposed New Electrical Network Configuration - Blouwater to Iscor/Ystervark Substations

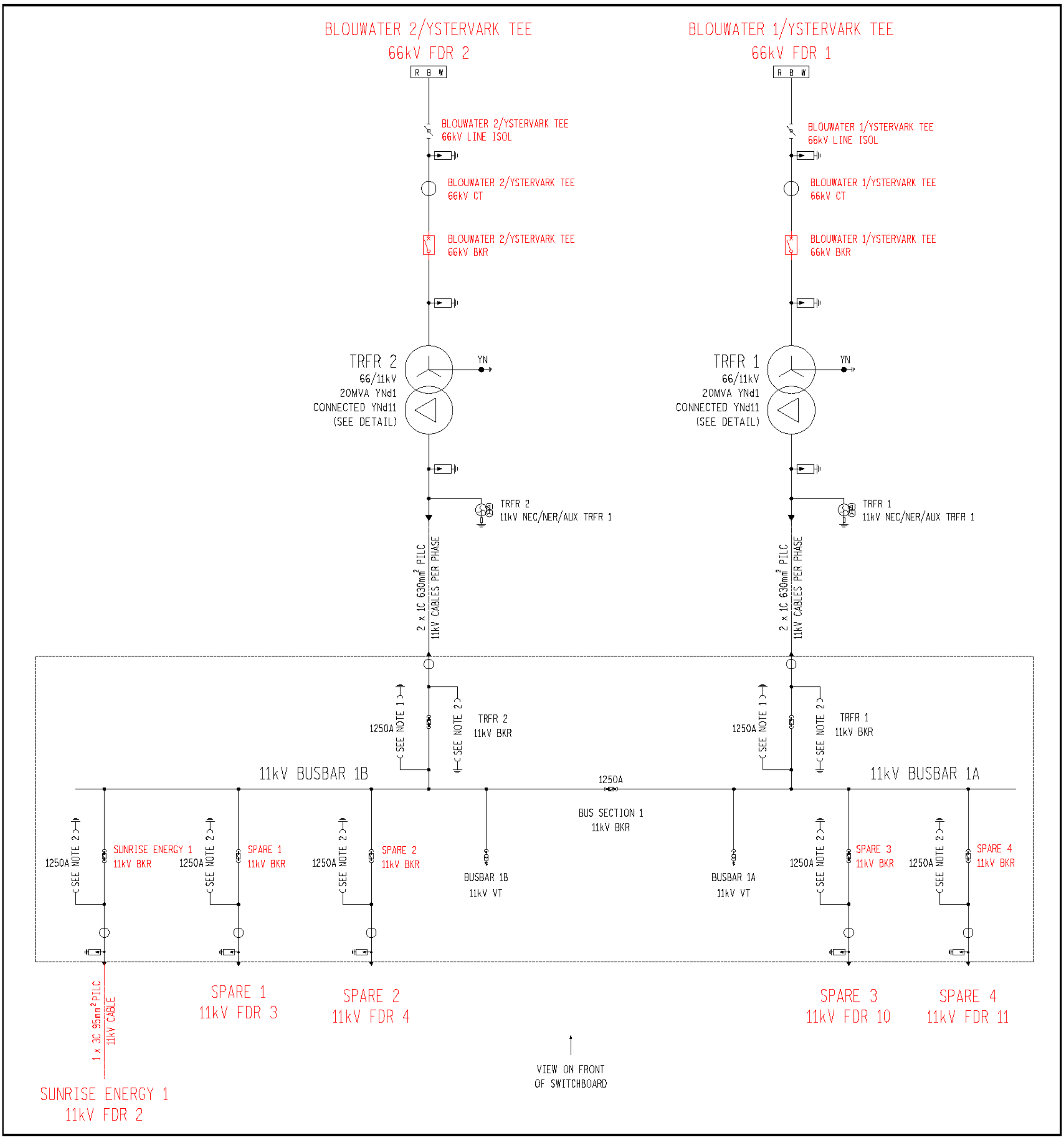


Figure 16: SED - Iscor 66/11kV Substation (Proposed)

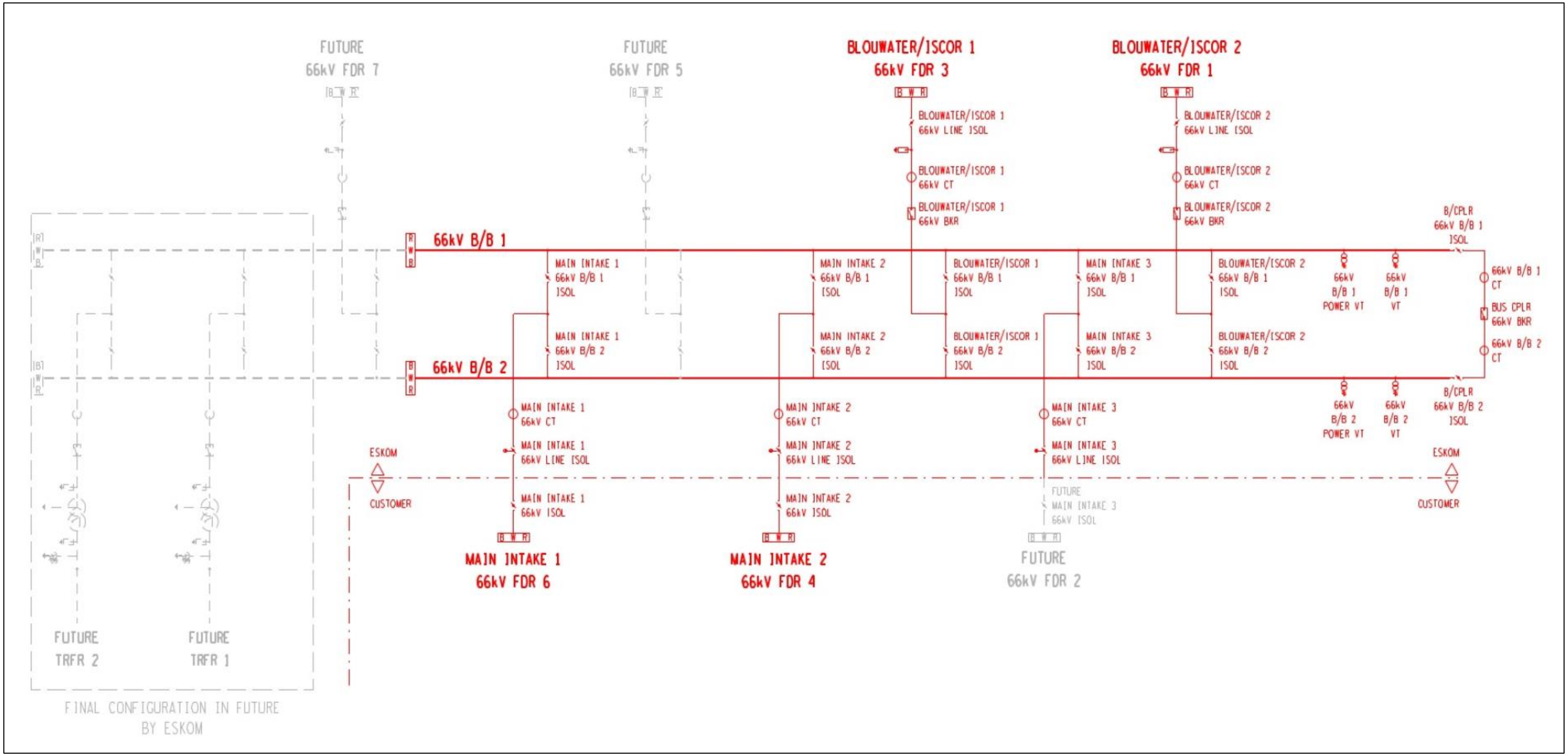


Figure 17: SED - Ystervark 66 - 132 kV Substation (Proposed)

6. Civil

6.1. Overview

The civil works to be undertaken at the new Main Intake Substation, together with Ystervark Substation, shall include but not be limited to the following:

- Vegetation search and rescue operations.
- Site clearance.
- Protection of existing underground services.
- Bulk earthworks - Substation platforms and internal roads.
- Bulk earthworks - external roads and detention pond.
- Excavation and backfilling for Substation steel structure foundations.
- Detention pond associated concrete works.
- Substation platform and hardstand layerworks.
- Hardstand and roads surfacing.
- External and internal civil and building services, including:
    - Water, fire hydrant and building water infrastructure and connections.
    - Stormwater channels, subsoil cut-off drainage and pipe infrastructure for building, hardstand and roads rainwater run-off.
    - Stormwater detention pond and associated in-flow, overflow and floor structures.
    - Services sleeves for all current and future electrical and electronic cables.
    - Conservancy tank for Ystervark 132 kV relay house.
    - Wastewater and oil wastage channels, structures and underground pipework.
- Perimeter and internal fencing.
- Perimeter and internal pedestrian and vehicular sliding and swing gates.
- Vegetation rehabilitation.

6.2. Specification

6.2.1. Site Clearance (SANS 1200 C)

Prior to commencement of any clearing and grubbing on site, a nominated and suitably qualified/specialist botanist will undertake search and rescue activities of key plant species in the construction footprint where necessary. The rescued plant species shall be maintained and propagated in a nursery for the duration of construction, where after these shall be planted within areas identified by Transnet for rehabilitation. Areas rehabilitated shall provide for homogenous representativity of the surrounding vegetation.

All trees and shrubs within the site with a height exceeding 1m shall be removed by hand and collected for further processing by grinding and mulching. The recovered chippings shall be placed in stockpile and carefully preserved for later mulching of areas where natural vegetation is to be re-established. The exposed surfaces of the stockpile shall be covered in hessian or equivalent approved matting.

De-stumping of roots and stumps shall be done as part of the subsequent further clearing and grubbing of the site and removal of topsoil. Topsoil, including grass and other vegetation, shall be removed from within the footprint of the site to a depth of 200 mm. Sufficient quantities of topsoil shall be stockpiled on site for later re-use in the rehabilitation of exposed embankments and other disturbed areas.

The following measures shall be adopted during the removal and stockpiling of topsoil:

- Naturally occurring vegetation removed by site clearance operations may be grubbed in with the topsoil for stockpiling.
- Topsoil stripping shall not occur in wet weather.
- During stripping and stockpiling, the topsoil shall not be compacted or pushed for a distance of more than 50m.
- Topsoil shall only be handled twice, i.e. once to strip and stockpile, and secondly to replace, level, shape and scarify.

All stockpiles of topsoil shall be managed as follows:

- Stockpile(s) shall not be higher than 2m.
- The slopes of the stockpiles shall be no steeper than 1:2.
- Topsoil materials shall not be contaminated with any other granular materials, rubble or building material or be subjected to compaction or contamination by the Contractor’s vehicles and machinery.
- All stockpiles shall be protected from erosion due to wind or rain.
- All exposed stockpile surfaces shall be fully covered with hessian or similar approved matting.
- The topsoil stockpiles shall be kept damp by regular watering.
- The Contractor shall remove exotic/invasive species from the topsoil stockpiles.

The allocated stockpile area is shown in Figure 18 below.

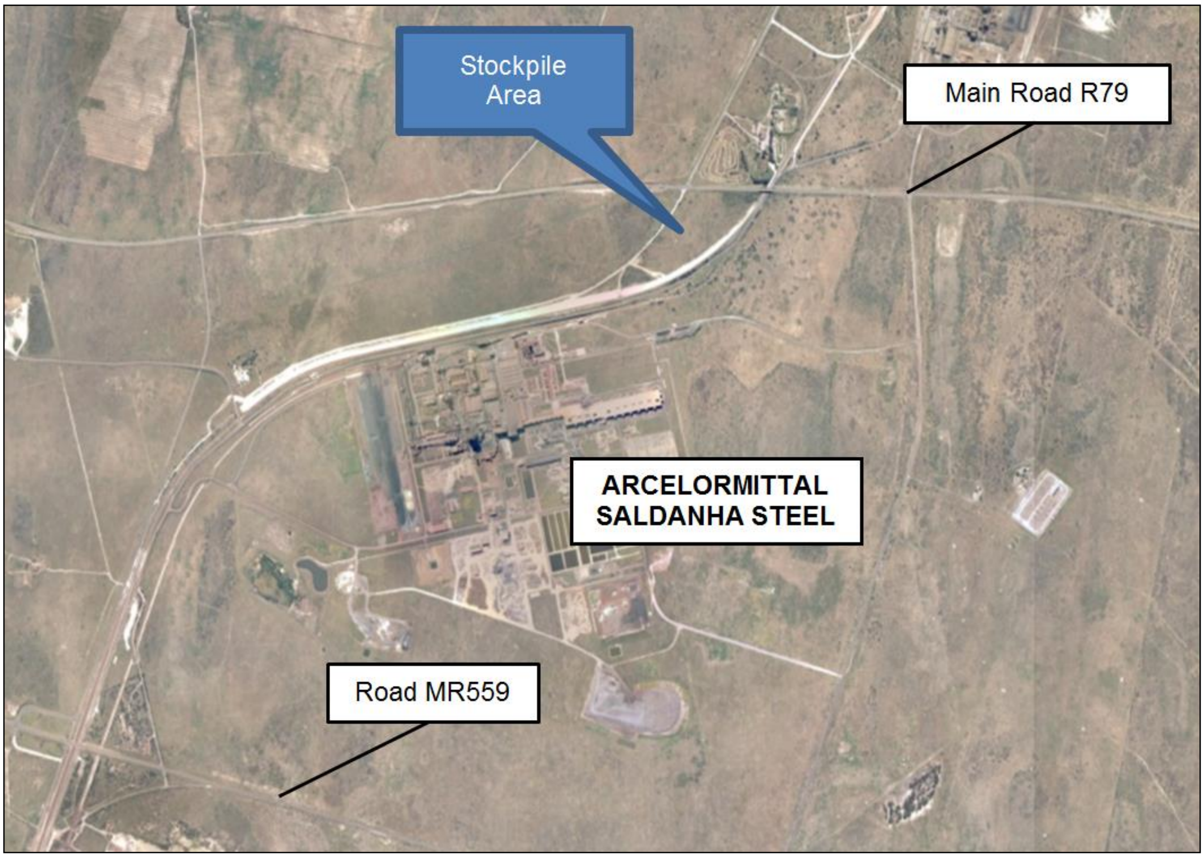


Figure 18: Stockpile Area

6.2.2. Site Establishment

The designated proposed location for the site camp is adjacent to existing Substation H, within the Port boundary, as indicated in Figure 19 below. The camp area has an extent of approximately 30 m x 45 m, which will be adequate for the establishment of site offices with limited storage space. The designated camp area is not intended as the main laydown area.

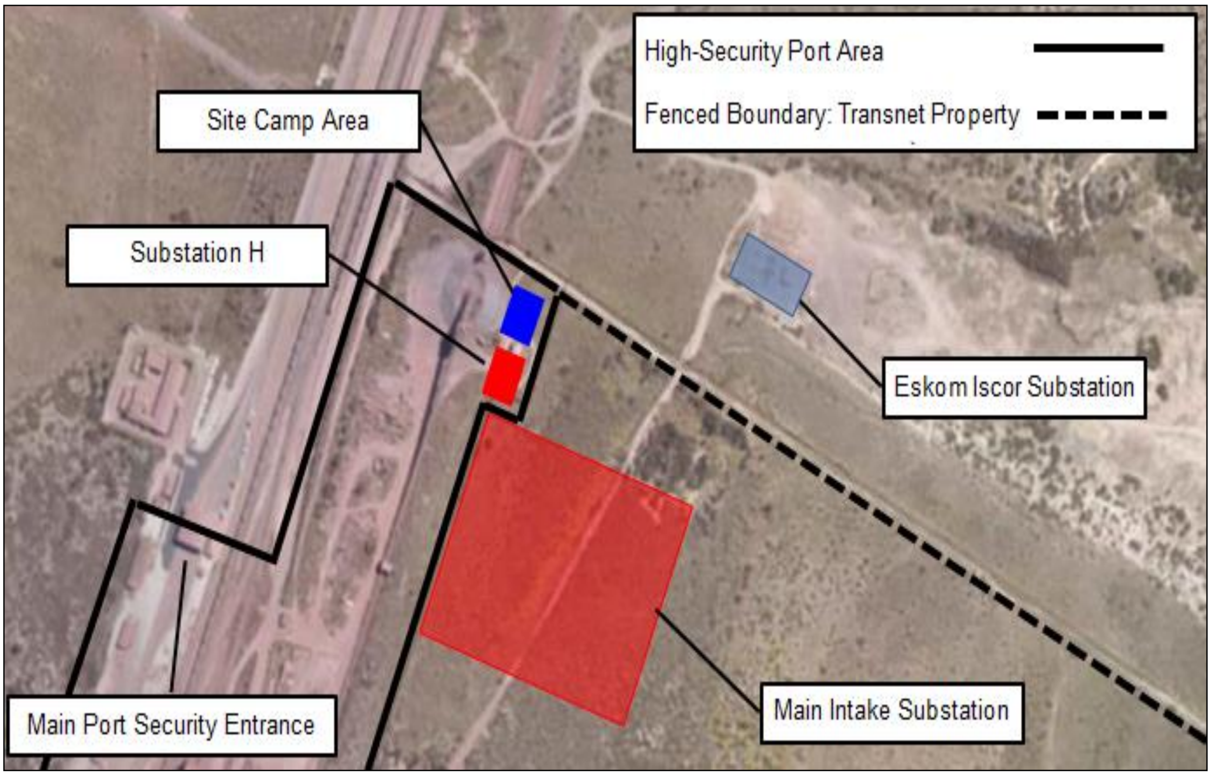


Figure 19: Site Camp

The full extent of the camp area shall be enclosed with 2 m high security fencing. A gate shall also be provided on the Western side of the camp area, at the entrance to the secure Port area, which shall be manned at all times and shall be locked outside of working hours.

Accommodation of the Contractor's staff at the yard and laydown areas will not be permitted. No electricity, water or sanitation will be available at the site camp or any laydown areas and the Contractor will thus be required to make his own provision for these services.

A take-off point for obtaining potable water is shown in Figure 20 overleaf. Should the Contractor wish to make use of this take-off point, the Contractor may have to provide, at his own cost, a metered water take-off point for taking water from this point.

Figure 20: Water Take-off Point

6.2.3. Platform and Earthworks (SANS 1200D)

Bulk earthworks will be required to create a platform, with an extent of approximately 120 m x 147 m, to accommodate the new Substation yard, switch house for Transnet, Eskom control building, transformers, switchgear, bus bars, conductors and the like. The earthworks will entail excavations and backfilling. A layer of G5 materials with a soil resistivity (p) value of between 10 -100 Ωm shall be placed and compacted above the indicated finished levels for the bulk earthworks. The G5 layer thickness shall be as follows:

- Beneath Transnet's 11kV Switch House : 1.5 m
- For remainder of platform : 1.15 m

The G5 layer shall be brought in from commercial sources and is to be placed beneath and above the earth mat covering the full extent of the platform. Should the excavated materials consistently meet the soil classification for resistivity as detailed above, Transnet may consent to the use of these materials for backfilling of the platform area.

Compaction requirements for bulk earthworks are as follows:

- The base of the excavated area shall be ripped to a depth of 150 mm and recompacted to 93% of MOD AASHTO density.
- The G5 layer, extending over the full extent of the platform and earthmats, shall be compacted to 95% MOD AASHTO, in layers no thicker than 150 mm.
- Backfilled areas beyond the earthmats and platform shall comprise of G7 materials (minimum) and shall be compacted to 93% MOD AASHTO, in layers no thicker than 300 mm.

Excess cut materials shall be disposed of at a designated stockpile area within the Transnet property. Prior to the commencement of bulk earthworks, all topsoil shall be neatly removed to a depth of 200 mm and stockpiled outside of the works area, to be used for slope protection purposes upon completion of the earthworks. Topsoil may not be contaminated during the course of the earthworks operations.

Areas within the Substation yard are to be covered with a Class A4 Bidim layer and a 100 mm layer of 26.5 mm to 37.5 mm crushed washed stone. This shall extend to 1.2 m beyond the perimeter fence. The Contractor shall dispose of clean, granular materials, including hard rock excavations and unsuitable, oversized materials (cobbles and/or boulders) at a designated stockpile area within the Transnet property.

All other spoil materials, including materials from site clearance operations shall be disposed of at a registered waste disposal site.

6.2.4. Stormwater Drainage (SANS 1200LD)

Stormwater run-off discharging from the undisturbed areas to the East, North and South of the footprint of the bulk earthworks will be re-routed by means of an unlined berm immediately beyond the perimeter of the cut slopes and discharged to adjoining open areas. The run-off will be discharged to areas outside of the Substation platform. Refer to Figure 21 below for typical detail of the berm.

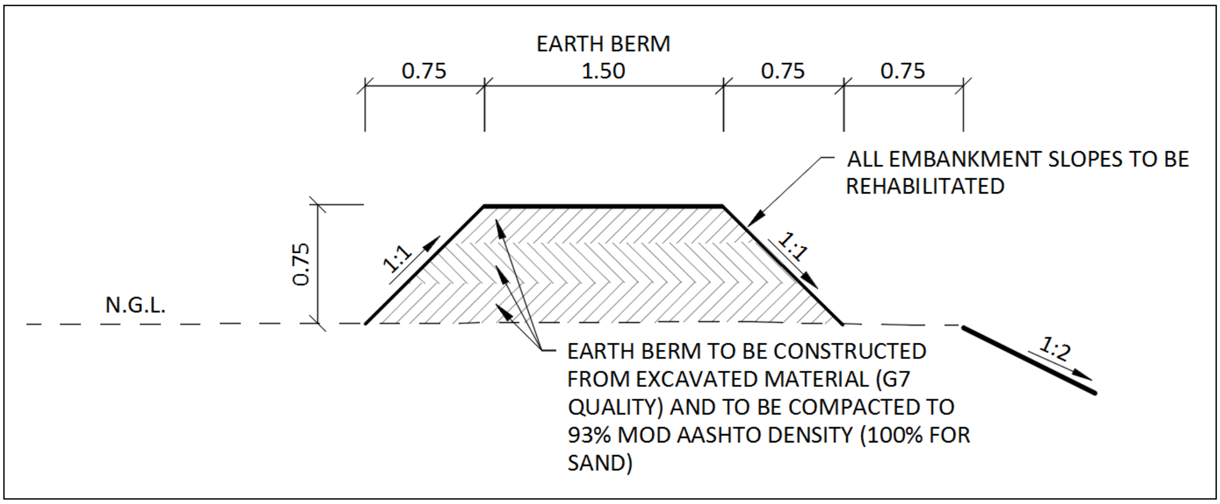


Figure 21: Cut off berm

Surface run-off generated within the platform area as well as from the perimeter and internal roads will be collected via a series of concrete channels, discharging into catch-pits and a below-ground system of uPVC and concrete pipes.

A series of subsurface drains will also be installed along the Northern, Eastern and Southern perimeter of the platform, as well as within the platform area. These drains will discharge into the stormwater catch-pits and manholes. All surface and subsurface run-off will be discharged into a detention pond, which is to be constructed immediately north of the Substation platform. Refer to the following typical stormwater details that will be utilised:

- Figure 22: Typical catch-pit detail.
- Figure 23: Typical subsoil detail.
- Figure 24: Typical cast in-situ concrete channel detail.
- Figure 25: Typical precast concrete channel detail.
- Figure 26: Typical Armorflex lined channel detail.
- Figure 27: Detention pond Armorflex lined bottom detail (including Armorflex notes).
- Figure 28: Typical concrete headwall detail (Front Elevation).
- Figure 29: Typical concrete headwall detail (Plan).

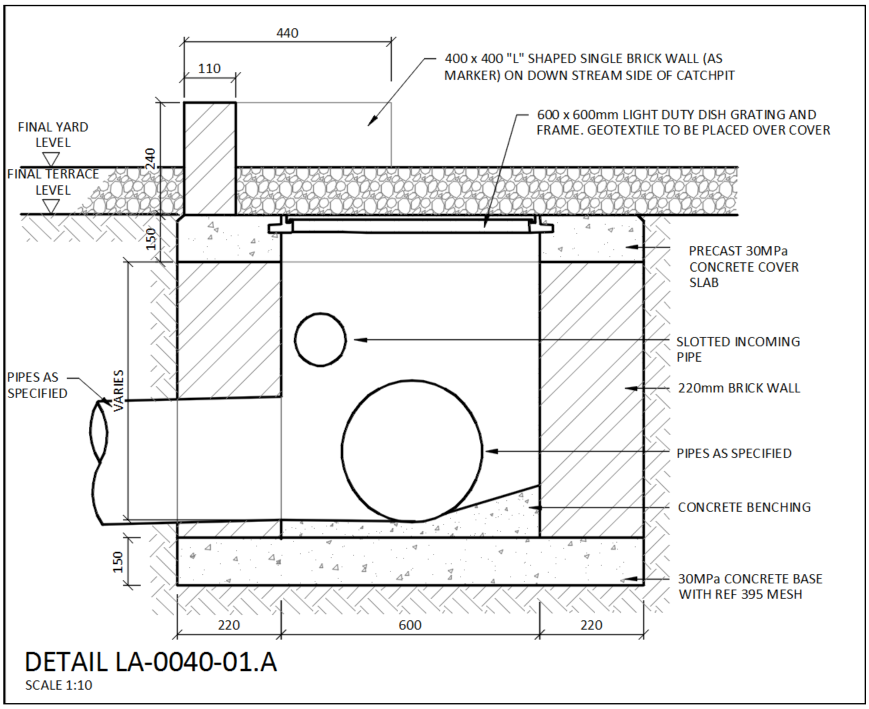


Figure 22: Typical Catch-pit Detail

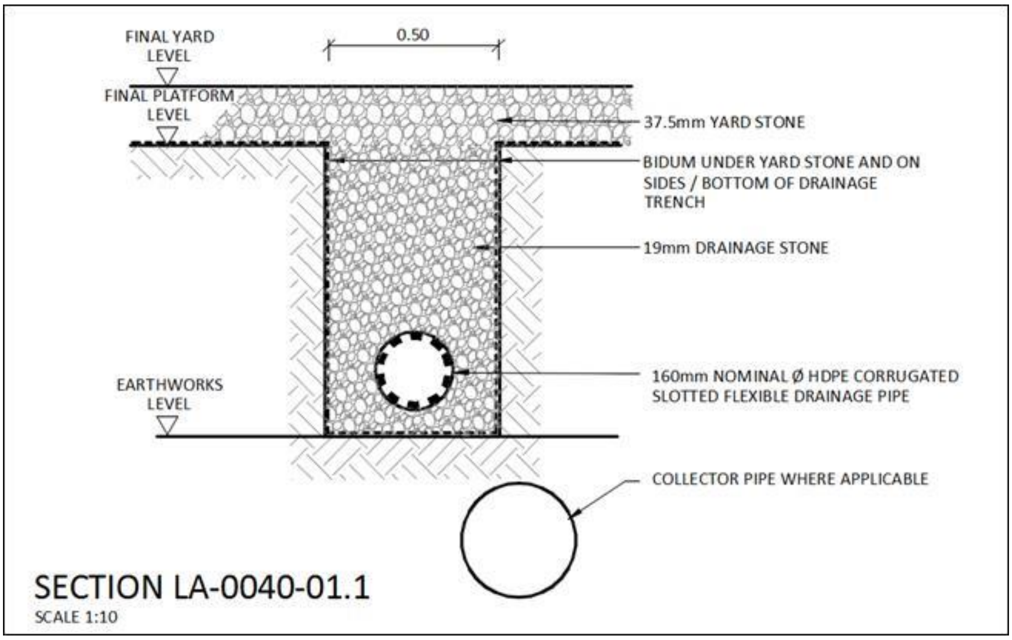


Figure 23: Typical Subsoil Detail

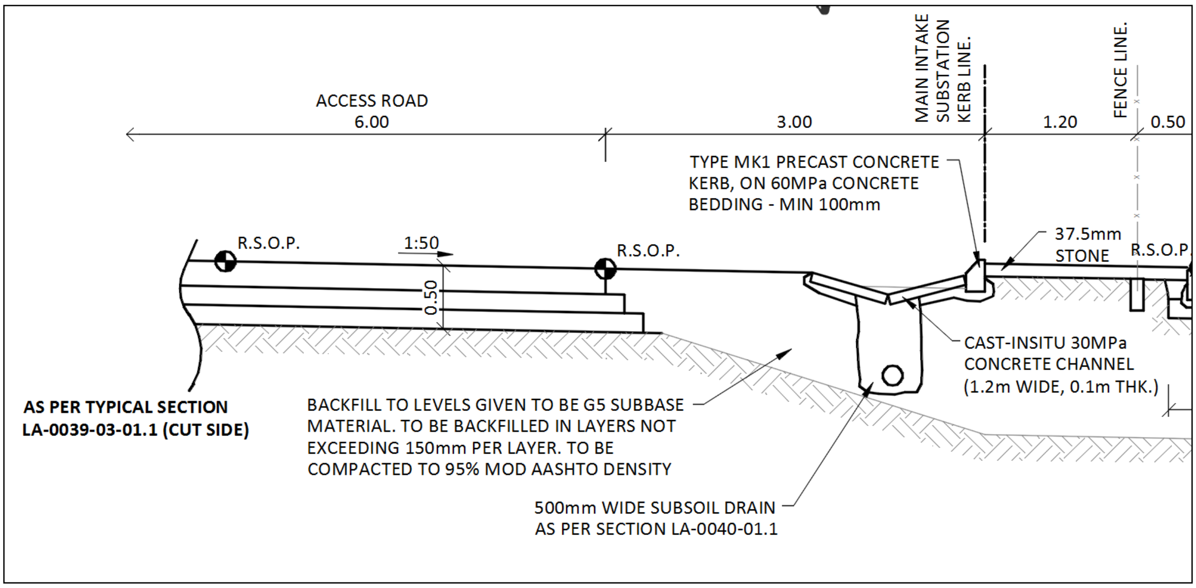


Figure 24: Typical Cast In-Situ Concrete Channel Detail

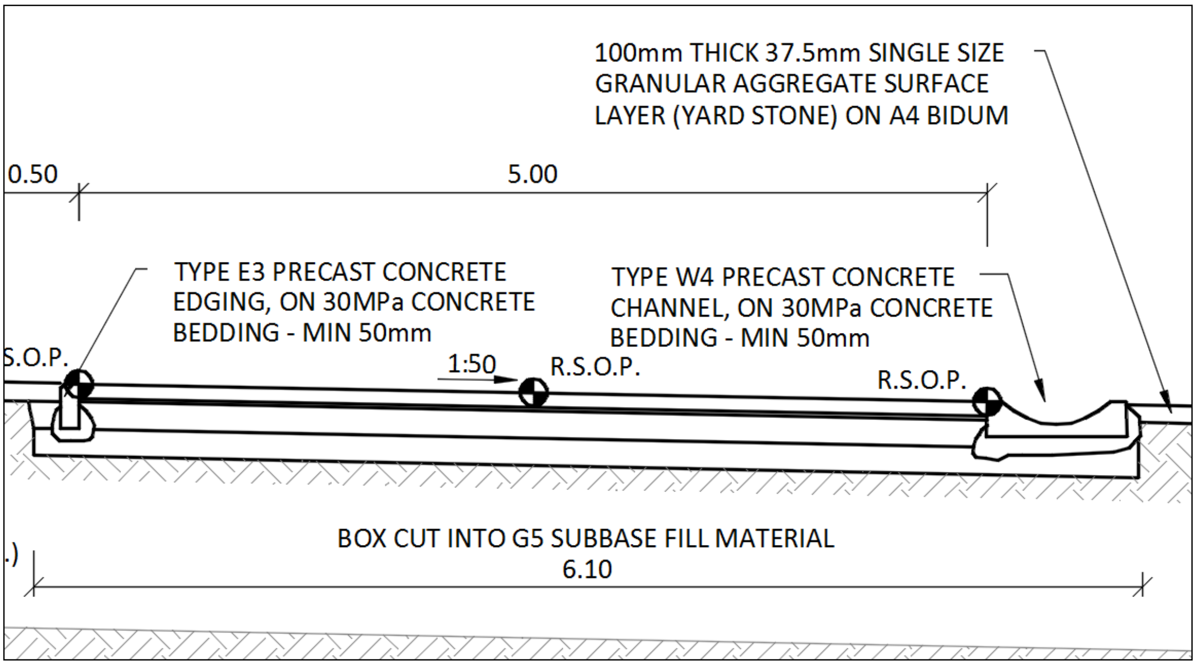


Figure 25: Typical Precast Concrete Channel Detail

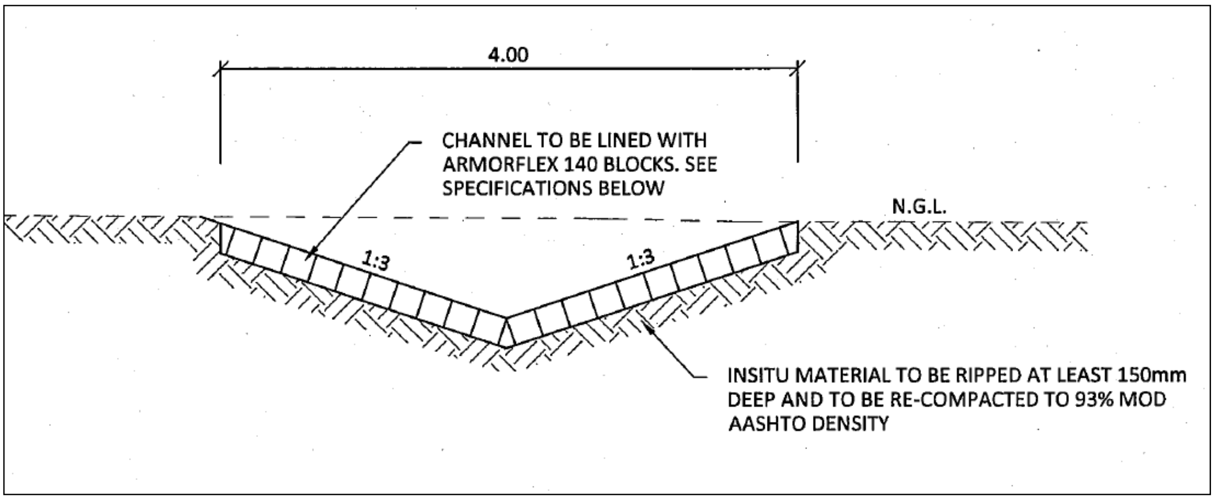


Figure 26: Typical Armorflex Lined Channel Detail

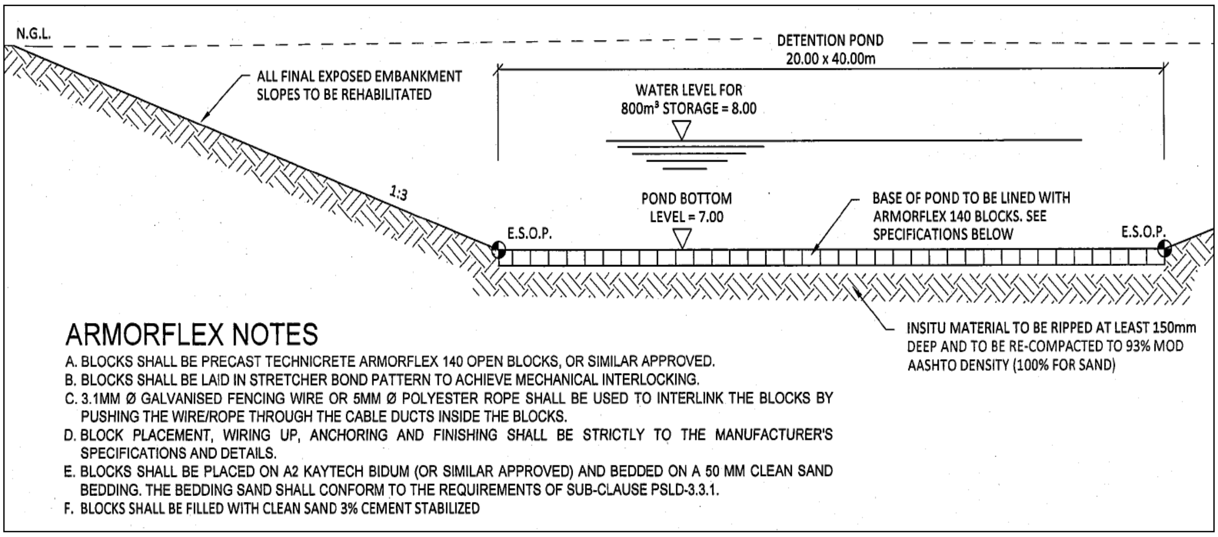


Figure 27: Detention Pond Armorflex Lined Bottom Detail (Including Armorflex Notes)

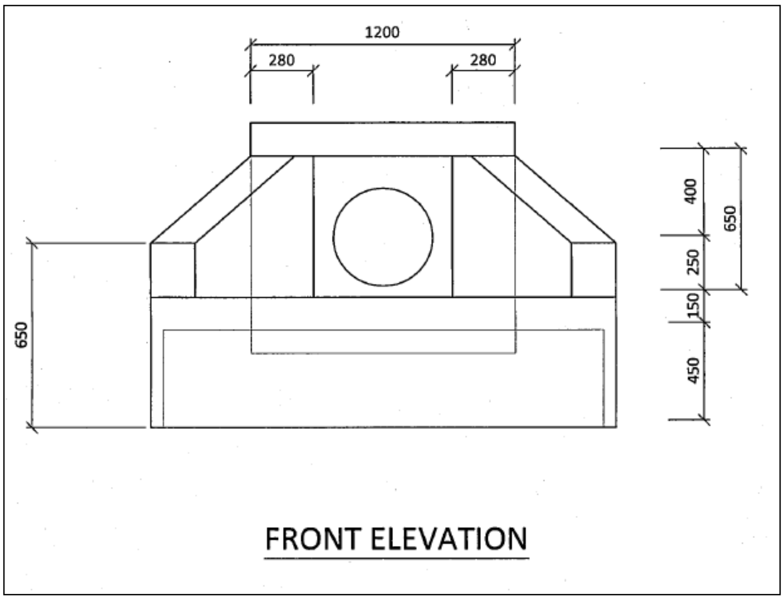


Figure 28: Typical Concrete Headwall Detail (Front Elevation)

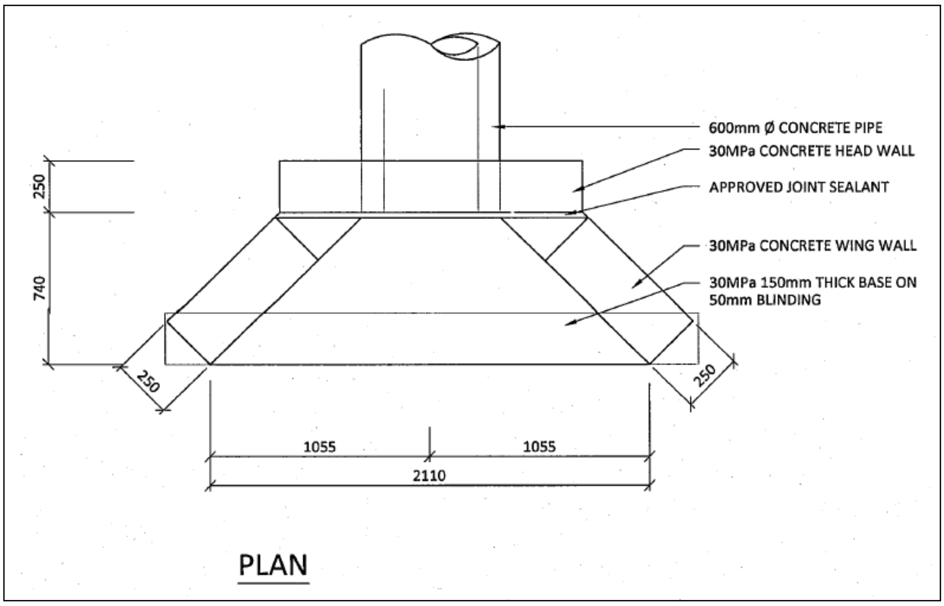


Figure 29: Typical Concrete Headwall Detail (Plan)

6.2.5. Road and Hardstand Design

New external gravel roads are to be provided to allow separate access to the Eskom and Transnet Substations. The external roads will follow along the outside of the substation perimeter fences.

Referencing Figure 30 and Figure 31 overleaf, routine access for Transnet's operating staff to their substation will be off the new Service Road 1 between the Port and Tippler 3, following the alignment of the existing track to Substation H and continuing between ArcelorMittal's existing conveyor CV-305 to the Port and the new perimeter fence on the Western side of the Substation yard, up to the entrances for the Substation from the Northern and Southern sides of the yard.

An alternative access route adjacent to Substation H can be used via the Port onto Sunrise Energy property, which links up with the existing gravel road used by Eskom currently to gain access to Iscor Substation.

Routine access for Eskom personnel will be via the abovementioned existing gravel road to Iscor Substation on Sunrise Energy property, which is to be extended from the Northern boundary of Transnet's property, abutting the Sunrise Energy property, to the new Substation. A new gate is to be provided at the boundary fence.

This access shall also be used during construction of the New Main Intake Substation (Including the Ystervark section), until such time as the service roads between the Port and the Tippler 3 building, to be constructed by Others, have been completed.

It should be noted that Sunrise Energy has indicated previously that possible access via their plant area could be considered, to aid both Transnet and Eskom for the delivery of large equipment such as transformers, due to the turning radii of the transport vehicles.

Furthermore, Sunrise Energy will be permitted to use the access roads on Transnet property as emergency escape routes for their staff and vehicles.

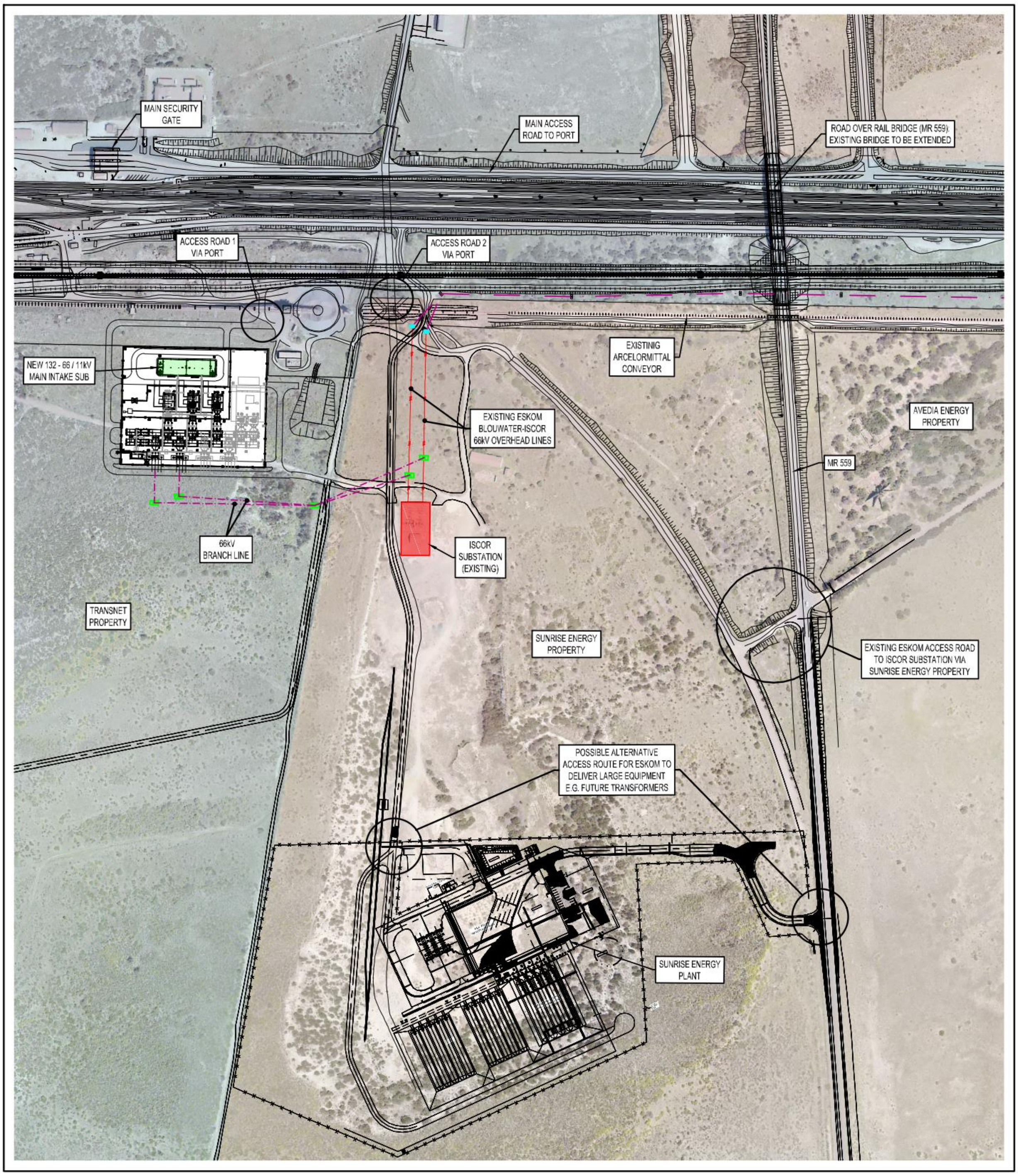


Figure 30: Access Roads

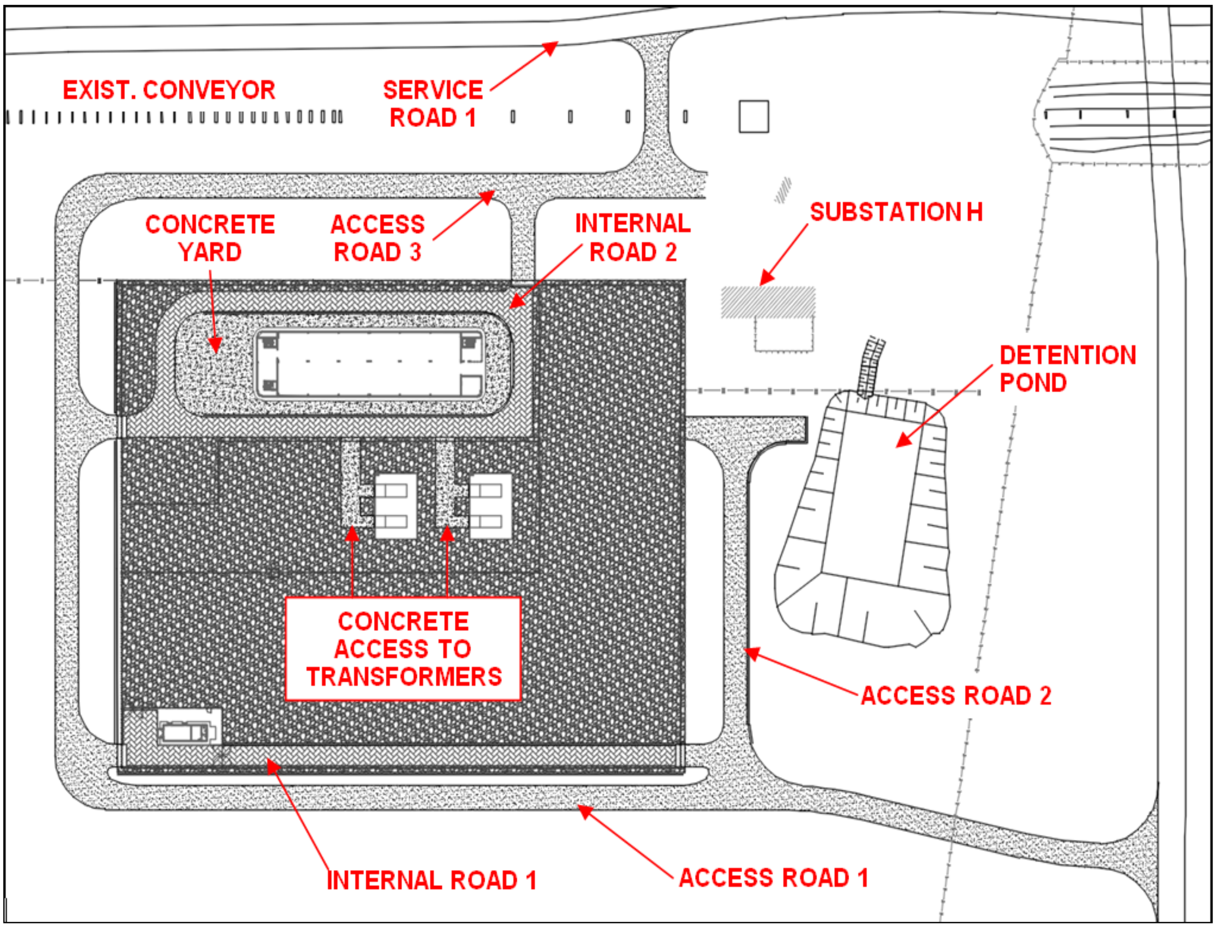


Figure 31: Layout of Roads and Hardstand Areas

Access Roads 1 and 2, serving the Eskom Substation, will include the following layerworks:

- 200 mm Gravel wearing course compacted to 98% MOD AASHTO.
- 150 mm G5 subbase compacted to at least 95% MOD AASHTO.
- 150 mm G7 selected subgrade compacted to at least 95% MOD AASHTO.
- 150 mm Rip and re-compact in-situ soil to at least 93% MOD AASHTO.

The typical cross-section detail for Access Roads 1 and 2 is shown in Figure 32 overleaf.

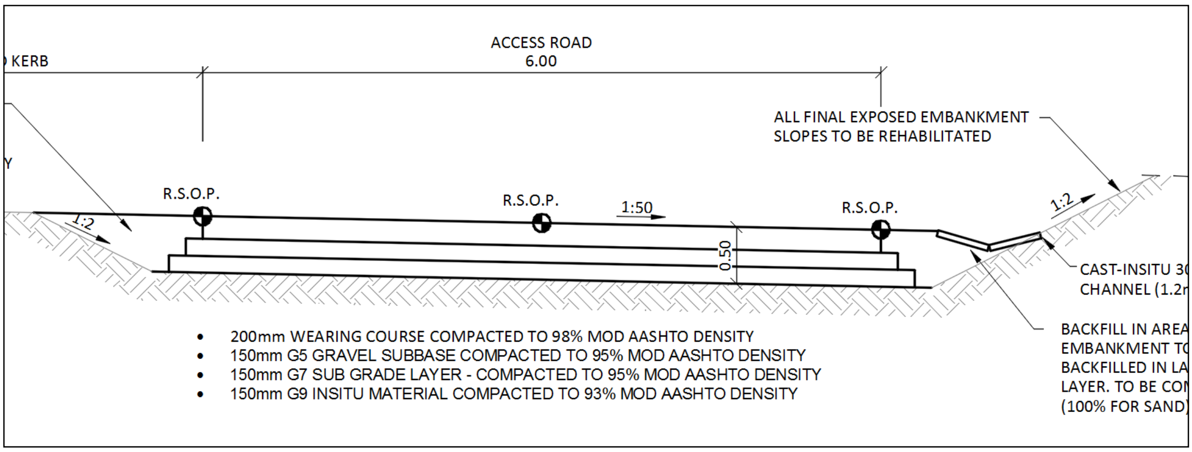


Figure 32: Typical Cross-section Details of Access Roads 1 & 2

Access Road 3, serving Transnet's Substation, shall include the following layerworks:

- 200 mm Gravel wearing course compacted to 98% MOD AASHTO.
- 150mm G5 Gravel subbase compacted to 95% MOD AASHTO.
- 150 mm G7 selected subgrade compacted to at least 95% MOD AASHTO.
- 150 mm Rip and re-compact in-situ soil to at least 93% MOD AASHTO.

Two internal roads with segmental block paving are to be provided within the fenced-off Substation yard, providing separate access to the Eskom and Transnet buildings and parts of the yard respectively. These roads will have the following layerworks:

- 80 mm S-A Interlocking heavy duty pavers on 20mm sand bedding.
- 150 mm C3 cement-stabilized gravel base compacted to 97% MOD AASHTO density.
- 150 mm rip and re-compact previously imported G5 materials for platform area to 95% MOD AASHTO.
- G5 Fill layers compacted to 95% MOD AASHTO.

Refer to typical cross-section detail for Internal Roads in Figure 33 overleaf.

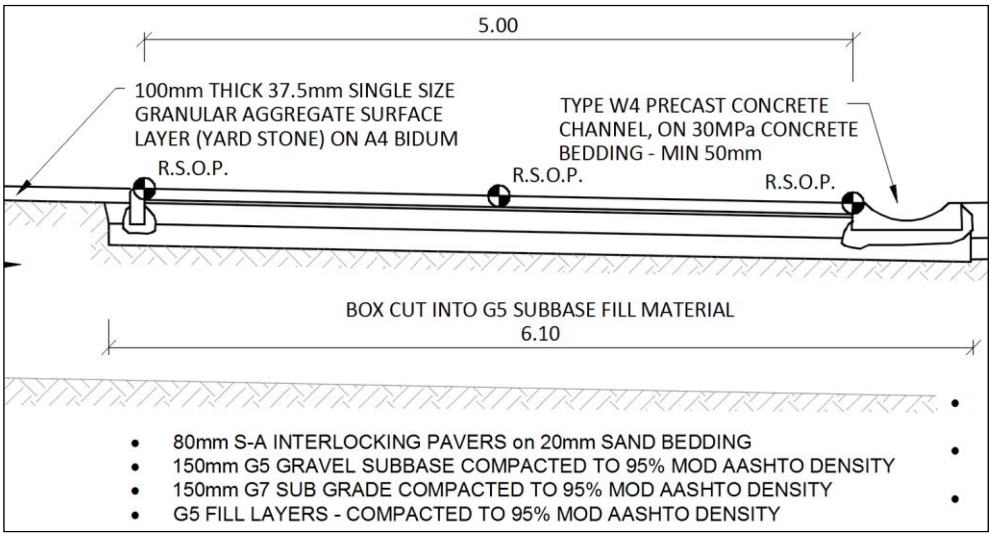


Figure 33: Typical Cross-section Details of Internal Roads

Concrete-surfaced access is to be provided to the transformers and to the open area between the Main Intake Substation building and internal block-paved Road No. 2, to include the following:

- 250 mm jointed concrete slab with 28-day cube strength of 40 MPa and design flexural of 3.8 MPa.
- 150 mm C3 cement-stabilized subbase, compacted to 97% MOD AASHTO.
- 150 mm rip and re-compact previously imported G5 materials to platform area to 95% MOD AASHTO.

Refer to typical concrete surface bed details in Figure 34 to Figure 38 below.

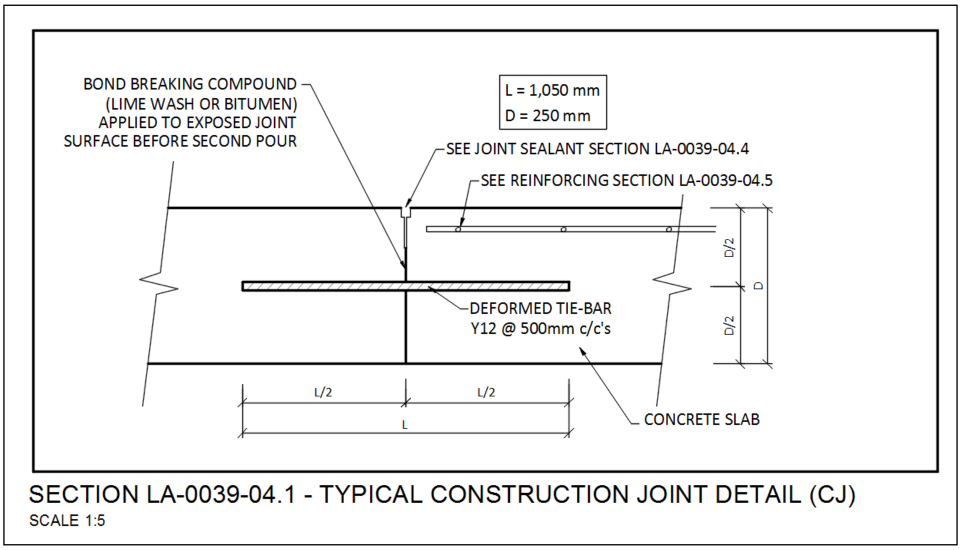


Figure 34: Typical Construction Joint Detail

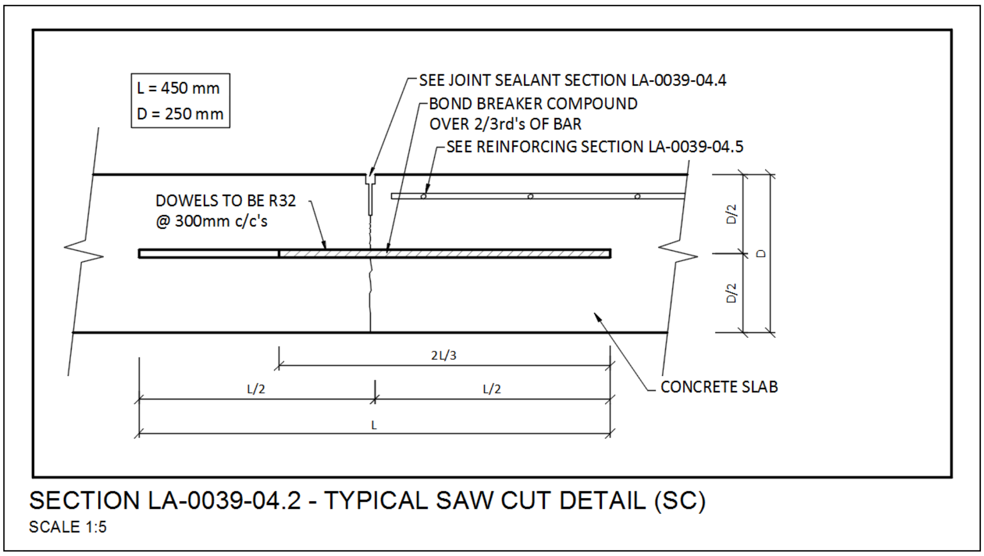


Figure 35: Typical Saw Cut Detail

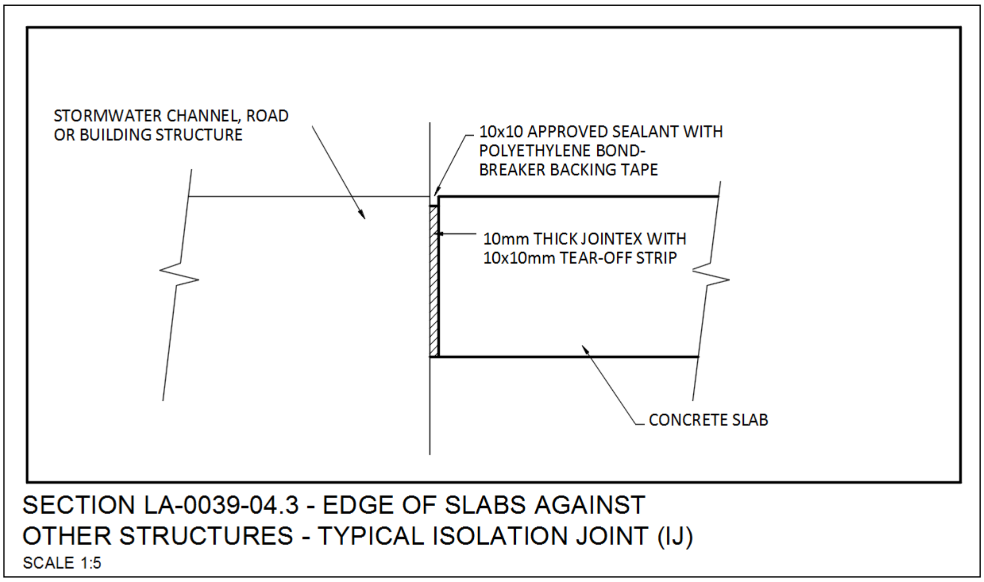


Figure 36: Edge of Slabs Against Other Structures - Typical Isolation Joint

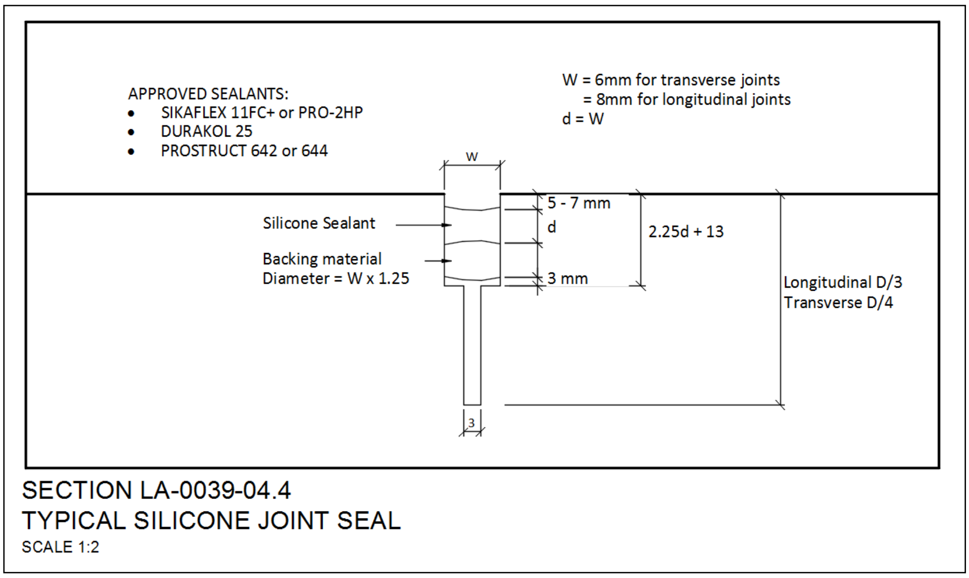


Figure 37: Typical Silicone Joint Seal

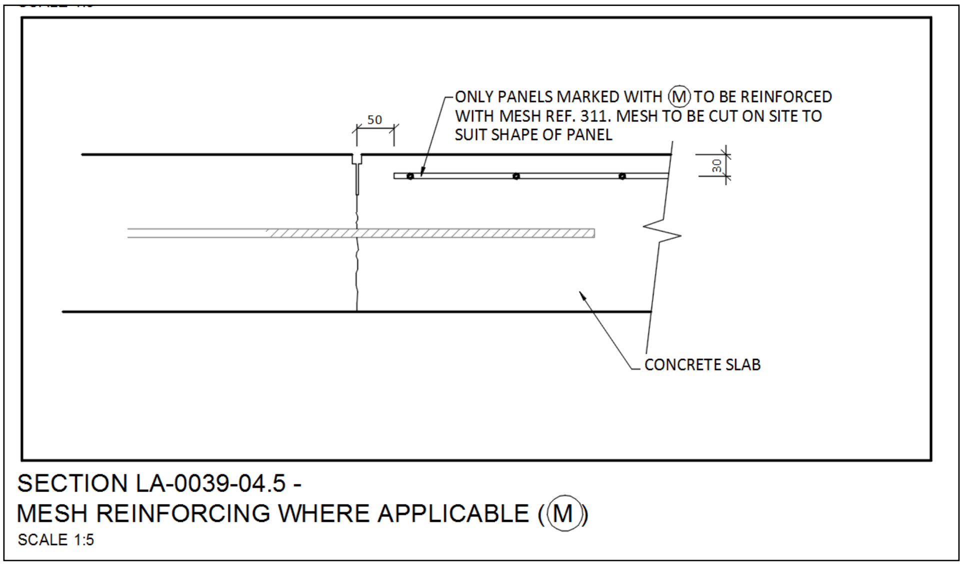


Figure 38: Mesh Reinforcing

The external roads are designed to have sufficiently large radii (15 m) at curves to accommodate low bed truck turning circles. The width of all external access roads are 6 m and the width of all internal roads are 5 m.

6.2.6. Earthworks - Pipe Trenches (SANS 1200DB)

Excavation of pipe trenches must be at least the width of the pipe diameter plus a side allowance of 300 mm on either side of the pipe.

All pipe trenches underneath roadways, parking areas and all hard-standing areas subject to road traffic or building loads shall be backfilled with sand up to the underside of the layerworks in layers of not more than 150 mm and compacted to 100% MOD AASHTO maximum density. Sand is defined as non-plastic material and shall comply with the following sieve analysis:

% passing:	4.740 mm sieve	-	95% minimum.
	0.425 mm sieve	-	50% minimum.
	0.75 mm sieve	-	10% maximum.

6.2.7. Bedding, Blanket and Backfill

Bedding will consist of selected granular material. This is material of granular, non-cohesive nature that is singularly graded between 0,6 mm and 19 mm, is free-draining and has a compact ability factor not exceeding 0,4.

Blanket material is selected fill material which has a PI less than 6 and that is free from vegetation, lumps and stones exceeding 30 mm in diameter. Tests must be performed to confirm material is suitable for bedding.

Backfill material will be selected material from trench excavations on site. Tests must be performed to confirm material is suitable for bedding.

6.2.8. Stormwater, Seepage and De-watering

In addition to the Contractor's responsibility for dealing with water, the Contractor may also be instructed to place a crushed stone bedding layer on a geofabric on the trench bottom.

6.2.9. Water

The following water supplies, and connections will be provided for the Substation:

- Two new 110 mm diameter water mains, teeing off from an existing 160mm main near the Western boundary of the Substation platform, are to be provided along the Northern and Southern side of the site, to feed the fire hydrants on either side of the platform. Refer to Figure 39 below for details of the Southern fire hydrant connection.
- A 32 mm diameter connection will supply water for the HVAC chillers located inside Transnet's 11 kV Switch House, taken from the new 110 mm main on the Southern side of the site. Refer to Figure 39 below for details of 32 mm HVAC water feed.
- Water to the ablution facilities at the Eskom relay house at the South-Eastern corner of the site will be obtained via a 1500 ℓ rainwater harvesting tank, to be provided immediately adjacent to the building. Refer to Architect's section of this report for further details of the harvesting tank.

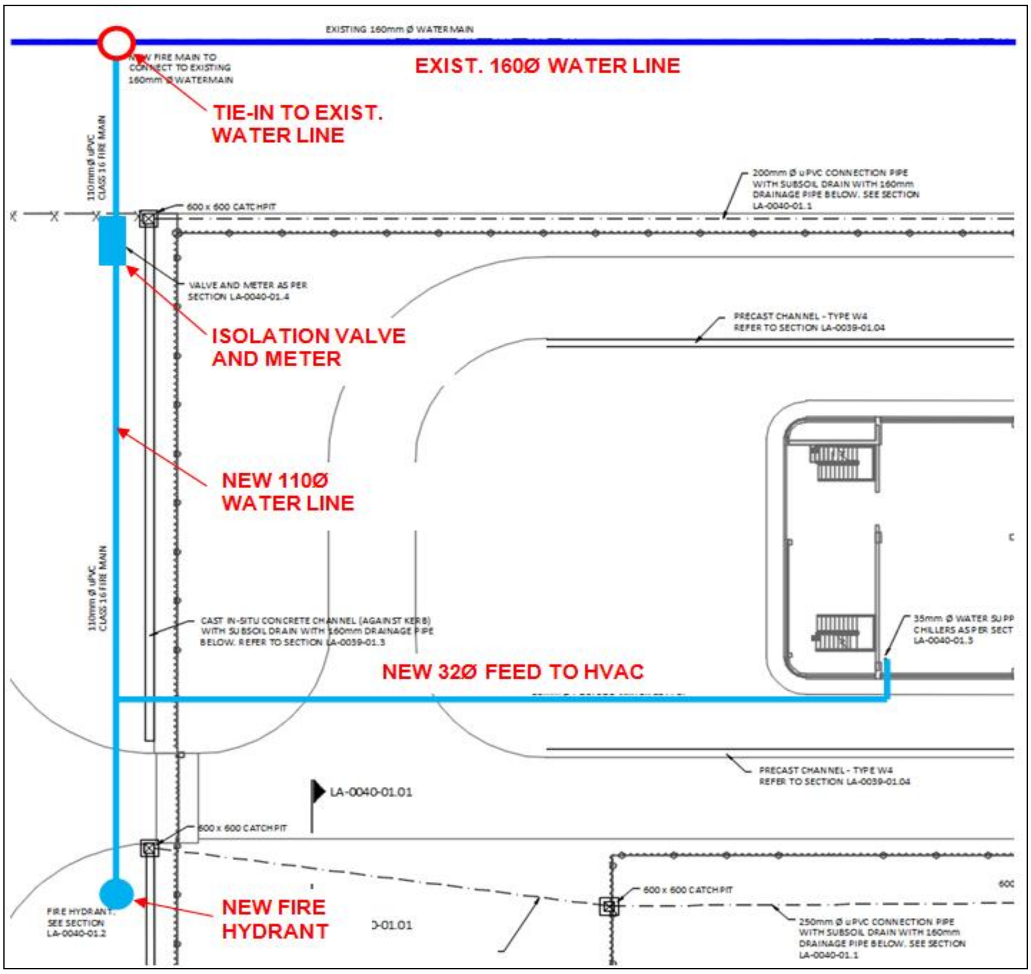


Figure 39: Fire Hydrant and HVAC Water Feed Connection

The following typical water related details will apply:

- Figure 40: Typical fire hydrant detail.
- Figure 41: Typical building connection detail.
- Figure 42: Typical valve/flow meter manhole chamber detail.

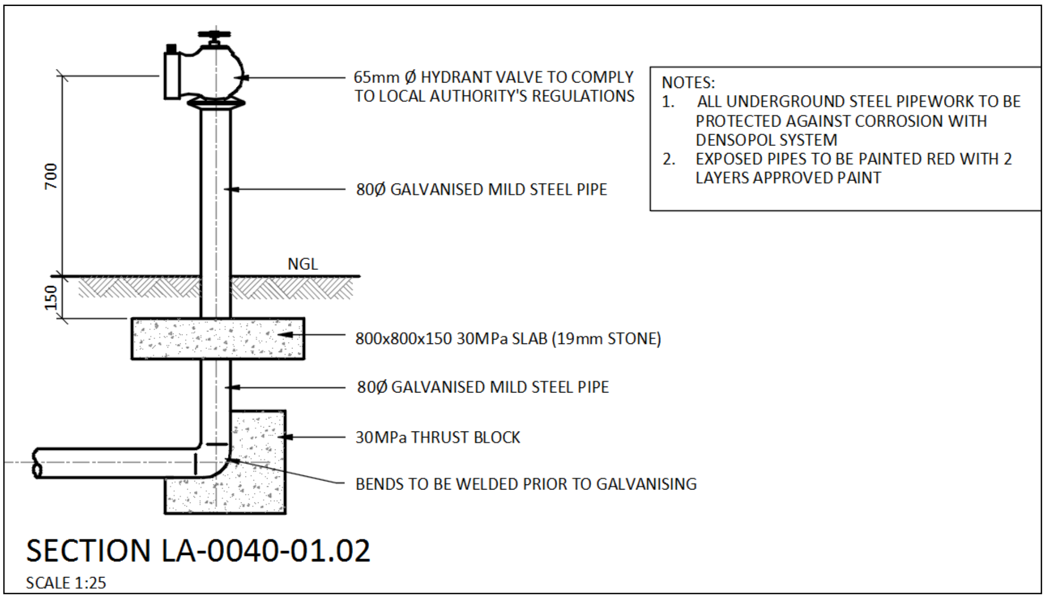


Figure 40: Typical Fire Hydrant Detail

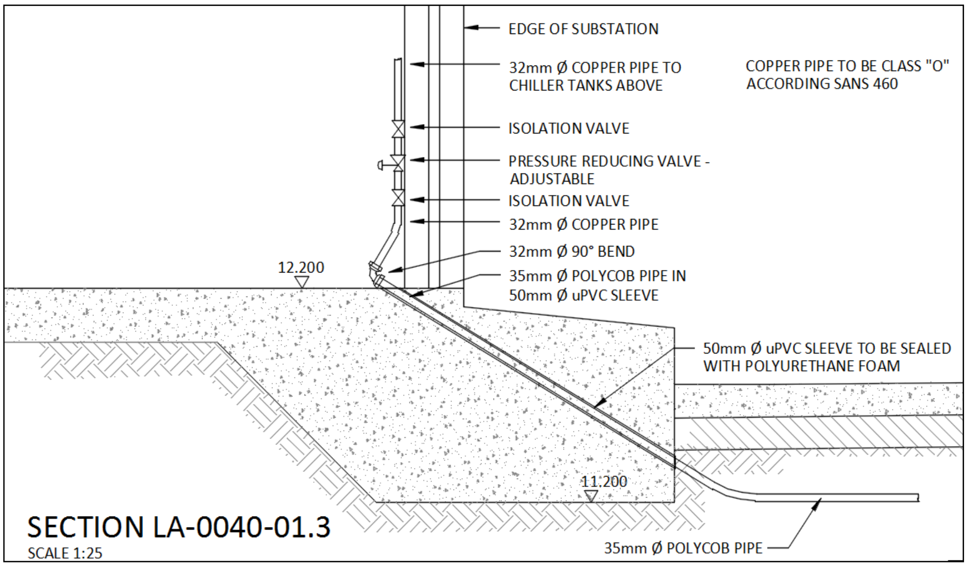


Figure 41: Typical Building Connection Detail

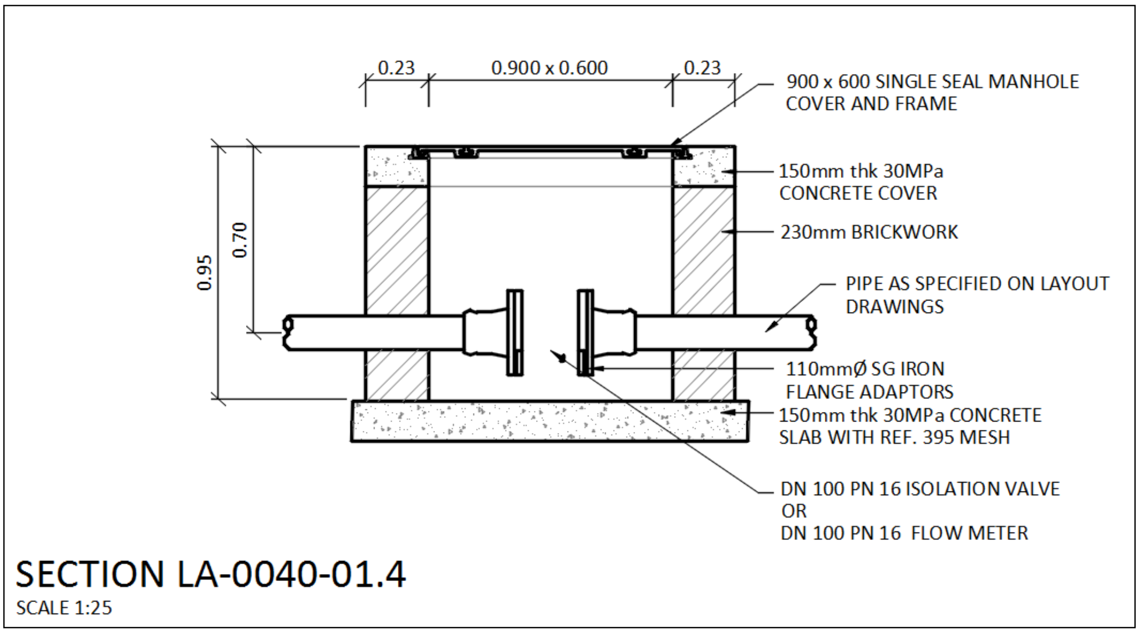


Figure 42: Typical Valve/Flow Meter Manhole Chamber Detail

6.2.10. Sewer and Wastewater Drainage

A 6000 ℓ conservancy tank (refer to Figure 43 below) will be provided for the Ystervark building sewer drainage needs. The conservancy tank will be fed by a 110 mm diameter underground sewer pipe at gradient 1:40 (refer to layout in Figure 44 below). The tank will have to be periodically cleaned and pumped out.

A standard 450 mm x 450 mm sewer manhole will be placed between the Ystervark building and the conservancy tank as part of the sewer reticulation system. Refer to typical sewer manhole detail in Figure 45 overleaf.

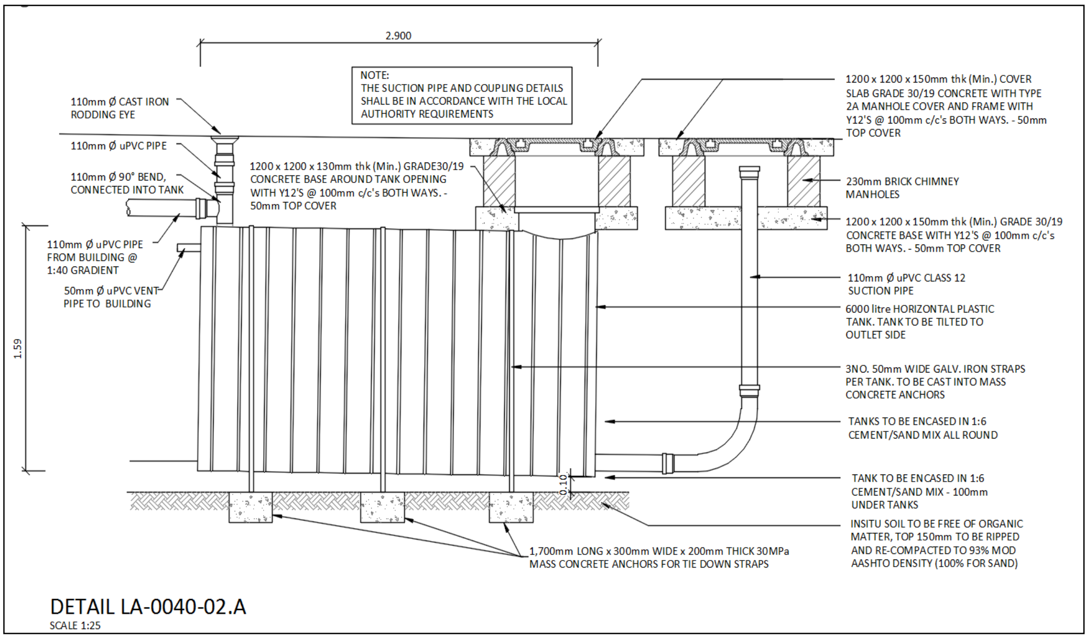


Figure 43: Conservancy Tank Details

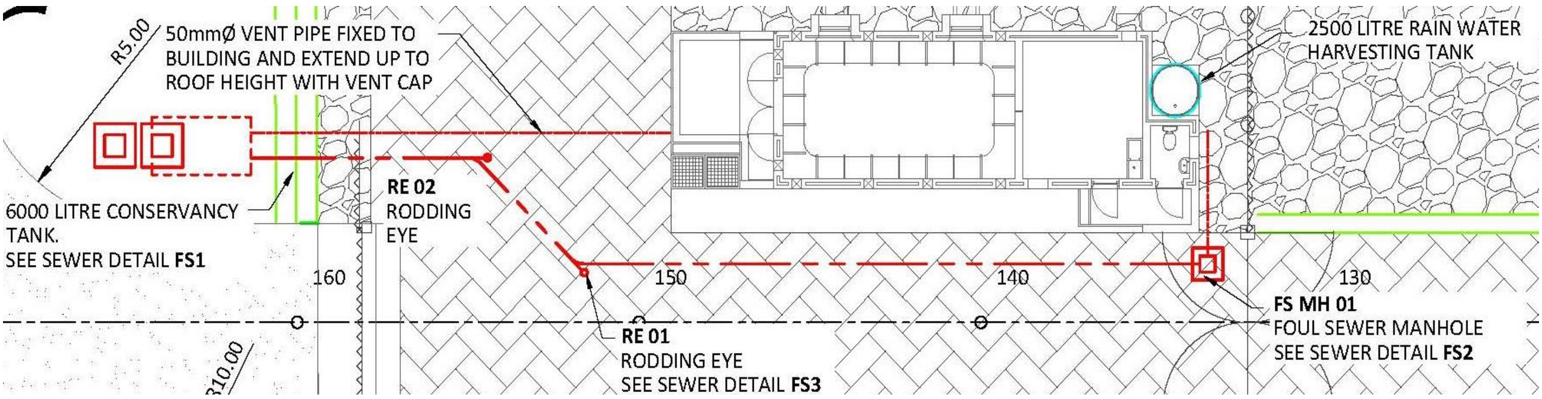


Figure 44: Sewer Pipe Layout

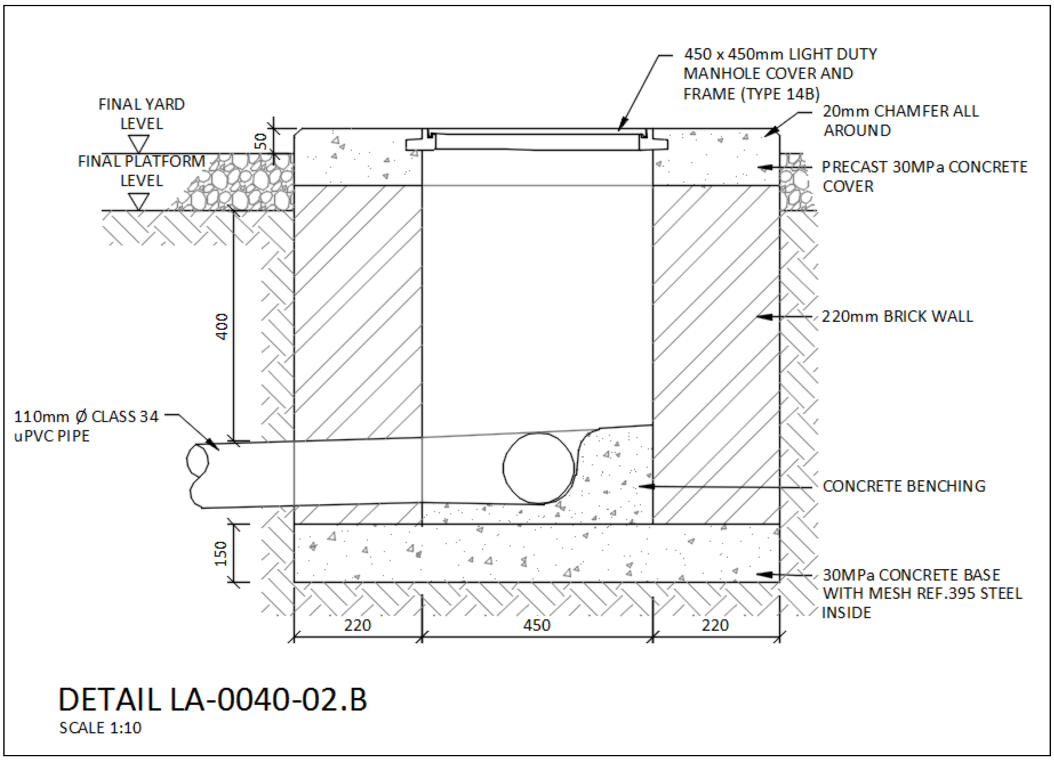


Figure 45: Typical Sewer Manhole Detail

6.2.11. Fencing

The entire Substation area shall be fenced off with 2.4 m high steel palisade fencing. Further fencing, to the same standard, is to be provided within the Substation yard, subdividing the following areas:

- The Eskom relay house at the South-Eastern corner of the Substation, which is to be fenced off from the rest of the yard, with separate vehicular and pedestrian access to the rest of the Eskom yard.

- The transformers and associated equipment, with separate gated vehicle and pedestrian access at the Transnet portion of the Substation, and removable panels at the Eastern internal boundary fence between the Eskom and Main Intake Substations.

- Further internal demarcating fencing between the Ystervark and Main Intake Substations.

The following access points and gates shall be provided:

- One 5.5 m wide sliding gate is to be provided for vehicular access from the existing Sunrise Energy gravel road onto Access Road 1.

- One 5.0 m wide sliding gate will be provided for at the Northern side, and three 5.0 m wide sliding gates at the Southern side, for vehicular access to Ystervark Substation.

- Two 5.0 m wide sliding gates are to be provided for vehicular access from both the Western and Southern side of Main Intake Substation.

- One 5.0 m wide double swing gate and one 1.0 m wide pedestrian swing gate to allow access from the Eskom relay house section to the rest of the Ystervark Substation yard.

- One 5.0 m wide double swing gate and one 1.0 m wide pedestrian swing gate to allow access to the transformer areas within the Transnet portion of the Substation.

- One 5.0 m wide double swing gate is to be installed between Access Road 1 and Access Road 3 to provide access from the Main Intake Substation site to the rest of the Port.

- Removable 5.0 m wide panels along the Transnet portion fence line for the transformer area, as well as at the Eastern internal boundary fence between Ystervark and Main Intake Substations, for future access to the transformers and associated equipment.

The following typical fence details will apply:

- Figure 46: Typical fence panel detail.
- Figure 47: Typical 5.0m double swing gate detail.
- Figure 48: Typical 1.0m pedestrian swing gate detail.
- Figure 49: Typical sliding gate detail.

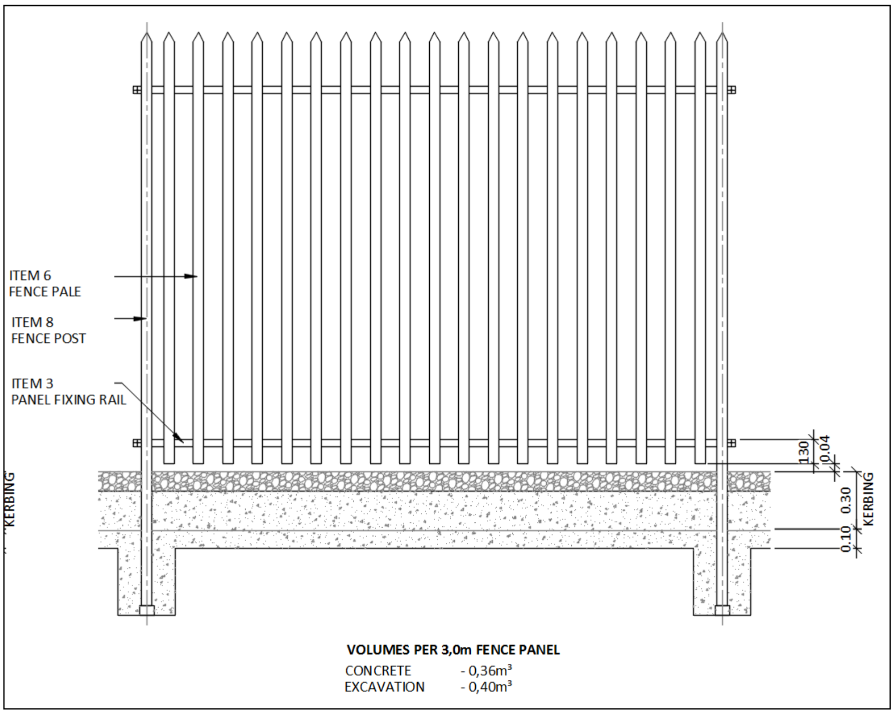


Figure 46: Typical Fence Panel Detail

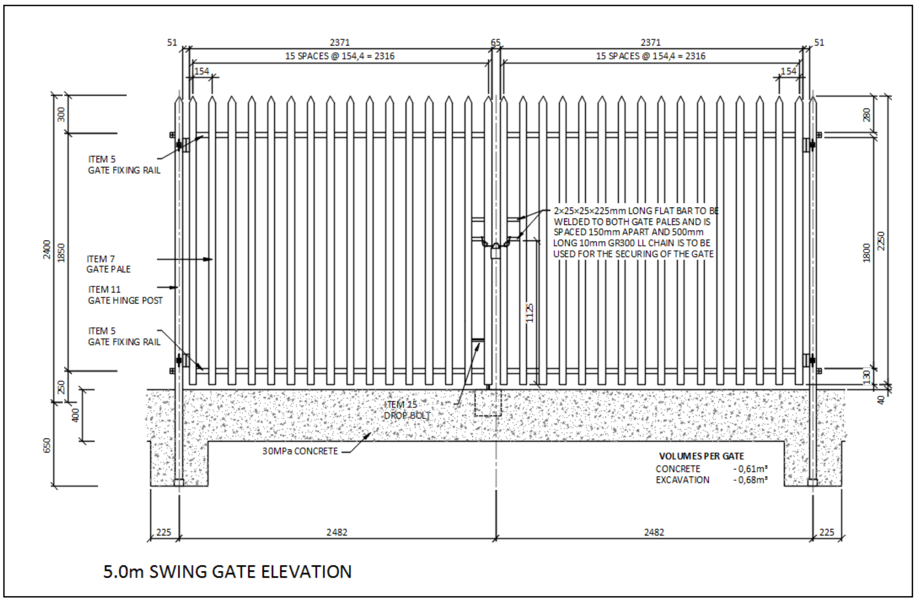


Figure 47: Typical 5.0 m Double Swing Gate Detail

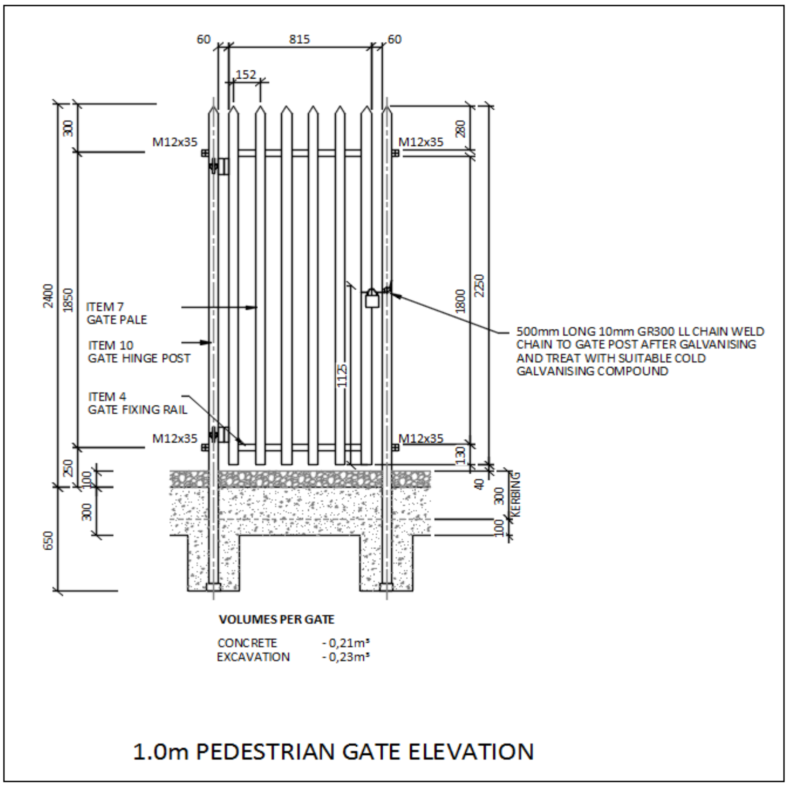


Figure 48: Typical 1.0 m Pedestrian Swing Gate Detail

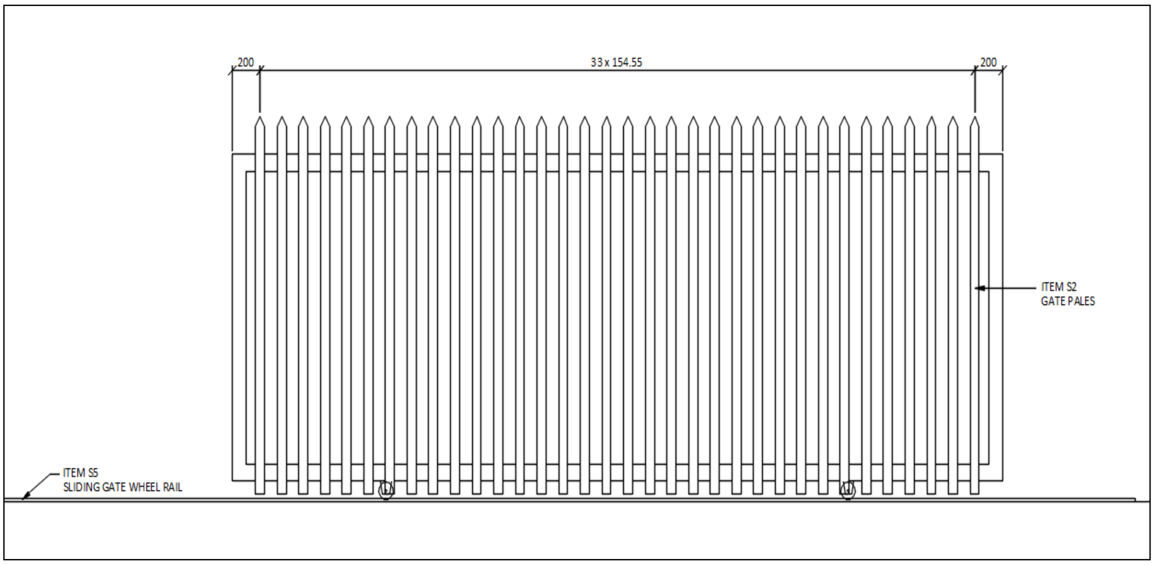


Figure 49: Typical Sliding Gate Detail

6.2.12. Cable Trenches

Underground cable trenches have been allowed for within the Ystervark and Main Intake Substations. All trenches are linked to one another and critical equipment, with various cable road crossings and cable/sleeve transition structures.

The following typical cable trench details will apply:

- Figure 50: Typical brick trench detail.
- Figure 51: Typical cable sleeve transition detail (1).
- Figure 52: Typical cable sleeve transition detail (2).

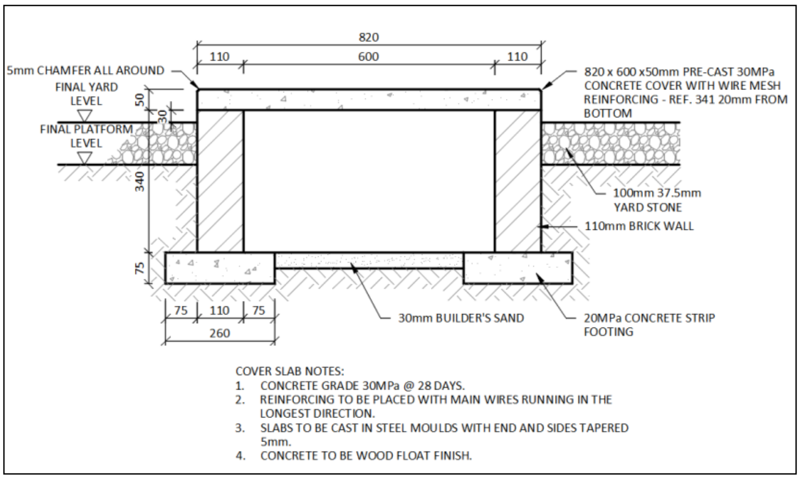


Figure 50: Typical Brick Trench Detail

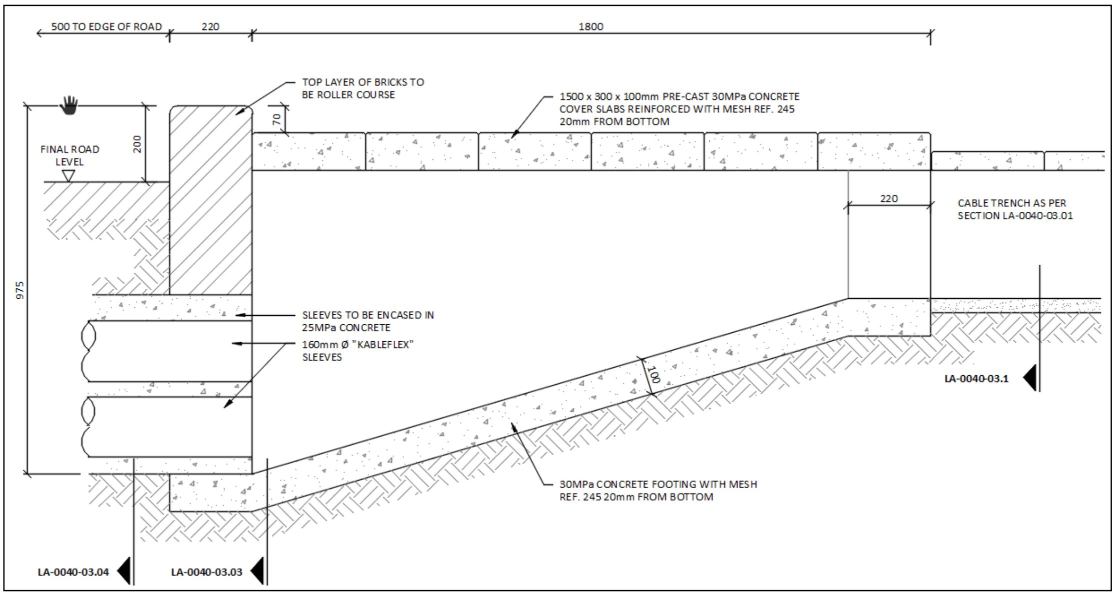


Figure 51: Typical Cable Sleeve Transition Detail (1)

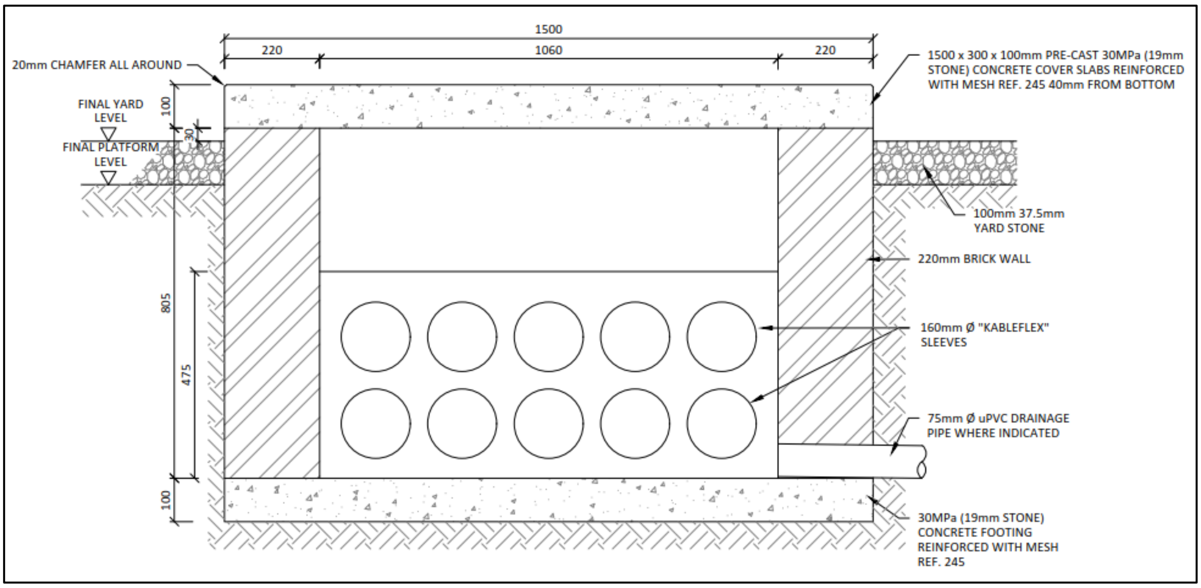


Figure 52: Typical Cable Sleeve Transition Detail (2)

6.2.13. Soil & Vegetation Rehabilitation

The minimum requirements for the following soil and vegetation rehabilitation activities:

a) Topsoiling
b) Mulching
c) Fertilising
d) Hydroseeding
e) Erosion matting
f) Herbicide application
g) Watering/irrigation
h) Weed removal

6.2.13.1 Topsoiling

Restoration of exposed embankments, including topsoil placement and re-establishment of vegetation, shall be done as soon as practical after substantial, continuous sections of the cut and fill slopes or trench backfilling have been completed.

The Contractor shall be responsible for the prevention of erosion at all areas impacted upon by the Contractors activities. All erosion repairs must be implemented at the first signs thereof and no erosion shall be allowed to develop on a large scale.

The Contractor shall plan all final earthworks shaping and trimming operations to allow for topsoil application. Final, trimmed levels for the bulk earthworks must make provision for the specified depth of reapplied topsoil.

All areas where rehabilitation is required shall be scarified and/or ripped prior to the application of topsoil, to ensure a uniform level of compaction for vegetation growth. This operation shall be restricted to a depth of 150 mm. Care shall be taken to avoid soil inversion where the topsoil has not been removed.

At all completed, exposed cut and fill slopes, or other areas where topsoil was removed, topsoil shall be uniformly spread to a depth of approximately 200 mm and re-contoured over the full extent of such areas. Compaction of topsoil shall be kept to a minimum.

Ripping and/or scarifying shall not be undertaken under wet conditions.

6.2.13.2 Mulching

Mulch shall primarily be obtained from the stockpiles retained on Site following the clearance of shrubs and trees.

Provision is made for supplementing the quantities of mulch obtained from Site with mulch to be procured by the Contractor from commercial sources. The specification for such imported mulch shall be as follows:

a) The chips shall be no longer than 50 mm in length or breadth and shall be free of alien invasive seed.
b) The wood shall be chipped during winter.
c) Chips shall not be made from wood treated with preservatives.
d) Half-composted chips shall be utilised in preference to non-composted chips.

Following topsoiling, as described above, the mulch shall be spread over the re-contoured areas. Mulch shall be applied by hand to achieve a layer of uniform thickness of approximately 25 mm, at a coverage rate of around 100 kg per 250 m². The mulch shall be rotovated or mixed by hand with the upper 100 mm layer of topsoil. These works shall not be undertaken under conditions of high wind strength.

In very rocky areas the Employer may instruct the Contractor to apply the mulch prior to placement of the topsoil.

Following mixing of the mulch with the topsoil, further scarifying shall be undertaken to create contoured furrows of approximately 100 mm depth at horizontal spacings of between 300 mm and 400 mm, to provide for the establishment of vegetation.

6.2.13.3 Fertilizer

The nominated soil and vegetation specialist will undertake tests on the recovered topsoil, to determine the type and application rate for fertilizers to be applied to the prepared surfaces. The specialist shall also advise on the methods of application for such fertilizers, which may include mixing and application as part of the hydroseeding operations.

All fertilizers shall be safely stored in plastic bags, labelled to indicate the weight and content of each bag, including the proportion of each constituent. Fertilizer shall not be directly exposed to adverse weather conditions, such as harsh sun, rain, wind and the like. Fertilizer shall be dry, free-flowing and free from lumps.

6.2.13.4 Hydroseeding

The final mix to be used for hydroseeding will be confirmed in conjunction with the recommendations of the nominated soil and vegetation specialist.

The following further provisions shall apply:

a) Seed shall only be purchased from South African National Seed Organisation (SANSOR) accredited dealers; or hand collected from the site prior to the commencement of site clearance.
b) Seed shall be labelled in accordance with the Government Seed Act (Act 28 of 1961), as amended. The Contractor shall provide signed certification from the seed merchants to the Employer, confirming that each container of seed as delivered is labelled and the content is in accordance with the provisions of this act.
c) Each lot of commercial seed shall be subject to sampling and testing at the discretion of the Employer. Sampling and testing shall be in accordance with the latest rules and regulations of the Government Seed Act.
d) All seed shall be transported in 50kg hessian bags and kept dry at all times.
e) All seed shall be stored in a facility that is cool (between 7° and 10°C), dry, damp proof and rodent free.

The soil and vegetation conservation specialist shall provide a hydroseeding machine capable of dispensing a uniform solution of seed, anti-erosion compound, fertiliser and water. The hydroseeding machine shall be thoroughly cleaned after each application and before a different seed mix is introduced into it to prevent contamination of the project specific seed mix with alien seed stock that could potentially become invasive.

The seed mix shall be dispensed at a rate of not less than 20 kilolitres of water per hectare.

Hydroseeding should only be carried out after the first good rains (minimum of 5 mm) have fallen during the winter rainfall period. Watering shall commence and continue until after the seeds have germinated and growth begins. The Contractor shall continue watering as required until the vegetation is able to survive independently.

The hydroseeder shall be capable of pumping the specified seed mix, fertiliser, soil stabiliser, aqueous smoke solution, mulch and wetting agent (mixed in water) at the specified rates over the areas to be seeded. The hydroseeder shall have an agitation system, which shall be sufficient to agitate, suspend and homogeneously mix the specified slurry.

The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.

The slurry tank shall be mounted on a travelling unit, either self-propelled or drawn by a separate unit. The travelling unit shall be capable of placing the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded to provide uniform distribution without waste.

6.2.13.5 Erosion Matting

The minimum requirements for the erosion matting shall be as follows:

The netting/matting shall be biodegradable and made from coir or similar material.

a) The netting/matting shall be sufficiently robust to last for a period of not less than 5 years under normal service conditions.
b) Holes in the netting/matting shall have a minimum size of 400 mm² and a maximum size of 900 mm² and be made from at least 4.0 mm to 6.0 mm thick cord.

A 1.0 m² sample of the geofabric or geogrid fabric shall be submitted to the Employer for approval prior to procurement.

The Contractor shall place a biodegradable netting/matting for slope stabilisation and erosion prevention, as directed by the Employer. The substratum shall be levelled to ensure that there are no intrusions or depressions within the area where the matting is to be placed, to prevent erosive damage.

The matting shall be staked to the ground and shall be placed with fish-scale pattern overlaps from the bottom of the slope upwards to prevent water from undermining the matting and undercutting the embankments.

6.2.13.6 Re-Establishment of Recovered Vegetation

The nominated soil and vegetation specialist, will be responsible for planting recovered species, temporarily held at the nursery, as well as bulbs and seeds collected from other parts of the Site.

The timing and sequencing of these revegetation activities will be determined in conjunction with the nominated soil and vegetation specialist.

6.2.13.7 Weed Control

The Contractor shall implement a weed control programme covering all disturbed areas before and after rehabilitation, as described above, extending up to the expiry of the defects liability period.

All weeds shall be removed before hydroseeding and the reestablishment of vegetation and taken to a registered landfill site. The handling and transportation of such weeds may not give rise to the spread of weed species along public or private roads.

6.2.13.8 Watering/Irrigation of Re-Vegetated Areas

The Contractor shall provide all watering to re-vegetated areas, as required to ensure the proper reestablishment of such vegetation. The Contractor shall use a fine nozzle spray to prevent the scouring of stabilised soils, resulting in erosion. Water used for the irrigation of re-vegetated areas shall be free of chlorine and other pollutants that will have a detrimental effect on the plants and shall be free of Phytophthora.

The Contractor shall supply all water and provide all pipe-work, pumps, irrigation equipment and other plant as necessary, which shall be approved by the Employer and remain available until the end of the defects liability period.

6.2.13.9 Herbicide

The Employer may instruct the Contractor to apply selected herbicides to rehabilitated areas. All precautionary measures for the handling and application of such herbicides shall be strictly adhered to, including, but not limited to, the manufacturer's specifications and guidelines.

6.3 Final Bill of Materials & Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

WCOU_BOM-18-04

JOB NAME	Ystervark 66 - 132 kV Substation	LASTEST REV :	0
JOB NUMBER:	153272156-00003		
BOM TYPE:	Final		
PREPARED BY :	AECOM		
Tel No	Tel: 021 950 7500		
DATE PREP. :	03 April 2020		

CIVIL BILL OF MATERIALS & QUANTITIES

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
	MAIN INTAKE SUBSTATION										
SANS 1200 C	**SITE CLEARANCE**										
8.2.1	Clear and grub	ha	**2.400**								
PSC 8.2.2	Clearing of vegetated areas and treatment by grinding and mulching										
PSC 8.2.2.a)	a) Clear trees and shrubs by hand	m²	**24 000**								
PSC 8.2.2.b)	b) Treatment by grinding and mulching	Sum	**1**								
PSC 8.2.2.c)	c) Stockpiling and protection of recovered organic materials	Sum	**1**								
PSC 8.2.3	Remove existing steel palisade fences and hand over to *Employer*	m	**250**								
PSC 8.2.4	Location of existing services										
PSC 8.2.4.a)	a) Site survey by ground-penetrating radar and cable detector	Sum	**1**								
PSC 8.2.4.b)	b) Excavation by hand in soft and intermediate materials to expose existing services	m³	**100**								
PSC 8.2.5	Temporary protection of known underground services										
PSC 8.2.5.a)	a) 1 x 160mm Ø water main line	Sum	**1**								
PSC 8.2.5.b)	b) 1 x 160mm Ø foulsewer rising main line	Sum	**1**								
PSC 8.2.5.c)	c) 3 x HV electrical cables	Sum	**1**								
PSC 8.2.5.d)	d) 2 x Communication cables	Sum	**1**								
PSC 8.2.5.e)	e) 1 x Electrical lighting cable	Sum	**1**								
PSC 8.2.5.f)	f) 1 x Existing duct at northern entrance to Main Intake substation on Access Road 1	Sum	**1**								
PSC 8.2.10	Temporary protection and relocation of unknown existing services	PS	**1**								
PSC 8.2.21	Remove existing road signs	No.	**4**								
SANS 1200 D	**EARTHWORKS**										
PSD 8.3.1.2	Remove topsoil to a nominal depth of 200mm and stockpile on Site	m³	**4 800**								
PSD 8.3.1.3	Carry out topographic survey of the Site:										
PSD 8.3.1.3.a)	a) After search and rescue, Site clearance and removal of topsoil	m²	**24 000**								
PSD 8.3.1.3.b)	b) After exposure of rock surface	m²	**10 000**								
8.3.2	Bulk Excavations										
PSD 8.3.2.a)	a) Excavate in soft and intermediate materials and use for embankment or backfill or dispose, as ordered										
	i) Cut to spoil	m³	**10 000**								
	ii) Cut to fill	m³	**8 600**								
8.3.2.b)	b) Extra-over for:										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
	2) hard rock excavation	m³	6 500								
8.3.4	Importing of Materials										
8.3.4.a)	a) Extra-over for importation of materials from borrow pits (Tippler 3 construction site or designated stockpile area)	m³	4 200								
PSD 8.3.6	Overhaul	m³.km	150 000								
PSD 8.3.14	Additional processing of materials by heavy, vibratory grid or padfoot rollers	m³	3 500								
PSD 8.3.15	Removal of oversize materials	m³	1 050								
SANS 1200 DA	**EARTHWORKS (SMALL WORKS)**										
PSDA 8.3.1	Excavation										
PSDA 8.3.1.b)	b) Excavate in all soft and intermediate materials, use for backfill or dispose of excess material										
	i) For structural steel concrete foundations	m³	500								
	iii) For concrete foundations and thickenings at the Ystervark building	m³	55								
	iv) For 40MVA Transformer concrete plinths	m³	250								
SANS 1200 DB	**EARTHWORKS (PIPE TRENCHES)**										
PSDB 8.3.2	Excavation and backfilling of all trenches										
PSDB 8.3.2.a)	a) Excavate in all soft and intermediate materials for all trenches, backfill, compact and dispose of surplus material										
	i) By conventional methods (machine excavation), for:										
	2) 110mm Ø foulsewer pipe										
	i) Exceeding 0.5m but not exceeding 1.0m	m	25								
	ii) Exceeding 1.0m but not exceeding 2.0m	m	5								
	3) 110mm Ø fire water pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	40								
	ii) Exceeding 1.5m but not exceeding 2.0m	m	15								
	4) 110mm Ø single sleeve										
	i) Exceeding 0.5m but not exceeding 1.0m	m	5								
	ii) Exceeding 1.0m but not exceeding 2.0m	m	5								
	7) 160mm Ø sleeve bundles (4 sleeves per bundle)										
	i) Exceeding 0.5m but not exceeding 1.5m	m³	35								
	ii) Exceeding 1.5m but not exceeding 2.0m	m³	12								
	8) 160mm Ø sleeve bundles (2 sleeves per bundle)										
	i) Exceeding 0.5m but not exceeding 1.5m	m³	12								
	ii) Exceeding 1.5m but not exceeding 2.0m	m³	8								
	20) 160mm Ø subsoil pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	665								
	21) 110mm Ø class 34 uPVC stormwater pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	15								
	22) 200mm Ø class 34 uPVC stormwater pipe										
	23) 250mm Ø class 34 uPVC stormwater pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	170								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	CIVIL ACTIVITIES										
	ii) Exceeding 1.5m but not exceeding 2.0m	m	**50**								
	24) 300mm Ø class 100D concrete stormwater pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	**55**								
	ii) Exceeding 1.5m but not exceeding 2.0m	m	**35**								
	26) 450mm Ø class 100D concrete stormwater pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	**70**								
	ii) Exceeding 1.5m but not exceeding 2.0m	m	**30**								
	27) 600mm Ø class 100D concrete stormwater pipe										
	i) Exceeding 0.5m but not exceeding 1.5m	m	**25**								
	ii) Exceeding 1.5m but not exceeding 2.0m	m	**20**								
	28) Cable trench, 0.6m wide (for control cables to equipment)										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**100**								
	29) Cable trench, 0.25m wide (for control cables to lights)										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**230**								
	30) 50mm Ø foul sewer vent pipe										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**15**								
	ii) By hand, for:										
	1) 160mm Ø single split sleeve										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**30**								
	ii) Exceeding 1.0m but not exceeding 2.0m	m	**120**								
	2) Earthing mat installations										
	i) 500mm wide x 1,000mm deep trench	m	**8 100**								
	3) Cable trench, 0.6m wide (for control cables to equipment)										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**100**								
	4) Cable trench, 0.25m wide (for control cables to lights)										
	i) Exceeding 0.5m but not exceeding 1.0m	m	**230**								
	5) 1,200mm wide x 100mm deep excavation for in-situ cast concrete lined V-drain	m	**420**								
	6) 4,000mm wide x 800mm deep excavation for precast concrete lined V-drain	m	**45**								
8.3.2.b)	b) Extra-over item a) above for:										
	2) Hard rock excavation	m³	**25**								
8.3.2.c)	c) Excavate and dispose of unsuitable material from trench bottom (provisional)	m³	**50**								
PSDB 8.3.3	Excavation Ancillaries										
8.3.3.1	Make up deficiency in backfill material (provisional):										
8.3.3.1.a)	a) from other necessary excavations on Site	m³	**50**								
8.3.3.1.c)	c) by importation from commercial or off-site sources selected by the Contractor	m³	**50**								
SANS 1200 DM	**EARTHWORKS (ROADS, SUBGRADE)**										
PSDM 8.3.3	Treatment of Road-bed										
PSDM 8.3.3.c)	c) Surface preparation and compaction of in-situ materials to minimum of 93% of MOD AASHTO maximum density (100% for sand)										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	CIVIL ACTIVITIES										
	i) For building and walkway platforms	m³	**60**								
	ii) For general landscaping areas	m³	**1 400**								
	iii) For access roads and hardstand areas	m³	**2 050**								
	iv) For electrical yard areas	m³	**1 700**								
PSDM 8.3.17	Imported 150mm gravel G7 selected layer compacted to 95% of MOD AASHTO maximum density (for road and hardstand layerworks)	m³	**750**								
PSDM 8.3.20	Imported 150mm gravel G7 selected layer compacted to 93% of MOD AASHTO maximum density (for road shoulders)	m³	**800**								
PSDM 8.3.18	G5 subbase engineered fill for:										
PSDM 8.3.18.c)	c) Main Intake substation buildings and yard platform	m³	**12 600**								
PSDM 8.3.19	400mm Ø augured holes for conductive concrete applications for:										
SANS 1200 G	**CONCRETE (STRUCTURAL)**										
SANS 1200 L	**MEDIUM-PRESSURE PIPELINES**										
PSL 8.2.1	Supply, handle, lay, bed (for flexible pipes), joint, test and disinfect pipes complete with couplings (waste and cut lengths to be allowed for in these rates):										
PSL 8.2.1.a)	a) 110mm Ø uPVC class 16 fire water pipe	m	**55**								
PSL 8.2.2	Extra-over PSL-8.2.1 for the supplying, laying, and bedding of fittings and specials complete with couplings, including cutting pipes to length where required, test and disinfect:										
PSL 8.2.2.d)	d) 32mm Ø x 32mm Ø Philmac (or equivalent approved) PN16 elbow	No.	**2**								
PSL 8.2.3	Extra-over PSL-8.2.1 for the supplying, handling, fixing, bedding and commissioning of valves and flow meters complete with couplings (including bolts, nuts, washers and packings)										
PSL 8.2.3.a)	a) New DN100 PN16 isolating valve	No.	**1**								
PSL 8.2.3.b)	b) New DN100 PN16 flow meter	No.	**1**								
PSL 8.2.11	Anchor/thrust blocks and pedestals (30 MPa concrete/19mm stone)	m³	**2**								
PSL 8.2.13	Valve, hydrant and flow meter chambers, for:										
PSL 8.2.13.a)	a) New DN100 PN16 isolating valve	No.	**1**								
PSL 8.2.13.b)	b) New DN100 PN16 flow meter	No.	**1**								
PSL 8.2.17	Connecting to existing water mains										
PSL 8.2.17.d)	d) Connection of new 110mm Ø uPVC fire water pipe to existing 160mm Ø existing water main line by means of "hot-tap" connection	No.	**1**								
PSL 8.2.19	Install external standard pillar type fire hydrant in accordance with:										
PSL 8.2.19.c)	c) Section LA-0057-01.2 of drawing 1924701-2-510-C-LA- 0057-01	No.	**1**								
PSL 8.2.20	Pipe Markers										
PSL 8.2.20.a)	a) Marker posts	No.	**3**								
PSL 8.2.20.b)	b) Kerb/edging marks	No.	**2**								

					LABOUR & PLANT						
CODE	**DESCRIPTION**	**UNIT**	**QTY.**	**ADD. QTY.**	**B, P&G %**	**RATE (R)**	**POINTS/ UNIT**	**HOURS**	**TOTAL HOURS**	**TOTAL (R)**	**POINTS TOTAL**
		CIVIL ACTIVITIES									
PSL 8.2.21	Install internal cold water copper pipes at Eskom Ystervark building at Main Intake Substation, with the following nominal diameters:										
PSL 8.2.21.a)	a) 32mm	m	**2**								
PSL 8.2.21.b)	b) 15mm	m	**2**								
PSL 8.2.22	Install internal/building cold water brass shut-off gate valve at Eskom Ystervark building at Main Intake Substation, with the following nominal diameter:										
PSL 8.2.22.a)	a) 32mm	No.	**1**								
SANS 1200 LB	**BEDDING (PIPES)**										
PSLB 8.2.2	Supply only of bedding by importation										
PSLB 8.2.2.3	From commercial sources										
8.2.2.3.a)	a) Selected granular material	m³	**280**								
8.2.2.3.b)	b) Selected fill material	m³	**980**								
PSLB 8.2.2.3.c)	c) 13mm stone bedding	m³	**30**								
PSLB 8.2.6	Supply, handle and install nonwoven polyester geotextile										
PSLB 8.2.6.a)	a) A5 bidim (2.65m wide)	m	**220**								
PSLB 8.2.7	Bedding and padding for underground cables										
PSLB 8.2.7.a)	a) For cable trench, 0.6m wide (for control cables to equipment)	m³	**40**								
PSLB 8.2.7.b)	b) For cable trench, 0.25m wide (for control cables to lights)	m³	**40**								
SANS 1200 LC	**CABLE DUCTS**										
PSLC 8.2.5	Supply, lay, bed and prove ducts/sleeves including draw wires. Ducts to be "Kableflex" or approved equivalent										
PSLC 8.2.5.a)	a) 110mm Ø HDPE single ducts/sleeves (placed as single unit)	m	**10**								
PSLC 8.2.5.f)	f) 160mm Ø HDPE sleeves (part of 4 sleeve bundles)	m	**150**								
PSLC 8.2.5.g)	g) 160mm Ø HDPE sleeves (part of 2 sleeve bundles)	m	**80**								
8.2.7	Draw pits/manholes										
PSLC 8.2.8	Cable and cable duct markers										
PSLC 8.2.8.a)	a) Route markers (marker posts)	No.	**50**								
PSLC 8.2.8.b)	b) Kerb/edging marks	No.	**20**								
PSLC 8.2.10	Closing and/or sealing of sleeve/duct ends										
PSLC 8.2.10.c)	c) Sleeve/duct ends sealed with plastic end caps	No.	**70**								
PSLC 8.2.11	Supply, lay, bed and prove split sleeve/duct										
PSLC 8.2.11.a)	a) 160mm Ø HDPE Kableflex split ducts complete with draw wire	m	**75**								
PSLC 8.2.12	Cable Trenches										
PSLC 8.2.12.a)	a) Install brick cable service trench complete with precast concrete cover slabs, and the like in accordance with section LA-0057-03.1 of drawing number 1924701-2-510-C-LA-0057-03	m	**295**								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
PSLC 8.2.12.d)	d) Install cable/sleeve road crossing Type 2 complete in accordance with section LA-0057-03.5 as well as details LA-0057-03.A and LA-0057-03.B of drawing number 1924701-2-510-C-LA-0057-03	No.	3								
PSLC 8.2.13	Installation of danger tape	m	2 000								
SANS 1200 LD	**SEWERS**										
8.2	SCHEDULED ITEMS										
PSLD 8.2.1	Supply, handle, lay, joint, bed and test pipelines										
PSLD 8.2.1.b)	b) 110mm Ø uPVC class 34 heavy duty foulsewer gravity pipes	m	30								
PSLD 8.2.3	Foulsewer Manholes										
PSLD 8.2.3.b)	b) 450mm x 450mm brick manhole (internal size)	No.	1								
PSLD 8.2.13	Installation of 6,000ℓ conservancy tank system complete with all fittings, manholes, strapping, and the like in accordance with detail LA-0057-02.A of drawing number 1924701-2-510-C-LA-0057-02	Sum	1								
PSLD 8.2.14	Install uPVC sewer vent pipes with the following nominal diameters:										
PSLD 8.2.14.a)	a) 110mm Ø	m	2								
PSLD 8.2.14.b)	b) 50mm Ø	m	20								
PSLD 8.2.18	Install one-way vent valves with the following nominal diameters:										
PSLD 8.2.18.a)	a) 110mm Ø	No.	1								
PSLD 8.2.18.b)	b) 50mm Ø	No.	1								
SANS 1200 LE	**STORMWATER DRAINAGE**										
PSLE 8.2.1	Supply, handle, lay and bed spigot and socket stormwater pipes										
PSLE 8.2.1.a)	a) 110mm Ø class 34 uPVC stormwater pipe	m	20								
PSLE 8.2.1.c)	c) 250mm Ø class 100D concrete stormwater pipe	m	220								
PSLE 8.2.1.d)	d) 300mm Ø class 100D concrete stormwater pipe	m	120								
PSLE 8.2.1.e)	e) 450mm Ø class 100D concrete stormwater pipe	m	100								
PSLE 8.2.1.f)	f) 600mm Ø class 100D concrete stormwater pipe	m	45								
PSLE 8.2.8	Supply and install manholes, catch pits, and the like										
PSLE 8.2.8.b)	b) 600mm x 600mm catch pit in accordance with detail LA-0057-01.B of drawing 1924701-2-510-C-LA-0057-01										
	i) Exceeding 0.5m but not exceeding 1.0m	No.	10								
	ii) Exceeding 1.0m but not exceeding 2.0m	No.	2								
PSLE 8.2.8.c)	c) 900mm x 900mm catch pit in accordance with detail LA-0057-01.A of drawing 1924701-2-510-C-LA-0057-01										
	i) Exceeding 0.5m but not exceeding 1.5m	No.	4								
	ii) Exceeding 1.5m but not exceeding 2.0m	No.	6								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
PSLE 8.2.17	Supply, handle, lay, joint and bed spigot and socket HDPE perforated subsoil pipes										
	a) 160mm Ø subsoil pipe in 500mm wide trench lined with A2 bidim and filled with 19mm clean, washed drainage stone, in accordance with section LA-0057-01.1 of drawing 1924701-2-510-C-LA-0057-01										
	i) Exceeding 0.5m but not exceeding 1.5m	m	**660**								
PSLE 8.2.18	30MPa (19mm stone) concrete stormwater headwalls complete as per the following details:										
PSLE 8.2.18.b)	b) LA-0055-03.A of drawing number 1924701-2-510-C-LA-0055-03	No.	**1**								
PSLE 8.2.19	Lining of detention pond base, headwall outflow area and pond overflow area with Armorflex blocks (or equivalent approved)	m²	**835**								
PSLE 8.2.20	Lining of open V-drain channels, with:										
PSLE 8.2.20.a)	a) 1,200mm wide x 100mm thick 30MPa (19mm stone) in-situ cast concrete	m	**490**								
PSLE 8.2.20.b)	b) 4,000mm wide x 800mm deep precast concrete Armorflex blocks (or equivalent approved) in accordance with section LA-0055-03.2 of drawing 1924701-2-510-C-LA-0055-03	m	**45**								
PSLE 8.2.21	Supply, handle, place on pedestal (measured elsewhere) an external 2,500ℓ horizontal stormwater harvesting tank (Jo-Jo tank or similar/equivalent approved) complete with fittings, lid and the like	No.	**1**								
PSLE 8.2.22	Grouted stone pitching on a concrete bed	m²	**20**								
PSLE 8.2.24	Connection of 110mm Ø Drainage Pipes to Sleeve Trenches	No.	**10**								
SANS 1200 ME	**SUBBASE**										
8.3.3	Construct the subbase gravel wearing course with material from commercial sources										
8.3.3.a)	a) 200mm subbase gravel wearing course for access roads compacted to 98% of MOD AASHTO maximum density	m³	**640**								
8.3.3	Construct the subbase course with material from commercial sources										
8.3.3.a)	a) 150mm C3 gravel subbase layer (for concrete and block paved roads) compacted to 97% of MOD AASHTO maximum density	m³	**120**								
8.3.3.b)	b) 150mm G5 gravel subbase layer (for gravel access roads) compacted to 95% of MOD AASHTO maximum density	m³	**350**								
8.3.5	Process subbase material by the following process:										
8.3.5.d)	d) Stabilization										
	i) 150mm C3 gravel subbase layer	m³	**120**								
8.3.8	Stabilizing agent										
8.3.8.b)	b) Portland cement										
	i) 150mm C3 gravel subbase layer	t	**42**								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
PSME 8.3.12	Tie new G5 gravel subbase layer in with existing road layerworks by means of benching	m	30								
PSME 8.3.13	Tie new G7 gravel selected layer in with existing road layerworks by means of benching	m	60								
PSME 8.3.14	Construct 100mm thick drainage layer/wearing course from 37.5mm clean single-sized crushed concrete stone aggregate compacted until stone interlocking is achieved	m^3	1 155								
PSME 8.3.15	Supply, handle and install nonwoven polyester geotextile										
PSME 8.3.15.a)	a) A4 bidim (or similar/equivalent approved)	m^2	11 550								
SANS 1200 MJ	**SEGMENTED PAVING**										
8.2.2	Construction of paving complete	m^2	835								
8.2.3	Cutting units to fit edge restraints	m	320								
SANS 1200 MK	**KERBING AND CHANNELLING**										
PSMK 8.2.1	Concrete kerbing, edging and channelling										
PSMK 8.2.1.a)	a) Type E3 precast edging on 30MPa bedding	m	155								
PSMK 8.2.1.b)	b) Type W4 stormwater precast channel on 30MPa bedding	m	145								
PSMK 8.2.1.e)	e) Type MK1 precast kerbing (mountable kerb) on 30MPa bedding	m	350								
PSMK 8.2.7	Trimming of excavations for concrete-lined open drains in soft and intermediate material, for:										
PSMK 8.2.7.a)	a) 1,200mm wide x 100mm thick 30MPa in-situ cast concrete open V-drain	m	460								
PSMK 8.2.7.b)	b) 4,000mm wide x 800mm deep precast concrete Armorflex blocks (or equivalent approved) in accordance with section LA-0055-03.2 of drawing 1924701-2-510-C-LA-0055-03	m	45								
SANS 1200 MM	**ANCILLARY ROADWORKS**										
PSMM 8.7	SIGNAGE										
PSMM 8.7.1	Road signs with painted background and symbols and with signboard constructed from aluminium sheeting (2mm thick) complete and in accordance to class III of SANS 1519										
PSMM 8.7.1.b)	b) Danger plate sign (Type W401) 150mm wide x 600mm high rectangular size including galvanized steel post 75mm diameter including concrete base with excavations and backfilling, 1,500mm high	No.	12								
PSMM 8.7.1.c)	c) Danger plate sign (Type W402) 150mm wide x 600mm high rectangular size including galvanized steel post 75mm diameter including concrete base with excavations and backfilling, 1,500mm high	No.	12								
PSMM 8.7.1.d)	d) Stop sign (Type R1) 900mm high octagon size including galvanized steel post 75mm diameter including concrete base with excavations and backfilling, 2,500mm high	No.	2								

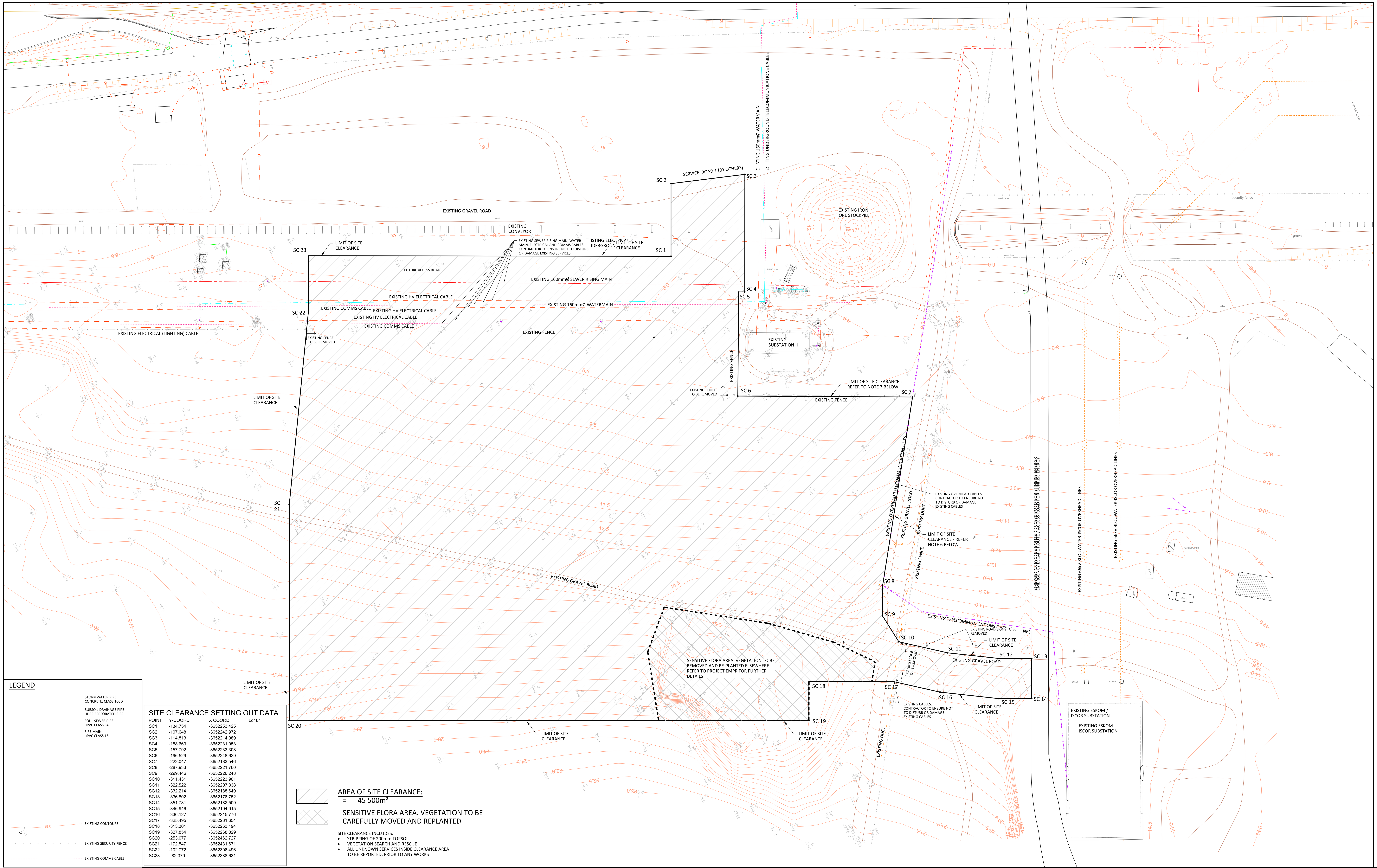
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
PSMM 8.7.1.e)	e) Speed limit sign (Type R201) 900mm circular size including galvanized steel post 75mm diameter including concrete base with excavations and backfilling, 2,500mm high	No.	**8**								
PSQ	**STEEL PALISADE FENCING AND GATES**										
PSQ 3.1	Clearing the fence line, 2.0m wide strip	m	**530**								
PSQ 3.2	Supply and erect new 2.4 m high steel palisade fencing in accordance with drawing numbers 1924701-2-510-C-LA-0056-03, 1924701-2-510-C-DE-0011-01 and 1924701-2-510-C-DE-0011-02	m	**530**								
PSQ 3.3	Extra over item PSQ 3.2 for supplying and erecting new fencing for corners	No.	**18**								
PSQ 3.4	Extra over item PSQ 3.2 for supplying and erecting new 5.0m long removable palisade fence panels	No.	**3**								
PSQ 3.5	Supply and erect new steel palisade gates in accordance with drawing numbers 1924701-2-510-C-LA-0056-03, 1924701-2-510-C-DE-0011-01 and 1924701-2-510-C-DE-0011-02, for:										
PSQ 3.5.a)	a) 5.0m double leaf swing gate	No.	**1**								
PSQ 3.5.b)	b) 5.5m sliding gate	No.	**4**								
PSQ 3.5.c)	c) 1.0m single leaf pedestrian swing gate	No.	**1**								
PSQ 3.6	30MPa (19mm stone) Concrete gate ramp in accordance with section LA-0056-01.6 of drawing 1924701-2-510-C-LA-0056-01 to be constructed with the 5.5m sliding gate	No.	**5**								
PSS	**SOIL AND VEGETATION REHABILITATION**										
PSS 12.1	Nominated soil and vegetation conservation specialist	PS	**1**								
PSS 12.2	Topsoiling	m²	**18 800**								
PSS 12.3	Mulching										
PSS 12.3.a)	a) Application of mulch from stockpiles on Site	m²	**5 000**								
PSS 12.3.b)	b) Procurement and application of mulch from commercial sources	m²	**13 800**								
PSS 12.4	Hydroseeding										
PSS 12.4.a)	a) Procure hydroseed mix	PS	**1**								
PSS 12.4.b)	b) Application of hydroseeding	m²	**18 800**								
PSS 12.5	Erosion matting	m²	**7 500**								
PSS 12.6	Watering after hydroseeding	ℓ	**200 000**								
PSS 12.7	Provisional sums										
PSS 12.7.a)	a) Fertilizer	PS	**1**								
PSS 12.7.b)	b) Herbicide	PS	**1**								
PSS 12.7.c)	c) Other proprietary products	PS	**1**								

6.4 Geotechnical Report

A geotechnical Investigation was carried out by AECOM of which all the relevant findings and test results are contained in the Geotechnical Report no. 1924701-2-300-H-PRT-001 Rev 00 (refer to FDP document 'Ystervark 66 - 132 kV Substation - Book 2, Job no. 153272156-00003').

6.5 Detailed Drawings

Drawing No	Drawing Name	Rev
D-WC-8118-19-01	Existing Services	00
D-WC-8118-19-02	Earthworks Layout	00
D-WC-8118-19-03	Roads, Stormwater, Sewer and Fire Water Layout	00
D-WC-8118-19-04	Road Sections	00
D-WC-8118-19-05	Details	00



LEGEND

STORMWATER PIPE
CONCRETE, CLASS 100D

SUBSOIL DRAINAGE PIPE
HDPE PERFORATED PIPE

FOUL SEWER PIPE
uPVC CLASS 34

FIRE MAIN
uPVC CLASS 16

EXISTING CONTOURS

EXISTING SECURITY FENCE

EXISTING COMMS CABLE

SITE CLEARANCE SETTING OUT DATA

POINT	Y-COORD	X COORD	Lo18°
SC1	-134.754	-3652253.425	
SC2	-107.648	-3652242.972	
SC3	-114.813	-3652214.089	
SC4	-158.663	-3652231.053	
SC5	-157.792	-3652233.308	
SC6	-196.529	-3652248.629	
SC7	-222.047	-3652183.546	
SC8	-287.933	-3652221.760	
SC9	-299.446	-3652226.248	
SC10	-311.431	-3652223.901	
SC11	-322.522	-3652207.338	
SC12	-332.214	-3652188.649	
SC13	-336.802	-3652176.752	
SC14	-351.731	-3652182.509	
SC15	-346.946	-3652194.915	
SC16	-336.127	-3652215.776	
SC17	-325.495	-3652231.654	
SC18	-313.301	-3652263.194	
SC19	-327.854	-3652268.829	
SC20	-253.077	-3652462.727	
SC21	-172.547	-3652431.671	
SC22	-102.772	-3652396.496	
SC23	-82.379	-3652388.631	

AREA OF SITE CLEARANCE:
= 45 500m²

SENSITIVE FLORA AREA. VEGETATION TO BE CAREFULLY MOVED AND REPLANTED

SITE CLEARANCE INCLUDES:
- STRIPPING OF 200mm TOPSOIL
- VEGETATION SEARCH AND RESCUE
- ALL UNKNOWN SERVICES INSIDE CLEARANCE AREA TO BE REPORTED, PRIOR TO ANY WORKS

DRG NO.	REFERENCE DRAWINGS:
.	.
.	.
.	.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	JVB	FVL	FR	20/04/2020	1532721564-00003

Eskom

YSTERVARK SUBSTATION

EXISTING SERVICES

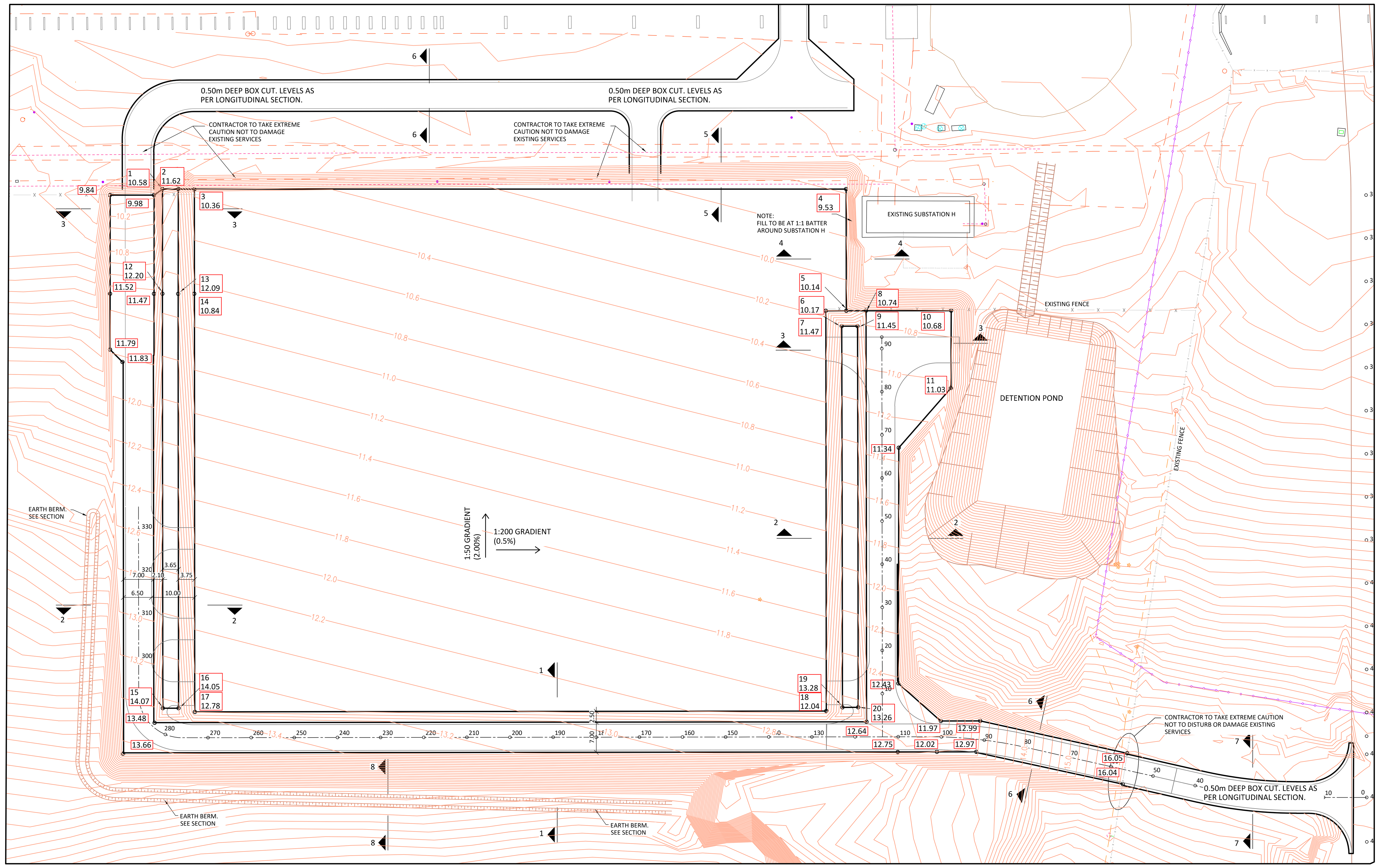
SCALE 1 : 500

THIS DRAWING IS THE PROPERTY OF ESKOM

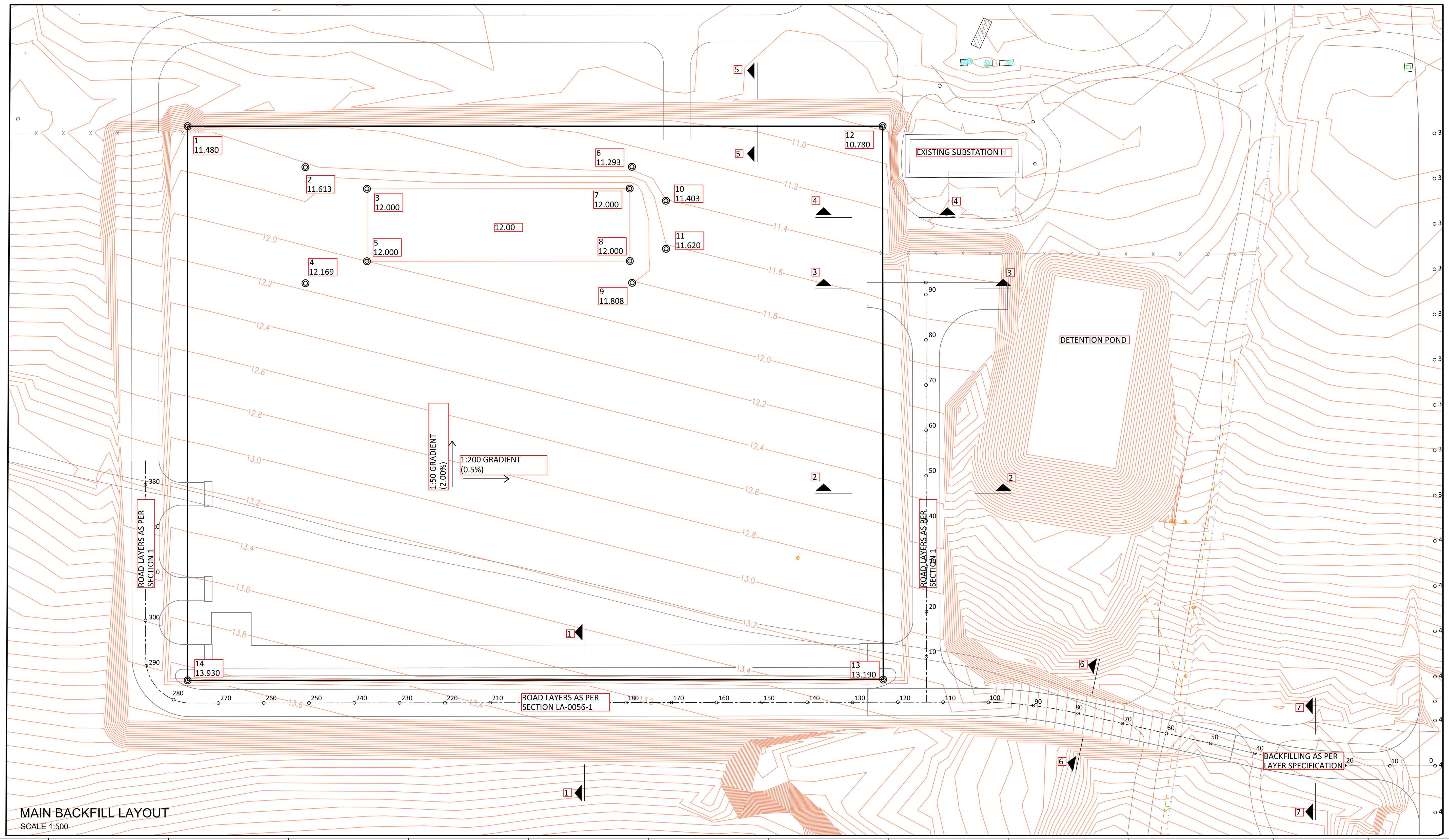
AUTH: F RICKETTS	AUTH: —
DATE: 20/04/2020	DATE: __/__/____
CHKD: F RICKETTS	CHKD: —
DATE: 20/04/2020	DATE: __/__/____
DRAWN: J VAN BRUGGEN	DRAWN: —
DATE: 20/04/2020	DATE: __/__/____

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	19	1	00

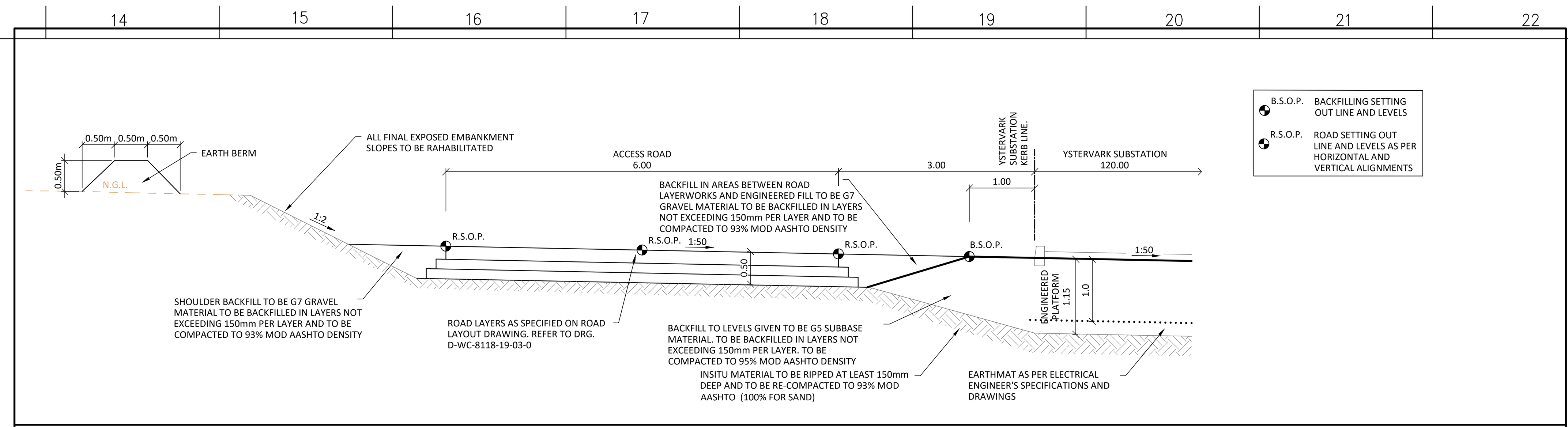
A0L



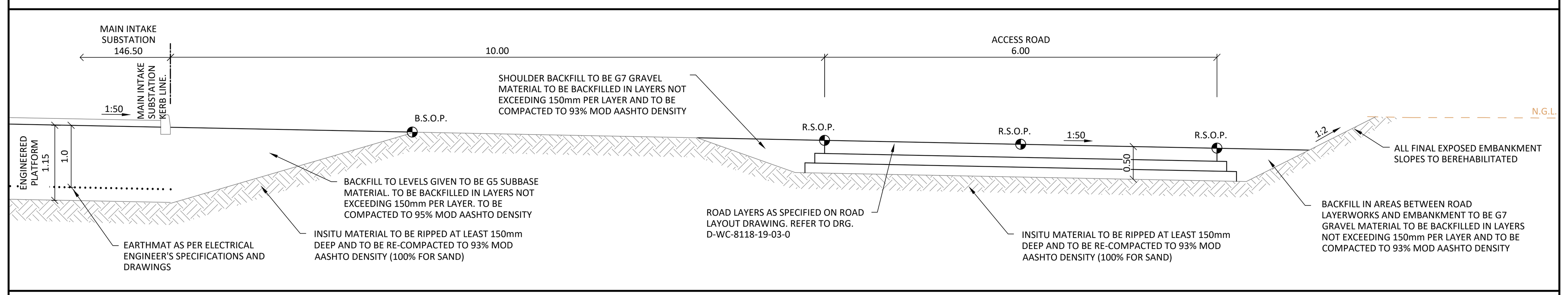
EARTHWORKS LAYOUT
SCALE 1:500



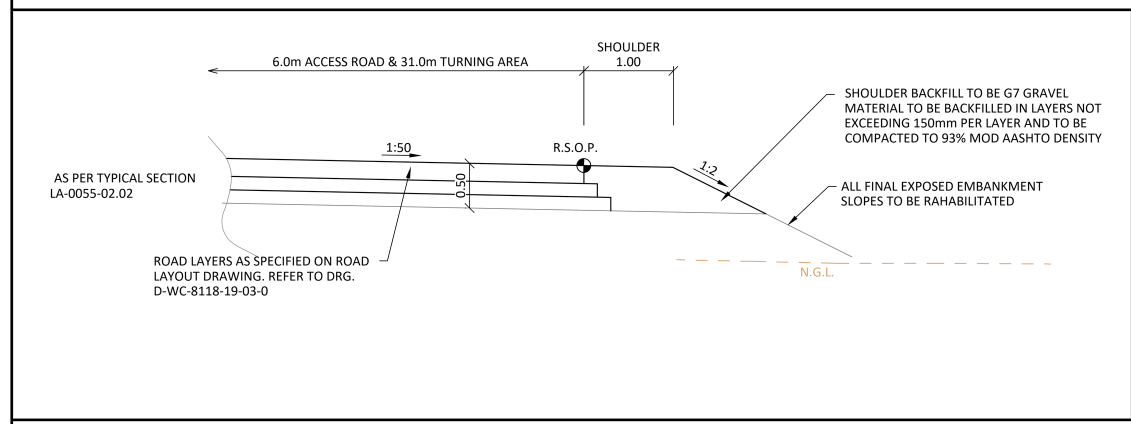
MAIN BACKFILL LAYOUT
SCALE 1:500



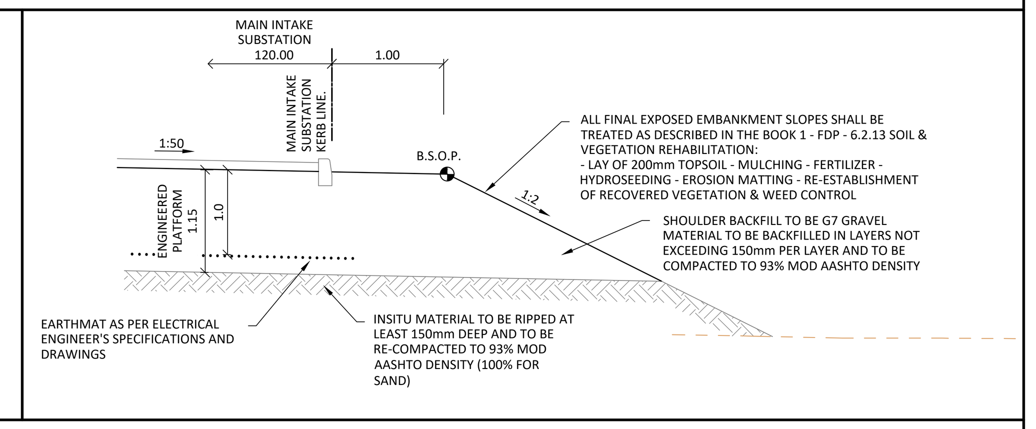
TYPICAL SECTION 1
SCALE 1:50



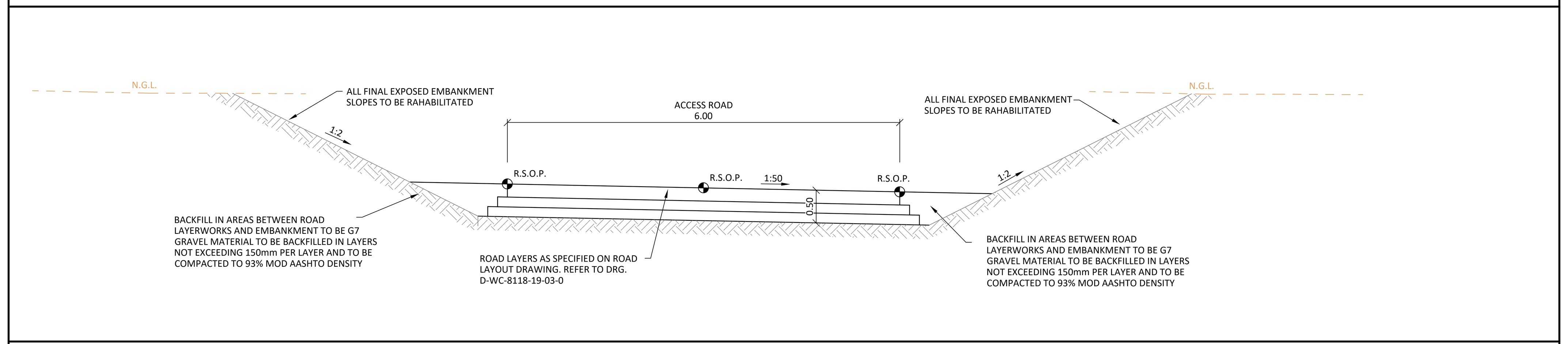
TYPICAL SECTION 2
SCALE 1:50



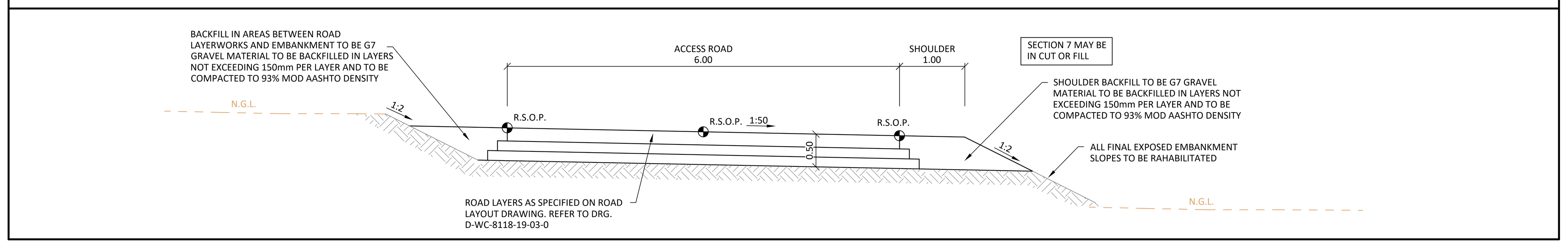
TYPICAL SECTION 3
SCALE 1:50



TYPICAL SECTION 4 & 5
SCALE 1:50



TYPICAL SECTION 6
SCALE 1:50



TYPICAL SECTION 7
SCALE 1:25

EARTHWORKS SETTING OUT DATA

POINT	Y COORD	X COORD	EARTHWORKS LEVEL
1	-113.338	3652386.309	10.58
2	-114.649	3652382.899	11.62
3	-116.065	3652379.450	10.36
4	-170.361	3652238.437	9.53
5	-196.707	3652248.561	10.14
6	-195.003	3652252.995	10.17
7	-199.657	3652250.829	11.47
8	-198.343	3652244.301	10.74
9	-200.966	3652247.421	11.45
10	-205.429	3652225.858	10.68
11	-222.163	3652232.381	11.03
12	-135.993	3652395.066	12.20
13	-137.310	3652391.660	12.09
14	-138.646	3652388.183	10.84
15	-225.683	3652429.556	14.07
16	-226.993	3652426.149	14.05
17	-229.178	3652422.922	12.78
18	-281.643	3652286.281	12.04
19	-282.189	3652282.487	13.28
20	-283.498	3652279.080	13.26

ALL R0AD DATA AS PER R0ADS SETTING OUT DATA

CUT TO FILL (PLATFORMS, R0ADS & DETENTION POND) 8,000m³
CUT TO FILL (BERMS) 600m³
CUT TO SPOIL 10,000m³

BACKFILLING SETTING OUT DATA

POINT	Y COORD	X COORD	BACKFILL LEVEL
1	-114.509	3652382.717	11.480
2	-132.316	3652361.745	11.613
3	-156.238	3652370.937	12.169
4	-141.660	3652350.775	12.000
5	-156.595	3652356.528	12.000
6	-158.181	3652294.425	11.293
7	-162.497	3652296.615	12.000
8	-177.430	3652302.360	12.000
9	-182.104	3652303.616	11.808
10	-167.872	3652290.114	11.403
11	-177.792	3652293.925	11.620
12	-169.714	3652239.569	10.780
13	-283.814	3652283.419	13.190
14	-228.737	3652426.769	13.930

ALL R0AD DATA AS PER R0ADS SETTING OUT DATA

G5 SUBBASE BACKFILL VOLUMES 12,000m³
CUT TO FILL (ROADS) 1,000m³

00	FIRST ISSUE	JVB	FVL	FR	20/04/2020	1532721564-00003
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.

DRG NO. REFERENCE DRAWINGS:

Eskom

YSTERVARK SUBSTATION

EARTHWORKS LAYOUT

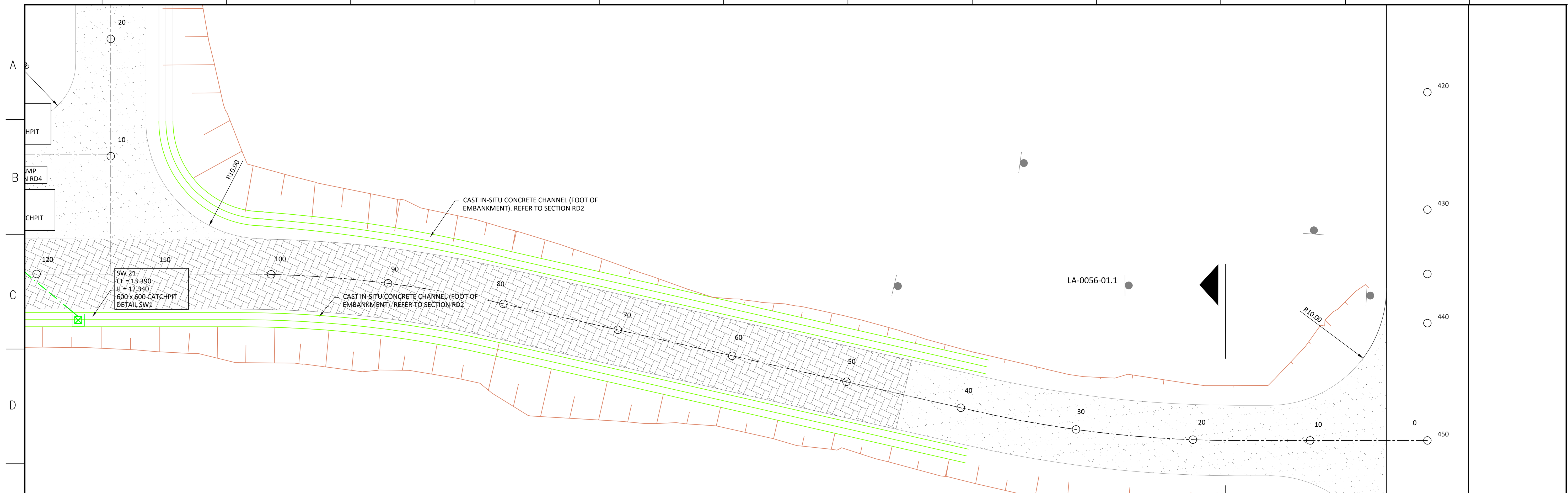
AUTH: F RICKETTS DATE: 20/04/2020
CHKD: F RICKETTS DATE: 20/04/2020
DRAWN: J VAN BRUGGEN DATE: 20/04/2020
AUTH: — DATE: __/__/____
CHKD: — DATE: __/__/____
DRAWN: — DATE: __/__/____

SCALE 1 : 500
THIS DRAWING IS THE PROPERTY OF ESKOM

SET	SHEET	REVISION
19	2	00

D-WC-8118

A0L



SETTING OUT DATA-Access road 1

NAME	CH	Y	X	LENGTH (m)	RADIIUS
START BCC1	0.000 21.882	-345.418 -337.570	3652176.587 3652197.013	21.882	
C1	C1	PI -335.561	PI 3652202.244	11.221	50.000
ECC1 BCC2	33.043 85.938	-332.442 -303.012	3652206.901 3652250.852	52.895	
C2	C2	PI -299.894	PI 3652255.508	11.221	50.000
ECC2 BCC3	97.099 276.226	-297.884 -233.662	3652260.739 3652427.893	179.067	
C3	C3	PI -230.075	PI 3652437.228	15.708	10.000
ECC3 END	291.874 407.874	-220.741 -112.458	3652433.641 3652392.039	122.000	

SETTING OUT DATA-Internal road 1

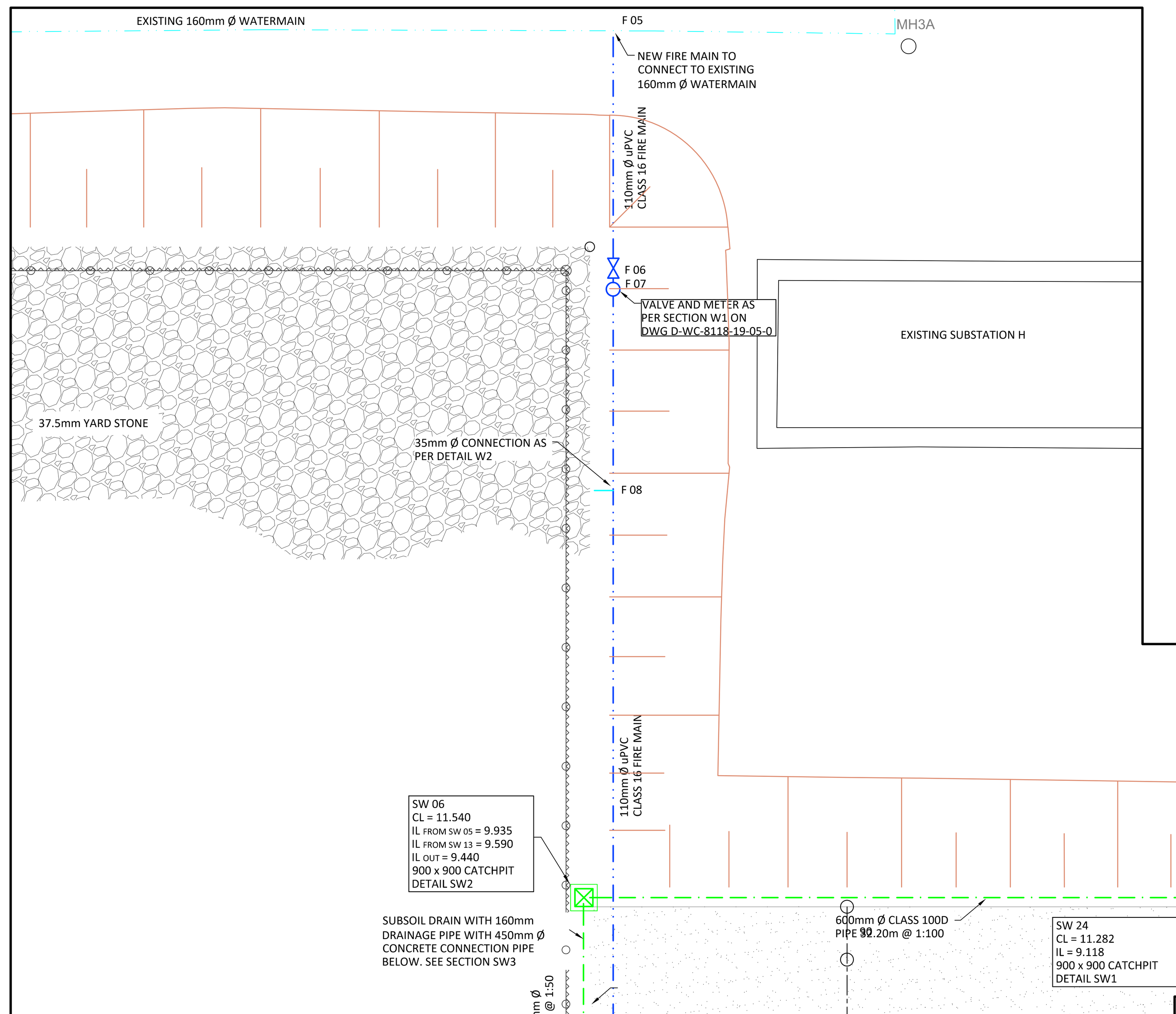
NAME	CH	Y	X	LENGTH (m)	RADIIUS
START END	0.000 172.399	-282.369 -220.539	3652272.634 3652433.564	172.399	

VERTICAL ALIGNMENT-Access road 1

NAME	CH	ELEVATION	GRADE IN	GRADE OUT	CURVE LENGHT	K VALUE	CURVE RADUIS
START	0.00	15.643		-1.00%			
VC1	10.000	15.543	-1.00%	3.00%	7.000	1.75	175.009
VC2	55.000	22.893	3.00%	-7.08%	20.000	1.98	198.435
VC3	107.000	13.212	-7.08%	0.50%	20.000	2.64	263.892
VC4	285.000	14.102	-0.50%	-2.00%	20.000	8.00	800.000
VC4	380.000	12.202	-2.00%	-8.00%	10.000	1.67	226.758
END	407.874	9.973	-8.00%				

VERTICAL ALIGNMENT-Internal road 1

NAME	CH	ELEVATION	GRADE IN	GRADE OUT	CURVE LENGHT	K VALUE	CURVE RADUIS
START	0.00	13.141		0.50%			
VC1	5.000	13.226	0.50%	1.75%	0.000	-	-
VC2	13.000	13.36	1.75%	0.50%	SEE SECTION LA-0055-02.6		
VC3	159.399	14.040	0.50%	0.75%	SEE SECTION LA-0055-02.6		
VC4	227.399	13.980	0.75%	0.55%	0.000	-	-
END	172.399	14.008	0.55%				



EXTERNAL ACCESS ROADS 1 & 2 (6.0m WIDE GRAVEL)

- 200mm GRAVEL WEARING COURSE COMPACTED TO 98% MOD AASHTO DENSITY
- 150mm G5 GRAVEL SUBBASE COMPACTED TO 95% MOD AASHTO DENSITY
- 150mm G7 SELECTED SUB GRADE LAYER - COMPACTED TO 95% MOD AASHTO DENSITY
- 150mm G9 INSITU MATERIAL COMPACTED TO 93% MOD AASHTO DENSITY

EXTERNAL ACCESS ROADS 1 & 2 (6.0m WIDE PAVED)

- 80mm S-A INTERLOCKING CONCRETE HEAVY DUTY PAVERS on 20mm SAND BEDDING PLACED IN HERRINGBONE PATTERN
- 100mm C3 CEMENT STABILIZED GRAVEL BASE COMPACTED TO 97% MOD AASHTO DENSITY
- 150mm G5 GRAVEL SUBBASE COMPACTED TO 95% MOD AASHTO DENSITY
- 150mm G7 SELECTED SUB GRADE LAYER - COMPACTED TO 95% MOD AASHTO DENSITY
- 150mm G9 INSITU MATERIAL COMPACTED TO 93% MOD AASHTO DENSITY

INTERNAL ROADS (5.0m WIDE) & ACCESS TO SUBSTATION

- 80mm S-A INTERLOCKING CONCRETE HEAVY DUTY PAVERS on 20mm SAND BEDDING PLACED IN HERRINGBONE PATTERN
- 150mm C3 CEMENT STABILIZED GRAVEL BASE COMPACTED TO 97% MOD AASHTO DENSITY
- RIP IMPORTED G5 MATERIALS TO DEPTH OF 150mm AND RE-COMPACT TO 95% MOD AASHTO.

SUBSTATION YARD

- 100mm THICK 37.5mm SINGLE SIZE GRANULAR AGGREGATE SURFACE LAYER (YARD STONE) ON A4 BIDUM
- G5 SUBBASE FILL LAYERS - COMPACTED TO 95% MOD AASHTO DENSITY IN LAYERS NOT EXCEEDING 150mm

STORMWATER SETTING OUT DATA

POINT	Y COORD	X COORD	COVER	INVERT
SW1	-117.149	3652380.660	11.520	10.920
SW2	-135.398	3652333.164	11.290	10.670 (From SW 01) 10.620 (To SW 03)
SW3	-153.786	3652285.304	11.108	10.365 (From SW 02) 10.315 (From SW 04) 10.315 (To SW 05)
SW4	-158.356	3652294.795	11.295	10.415
SW5	-169.795	3652243.635	10.885	10.095
SW6	-200.166	3652255.296	11.540	9.935 (From SW 05) 9.590 (From SW 13) 9.440 (To SW 24)
SW7	-153.422	3652394.575	12.295	11.645
SW8	-163.945	3652370.863	12.295	11.515
SW9	-174.298	3652343.923	12.150	11.405 (From SW 08) 11.440 (From 110mm Ø) 10.800 (To SW 10)
SW10	-183.184	3652320.797	12.030	10.685 (From SW 09) 11.320 (From 110mm Ø) 10.685 (To SW 12)
SW11	-177.598	3652294.130	11.615	10.915
SW12	-193.609	3652293.662	11.855	10.545 (From SW 10) 10.840 (From SW 11) 10.495 (To SW 13)
SW13	-207.356	3652258.070	11.695	10.308 (From SW 12) 9.730 (From SW 20) 9.730 (To SW 06)
SW14	-182.683	3652405.801	12.965	12.315
SW15	-188.783	3652389.927	12.940	12.235 (From SW 14) 11.350 (From Oil Trap) 11.200 (To SW 16)
SW16	-197.686	3652366.755	12.818	11.080
SW17	-206.380	3652344.126	12.697	10.945
SW18	-215.216	3652321.128	12.573	10.847
SW19	-221.622	3652304.454	12.483	10.762 (From SW 18) 10.660 (To SW 20)
SW20	-235.589	3652268.977	12.300	10.473 (From SW 19) 11.195 (From SW 23) 10.325 (To SW 13)
SW21	-294.573	3652280.300	13.390	12.340
SW22	-282.116	3652286.781	13.195	12.166
SW23	-274.750	3652283.951	13.135	12.020
SW24	-211.981	3652224.545	11.282	9.118
SW25	-215.009	3652219.593		8.000

FOUL SEWER SETTING OUT DATA

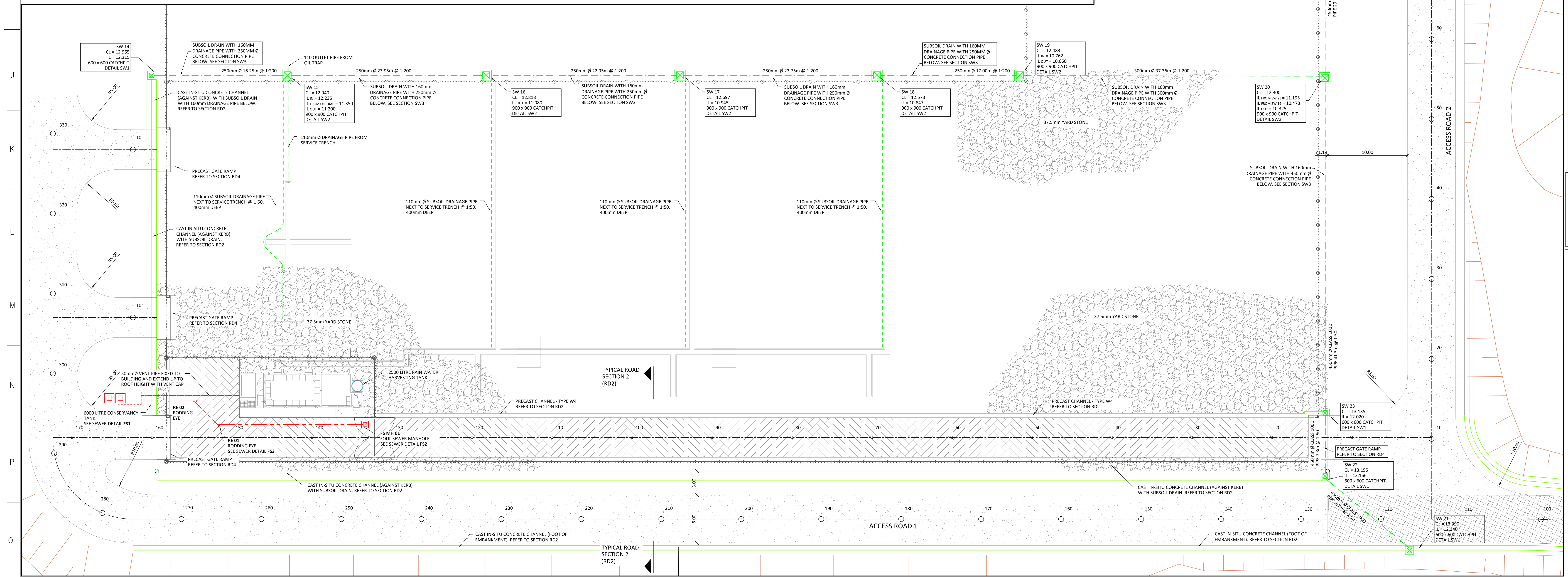
POINT	Y COORD	X COORD	COVER	INVERT	DESCRIPTION
FS 01	-233.031	3652396.526	13.795	12.980	SEWER MANHOLE
RE 01	-226.390	3652413.807	13.815	12.800	SEWER RODDING EYE
RE 02	-222.587	3652415.499	13.804	12.758	SEWER RODDING EYE
FS 02	-220.289	3652421.546	N/A	12.700	100Ø INLET INTO CONSERVANCY TANK
FS 03	-218.494	3652425.217	13.817		100Ø SUCTION OUTLET FROM CONSERVANCY TANK

WATER AND FIRE SETTING OUT DATA

POINT	Y COORD	X COORD	DESCRIPTION
F1	-106.417	3652378.262	"HOT TAP" CONNECTION TO EXIST. 160Ø WATER LINE
F2	-117.298	3652382.435	100DN ISOLATION VALVE IN CHAMBER (TO DETAIL W1)
F3	-118.288	3652382.823	100DN METER IN CHAMBER (TO DETAIL W1)
F4	-154.845	3652396.869	FIRE HYDRANT ((TO DETAIL F1)
F5	-159.871	3652238.231	"HOT TAP" CONNECTION TO EXIST. 160Ø WATER LINE
F6	-171.055	3652242.521	100DN ISOLATION VALVE IN CHAMBER (W1)
F7	-172.044	3652242.909	100DN METER IN CHAMBER (TO DETAILW1)
F8	-181.359	3652246.487	32Ø SADDLE ON 110Ø (TO DETAIL W2)
F9	-208.602	3652256.954	FIRE HYDRANT ((TO DETAIL F1)

LEGEND

- STORMWATER PIPE CONCRETE, CLASS 100D
- SUBSOIL DRAINAGE PIPE HDPE PERFORATED PIPE
- FOUL SEWER PIPE uPVC CLASS 34
- FIRE MAIN uPVC CLASS 16



ROADS, SURFACING, STORMWATER DRAINAGE, DOMESTIC AND FIRE WATER LAYOUT
SCALE 1:200

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	JVB	FVL	FR	20/04/2020	1532721564-00003

DRG NO. REFERENCE DRAWINGS:

Eskom

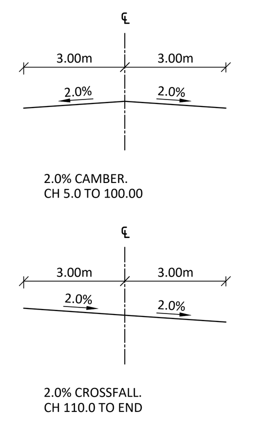
YSTERVARK SUBSTATION

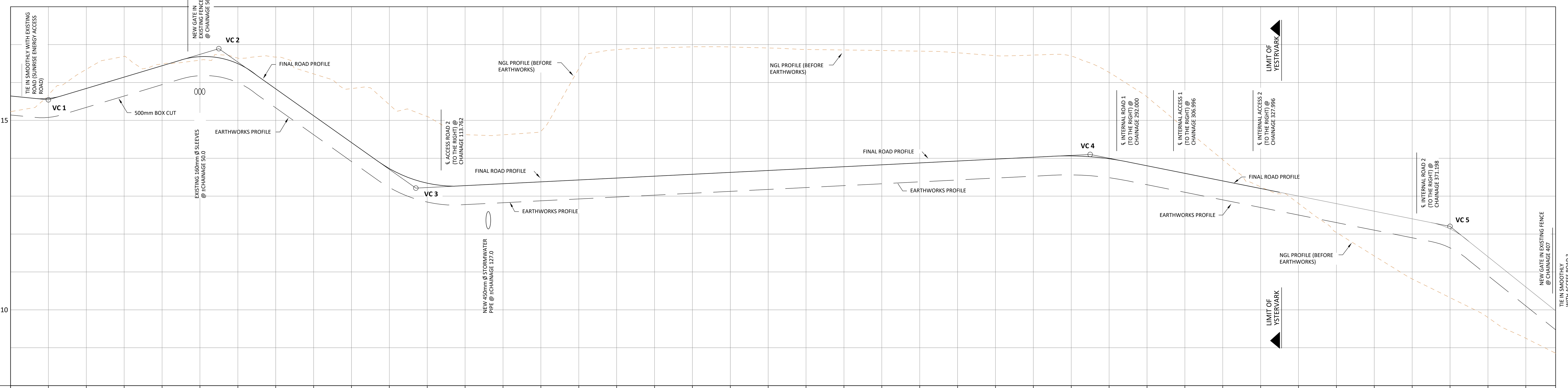
ROADS, STORMWATER, SEWER AND FIRE WATER LAYOUT

SCALE 1 : 500	AUTH: F RICKETTS	AUTH: —
THIS DRAWING IS THE PROPERTY OF ESKOM	DATE: 20/04/2020	DATE: __/__/____
	CHKD: F RICKETTS	CHKD: —
	DATE: 20/04/2020	DATE: __/__/____
	DRAWN: J VAN BRUGGEN	DRAWN: —
	DATE: 20/04/2020	DATE: __/__/____

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	19	3	00

A0L





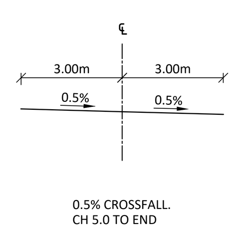
Access road 1
(CH 0 TO CH 407.874)

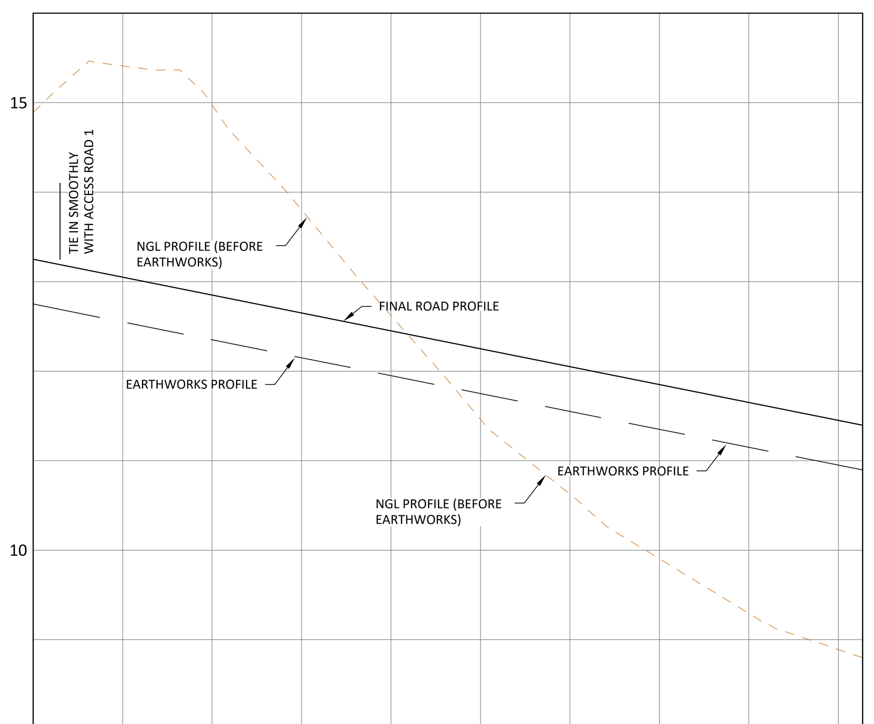
DATUM 8.000

DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
EARTHWORKS LEVELS	15.232	15.676	22.347	22.690	22.491	22.591	15.996	15.331	14.623	13.915	13.228	12.843	12.777	12.827	12.877	12.927	12.977	13.027	13.077	13.127
VERTICAL PROFILE GRADES	BVC 6.500; 7.00m K=2; -1.00%; 10.000	EVC 13.500; 15.543	3.00%		BVC 45.000; 20.00m K=2	55.000	22.893; EVC 65.000	-7.08%		BVC 97.000; 20.00m K=3	107.000	13.212; EVC 117.000							0.50%	
FINAL DESIGN ROAD LEVELS – LEFT EDGE 3.0m	15.585	15.518	15.785	22.085	22.385	22.622	22.418	15.773	15.065	14.357	13.667	13.378	13.335	13.385	13.435	13.485	13.535	13.585	13.635	13.685
FINAL DESIGN ROAD LEVELS – CENTRE LINE	15.643	15.578	15.843	22.143	22.443	22.680	22.476	15.831	15.123	14.415	13.725	13.320	13.277	13.327	13.377	13.427	13.477	13.527	13.577	13.627
FINAL DESIGN ROAD LEVELS – RIGHT EDGE 3.0m	15.585	15.518	15.785	22.085	22.385	22.622	22.418	15.773	15.065	14.357	13.667	13.262	13.219	13.269	13.319	13.369	13.419	13.469	13.519	13.569
HORIZONTAL CURVES			21.88 RADUIS=50.00m LENGHT=11.22m 33.04							85.94 RADUIS=50.00m LENGHT=11.22m 97.10										

DISTANCE (m)	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	407.874
EARTHWORKS LEVELS	13.177	13.227	13.277	13.327	13.377	13.427	13.477	13.527	13.561	13.487	13.302	13.102	12.902	12.702	12.502	12.302	12.102	11.902	11.635	11.067	10.103	9.473
VERTICAL PROFILE GRADES									BVC 275.000; 20.00m K=8; 285.000	14.102	EVC 295.000			-2.00%					BVC 375.000; 10.00m K=2; 380.000	EVC 385.000; 12.202	-8.00%	
FINAL DESIGN ROAD LEVELS – LEFT EDGE 3.0m	13.735	13.785	13.835	13.885	13.935	13.985	14.035	14.085	14.120	14.044	13.860	13.660	13.460	13.260	13.060	12.860	12.660	12.460	12.185	11.460	10.661	10.031
FINAL DESIGN ROAD LEVELS – CENTRE LINE	13.677	13.727	13.777	13.827	13.877	13.927	13.977	14.027	14.061	13.986	13.802	13.602	13.402	13.202	13.002	12.802	12.602	12.402	12.127	11.402	10.603	9.973
FINAL DESIGN ROAD LEVELS – RIGHT EDGE 3.0m	13.619	13.669	13.719	13.769	13.819	13.869	13.919	13.969	14.003	13.928	13.744	13.544	13.344	13.144	12.944	12.744	12.544	12.344	12.069	11.344	10.545	9.915
HORIZONTAL CURVES									276.17 RADUIS=10.00m LENGHT=15.71m 291.87													

LONGITUDINAL SECTION: ACCESS R0AD 1
SCALE HOR 1:500
VERT 1:50



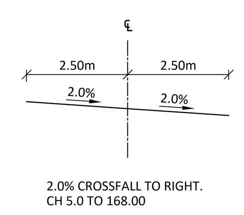


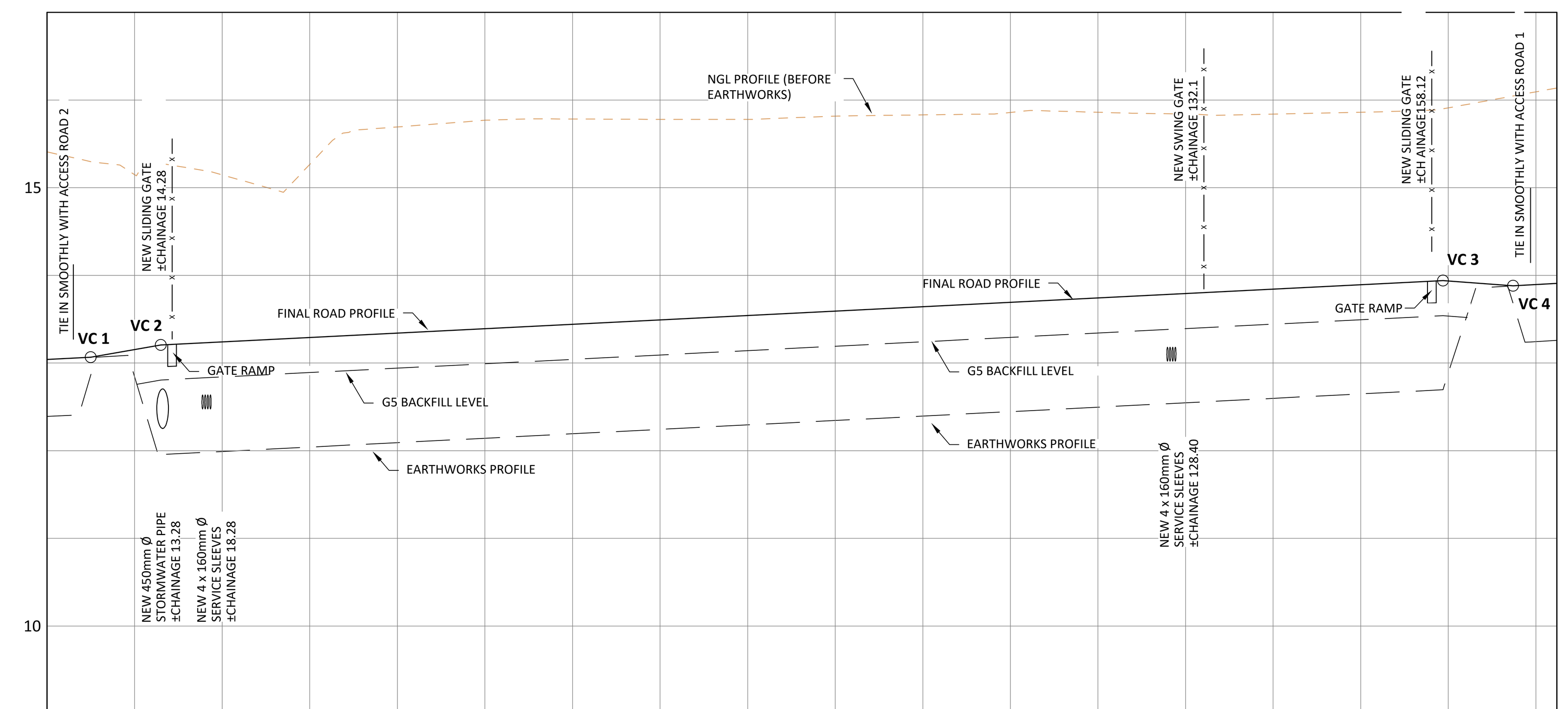
Access road 2
(CH 0 TO CH 92.701)

DATUM 8.000

DISTANCE (m)	0	10	20	30	40	50	60	70	80	90	92.701
EARTHWORKS LEVELS	12.750	12.550	12.350	12.105	11.950	11.750	11.550	11.350	11.150	10.950	10.896
VERTICAL PROFILE GRADES						-2.00%					
FINAL DESIGN ROAD LEVELS – LEFT EDGE 3.0m	13.187	12.987	12.787	12.587	12.387	12.187	11.987	11.787	11.587	11.387	11.333
FINAL DESIGN ROAD LEVELS – CENTRE LINE	13.245	13.045	12.845	12.645	12.445	12.245	12.045	11.845	11.645	11.445	11.391
FINAL DESIGN ROAD LEVELS – RIGHT EDGE 3.0m	13.303	13.103	12.903	12.703	12.503	12.303	12.103	11.903	11.703	11.503	11.449
HORIZONTAL CURVES											

LONGITUDINAL SECTION: ACCESS ROAD 2
SCALE HOR 1:500
VERT 1:50





Internal road 1
(CH 0 TO CH 172.399)

DATUM 9.000

DISTANCE (m)	0		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	172.399
LEVELS ON G5 BACKFILL	11.391		12.840	12.841	12.891	12.841	12.991	13.041	13.091	13.141	13.191	13.241	13.291	13.341	13.391	13.441	13.591	12.840	13.245	13.258
VERTICAL PROFILE GRADES	0.50%	ZERO CURVE; 5.00	1.75%; 13.226; 13.00	ZERO CURVE; 13.360						0.50%							ZERO CURVE; 159.399; 227.399	-0.75%; 14.040; ZERO CURVE	0.55%; 13.980	
FINAL DESIGN ROAD LEVELS – LEFT EDGE 2.5m	12.991		13.103	13.191	13.241	13.291	13.342	13.392	13.442	13.492	13.542	13.592	13.642	13.692	13.743	13.793	13.843	13.886	13.845	13.858
FINAL DESIGN ROAD LEVELS – CENTRE LINE	13.141	13.226	13.153	13.241	13.291	13.341	13.392	13.442	13.492	13.542	13.592	13.642	13.692	13.742	13.793	13.843	13.893	13.936	13.895	13.908
FINAL DESIGN ROAD LEVELS – RIGHT EDGE 2.5m	13.091		13.203	13.291	13.341	13.391	13.442	13.492	13.542	13.592	13.642	13.692	13.742	13.792	13.843	13.893	13.943	13.986	13.945	13.958
HORIZONTAL CURVES																				

LONGITUDINAL SECTION: INTERNAL ROAD 1
SCALE HOR 1:500
VERT 1:50

DRG NO.	REFERENCE DRAWINGS:
.	.
.	.
.	.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	JVB	FVL	FR	20/04/2020	1532721564-00003

Eskom

YSTERVARK SUBSTATION

ROAD SECTIONS

SCALE 1 : 500	AUTH: F RICKETTS	AUTH: —
THIS DRAWING IS THE PROPERTY OF ESKOM	DATE: 20/04/2020	DATE: __/__/____
	CHKD: F RICKETTS	CHKD: —
	DATE: 20/04/2020	DATE: __/__/____
	DRAWN: J VAN BRUGGEN	DRAWN: —
	DATE: 20/04/2020	DATE: __/__/____

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	19	4	00

A0L


SEWER DETAIL FS1
CONSERVANCY TANK
SCALE 1:25
SEWER DETAIL FS2
MANHOLE
SCALE 1:10
SEWER DETAIL - FS3
RODDING EYE
SCALE 1:10
FOUL SEWER
FIRE DETAIL F1
SCALE 1:25
FIRE
STORMWATER DETAIL SW1
SCALE 1:10
STORMWATER DETAIL SW2
SCALE 1:10
STORMWATER DETAIL SW3
SCALE 1:10
STORMWATER
WATER DETAIL W1
SCALE 1:25
WATER DETAIL W1
SCALE 1:5
WATER
ROAD SECTION 1 (RD1)
SCALE 1:50
CHANNEL SECTION RD3
SCALE 1:25
SECTION RD4 (GATE RAMP)
SCALE 1:50
ROAD SECTION 2 (RD2)
SCALE 1:50
GEOMETRY / ROADS
TYPICAL SECTION LA-0057-03.1
SCALE 1:10
TYPICAL SECTION LA-0057-03.5
SCALE 1:10
WIDTH OF CROSSING = 3.050m
DETAIL LA-0057-03.A
SCALE 1:5
DETAIL LA-0057-03.B
SCALE 1:10
TRENCHES
00 FIRST ISSUE JvB FVL FR 20/04/2020 1532721564—00003
REV REVISION DESCRIPTION BY CHKD AUTH DATE PROJECT NO.
DWG NO. REFERENCE DRAWINGS
Eskom
YSTERVARK SUBSTATION
DETAILS
AUTH: F RICKETTS
DATE: 20/04/2020
CHKD: F RICKETTS
DATE: 20/04/2020
DRAWN: J VAN BRUGGEN
DATE: 20/04/2020
SCALE 1 : 500
THIS DRAWING IS THE PROPERTY OF ESKOM
D-WC-8118
SET 19
SHEET 5
REVISION 00
A0L

7 Structural

7.1 Overview

The structural works, which includes foundations and steelwork, to be undertaken at Ystervark Substation shall be for the following main items:

- 6 x 66 kV Surge Arrestors.
- 87 x 132 kV Post Insulators.
- 17 x 132 kV Isolators.
- 3 x 132 kV Circuit Breakers.
- 21 x 132 kV Current Transformers.
- 6 x 66 kV Voltage Transformers.
- 6 x 66 kV Power Voltage Transformers.
- 10 x 21 m Lightning/Lighting Masts.
- Gantries.

Additional foundations for the following items shall also apply:

- 3 x Interface junction boxes.
- 2 x Yard AC Distribution boards.

Structurally related works for the control building will also apply.

7.2 Specification

7.2.1 Foundations

All new foundations for equipment will be installed in accordance with SANS 1200 and SANS 2001 - CC1 latest revision. Where holding down HD bolts are required, they will be aligned for casting of concrete to a tolerance of ± 2 mm. Foundation tolerances to be in accordance with SANS Degree of Accuracy II (DOA II).

All new foundations will have 25 mm grout under base-plates only with SikaGrout 212. All HD bolts will have two nuts and two washers each, except for those required for junction boxes, which will have one nut and one washer accordingly. The grout will be a feather finish to allow water to run free from the base-plate. Grouting shall not apply to foundations for junction boxes.

7.2.2 Steelwork

All structural steelwork galvanizing shall be in accordance with SANS 121 (ISO 1461) - Heavy duty (Coastal) and Eskom standard 240-75655504 - Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Materials and Structures Manufactured from Steel Standard.

All bolted connections will be cleaned and filled with jointing compound. No paint barrier allowed.

7.3 Long Lead Time Bill of Materials

Not Applicable

7.4 Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0
JOB NUMBER:	153272156-00003	Eskom	This document is the property of Eskom
BOM TYPE:	Final		
PREPARED BY :	AECOM		
Tel No	Tel: 021 950 7500		
DATE PREP. :	Thursday, October 24, 2019		

STEELWORK

QTY	SAP	REFERENCE	Rev	kV	DESCRIPTION	Mass (kg)	Total Mass (kg)
	MAIN EQUIPMENT SUPPORTS					Mass (kg)	Total Mass (kg)
3	0182927	D-DT-5200-2A	13	132 kV	Circuit Breaker - 132kV	242 kg	727 kg
9	0186033	D-DT-5202-2A	17	132 kV	Isolator Std - 132kV Manual	548 kg	4933 kg
3	0528420	D-DT-5202-2B	2	132 kV	Isolator Std - 132kV Motor	550 kg	1651 kg
5	0528427	D-DT-5202-2I	2	132 kV	Isolator Inline - 132kV Manual	776 kg	3882 kg
2	0190412	D-DT-5219-4	4	132 kV	132kV Surge Arrester	208 kg	416 kg
66	0182752	D-DT-5206-2C	9	132 kV	Medium Equipment - 2,5m	125 kg	8222 kg
66	0182753	D-DT-5206-2H	7	132 kV	Medium Equipment - CAP M1	54 kg	3591 kg
10	0214509	D-DT-5217-7	3	132 kV	Lighting Mast	624 kg	6240 kg
2	0572427	D-DT-5276-2A	1		Yard AC Distribution Board Steelwork	70 kg	140 kg
	TUBULAR BUSBAR SUPPORTS					Mass (kg)	Total Mass (kg)
18	0220125	D-DT-5225-2A	7	132 kV	Tubular Busbar - 132kV	647 kg	11638 kg
	HIGH STRUNG BUSBAR					Mass (kg)	Total Mass (kg)
4	0559307	D-DT-5252-2A	3	132 kV	Columns - 132/C	1150 kg	4599 kg
2	0559310	D-DT-5252-2D	2	132 kV	Beams - 132/40/1	803 kg	1606 kg
4	0559311	D-DT-5252-2E	2	132 kV	Earthwire Support - 132/EW	241 kg	964 kg

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0
JOB NUMBER:	153272156-00003	Eskom	This document is the property of Eskom
BOM TYPE:	Final		
PREPARED BY :	AECOM		
Tel No	Tel: 021 950 7500		
DATE PREP. :	Thursday, October 24, 2019		

CONCRETE WORKS

QTY	SAP	REFERENCE	Rev	DESCRIPTION
	MAIN EQUIPMENT SUPPORT FOUNDATIONS			
4	N/A	0.54/4316	4	132kV Yard Steelwork foundations (Standard Foundations)
3	0182925	D-DT-5200-1A	9	Circuit Breaker - 132kV (Soil Type 1 & 2)
17	0182921	D-DT-5202-1A	14	Isolator - 132kV 3m & 3.6m (Soil Type 1 & 2)
66	0183872	D-DT-5206-1A	9	Medium Equipment (Soil Type 1 & 2)
10	0214508	D-DT-5217-1C	9	Lighting Mast - 21m (Soil Type 1 & 2)
2	0572428	D-DT-5276-1A		Yard AC Distribution Board (Soil Type 1 & 2)
4	N/A	D-WC-8118-11-5		Ystervark Substation 66kV Entrance Slabs
	TUBULAR BUSBAR			
18	0220123	D-DT-5225-1A	3	Tubular Busbar - 132kV 3m Phase CRS (Soil Type 1 & 2)
	TOTAL CONCRETE AND BRICK			25 MPa Concrete, use 355 kg cement, 0.70 m3 sand (max 5% moisture) and 0.78 m3 stone (19 mm). Cement : Water Ratio = 1.7

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0
JOB NUMBER:	153272156-00003	Eskom	This document is the property of Eskom
BOM TYPE:	Final		
PREPARED BY :	AECOM		
Tel No	Tel: 021 950 7500		
DATE PREP. :	Thursday, October 24, 2019		

HD BOLTS

QTY	SAP	REFERENCE	Rev	DESCRIPTION	Length	Bolts / FND	Thread
	HD BOLTS FOR STANDARD FOUNDATIONS						
17	0182921	D-DT-5202-1A	14	Isolator - 132kV 3m & 3.6m (Soil Type 1 & 2)	350 mm	8	M24
66	0183872	D-DT-5206-1A	9	Medium Equipment (Soil Type 1 & 2)	500 mm	4	M24
18	0220123	D-DT-5225-1A	3	Tubular Busbar - 132kV 3m Phase CRS (Soil Type 1 & 2)	500 mm	8	M24
2	0572428	D-DT-5276-1A		Yard AC Distribution Board (Soil Type 1 & 2)	500 mm	4	M24
10	0214508	D-DT-5217-1C	9	Lighting Mast - 21m (Soil Type 1 & 2)	1300 mm	4	M24
	HD BOLTS FOR 0.54 STANDARD AND COLUMNS AND BEAMS						
9	0186033	D-DT-5202-2A	17	Isolator Std - 132kV Manual	35 mm	16	M16
					40 mm	24	M16
					45 mm	36	M16
3	0528420	D-DT-5202-2B	2	Isolator Std - 132kV Motor	35 mm	16	M16
					40 mm	24	M16
					45 mm	38	M16
5	0528427	D-DT-5202-2I	2	Isolator Inline - 132kV Manual	35 mm	68	M16
					40 mm	24	M16
					45 mm	48	M16
2	0190412	D-DT-5219-4	4	132kV Surge Arrester	40 mm	12	M16
					236 mm	4	M16
					115 mm	4	M16
66	0182752	D-DT-5206-2C	9	Medium Equipment - 2,5m	40 mm	8	M16
					45 mm	12	M16
66	0182753	D-DT-5206-2H	7	Medium Equipment - CAP M1	40 mm	8	M16
					45 mm	4	M16
10	0214509	D-DT-5217-7	3	Lighting Mast	65 mm	24	M16
18	0220125	D-DT-5225-2A	7	Tubular Busbar - 132kV	240 mm	8	M20
					50 mm	48	M20
					40 mm	12	M16
4	0559307	D-DT-5252-2A	3	Columns - 132/C	45 mm	4	M20
					45 mm	12	M20
					50 mm	60	M20
					55 mm	48	M20
					60 mm	8	M20
2	0559310	D-DT-5252-2D	2	Beams - 132/40/1	40 mm	72	M16
					40 mm	8	M16
					45 mm	128	M16
					50 mm	8	M16
					50 mm	16	M20
					55 mm	4	M20
4	0559311	D-DT-5252-2E	2	Earthwire Support - 132/EW	40 mm	48	M20
					45 mm	16	M20
					50 mm	8	M20
					50 mm	12	M20
		TOTAL BOLTS					
532				Rod, Threaded Galv M16x35mm Wash+Nuts			
1864				Rod, Threaded Galv M16x40mm Wash+Nuts			
1990				Rod, Threaded Galv M16x45mm Wash+Nuts			
16				Rod, Threaded Galv M16x50mm Wash+Nuts			
240				Rod, Threaded Galv M16x65mm Wash+Nuts			
8				Rod, Threaded Galv M16x115mm Wash+Nuts			
8				Rod, Threaded Galv M16x236mm Wash+Nuts (J-bolt)			
192				Rod, Threaded Galv M20x40mm Wash+Nuts			
128				Rod, Threaded Galv M20x45mm Wash+Nuts			
1216				Rod, Threaded Galv M20x50mm Wash+Nuts			
200				Rod, Threaded Galv M20x55mm Wash+Nuts			
32				Rod, Threaded Galv M20x60mm Wash+Nuts			
144				Rod, Threaded Galv M20x240mm Wash+Nuts			
136	0185178	D-DT-3015	23	Rod, Threaded Galv M24x350mm Wash+Nuts			
416	0185179	D-DT-3015	23	Rod, Threaded Galv M24x500mm Wash+Nuts			
40	0219213	D-DT-3015	23	Rod, Threaded Galv M24x1300mm Wash+Nuts			
		TOTAL NUTS AND WASHERS					
4658				Total M16 Nuts			
1912				Total M20 Nuts			
592				Total M24 Nuts			

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0	This document is the property of Eskom
JOB NUMBER:	153272156-00003			
BOM TYPE:	Final			
PREPARED BY :	AECOM			
Tel No	Tel: 021 950 7500			
DATE PREP. :	Thursday, October 24, 2019			

REINFORCING

QTY	SAP	REFERENCE	Rev	DESCRIPTION	Reinforcing Type	Length	Total Length	No./Fnd
	REINFORCING FOR FOUNDATIONS				**Reinforcing Type**	**Length**	**Total Length**	**No./Fnd**
10	0214508	D-DT-5217-1C	**9**	Lighting Mast - 21m (Soil Type 1 & 2)	16mm Y 10mm R	1435 mm 7900 mm	344400 mm 395000 mm	24 5
18	0220123	D-DT-5225-1A	**3**	Tubular Busbar - 132kV 3m Phase CRS (Soil Type 1 & 2)	16mm Y 10mm Y	650 mm 3350 mm	187200 mm 361800 mm	16 6
4	N/A	D-WC-8118-11-5		Ystervark Substation 66kV Entrance Slabs surface bed entrance slab	245 Mesh	13.2 m²	105.6 m²	2
	TOTAL REINFORCING BARS							
	0164654	D-DT-7027	**1**	6mmØ Type R Reinforcing Bars				
	0172322	D-DT-7027	**1**	8mmØ Type R Reinforcing Bars				
395.00m	0404684	D-DT-7027	**1**	10mmØ Type R Reinforcing Bars				
361.80m	0164723	D-DT-7026	**3**	10mmØ Type Y Reinforcing Bars				
	0164656	D-DT-7026	**3**	12mmØ Type Y Reinforcing Bars				
531.60m	0164657	D-DT-7026	**3**	16mmØ Type Y Reinforcing Bars				
	0164658	D-DT-7026	**3**	20mmØ Type Y Reinforcing Bars				
	TOTAL REINFORCING MESH							
	buy out			245 Mesh	Total Area:	106 m²		

*** Ensure the correct area of 245 Mesh is bought rather than the number of specified sheets**

7.5 Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM WCOU_BOM-18-04

JOB NAME	Ystervark 66 - 132 kV Substation	LASTEST REV :	0
JOB NUMBER:	153272156-00003		
BOM TYPE:	Final		
PREPARED BY :	AECOM		
Tel No	Tel: 021 950 7500		
DATE PREP. :	Thursday, October 24, 2019		

STRUCTURAL ELEMENTS BILL OF QUANTITIES

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	POWER PLANT ACTIVITIES										
		CIVIL ACTIVITIES									
	Excavation:										
	Excavations soft	m³	233.50								
	Backfill and compact										
	Backfill and compact (Normal)	m³	39.72								
	Clearing of excess material to spoil										
	Clearing of excess material to spoil	m³	193.78								
	Foundations										
	Setting & Marking of foundations	each	106.00								
	Installing steel reinforcing	kg	1288.40								
	Concrete formwork	m²	232.41								
	Place concrete	m³	220.23								
	Finishing:										
	Finishing Foundation	each	106.00								
		ELECTRICAL ACTIVITIES									
	Layout of structures:										
	Layout Structures - Lattice	ton	49.9								
	Assemble Structures										
	Assemble Structures - Lattice	ton	49.9								
	Errect Structures										
	Errect Structures	ton	49.9								
	Finishing:										
	Finishing Handing Over Documentation	stru	194								
	Finishing Torque nuts	each	7162								

7.6 Non-Standard Material Specifications

Not Applicable

8 Architectural

8.1 Overview

The Ystervark Substation shall be provided with its own dedicated 132 kV relay house (control building), which is for the sole use of Eskom's operating & maintenance personnel. The building will comprise a single-storey brick structure, consisting of the following:

- Control Room.
- Battery Room.
- Ablution Facility.

Provision is also made for an external loading bay and a water storage tank. It is intended for the water tank, via rainwater harvesting, to provide water to the Ablution Facility inside the building, consisting of a wash hand basin (WHB) and toilet (WC), as well as the sink located in the battery room. This water supply is not intended for drinking water.

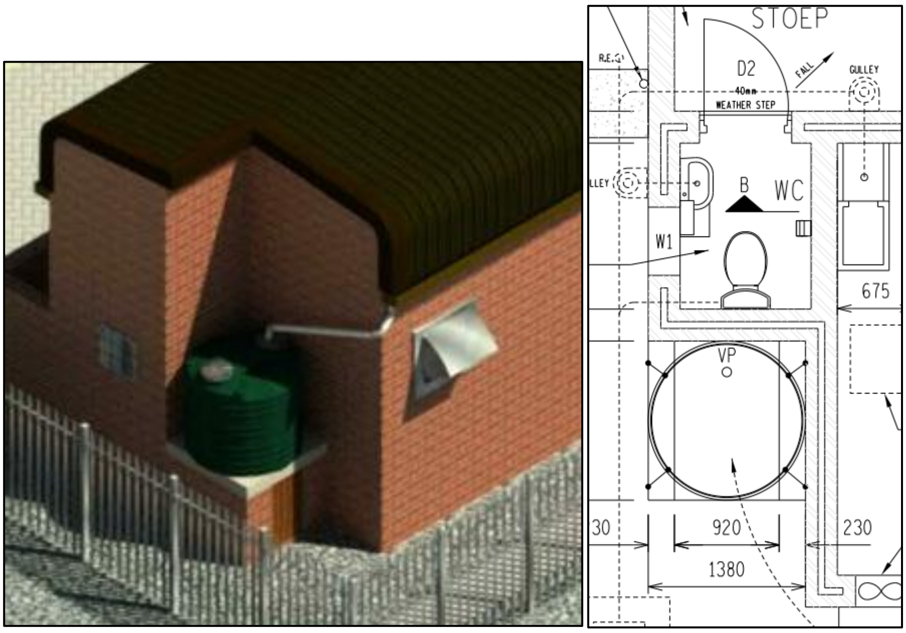


Figure 53: Perspective and plan views of rainwater storage tank and adjacency to Ablution and Battery Room

The 1500 liter rainwater storage tank is to be installed according to manufacturer's specifications, and strapped down to tank concrete slab, as noted on drawing Sheet 05 (D-WC-8118-18-05).

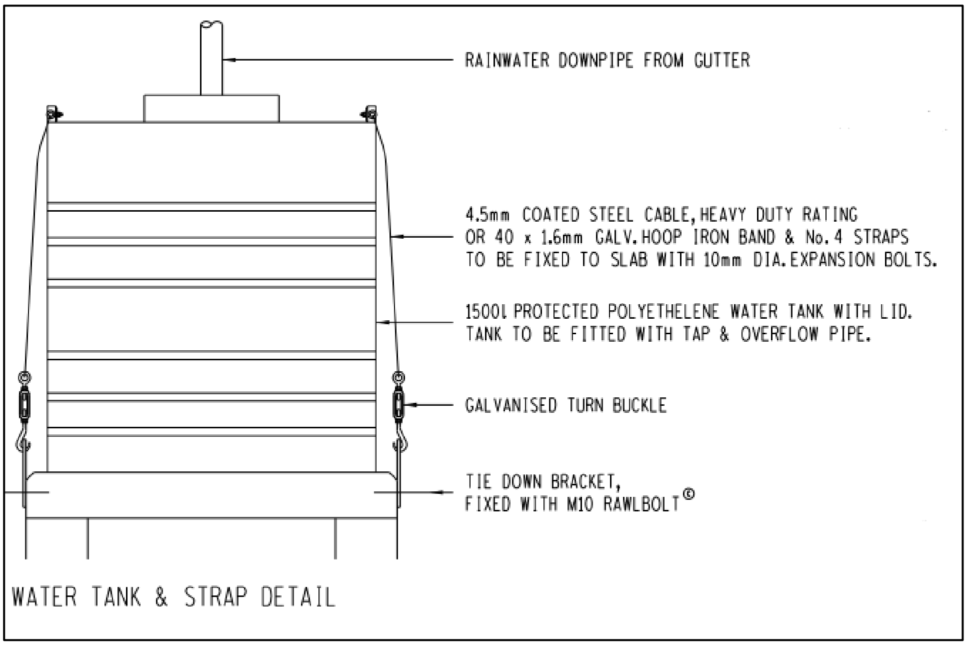


Figure 54: Detail showing fixing and strapping of rainwater tank (excerpt from Drawing Sheet 05)

<u>Fire and Life Safety compliance</u>

In accordance with the rational fire design report contained in document "Ystervark 66 - 132 kV Substation - Book 2, Job no. 153272156-00003", no dedicated fire detection will be required. Furthermore, the Eskom standard "240-56177186 - Battery Room Standard" also dictates that smoke detectors shall only be installed for battery rooms > 500 m².

In addition to the above, semi-sealed NiCad batteries (type - valve regulated) are used, as per D-DT-9308. Their hydrogen release characteristic has been calculated in accordance with the requirements of SANS 10108 and Eskom standard "240-56176113 - Classification of Battery Rooms Work Instruction".

Based on the latest fire rationale report, "Iron Ore Tippler 3 project bulk power upgrade: Fire Safety Design report /1924701-2-510-M-RPT-0001" it is noted that the calculations for the Battery Room ventilation is compliant as per the specified supply/extraction.

Furthermore, the Control Room is confirmed as not requiring artificial ventilation and the roof ventilators provided are sufficient and compliant. The building construction will enable the structure to withstand the effects of fire (i.e. remain stable) for longer than 60 minutes.

The single story substation buildings have exits at ground level and are not provided with any emergency routes.

This fire safety report includes the Hazardous Zone classification calculation for the Ystervark building, owing to the battery banks that will be housed in its dedicated Battery Room.
The Battery Room at the Ystervark Relay/Control Building shall be classified as a Zone 2 Hazardous Area and shall be subject to the provisions of the Employer Standards noted in section 5.5 of "Fire Safety Design report /1924701-2-510-M-RPT-0001".

Building occupancy classification of the Eskom Relay House (Control Building) is predominantly Plant Room (D4) but has also taken into consideration that it contains separate and different rooms: a normally unoccupied Relay/Control Room (D4), a Battery Room (D4), and Ablution Facility/Toilet (H3).

These are all separated from one another by means 120-minute rated fire walls. The 230 mm solid masonry internal dividing walls will provide 120-minute structural fire resistance, and 240-minute non-structural fire resistance (according to SANS 10177, Part Z). Service penetrations between individual rooms will be fire stopped with the appropriate fire rated material, according to manufacturer's instructions.

The building exterior walls consist of 280 mm cavity brickwork. Where used, the structural fire resistance of the building will be 90 minutes and therefore compliant with the regulations. Floor coverings, wall and ceiling finishes in the Battery Room are all non-combustible.

No fire hose reels are provided. Handheld or mobile fire extinguishers will be provided in place of every hose reel required by the National Building Regulations. The buildings considered here are unmanned and will be serviced from time to time by maintenance personnel and service providers only.

8.2 Building Elements

8.2.1 Foundations

Foundations Types and reinforcement are as specified by the Structural Engineer and indicated in the Notes on drawing Sheet 06 (D-WC-8118-18-06).

8.2.2 Concrete Landings

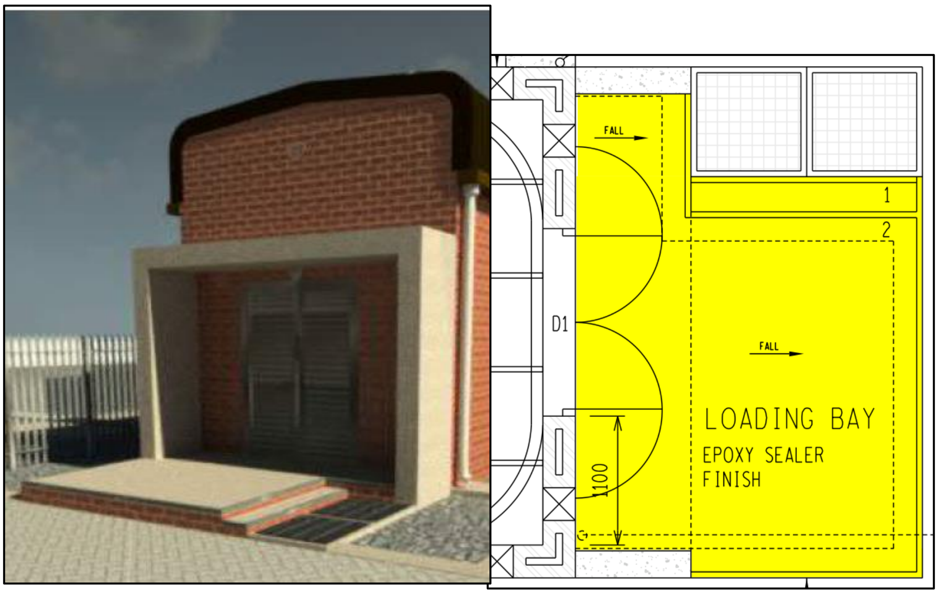


Figure 55: Perspective and plan views of Loading Bay landing and steps

The concrete Loading Bay, Stoep and Steps surface beds shall be 100 mm concrete of 30 MPa, as per Structural Engineer's specifications/drawings, with a brushed finished and power floated. A fall of approximately 1:30 is to be provided, away from the building in the directions as indicated on the plans. Construction joints shall be formed at a maximum as indicated by the Structural Engineer, or 2.5 m centres, in the absence of such note.

600 x 600 mm concrete splash slabs to be added where indicated on the drawings, to prevent erosion of soil below rainwater downpipe (RWDP) outlets. This may be precast slabs and does not need to be in-situ cast.

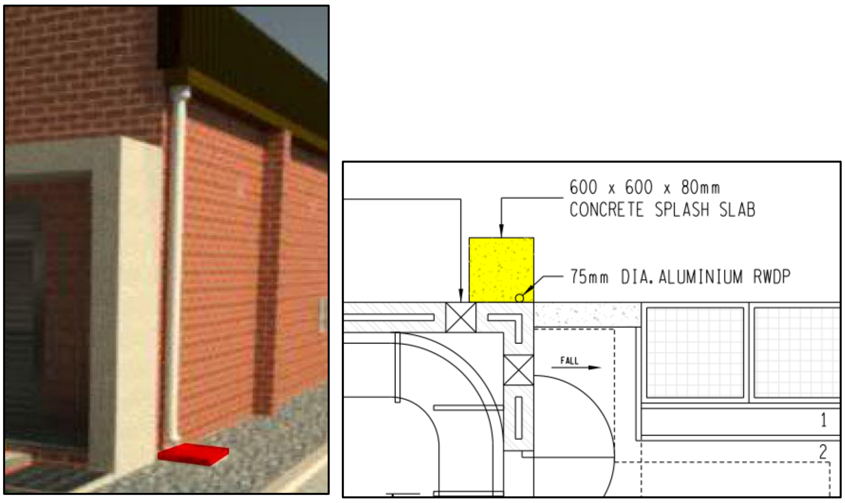


Figure 56: Perspective (left) and plan view (right) of concrete splash slab below rainwater downpipes.

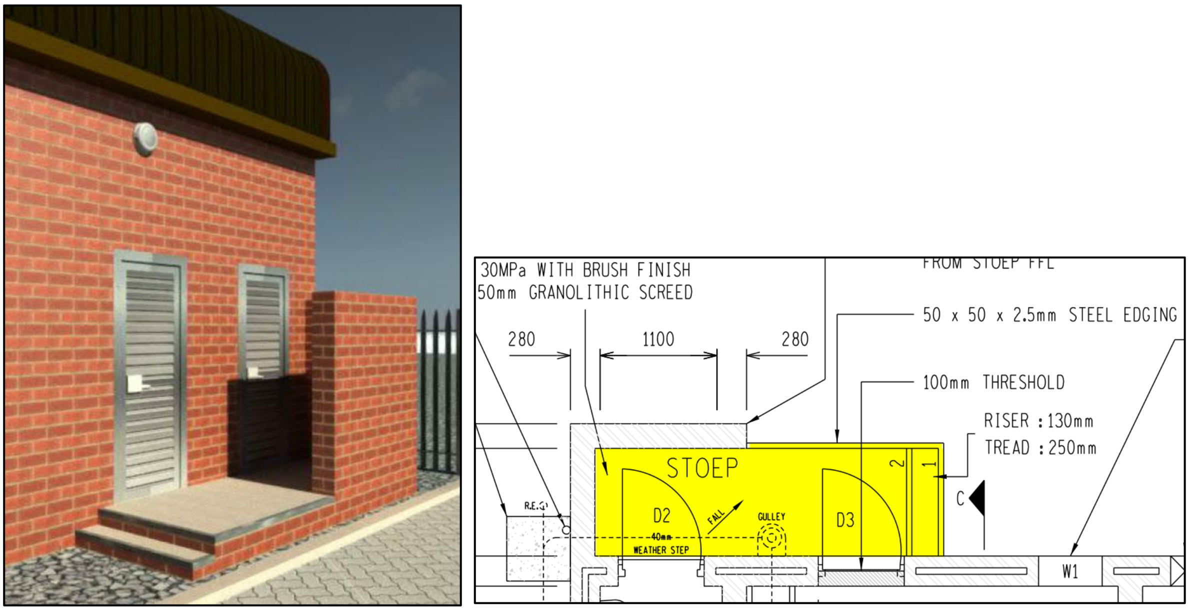


Figure 57: Plan and perspective views of Stoep landing and steps

Yard stone to Specialist's Design exterior surface finish is to surround the building, foot of the Stoep and Loading Bay, as indicated on the drawings and perspective below.

Figure 58: Perspective view indicating the yard stone layer around the building

This yard stone layer to extend below the rainwater storage tank platform.

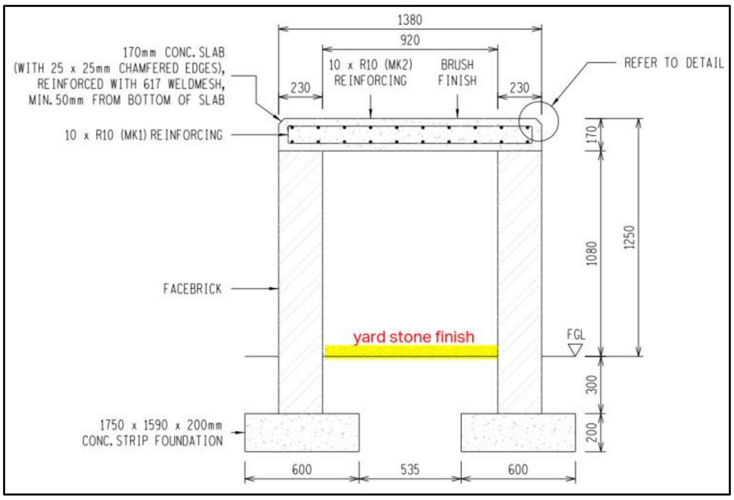


Figure 59: Excerpt showing the protected corner/edge detail of exposed external concrete slabs

Exposed, external edges and corners of the Loading Bay, Stoep landings and steps are to be protected by means of the a typical in-situ cast galvanised steel angle (as shown in Figure 60 below).

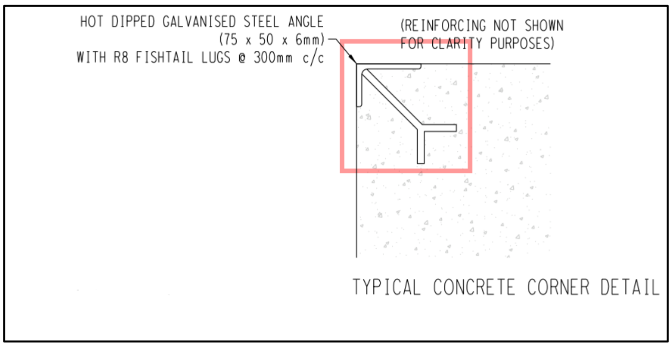


Figure 60: Excerpt showing the protected concrete slabs corner/edge typical detail

The water storage tank base slab foundations and slab are to be according to the dimensions and reinforcement schedule on drawing Sheet 06 (D-WC-8118-18-06). The slab corners are to be chamfered, as indicated on the detail drawing Sheet 05 (D-WC-8118-18-05) and the excerpt in Figure 61 below.

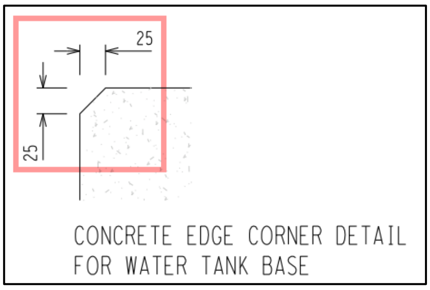


Figure 61: Excerpt showing the chamfered concrete slabs corner/edge typical detail of the water storage tank slab

<u>Concrete canopies and elevated covers</u>

The reinforced concrete weather canopy over Loading Bay, leading to the Control Room, as well as the in-situ cast concrete capping over the cable ducts are to be waterproofed to prevent moisture ingress from above.

a.b.e.® (African Bitumen Emulsions) torch-on 4 mm reinforced membrane is to be used as the primary waterproofing membrane, or an approved equivalent.

The cast concrete surface must be allowed to dry before the sheet is applied. Drying depends on the weather and may take from 8 days to 3 weeks. The concrete surface must either be plastered to fall, or cast to fall with a minimum of fall of 1:80. These cementitious surfaces must be clean and dry prior to application of the waterproofing membrane, having no sharp protrusions, providing a surface texture compared with at least a fine wood float finish. It must then be primed with a.b.e® "bitu.®prime" at a rate of approximately 3.5 m²/Litre. Depending on the surface, a second coat of primer may be required.

Installation to be executed by an experienced a.b.e® accredited installer. The membrane must be fully bonded by heat fusion to the “bitu.®prime” primed surface. During installation ensure that the side and end laps are 100 mm and 150 mm respectively. When two layers are applied, a.b.e.® torch-on installation should be fully torched to the first layer by heat fusion. The membrane must be laid in a centrally staggered manner with the side and end laps, ensuring that the laps and the membrane are not over heated. All installation to be according to manufacturer’s technical instructions.

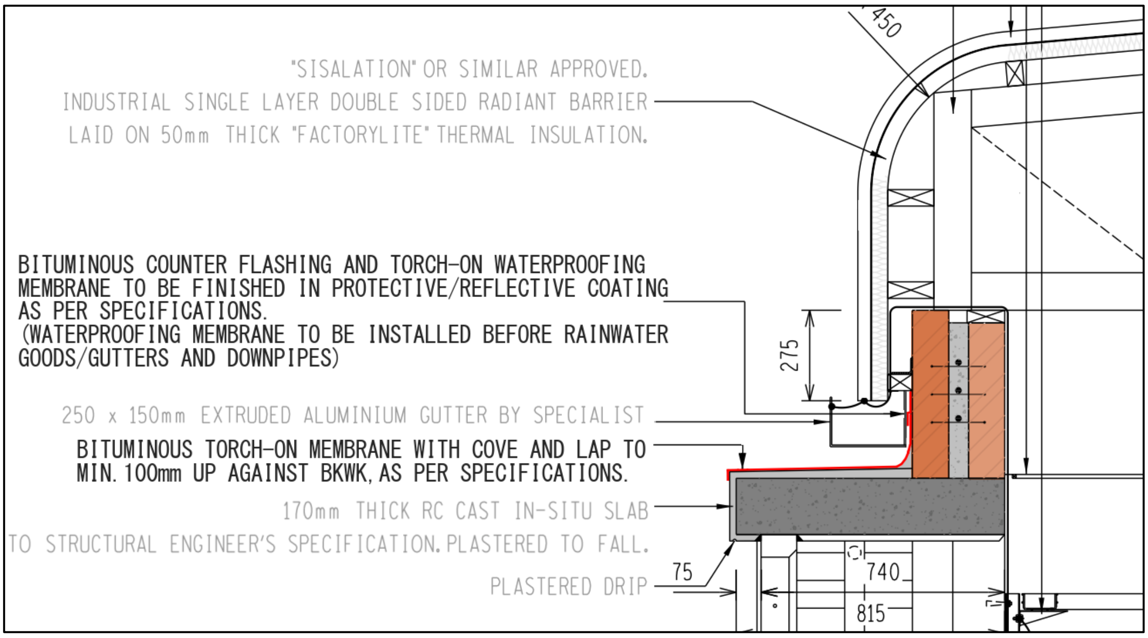


Figure 62: Typical detail showing waterproofing of concrete cable duct capping

2 to 3 months after completion, apply two coats of a.b.e.® silvakote to the surface to improve the resistance against UV rays, thereby prolonging product lifespan.

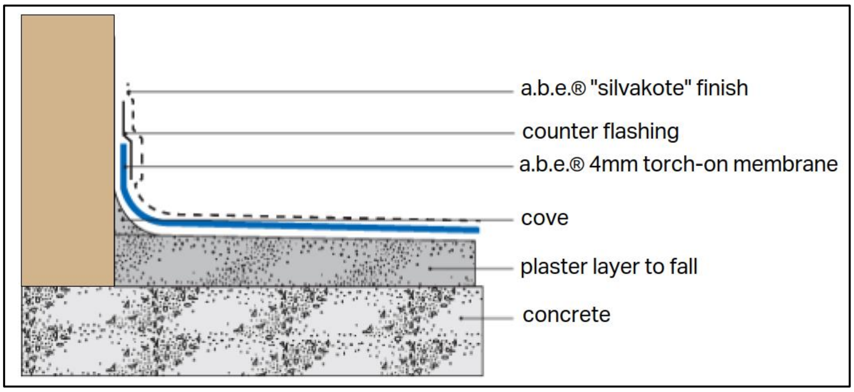


Figure 63: Typical detail showing waterproofing layering on top of concrete canopy and cable duct cappings

8.2.3 Surface bed / Floor slab

Soil substrate preparation with herbicides and insecticides shall comply with SABS 1165 and Structural Engineer's specifications on drawings and as indicated in this document. Soil poisoning shall carry a written ten-year guarantee.

The 150 mm thick 30 MPa power floated concrete surface bed/floor slabs shall be constructed on well compacted back-fill in 150 mm layers, with sand blinding layer as per Engineer's specifications in Section 7. Reinforcing to be mesh ref. 617 and to be carried through into the Stoep.

375 micron DPM (Damp Proof Membrane) to be lapped and sealed below concrete surface bed. DPM to overlap with stepped DPC (Damp Proof Course) at weep holes in external masonry cavity wall. DPM/DPC to be Gunplas "Brikgrip" 375 micron, or approved equivalent.

Floor tolerance to be a maximum of 0.5 mm over 1 m distance, and a maximum of 2 mm difference over the total length of the floor.

Battery Room - Expansion joints shall be avoided in the Battery Room. The floor shall be given a uniform cement screed fall, with a fall/slope of no less than 1:200 towards the door. To contain any spill or leak inside the room and prevent fluid discharge from the room, the doorway/threshold to the Battery Room shall have an elevated/built-up threshold of minimum 100 mm in height from adjacent interior floor finish.

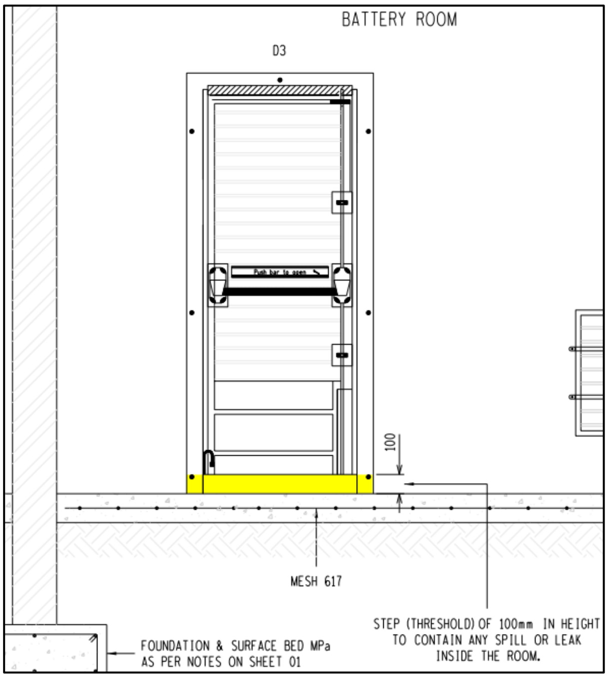


Figure 64: Excerpt of drawing showing the raised threshold of the Battery Room door from the floor surface

8.2.4 Walls and masonry

a.) General

Brickwork shall be built according to SANS 10400 Part K:Walls. The minimum crushing strength of all load-bearing brickwork / masonry units must be 14 MPa. All bricks are to be imperial format (i.e. approximately ± 222 x 106 x 73 mm).

All brickwork shown on the drawings shall be assumed to be load bearing, unless indicated otherwise. Clay bricks shall be wetted before being used.

Where ducts, sleeves or pipes are laid across a wall cavity, the construction must prevent the transmission of moisture. The cavity shall be kept free of mortar and debris as the works proceed. Ties shall be cleaned of mortar droppings. Mortar droppings reaching the base of the cavity shall be removed daily through temporary openings. Care shall be taken not to damage the DPC (Damp-Proof Course) while cleaning the cavity. Weep holes above stepped DPC every fourth brick and to be raked clear to drain the cavity.

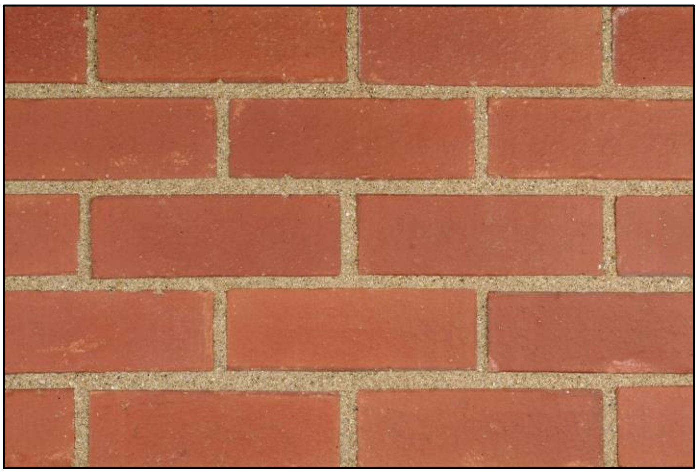


Figure 65: Face brick (FBX) finish/type – Corobrik “De Hoop Red smooth”

Brickwork shall be laid in half lap stretcher bond format with 10 mm raked joints for all face brick. All other joints to be keyed for plastering. Brickforce shall be 150 mm GMS (Galvanised Mild Steel) and shall be placed at every fourth (4^{th}) layer for any one/single or half-brick wall.

Continuous brickforce shall be placed at every layer for the first 4 (four) layers above and below the top of foundations and slabs respectively, as well as at windows and over door openings. Minimum laps to be 300 mm.

Continuous brickforce shall be placed at every layer for the first 3 (three) layers below the wall plate. At gables and fire walls, brickforce shall be placed at every third (3^{rd}) layer/course. For gables this is to be 75 mm wide brickforce.

Figure 66: South east aerial perspective

Galvanized wall ties of 3.15 mm diameter shall be used. In cavity walls, wall ties shall join each brickwork leaf to the other and shall be embedded in masonry joints at right angles to the leaf. Each tie shall be embedded to a depth of at least 50 mm in the mortar joint of each leaf.

Wall ties in external cavity walls shall be 5/m² in wall and 300 mm c/c (centre-to-centre) at jambs. Additional ties shall be provided at openings, discontinuities (e.g. control joints, external angles), at vertical intervals not exceeding 300 mm. For high-lift grouted walls, ties complying with the requirements of SANS 10164 Part 2, Annexure A (14) shall be spaced at intervals not exceeding 900 mm horizontally, and not exceeding 300 mm vertically, with each layer staggered by 450 mm.

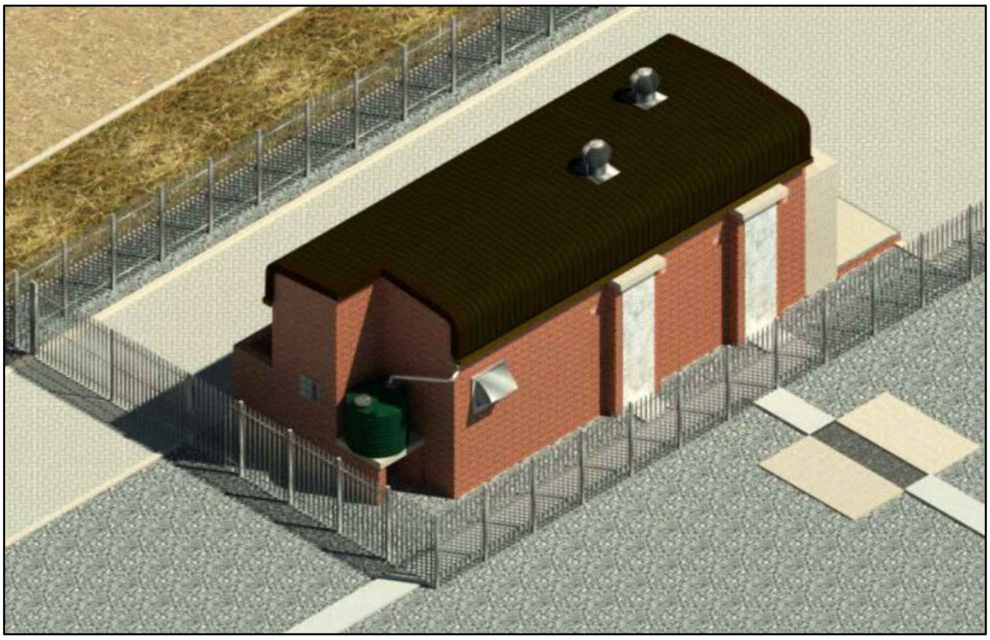


Figure 67: North west aerial perspective

Two coats of “ABE Brixeal” waterproofing, or approved equivalent, shall be applied to cement plaster surfaces on inner cavity walls, in accordance with the manufacturer’s recommendations. All surfaces shall be clean, dry, sound and free of oils and laitance. A special primer will not be required.

Brickwork mortar shall be a 1:4 ratio mix of cement:sand. Plasterwork shall be a 1:1:6 ratio mix of cement:lime:sand and approximately 15 mm in thickness.

Precast RC lintels to be installed on internal skin only/plastered and painted side, above all doors, double doors, windows and trench entrances into the building. Concrete and steel reinforced brickwork lintels to the exterior / face brick side of cavity walls.

Air bricks of cement type with vermin proofing (225 x 150 mm), internally and externally where indicated on plans and elevations and set flush with wall finish.

The position of brickwork wall stiffeners, expansion joints in brickwork/blockwork shall be as shown on the drawings, as indicated by the Structural Engineer, or as instructed by the Resident Engineer.

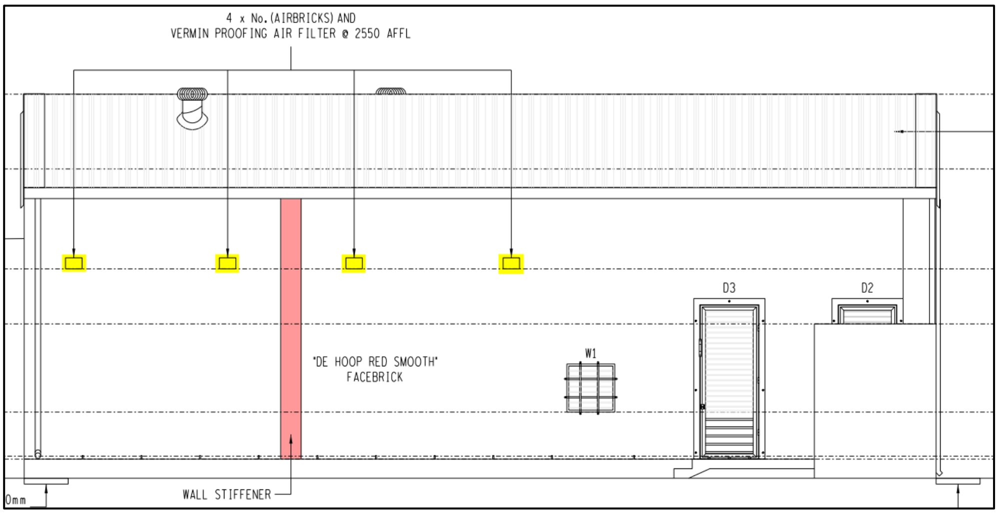


Figure 68: Excerpt from elevations showing airbricks and brick stiffeners

b.) Foundation Walls

All foundation walls shall be 280 mm wide cavity walls. The cavity to be filled with 20 MPa concrete and steel reinforcing of 3 x (three n.o.) Y12 reinforcing bars equally spaced and brickforce every course up to floor level.

The top two layers below ground level of the outer skin shall be FBX (Face Brick Extra). The rest of the outer skin below ground level shall be NFX (Non-Face Extra) masonry units of minimum 14 MPa compressive strength. Above this the masonry units are to match the rest of the exterior facebrick skin above ground level (FBX), laid in a Class II mortar.

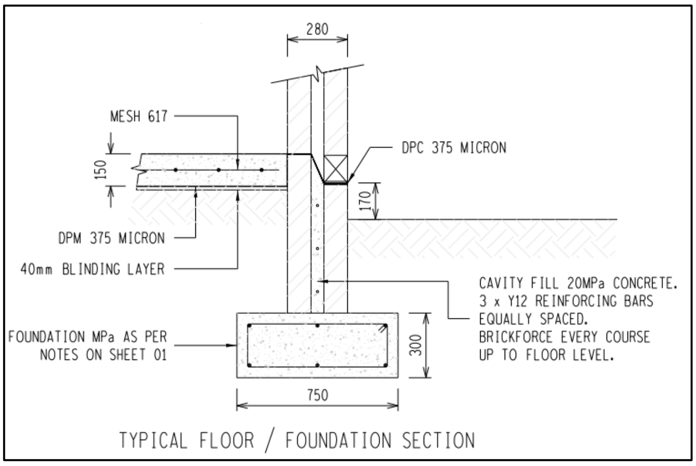


Figure 69: Typical foundation wall detail

c.) External Walls

Facebrick to be used shall be Corobrik "De Hoop Red smooth" FBX, or approved equivalent.

External walls shall be 280 mm wide cavity wall construction, as indicated on the drawings. The outer skin of the cavity wall shall be face-brick (FBX), laid in a Class II mortar. The inner skin of the cavity wall, where it is not exposed to the elements, shall be red clay stock brick/ROK (Run Of Kiln), laid in Class II mortar, plastered and painted. 230 mm "single brick" load bearing walls are to be used where indicated on the drawings and wall ties/brickforce to be applied as per specifications.

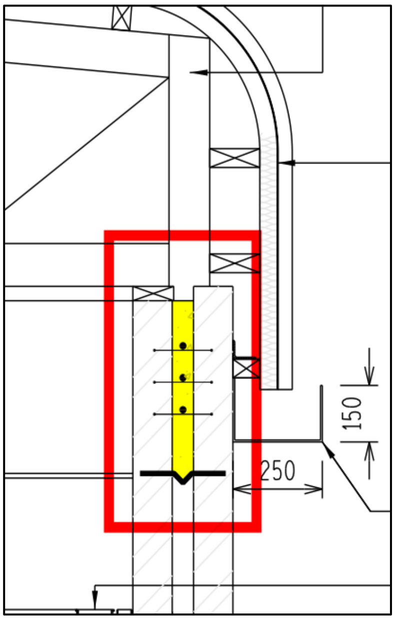


Figure 70: Typical ring beam detail

GMS cavity closer to be installed as per detail below wall plate and cavity filled with 30MPa concrete comprising steel reinforcement of 3 x (three n.o.) Y12 reinforcing bars, GMS hoop iron wrapped around the rebar, to securing roof truss / rafters down into brickwork. Brickforce to be installed as per specifications; continuous brickforce placed at every layer for the first 3 (three) layers below the wall plate.

d.) Internal Walls

All non-load bearing internal walls shall be 110 mm "half brick" walls, constructed of minimum 7 MPa NFP (Non-Face plaster) stock brick or ROK's, laid in Class II mortar, plastered and tiled or painted, as specified on the drawings.

Plasterwork shall be a 1:1:6 ratio mix of cement:lime:sand, and approximately 15 mm in thickness, finished with a smooth steel float. Joints to be keyed for plastering.

Any floor ducts, where applicable, are to be "bagged".

All internal load bearing or internal fire walls shall be 230 mm "single brick" walls, constructed of minimum 14 MPa NFP stock brick with ties/brickforce to be applied as per specifications. All fire walls to extend to underside of roof sheeting.

Figure 71: North east aerial perspective

8.2.5 Finishes – walls, floors, general

8.2.5.1 General:

a.) Galvanising

i. All galvanising shall be according to SANS 121.
ii. The coating thicknesses shall comply with SANS 121, to suit the requirements of the specification.
iii. Where galvanising is visible, the final finish shall be smooth, continuous, consistent and free from flux staining and other forms of staining. Coating weight shall be consistent, maintaining a uniform appearance throughout the service life of the works.

b.) Painting of galvanised steel

i. Surface preparation shall be as recommended by the manufacturer of the applied coating system and to SANS 121. “Galvkleen”, or approved equivalent, is to be used, followed by 1 (one) coat universal primer, followed by 1 (one) coat gloss enamel paint.
ii. Sprayed metal coatings shall be to SANS 1391.
iii. The minimum coating thickness shall comply with SANS 1391.

c.) Powder coating

i. Powder coated architectural aluminium shall comply with SANS 1796:2013 or SANS 1274 for all other substrates.
ii. Powder coated materials shall comply with SANS 1578 – 1 Durable Organic Powders.
iii. The colour of the powder coating shall be charcoal, and RAL codes based on the manufacturer’s range.
iv. All powder coating shall be done only by applicators certified under SANS 1796 and approved by the powder manufacturer.

8.2.5.2 Loading bay, Entrance and Control Room:

Wood floated finish to concrete surface bed with, and sealed Sika “Purigo® 5 S” penetrating cement sealer, or approved equivalent, applied as per manufacturer’s specifications. Maximum slope deviation tolerance shall be 1 mm over 1 m installed/applied to manufacturer’s specifications.

8.2.5.3 Toilet and Store Room:

Floor finish to be epoxy paint finish consisting of the following, or approved equivalent, applied as per manufacturer’s specifications:

i. One coat of BASF “Mastertop® Primer 1200 Plus” resin with Solvent No 2 with “Mastertop 1210 Plus” aggregate.
ii. Top coat of light grey BASF “Mastertop® 1210 Plus”.

Figure 72: Typical Mastertop installation

8.2.5.4 <u>Battery Room:</u>

Floor finish to be Sikafloor® 381, 5 mm thick self-levelling screed with accompanying primer, or approved equivalent. Colour to be light grey. Product is to be applied according to manufacturer's instructions.

The floor finish shall form a continuous skirting up against the wall. The skirting shall extend to a height of 100 mm above lowest point of the floor level.

Figure 73: Typical Sikafloor installation

8.2.5.5 <u>Walls & Ceilings:</u>

a.) Internal walls and ceilings

i. 1x (one n.o.) filler coat, 1 (one) layer universal undercoat, followed by 2 (two n.o.) coats AkzoNobel Dulux "wash 'n wear" PVA, or equivalent approved.

ii. Final coat to be applied contractor, only after commissioning of all electrical equipment.

iii. Colour to be white.

b.) Battery Room – Wall and ceiling finish to be AkzoNobel-Dulux Trade “Tuffcote Waterbased Epoxy Enamel” paint, or approved equivalent. Colour to be white and it is to be applied with the appropriate preparation and/or primer. Final finish to be a minimum of 100 micron thick and applied according to the manufacturer’s instructions.

8.2.6 Roof & rainwater goods

"Mitek" gang-nail timber roof truss based on design and supply by specialist contractor /manufacturer. Timber truss/rafter ends to receive 1 x (one n.o.) coat pink wood primer and 2 x (two n.o.) coats flat enamel paint.

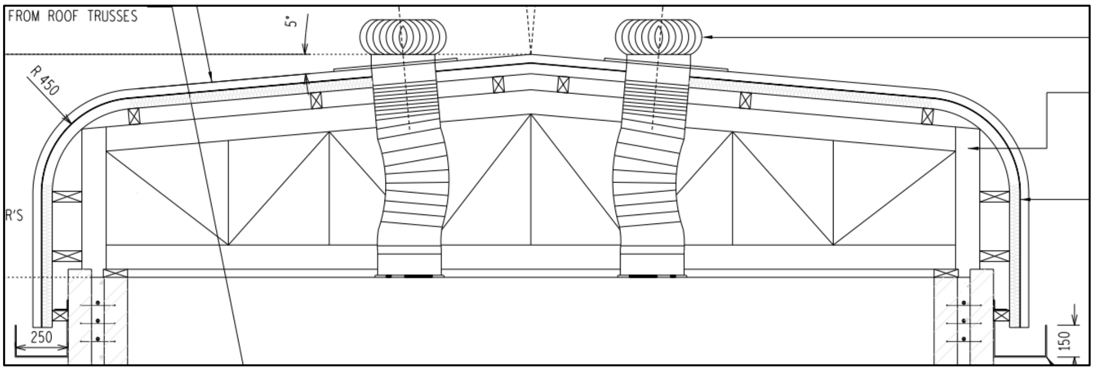


Figure 74: Typical section through roof

Wallplates to be 114 x 38 mm SAP fixed at minimum 600 mm c/c into brickwork with GMS hoop iron straps. Roof trusses fixed to and tied down to wallplate with GMS hoop iron and into ring beam, as per Section 8.2.4/b.).

Safintra or equivalent approved 0.80 mm thick 700 mm wide cover "Saflok 700" aluminium interlocking roof sheeting, with concealed fixing. Cranked ridge and bullnose cranked eaves (450 mm radius) as per drawings / detail. Roof pitch at 5°. Colour to be "Dark Brown". Longitudinal joints shall have lapped or interconnecting joints, which shall be fully weather- sealed. Simple butt joints and butt straps will not be acceptable. Joints, sealants and the like shall be designed to be capable of accommodating thermal movements of all flashings.

Sisalation FR430 fire retardant aluminium foil insulation, installed as per manufacturer's specification. Single layer industrial double-sided radiant barrier laid on 50 mm tich "Factorylite®" thermal insulation, making sure no gaps are left between adjacent sheets.

Figure 75: Aerial perspective showing roof

Sheeting to be earthed to Substation earth grid and ring earthing in roof, as per detail drawings and annotations provided.

Rates for profiled sheet roofing and rolled edges, ridges, flashing pieces and the like, comprising of metal, fibre-cement, plastic and the like, to include fixing accessories, including poly-closures/buttons, rivets and cups as recommended by manufacturer/supplier.

Sheet metal flashings shall have minimum 100 mm laps and linings to gutters.

Cappings, closure pieces, flashings, trims, sills, gutters, fillers, spacers, tapes, sealants, fixings and the like, which are not explicitly specified, shall be of types as recommended by the sheeting manufacturer.

Under-roof membrane (sheet sarking) to be lapped into gutters below flashing, according to manufacturer's specifications. All rainwater goods to be aluminium, as indicated on the drawings. Colour to match that of the roof sheeting (Dark Brown).

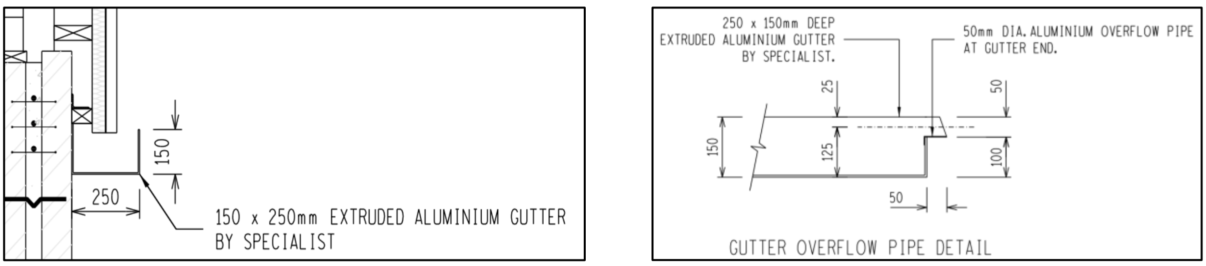


Figure 76: Typical aluminium gutter and overflow details

8.2.7 Ceilings

a.) Battery Room

4mm thick non-combustible fibre cement panel suspended ceiling, or approved equivalent, on 38 x 38 mm battens @ 500 mm c/c's, with gypsum cover cornice, at the height as indicated on the drawings, and above the cable trays.

Being considerably lighter than air, the hydrogen given off during battery charging will rise and accumulate in the highest locations of ceilings and overhead structures. All such high points shall be vented to the atmosphere as described in the ventilation section 3.4 of the Eskom Battery Room reference document.

The ceiling shall be given the same paint treatment as specified for the walls – see Section 8.2.5.

Ceiling boards shall be screwed into place with screws, nails are not permitted. Ceiling construction shall not consist of any metal parts except for the screws used to mount the ceiling boards.

b.) All other rooms

Skimmed 9.5 mm Rhinoboard ceiling on 38 x 38 mm treated SAP battens @ 500 mm c/c's, with 25 x 25 mm aluminum shadowline cornice/perimeter trim, at height as indicated on the drawings, and above the cable trays.

c.) General ceiling notes:

i. Suspended battens shall be accurately set out, to be free from undulations affecting the level or appearance of the ceiling.

ii. The ceiling support grid/battens shall be securely fixed with additional bracing and stiffening as necessary to provide a rigid system.

iii. Light fittings, grilles, fire and smoke barriers and the like shall be in the correct positions relative to the ceiling battens, prior to commencing installation. Common setting-out points shall be used.

iv. The plasterboard sheets shall be installed in accordance with the manufacturer's recommendations.

Trap doors are to be provided in the Control Room and Battery Room, as indicated on plan. Trap doors are to be positioned such that practical roof void access is possible, i.e. a minimum of 1,000 mm distance from the internal wall face - as indicated on the drawings.

Trap door size is to be 550 x 550 mm and positioned between the centres of roof trusses, with 2 x (two n.o.) brass pad bolts fitted per door.

All gaps at junctions with walls, cavity barriers, ducts, pipes and other penetrations shall be sealed using tightly packed mineral wool, intumescent sealant or other approved fireproof material, to prevent penetration of smoke and flames.

8.2.8 Ventilation

Figure 77: Exterior view showing airbricks, wall mounted extractor fan and roof ventilators.

a.) Battery Room

Ventilation by means of extractor fan, fitted with weather cowl on exterior, as per Mechanical Engineer's specifications.

Air supply by means of 600 x 600 x 300 mm precast concrete Wintec "Winblok® WB66(B)" unit, factory fitted with standard 6 x 20 mm solid steel burglar bars by Wintec. The Winblok unit is to come complete with natural anodized aluminium fixed louvres, "Winlouvre® WL(A)66F", fitted using non-ascetic silicone sealant (refer to drawing Sheet D-WC-8118-18-04).

b.) <u>Control Room</u>

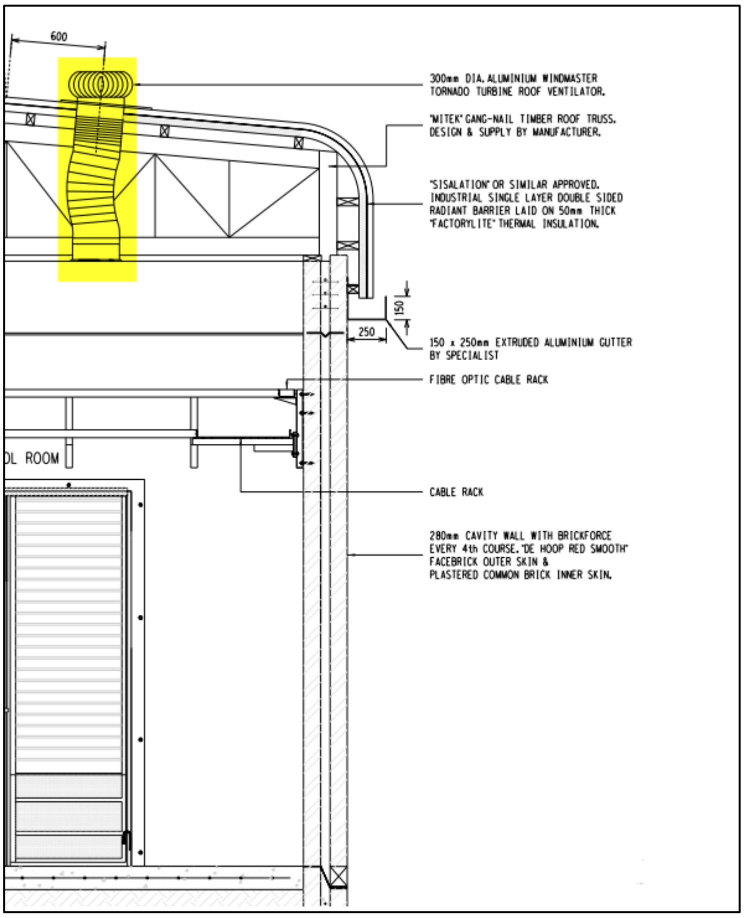


Figure 78: Typical section showing roof ventilators

Ventilation provided by means of airbricks (refer to Section 8.2.4) and 2 x (two n.o.) 300 mm Ø aluminium "Windmaster Tornado Turbine" roof mounted ventilators, installed according to manufacturer's instructions with matching ducting and collar / diffuser fitted in ceiling.

c.) <u>Ablution Facility – Toilet</u>

Ventilation provided by means of airbricks (refer to Section 8.2.4) and 600 x 600 x 300 mm precast concrete Wintec "Winblok® WB66(B)" unit, factory fitted with standard 6 x 20 mm solid steel burglar bars by Wintec. The Winblok unit is to come complete with natural anodized aluminium fixed louvres, "Winlouvre® WL(A)66F", fitted using non-ascetic silicone sealant (refer to drawing Sheet D-WC-8118-18-04).

8.2.9 Service risers and shafts

SABS approved Nutec fibre cement, or approved equivalent, cable duct exterior covers as per detail drawings and annotations (drawing Sheet D-WC-8118-18-01).

Refer to drawing Sheet D-WC-8118-18-03 for lighting layout with legend of luminaire types on interior and exterior of the building.

Figure 79: Cable ducts highlighted on exterior

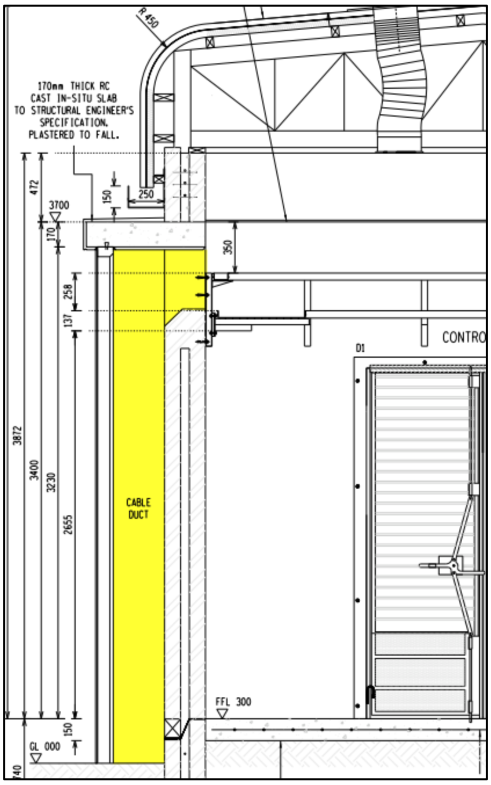


Figure 80: Typical section through cable duct, highlighted in yellow

8.2.10 Doors, windows, carpentry

All timber shall be free from decay or active insect attack, with no knots wider than half the section width. No knots, pitch pockets, splits and shakes will be allowed on faces to be exposed in finished work.

Doors, windows and accompanying ironmongery shall be as per the door and window schedule included on the drawing Sheet D-WC-8118-18-04.

To prevent fluid discharge, the doorway/threshold to the Battery Room shall be elevated with a bund wall matching the height of the skirting level of the adjacent interior floor finish, to contain any spill or leak inside the room.

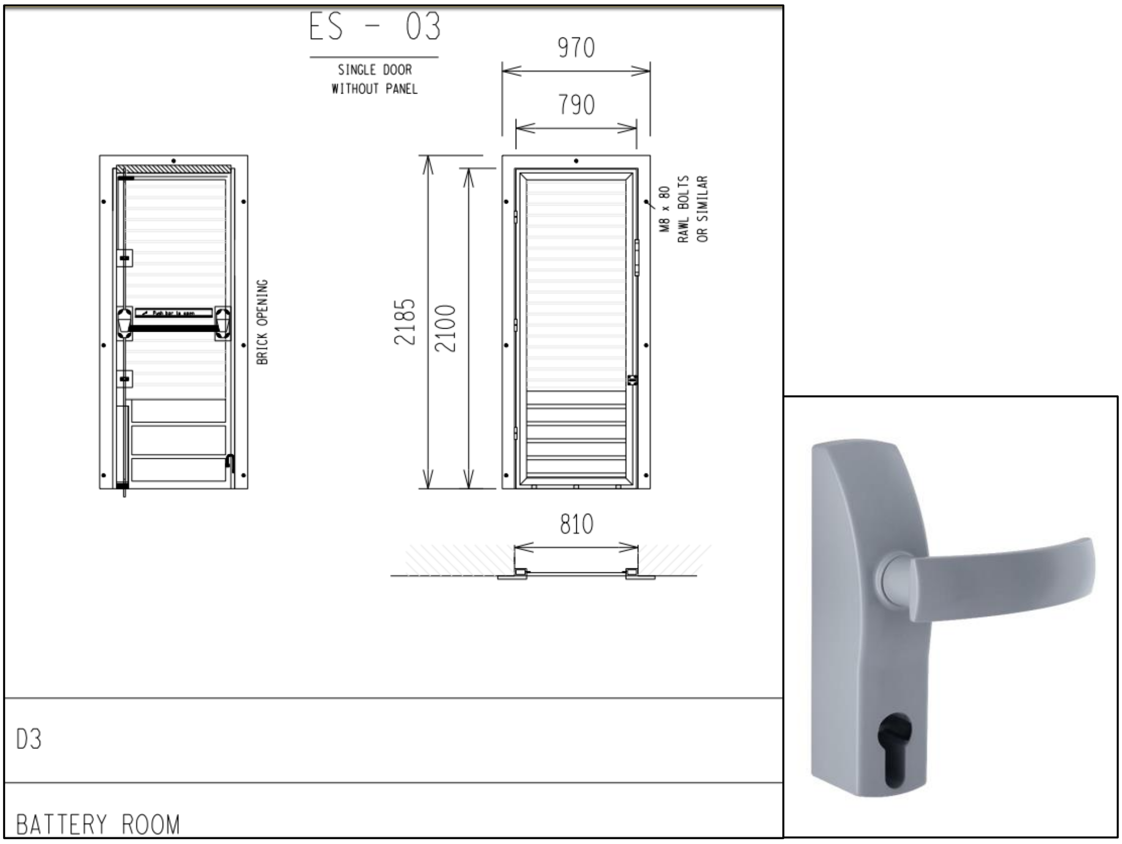


Figure 81: Excerpt from door and window schedule showing the Battery Room door with panic hardware and accompanying external access handle on to the right thereof.

8.2.11 Sanitary ware and brassware

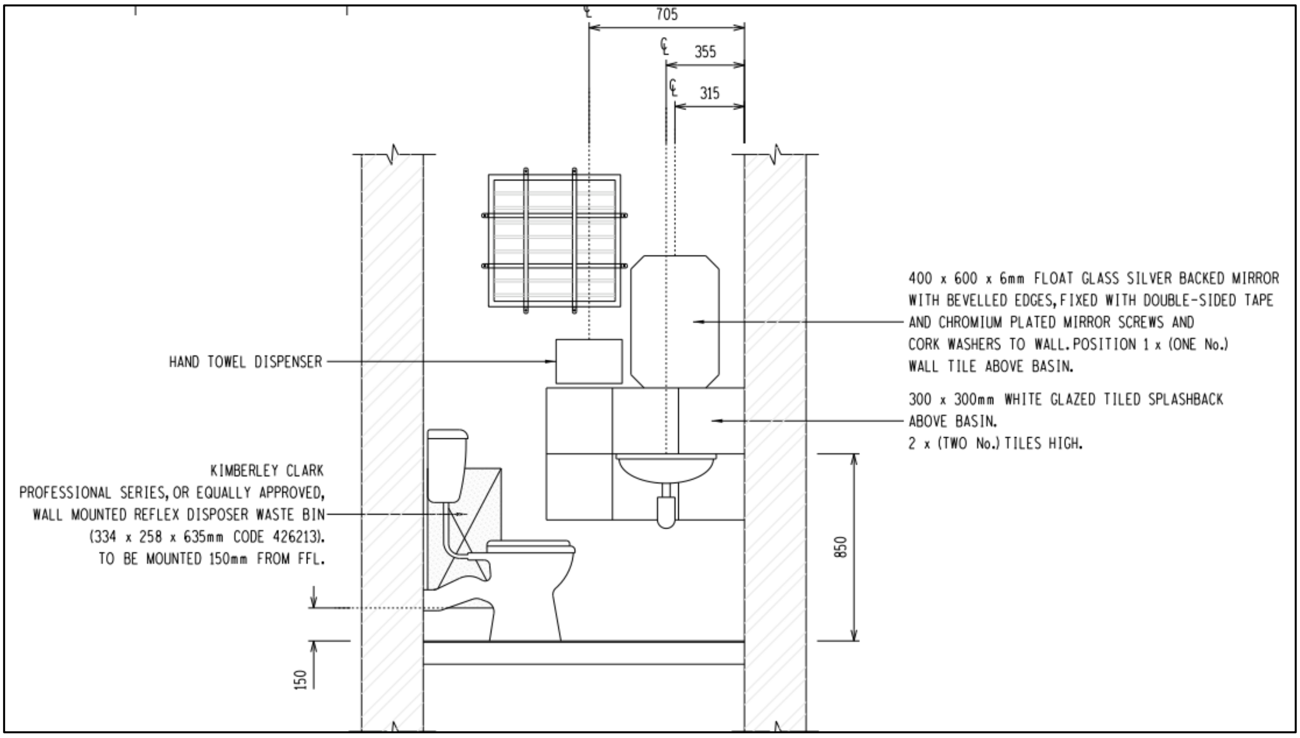


Figure 82: Typical section through the Ablution Facilty, showing fixtures and accessories

a.) <u>Ablution Facility – Toilet</u>

WC is to be Vaal Sanitary ware Protea (product code 750200), or approved equivalent, floor mounted white vitreous china pan comprising 90° outlet. Matching cistern, seat, lid and fitments. Cobra Star CP, or approved equivalent, stop cock/valve.

Hand basin to be Vaal Bantam 7030, 455 x 290 mm, or approved equivalent, white vitreous china complete with wall brackets and matching fixation bolts as per manufacturer's installation instructions. CP plug and chain to be included. Cobra 107EC-15 Star cold water bib tap, or approved equivalent.

Figure 83: Vaal Protea WC and cistern

Figure 84: Vaal Bantam hand basin and fixation bolts

b.) <u>Accessories</u>

i. 300x300mm white glazed tiled splashback above/below top of basin – as indicated on internal elevations on drawing Sheet D-WC-8118-18-04.

ii. 6mm float glass silver backed 400 x 600 mm mirror with bevelled edges, fixed with double-sided tape and chromium plated mirror screws and cork washers to wall. Position/bottom edge to be 1x (one n.o.) wall tile above basin.

iii. Kimberly Clark Professional Series square toilet tissue dispenser with locking mechanism (130 x 135 x 256 mm), or approved equivalent. White in colour.

iv. Kimberly Clark Professional Series wall mounted Reflex disposer waste bin (334 x 258 x 635 mm code 426213), or approved equivalent. Mounted with bottom 150mm above finished floor level, to allow for cleaning underneath.

c.) Battery Room

1 x (one n.o.) Vaal vitreous china white glazed drainer on matching wall brackets, installed as per drawings and according to manufacturer's specifications. Drainer to drain directly into adjacent sink.

Cobra (no519-21) hand shower to be installed over/above drainer; complete with trigger action control nozzle, wall bracket, hose, CP wall mounted elbow action tap, or approved equivalent.

Vaal (code 2360) vitreous china glazed 600 x 400 x 200 mm laboratory sink, complete with wall brackets, fixation bolts matching manufacturer's instructions, plug and chain, 38 mm acid resistant waste pipe, or approved equivalent.

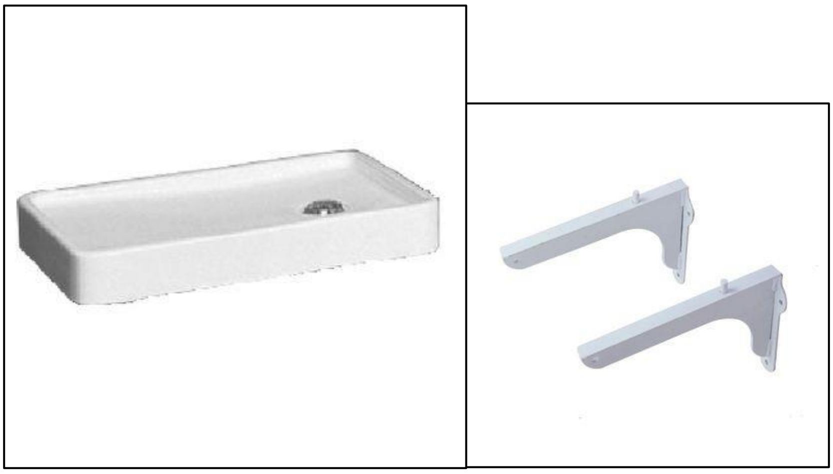


Figure 85: Vaal drainer with matching wall bracket

Cobra wall mounted elbow action tap with threaded spout to be installed over/above and centered on sink. 38 mm diameter acid resistant waste pipe supported with halved pipe holder.

Figure 86: Vaal 600x400mm lab sink

8.3 Final Bill of Materials & Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

WCOU_BOM-18-04

JOB NAME	Ystervark 66 - 132 kV Substation
JOB NUMBER:	153272156-00003
BOM TYPE:	Final
PREPARED BY :	AECOM
Tel No	Tel: 021 950 7500
DATE PREP. :	03 April 2020

LASTEST REV : 0

ARCHITECTURE BILL OF MATERIALS & QUANTITIES

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	B, P&G %	LABOUR & PLANT RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	SITE CLEARANCE										
	Site clearance										
	Digging up and removing rubbish, debris, vegetation, hedges, shrubs, bush, etc and trees not exceeding 200mm girth	m²	**62**								
	Stripping average 100mm thick layer top soil and removing from site	m²	**21**								
	Rip, scarify and compaction of surfaces to 93% Mod. AASHTO density										
	Compaction of cut platform level etc including scarifying for a depth of 100mm, breaking down oversize material, adding suitable material where necessary and compacting to 93% Mod AASHTO density	m²	**21**								
	EXCAVATION, FILLING, ETC OTHER THAN BULK (PROVISIONAL)										
	Excavations, etc										
	Excavation in earth not exceeding 2m deep										
	Trenches	m³	**26**								
	Back excavation of vertical sides of excavation in earth for working space including backfilling compacted to 98% Mod AASHTO density										
	Exceeding 500mm and not exceeding 1 500mm deep for placing and removing formwork 500mm away from excavated face	m²	**67**								
	Extra over all excavations for carting away										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Surplus material from excavations and/or stock piles on site to a dumping site to be located by the Contractor	m³	19								
	Risk of collapse of excavations										
	Sides of trench and hole excavations not exceeding 1500mm deep	m²	67								
	Keeping excavations free of water										
	Keeping excavations free of all water other than subterranean water	Item	1								
	Filling, etc										
	Earth filling obtained from the excavations and/or prescribed stock piles on site compacted to 98% Mod AASHTO density										
	Backfilling to trenches, holes, etc	m³	7								
	Imported clean fill material supplied by the contractor compacted to 98% Mod AASHTO density										
	Under floors, steps, pavings, etc	m³	18								
	Prescribed density tests on filling										
	Modified AASHTO Density test	No									
	CONCRETE, FORMWORK AND REINFORCEMENT										
	UNREINFORCED CONCRETE										
	15MPa/10mm concrete										
	Filling to cavity of hollow walls	m³	1								
	UNREINFORCED CONCRETE CAST AGAINST EXCAVATED SURFACES										
	15MPa/10mm concrete										
	Surface blinding under footings and bases	m³	2								
	30MPa/19mm concrete										
	Surface beds	m³	9								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	REINFORCED CONCRETE CAST AGAINST FORMWORK										
	30MPa/19mm concrete										
	Strip footings	m³	13								
	Slabs including beams and inverted beams	m³	1								
	Columns in foundations	m³	0								
	Columns	m³	1								
	TEST CUBES										
	Making and testing 150 x 150 x 150mm concrete strength test cube (1 set = 3no. cubes)	Sets	5								
	CONCRETE SUNDRIES										
	Finishing top surfaces of concrete smooth with a powerfloat										
	Surface beds, slabs, etc	m²	64								
	Finishing top surfaces of concrete smooth with a wood float										
	Surface beds, slabs, etc	m²	4								
	ROUGH FORMWORK (DEGREE OF ACCURACY III)										
	Rough formwork to sides										
	Strip footings	m²	33								
	Rectangular columns in foundations	m²	4								
	ROUGH FORMWORK (DEGREE OF ACCURACY II)										
	Rough formwork to sides										
	Rectangular columns not exceeding 3,500mm high	m²	15								
	Edges, risers, ends and reveals not exceeding 300mm high or wide	m	33								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	ARCHITECTURAL BUILDERS WORK										
	Rough formwork to soffits										
	Slabs propped up not exceeding 1,500mm high	m²	2								
	Slabs propped up exceeding 1,500mm and not exceeding 3,500mm high	m²	4								
	Slabs propped up exceeding 3,500mm and not exceeding 5,000mm high	m²	2								
	Boxing in rough formwork to form										
	25 x 25mm Chamfer to exposed edge of columns, beams, etc	m	21								
	REINFORCEMENT										
	REINFORCEMENT (PROVISIONAL)										
	Mild steel reinforcement to structural concrete work										
	10mm Diameter bars	t	0.04								
	High tensile steel reinforcement to structural concrete work										
	12mm Diameter bars	t	0.42								
	10mm Diameter bars	t	0.34								
	Mesh reinforcement										
	Type Ref 245 mesh reinforcement in concrete surface beds etc	m²	4								
	Type Ref 617 mesh reinforcement in concrete surface beds etc	m²	56								
	MASONRY										
	FOUNDATIONS										
	Brickwork of solid clay NFP load bearing bricks (7 MPa nominal compressive strength) in class II mortar										
	One brick walls	m²	29								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	280mm Hollow wall of two half brick skins including wire ties	m²	17								
	Mass brickwork	m³	2								
	SUPERSTRUCTURE										
	Brickwork of solid clay NFP load bearing bricks (7 MPa nominal compressive strength) in class II mortar										
	280mm Hollow wall of two half brick skins including wire ties	m²	123								
	One brick walls	m²	30								
	Half brick walls in beam filling	m²	14								
	Brick stiffener columns, 280 x 280mm	m	4								
	Air bricks:										
	229 x 152mm Terra-cotta vermin proofed air bricks built into brick wall.	No	10								
	FACE BRICKWORK										
	Corobrik® 15MPa De Hoop Red clay facebrick, bedded and jointed in Class II mortar and pointed with flush vertical and flush horizontal joints and perpends										
	Extra over NFP brickwork for face brickwork in foundations (Provisional).	m²	10								
	Extra over NFP brickwork for face brickwork.	m²	132								
	Extra over NFP brickwork for face brickwork in beamfilling	m²	14								
	Extra over NFP brickwork for face brickwork in piers.	m²	3								
	Labour and material in brick-on-edge cill 170mm wide sloping and slightly projecting on and including cement mortar bed and pointing on top and 110mm high face.	m	1								
	Labour and material in brick-on-edge lintel course 115mm wide and 115mm high and pointing on face and 115mm wide projecting soffit.	m	10								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	ARCHITECTURAL BUILDERS WORK										
	WINBLOK PRECAST										
	Wintec® Winblok precast concrete, bedded and jointed in Class II mortar and pointed with flush vertical and flush horizontal joints and perpends										
	Winblok WB66 (B) 600 x 600 x 300mm precast concrete window, complete with factory-fitted aluminium "Winlouvre WL (A) 66F" natural anodised louvres, and standard 20 x 6mm galvanised steel burglar bars, all in accordance with manufacturer specifications and architect's details	No	2								
	BRICKWORK SUNDRIES										
	Mortar fillets										
	Splayed mortar fillet one course high in 50mm cavity	m	43								
	Closing cavity of hollow walls										
	Closing 50mm cavity of hollow walls vertically with brickwork half brick wide	m	34								
	Closing 50mm cavity of hollow wall horizontally with one course of brickwork in header bond set slightly sloping	m	10								
	Brickwork reinforcement										
	75mm Wide reinforcement built in horizontally	m	1 361								
	150mm Wide reinforcement built in horizontally	m	428								
	Prestressed fabricated concrete lintels including necessary temporary supports										
	110 x 75mm Lintels in lengths not exceeding 3m	m	13								
	Galvanized hoop iron cramps, ties, etc										
	30 x 1,6mm Roof tie 1500mm long with one end built into brickwork and other end fixed to timber	No	56								
	Core drilled holes in brickwork										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	20mm Diameter hole through one brick wall	No	2								
	WATERPROOFING										
	DAMPPROOFING OF WALLS AND FLOORS										
	One layer of 375 micron "Consol Plastics Brikgrip DPC" embossed damp proof course										
	In walls	m²	26								
	One layer of 250 micron "Consol Plastics Brikgrip DPC" embossed damp proof course										
	Under surface beds	m²	60								
	WATERPROOFING TO ROOFS, BASEMENTS, ETC										
	Prepare surfaces and apply dual layer (4mm 3mm) "Index Fidia" torch-on waterproofing on cement screed or plastered surfaces, inclusive of all primers, laps, ends, etc. all in accordance to manufacturers specifications										
	On flat roofs	m²	6								
	On tops and sides of beams	m²	7								
	Additional membrane for dressing around 300mm diameter roof turbine ventilator	No	2								
	PROTECTIVE ROOFING PAINT										
	Two coats "Silvakote" bituminous aluminium paint										
	On waterproofing to roofs and parapet walls	m²	6								
	JOINT SEALANTS, ETC										
	Approved silicone pointing										
	Between timber door frames and walls etc	m	33								
	To sanitary ware	m	2								
	ROOF COVERING										
	ROOF COVERINGS										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	ARCHITECTURAL BUILDERS WORK										
	Safintra or similar approved 0.8mm "700mm profile" aluminium interlocking roof sheeting (dark brown colour) roof sheeting with 5° pitch, cranked ridge, bullnose cranked eaves and "FR430" fire retardant aluminium foil sisalation with 50mm thick "Factorylite" thermal insulation complete, all in accordance with architect drawing details and specifications										
	Roof sheeting not exceeding 5° pitch	m²	58								
	Vertical cranked roof sheeting	m²	24								
	0.8mm Verge cappings overall girth 600mm	m	15								
	Cut out for 300mm roof turbine ventilator (elsewhere measured)	No	2								
	ROOF VENTILATORS										
	300mm Diameter aluminium "Windmaster" tornado turbine roof ventilator	No	2								
	ROOF AND WALL INSULATION										
	Super Sisalation® FR430 or equal and approved fire retardant aluminium foil double sided insulation reflective foil										
	Insulation sheeting laid taut over purlins (at approximately 900mm centres) and fixed concurrent with roof covering with minimum 150mm stapled laps including galvanised steel straining wires at not exceeding 400mm centres and double-sided tape at edges where required	m²	82								
	Factorylite 50mm thick thermal insulation fixed to underside of sheeting	m²	82								
	CARPENTRY AND JOINERY										
	ROOFS ETC										
	Roof construction										
	Sawn softwood grade 5 SA Pine TT										
	Design, supply and install "Mitek" roof truss consisting of 114 x 38mm rafters fixed to 114 x 38mm wallplates, as per engineer's details	m²	58								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Eaves and verges										
	High density fibre cement fixed with countersunk brass screws										
	12 x 150mm Fascia boards complete with white PVC H-profile joiners	m	24								
	DUCTS, ETC.										
	Louvred cable duct covers consisting of 69 x 44 wrought meranti cleats bolted to brickwork with 1000 x 225 x 12mm fibre cement horizontal slats complete, all accordance with architect details and specifications										
	Louvre cover 1420 x 3710mm	No	2								
	Louvre cowl cover 730 x 730mm	No	1								
	CEILINGS AND PARTITIONS										
	CEILINGS, ETC.										
	Nailed up ceilings										
	9.5mm Rhinoboard with 63mm wide strips of mesh scrim nailed over joints and the whole finished with cretestone skim plaster trowelled to a smooth polished surface on 38 x 38mm treated pine brandering @ 500mm centres										
	Ceilings fixed to underside of timber rafters	m²	26								
	4mm Fibre cement boards on 38 x 38mm treated pine brandering @ 500mm centres										
	Ceilings fixed to underside of timber rafters	m²	13								
	Sundries										
	Extra-over gypsum ceilings for 600 x 600mm flush access hatch complete with frame, hinges, securing clip and support gridwork	No	1								
	Extra-over fibre cement ceilings for 600 x 600mm flush access hatch complete with frame, hinges, securing clip and support gridwork	No	1								
	Cornices, perimeter trim, etc										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Cornice										
	Donn T SM_25s shadowline cornice to skimmed ceilings	m	21								
	75mm Gypsum coved cornice	m	15								
	IRONMONGERY										
	BATHROOM ACCESSORIES										
	Supply and install complete										
	Kimberley Clark Professional Series 130 x 135 x 256mm square toilet tissue dispenser with locking mechanism complete	No	1								
	Kimberley Clark professional series wall mounted 300 x 200 x 120mm hand towel dispenser	No	1								
	Kimberley Clark professional series wall mounted 334 x 258 x 635mm (Code 426213) reflex waste disposal bin	No	1								
	Mirrors, supply and install complete										
	400 x 600 x 6mm Float glass silver backed mirror with bevelled edges, with concealed fixing to walls including chromium plater mirror screws and cork washers to walls	No	1								
	EXTRACTION										
	Design, supply and install complete										
	Wall mounted extractor fan, (at least) 20 L/s @ 60 Pa (external static pressure)	No	1								
	METALWORK										
	MENTIS										
	MENTIS GRATING										
	Mentis rectagrid "RS40"										
	Bearer bars framed all round with 40 x 3mm flat to fill entire frame	m²	2								
	Cast-in angles										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	45 x 45 x 5mm Equal angle with fish plates 50mm wide x 120mm long x 5mm thick at 250mm c/c cast-in	m	8								
	GALVANISED STEEL DOOR FRAMES										
	Purpose made steel door frames consisting of 32 x 32mm reinforced frame complete with "U" section inner frame, "Z" section outer frame, M8 x 80mm raw bolts, integrated 4 x 80mm bullet hinges per door leaf, and 40 x 40 x 3mm angles - all in accordance with architect's details and specifications										
	Frame to suit D1, overall size 1765 x 2475mm	No	1								
	Frame to suit D2 & D3, overall size 970 x 2185mm	No	2								
	GALVANISED STEEL DOOR										
	Purpose made steel doors complete with 75 x 1.2mm interlocking slats, 30 x 6mm self-adhesive rubber sealing strips and integrated 3 point locking system, cabin hooks and all required factory-fitted ironmongery - all in accordance with architect's details and specifications										
	D1 dual swing doors, overall size 1600 x 2400mm (800mm wide door leafs)	No	1								
	D2 single doors, overall size 790 x 2100mm	No	2								
	FLOOR TRIMS										
	Galvanised mild steel angles, fixed to concrete with lugs and anchors										
	Stair edging 50 x 50 x 2.5mm	m	28								
	PLASTERING										
	SCREEDS										
	Screeds wood floated, on concrete										
	30mm Thick on floors and landings	m²	2								
	30mm Thick on treads and risers	m²	5								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	ARCHITECTURAL BUILDERS WORK										
	Average 50mm thick on floors to falls and currents	m²	6								
	30 x 30mm Triangular mortar fillet against walls	m	24								
	GRANOLITHIC										
	Untinted granolithic on concrete										
	40mm Thick on floors and landings, with brushed non-slip finish	m²	3								
	40mm Thick on treads and risers, with brushed non-slip finish	m²	1								
	Skirting 100mm high	m	8								
	INTERNAL PLASTER										
	One coat cement plaster wood floated for tiles, on brickwork										
	On walls	m²	1								
	On narrow widths not exceeding 300mm wide	m²	8								
	One coat cement plaster steel trowelled, on brickwork										
	On walls	m²	191								
	EXTERNAL PLASTER										
	One coat cement plaster to brickwork										
	On walls	m²	18								
	On narrow widths	m²	9								
	One coat cement plaster to concrete										
	On soffits in narrow widths	m²	3								
	On projecting and isolated columns	m²	15								
	On slab edges	m²	2								
	Sundries										
	75mm Wide drip mould to underside of plastered soffits externally	m	10								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	TILING										
	WALL TILING										
	White glazed 300 x 300mm ceramic wall tiles, fixed to plastered walls including approved adhesive and grouting, etc. all in accordance to manufacturer specifications										
	On walls	m²	1								
	PLUMBING										
	RAINWATER DRAINAGE										
	Watertite, or equal approved										
	250 x 150mm Extruded aluminium gutters fixed to fibre cement fascia complete with brackets and fixing screws	m	24								
	Extra over 250 x 150mm rectangular gutter for stopped ends with 50mm diameter overflow spigot	No	1								
	Class 6 uPVC Pipes and fittings										
	75mm Diameter rainwater downpipes fixed to walls	m	10								
	Extra over 75mm diameter rainwater pipe for swan neck projections	No	2								
	Extra over gutter for outlet for 75mm diameter pipe	No	3								
	Extra over 75mm diameter rainwater pipe for shoes	No	3								
	SANITARY FITTINGS										
	Vaal, or equal approved										
	Vaal Bantam 455 x 290mm white vitreous china wash hand basin complete with wall brackets	No	1								
	Vaal Protea White vitreous china concealed toilet pan and cistern complete with plastic seat and lid	No	1								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	WASTE UNIONS ETC										
	Cobra, or equal approved										
	32mm Basin waste union chromium plated with plug unslotted (Code: 301)	No	1								
	40mm "Cobra", or equal approved, anti theft sink plug (Code: 309-40)	No	1								
	TRAPS ETC										
	uPVC										
	50mm Deep seal "P" or "S" trap	No	1								
	TAPS, VALVES, ETC										
	Cobra, or equal approved										
	Chrome cold water stop cock/valve	No	1								
	Chrome pillar tap	No	1								
	SANITARY PLUMBING										
	Class 12 PVC class 12 pipes to SABS 967 standards										
	50mm Pipes	m	2								
	110mm Pipes	m	2								
	Extra over Class 12 PVC class 12 pipes to SABS 967 standards for fittings										
	50mm Access bend	No	2								
	50mm Junction	No	1								
	110mm Pan connector	No	1								
	110mm Bends	No	2								
	110mm Junction	No	1								
	110mm "GI Two-way" vent valve	No	1								
	110mm Rodding eye	No	1								
	Testing										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Testing waste pipe system	Item	1								
	COLD WATER SUPPLY										
	Class 2 copper pipe										
	15mm Pipes chased in walls	m	6								
	Extra over class 2 copper pipes for solvent welded fittings										
	90° Elbows to 15mm diameter pipes	No	2								
	Valves										
	15mm diameter ball valve	No	1								
	VALVE BOXES, METER BOXES, ETC										
	Water meter										
	Water meter including meter box	No	1								
	Water meter chamber	No	1								
	Polycop piping										
	22mm Piping laid in trenches	m	6								
	Water connection to municipal										
	Water supply connection	No	1								
	Testing										
	Testing water pipe system	Item	1								
	PAINTWORK										
	PAINTWORK ETC TO NEW WORK										
	On internal smooth plastered surfaces										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon Cashmere" to approved colour										
	On walls and columns	m²	199								
	On external smooth precast concrete surfaces										

AECOM | TRANSNET GROUP CAPITAL | Final Design Package:

Ystervark 66 - 132 kV Substation

- Book 1

Job Number: 153272156-00003

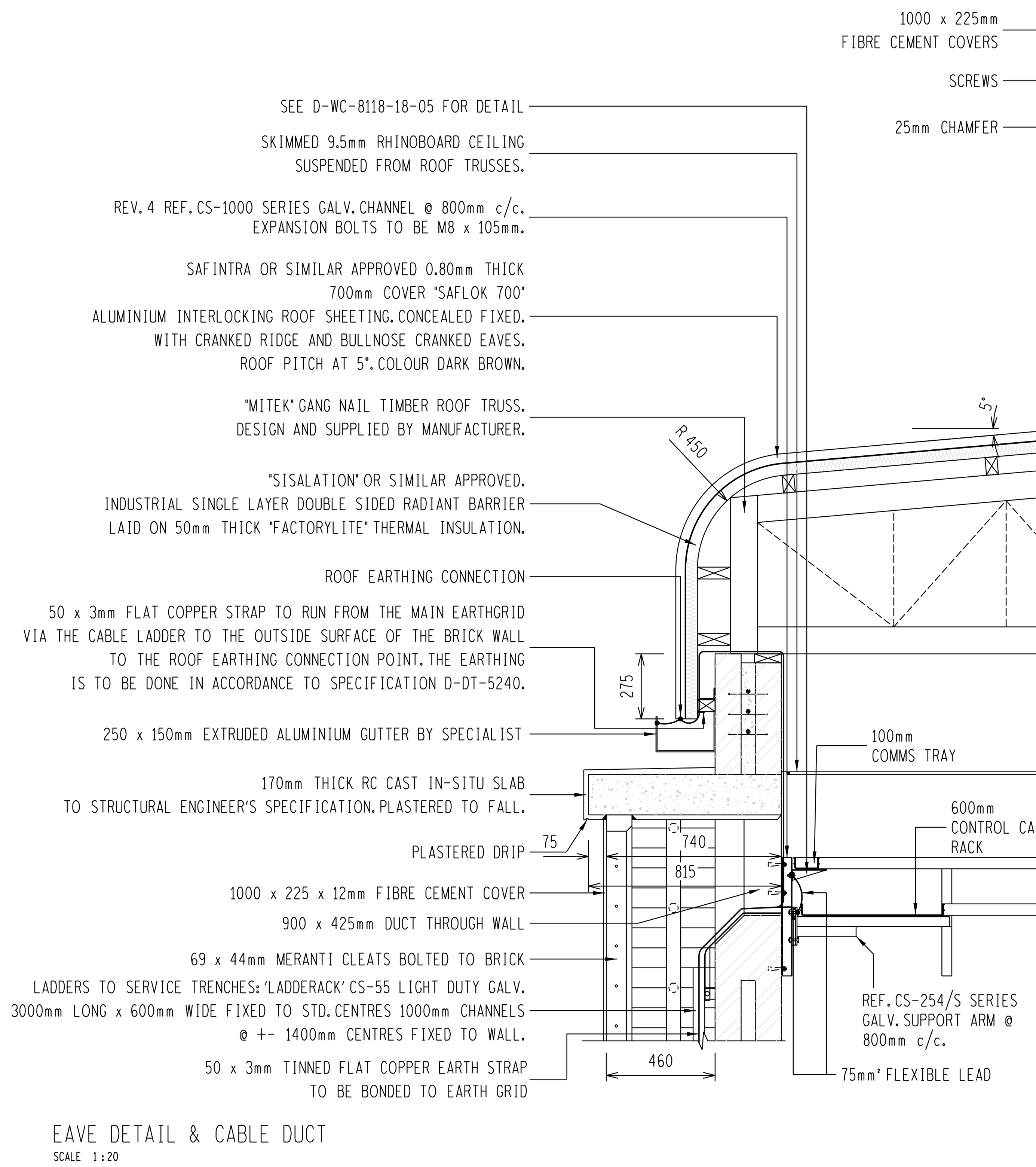
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	ARCHITECTURAL BUILDERS WORK										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon Wall & All" to approved colour										
	Precast concrete window frames	m²	1								
	On external smooth plastered surfaces										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon Wall & All" to approved colour										
	On walls	m²	27								
	On soffits	m²	3								
	On sides of beams	m²	2								
	On columns	m²	15								
	On internal plasterboard surfaces										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon Super Acrylic Polvin Matt" to approved colour										
	On ceilings	m²	27								
	On internal fibre-cement board surfaces										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon PSB 800" gloss enamel to approved colour										
	On ceilings	m²	13								
	On external fibre-cement board surfaces										
	Prepare surface and apply one coat "Plascon" alkali-resistant masonry primer and two coats "Plascon PSB 800" gloss enamel to approved colour										
	On louvres	m²	21								
	On fascia and barge boards not exceeding 300mm girth	m	24								
	On galvanized mild steel										

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Prepare and clean surfaces, apply one coat "Plascon PP 1000" metal primer, one coat "Plascon PU 800" universal undercoat and two coats "Plascon PSB 800" gloss enamel to approved colour										
	On steel door jamb linings, frames, etc	m²	9								
	On steel louvre doors	m²	14								
	On burglar bars	m²	1								
	On wood										
	Prepare surface and apply one coat "Plascon Woodprime Pink"										
	Backs of frames, lining, etc not exceeding 300mm wide	m	18								
	Prepare surfaces and apply one coat "Plascon Woodprime Pink", one coat "Plascon PU 800" universal undercoat and two coats "Plascon PSB 800" gloss enamel to approved colour										
	On door frames	m²	2								
	FLOOR EPOXY PAINTS										
	Specialist floor coatings applied to cement screed floors, all in accordance with manufacturer specifications										
	Mastertop 1200 Plus primer two layers "Mastertop 1210 Plus" aggregate top coats in light grey colour	m²	2								
	Sika "Purigo 5 S" penetrating cement sealer	m²	34								
	Sika "Purigo 5 S" penetrating cement sealer on treads and risers	m²	5								
	Sikafloor 381 self-levelling screed 5mm thick with epoxy primer in light grey colour	m²	13								
	FIRE STOPPING										
	120min Fire Stopping Sealants										
	To 20mm diameter core drilled holes though one brick walls	No	2								

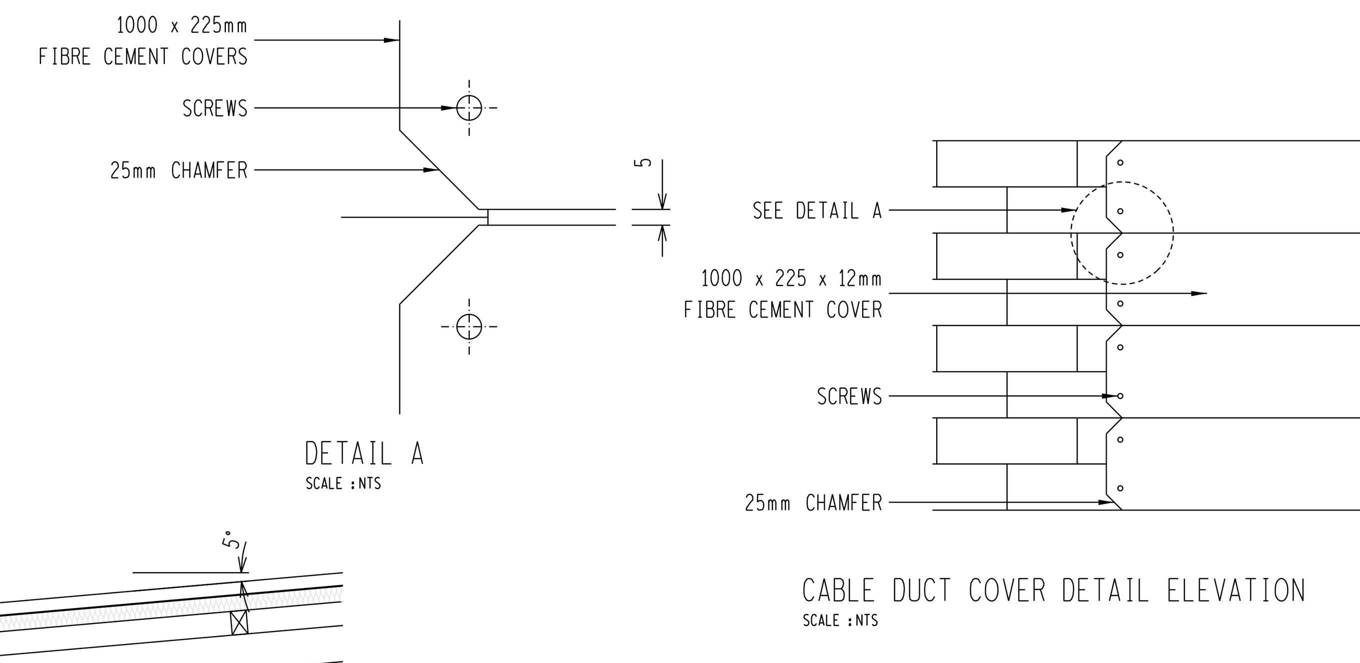
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		ARCHITECTURAL BUILDERS WORK									
	Between fibre cement ceiling boards and walls	m	**15**								
	EXTERNAL WORKS										
	ROADWORK, PAVING, ETC										
	Paving to rainwater control										
	600 x 600 x 80mm Precast concrete paving slabs, laid on compacted surfaces	No	**2**								

8.4 Detailed Drawings

Drawing No	Drawing Name	Rev
D-WC-8118-18-01	Relay House Building Ground Plan & Details	00
D-WC-8118-18-02	Relay House Building Elevations & Roof Plan	00
D-WC-8118-18-03	Relay House Building Power. Lighting & Basic Signage Layout	00
D-WC-8118-18-04	Relay House Building Door Schedule & Details	00
D-WC-8118-18-05	Relay House Building Sections & Details	00
D-WC-8118-18-06	Relay House Building Foundation & Steel Reinforcing Layout	00

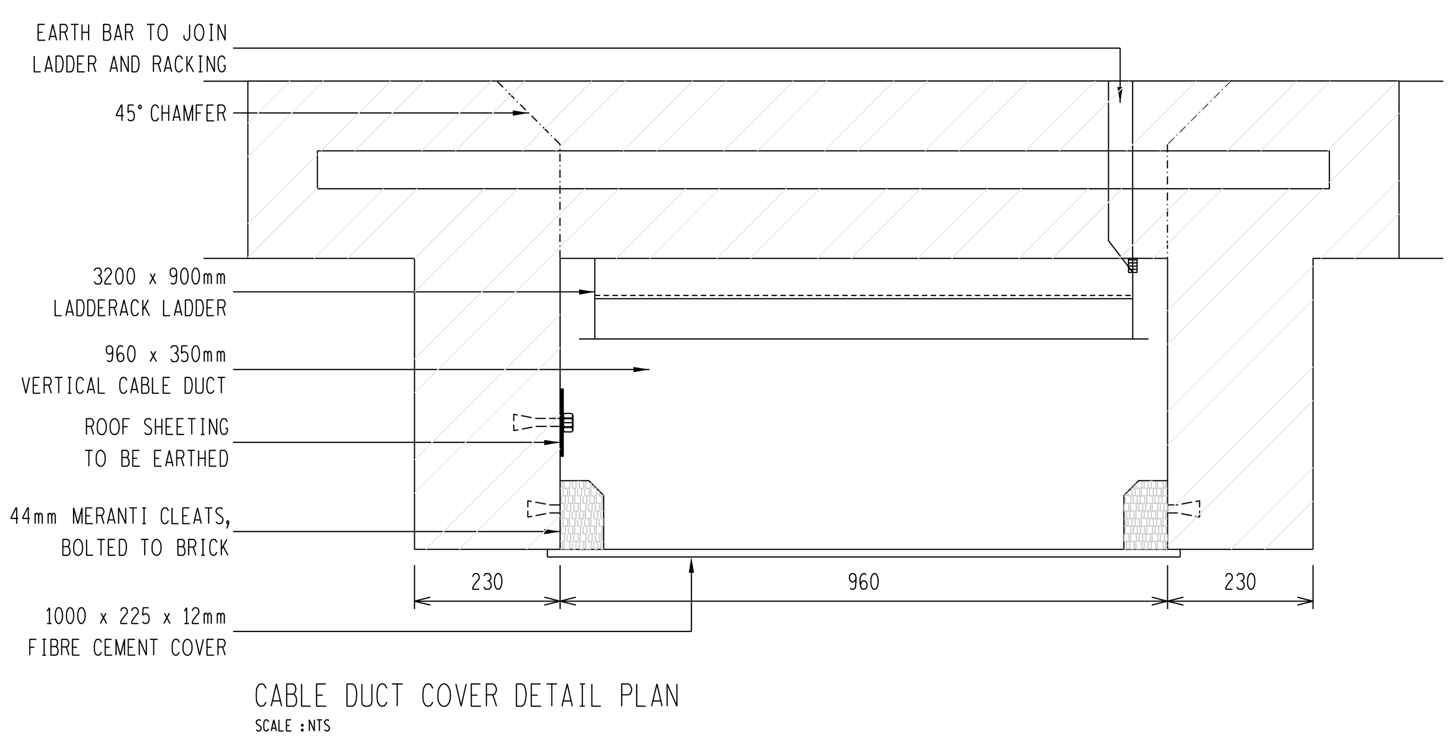


EAVE DETAIL & CABLE DUCT
SCALE 1:20



DETAIL A
SCALE :NTS

CABLE DUCT COVER DETAIL ELEVATION
SCALE :NTS



CABLE DUCT COVER DETAIL PLAN
SCALE :NTS

NOTES (CONTINUED):

PAINT:

INTERNAL WALLS & CEILINGS (EXCLUDING BATTERY ROOM): 1 FILLER COAT, 2 COATS DULUX "WASH 'N WEAR" PVA, OR SIMILAR APPROVED. COLOUR WHITE. FINAL COAT TO BE APPLIED BY CONTRACTOR ONLY AFTER COMMISSIONING OF ALL ELECTRICAL EQUIPMENT BY ESKOM.

INTERNAL WALLS & CEILINGS (BATTERY ROOM ONLY): AKZONOBEL DULUX TRADE "TUFFCOTE WATERBASED EPOXY ENAMEL" PAINT, OR APPROVED EQUIVALENT. COLOUR WHITE. TO BE APPLIED WITH THE APPROPRIATE PREPARATION AND/OR PRIMER. FINAL FINISH TO BE A MINIMUM OF 100 MICRON THICK AND APPLIED TO THE MANUFACTURER'S INSTRUCTIONS.

RAFTER ENDS AND TIMBER : 1 COAT PINK PRIMER, 2 COATS FLAT ENAMEL.

SANITARY WARE:

WC : VAAL SANITARY WARE PROTEA WHITE VITREOUS CHINA WITH SEAT AND LID. COBRA STAR CP STOP COCK/VALVE.

BASIN : VAAL BANTAM 455 x 290mm WHITE VITREOUS CHINA COMPLETE WITH WALL BRACKETS, CP PLUG AND CHAIN. COBRA STAR CP COLD WATER TAP. 300 x 300mm WHITE GLAZED TILED SPLASHBACK ABOVE BASIN - 3 (THREE N.O.) TILES HIGH. 6mm FLOAT GLASS SILVER BACKED MIRROR (400 x 600mm) ABOVE BASIN TO BE PROVIDED.

BATTERY ROOM & WC VENTILATION:

600 x 600 x 300mm PRECAST CONCRETE WINTEC "WINBLOK" WB66 (B) UNIT, FACTORY FITTED WITH STANDARD 20 x 6mm GALV. STEEL BURGLAR BARS BY WINTEC.

WIRE MESH TRAYS:

TRAYS TO BE AS O-LINE GRIDSPAN GS50, 600mm WIDE x 50mm HIGH WITH STD. HDG FINISH MOUNTED ON STD. OLCA22 / 650 SUPPORT ARMS FIXED TO WALL WITH M10 EXPANSION BOLTS. ARMS TO BE @ MAX. 800mm C/C. 100mm COMMS TRAY TO BE FIXED ABOVE 600mm TRAY. REFER TO DRAWING No. D-WC-8118-167-07 FOR FURTHER DETAILS.

LADDER:

TRAY AS ABOVE SUPPORTED ON 3 / 700mm LONG OL3300 CHANNELS FIXED TO WALL @ +- 800mm C.C. LADDER TO BE 3000mm IN LENGTH.
ALL CABLE TRAYS TO BE CONNECTED / BONDED FOR ELECTRICAL CONNECTIVITY TO FORM EARTH BAR.

NOTES:

GENERAL:

THIS SPECIFICATION TO BE READ IN CONJUNCTION WITH ESKOM's STANDARD SPECIFICATION AND GENERAL CONDITIONS OF CONTRACT.
CONTRACTOR TO PAY ALL FEES IN REGARD TO SERVICES SUPPLIED BY AND FOR THE LOCAL AUTHORITY.
PORTABLE LATRINES TO BE PROVIDED AND SERVICED BY CONTRACTOR.
CONTRACTOR TO INCLUDE IN HIS PRICING FOR THE TEMPORARY SUPPLY OF WATER AND POWER FOR CONSTRUCTION PURPOSES. SUPPLEMENTARY TO THIS DOCUMENT, THE ESKOM BATTERY ROOM STANDARD (DOCUMENT IDENTIFIER 240-56177186) IS TO BE USED AS REFERENCE.

FOUNDATIONS:

TO SIZES AND DEPTHS SHOWN. CONCRETE TO BE 30MPa STRENGTH.

WALLS:

BELOW GROUND : TOP TWO LAYERS, BELOW GROUND LEVEL, OF THE OUTER SKIN SHALL BE NFX MASONRY UNITS OF MINIMUM 14MPa COMPRESSIVE STRENGTH. ABOVE THIS THE MASONRY UNITS ARE TO MATCH THE REST OF THE EXTERIOR FACEBRICK SKIN ABOVE GROUND LEVEL (FBX), LAID IN CLASS II MORTAR.
INTERNAL WALLS : RED CLAY R.O.K. BRICKS (MINIMUM COMPRESSION STRENGTH 7MPa).
FIRE WALLS : MASONRY FIRE WALLS SEPARATING BATTERY ROOM FROM ADJACENT ROOMS/SPACES TO TERMINATE AGAINST UNDERSIDE OF ROOF SHEETING. INTERNAL FIRE WALLS SHALL BE 230mm "SINGLE BRICK" WALLS, CONSTRUCTED OF MINIMUM 14MPa NFP STOCK BRICK. BRICKFORCE TO BE INSTALLED AT EVERY THIRD LAYER/COURSE. PENETRATIONS AND OPENINGS IN FIRE WALLS TO BE FIRE STOPPED TO MATCH WALL INTEGRITY AND ACCORDING TO MANUFACTURER'S APPLICATION INSTRUCTIONS.
FACEBRICKS : COROBRIK DE HOOP RED FLUSH JOINTED FBS SMOOTH TEXTURE - IMPERIAL FORMAT - 222x106x73. TO START 1 COURSE BELOW FINAL GROUND LINE. CAVITY WALLS TO BE 110-60-110 SKINS WITH 60mm AS THE CAVITY.
BRICKFORCE : 150mm WIDE GALV. TO FIRST 4 COURSES ABOVE FOUNDATIONS AND TOP 3 COURSES BELOW WALLPLATE. GABLES 75mm WIDTH EVERY 4th COURSE TO RIDGE.
WALLTIES : GALV. "BUTTERFLY" TYPE, 5 PER m² IN WALL, 300mm C/C AT JAMBS.
D.P.C. : GUNPLAS "BRIKGRIP" 375 MICRONS, STEPPED AT FLOOR LEVELS IN CAVITY WALLS AND AROUND OPENINGS.
JOINTS : FACEBRICK, 10mm RAKED. ALL OTHER JOINTS TO BE KEYED FOR PLASTERING. EVERY 4th PERPEND ABOVE STEPPED DPC TO BE RAKED CLEAR TO DRAIN CAVITY.
MORTAR : 1:4 (CEMENT:SAND).

WALL FINISHES INTERNALLY:

15mm THICKNESS, SMOOTH STEEL FLOAT FINISH. MIX 1:1:6 (CEMENT:LIME:SAND). FLOOR DUCTS TO BE BAGGED.

FLOORS - CONTROL ROOM, WC AND LOADING BAY:

150mm THICKNESS 30MPa POWER FLOATED CONCRETE ON 375 MICRON DPM ON SAND FILL COMPACTED IN 150mm LAYERS.
REINFORCING TO BE MESH REF. 617 CARRIED THROUGH INTO STOEP. THRESHOLDS TO BE 40mm MIN.

FLOOR - BATTERY ROOM:

AVOID EXPANSION JOINTS. FLOOR SHALL BE GIVEN A UNIFORM CEMENT SCREED FALL, WITH A FALL / SLOPE OF NO LESS THAN 1:200 TOWARDS THE DOOR. THE DOORWAY / THRESHOLD SHALL BE ELEVATED TO FORM A BARRIER TO MINIMUM 100mm IN HEIGHT FROM ADJACENT INTERIOR FLOOR FINISH.

N.B.: FLOOR LEVELS TO BE LAYED TO A TOLERANCE OF 0.5m PER METRE WITH A MAXIMUM OF 2mm DIFFERENCE OVER THE LENGTH.

STEPS:

30MPa CONCRETE.

STOEP:

30MPa 100mm THICK WITH MESH REF 245. 30mm TOP COVER.

FLOOR FINISHES:

BATTERY ROOM:
SIKAFLOOR-381 5mm THICK SELF-LEVELLING SCREED WITH ACCOMPANYING PRIMER, OR APPROVED EQUIVALENT, APPLIED ACCORDING TO MANUFACTURER'S INSTRUCTIONS. COLOUR LIGHT GREY.
FLOOR FINISH SHALL FORM A CONTINUOUS SKIRTING AGAINST THE WALL AND EXTEND TO A HEIGHT OF 100mm ABOVE LOWEST POINT OF THE FLOOR LEVEL.

CONTROL ROOM AND LOADING BAY:
SIKA "PURIGO 5 S" PENETRATING CEMENT SEALER, OR APPROVED EQUIVALENT, APPLIED AS PER MANUFACTURER'S SPECIFICATION.

WC:
1 (ONE N.O.) COAT "MASTERTOP PRIMER 1200 PLUS" RESIN WITH SOLVENT No 2 WITH "MASTERTOP 1210 PLUS" AGGREGATE, OR APPROVED EQUIVALENT. TOP COAT OF LIGHT GREY "MASTERTOP 1210 PLUS".

STOEP:
GRANOLITHIC SCREED LAID TO FALL AS PER LAYOUT.

AIR BRICKS:

225 x 150mm CEMENT TYPE WITH VERMIN PROOFING, INTERNALLY AND EXTERNALLY. HEIGHT @ 2600mm AFFL.

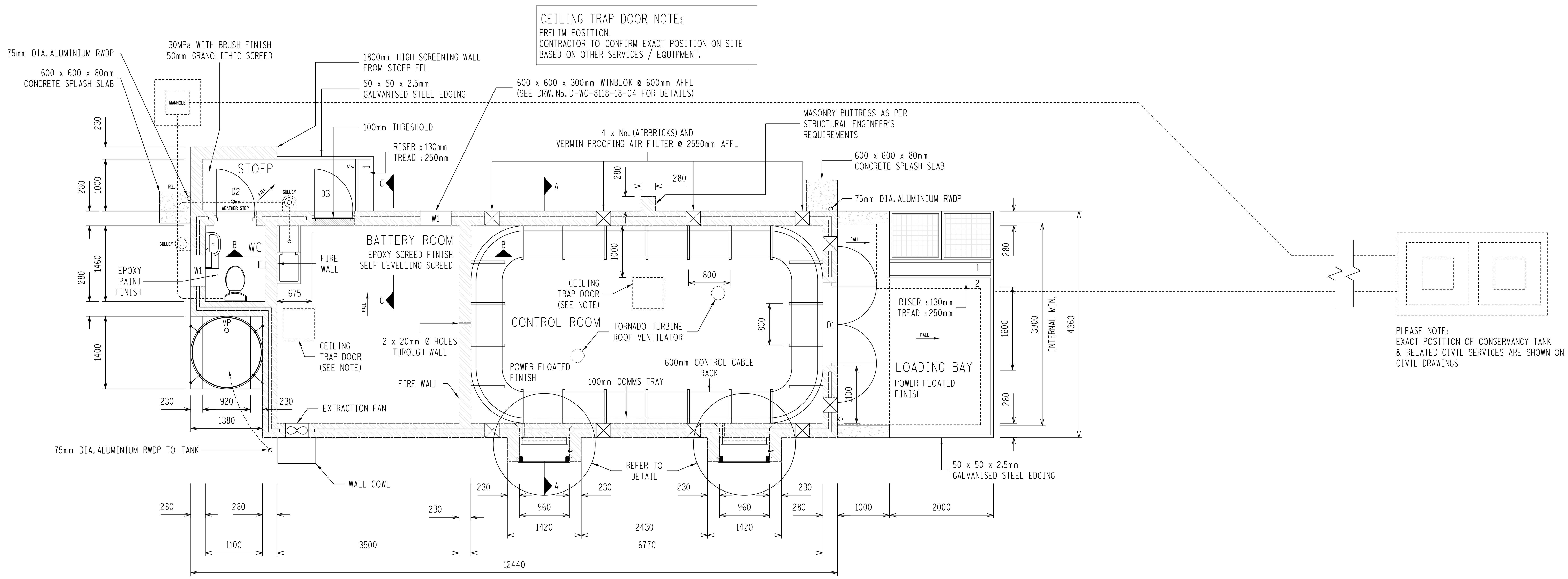
CEILINGS (EXCLUDING BATTERY ROOM):

SKIMMED 9.5mm RHINOBOARD CEILING ON 38 x 38mm TREATED PINE BATTENS @ 500mm C/C, WITH 25 x 25mm SHADOWLINE CORNICE. CEILING HEIGHT AT 3400mm AFFL.

CEILING - BATTERY ROOM ONLY:

4mm THICK NON-COMBUSTIBLE FIBRE CEMENT PANEL SUSPENDED CEILING, OR APPROVED EQUIVALENT, ON 38 x 38mm BATTENS @ 500mm C/C's. CEILING HEIGHT AT 3400mm AFFL.

CEILING TRAP DOOR NOTE:
PRELIM POSITION.
CONTRACTOR TO CONFIRM EXACT POSITION ON SITE BASED ON OTHER SERVICES / EQUIPMENT.



PLAN LAYOUT
SCALE 1:50

SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS
DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	
00	FIRST ISSUE	K.S.				IPP39344514-00003

AECOM

SCALE :AS SHOWN
THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: P. KOK
DATE: 20/04/2020
CHKD: P. KOK
DATE: 26/02/2020
DRAWN: K. STEYNBERG
DATE: 16/10/2019
ACC:
DATE: / /
CHKD:
DATE: / /
DRAWN:
DATE: / /

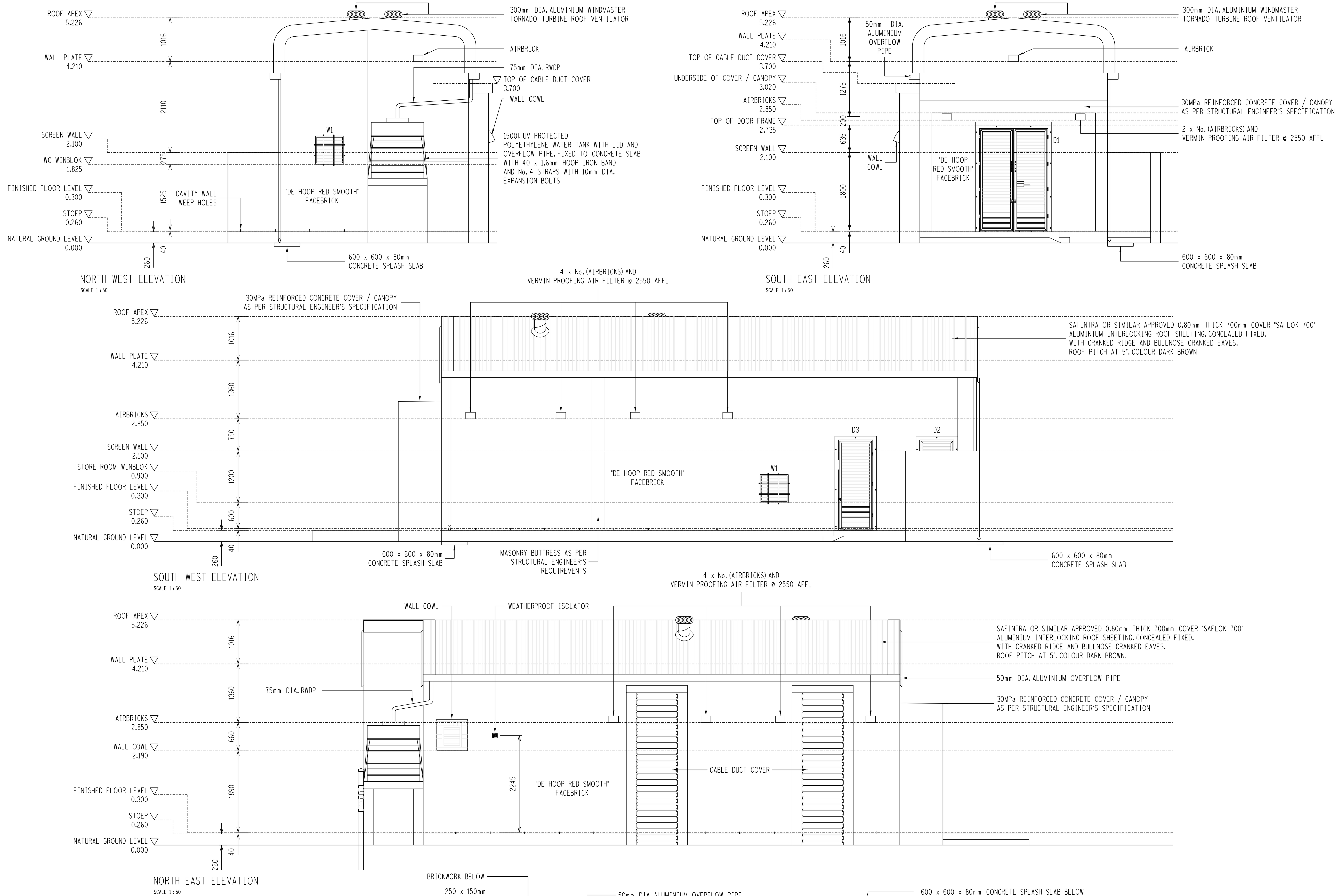
Eskom

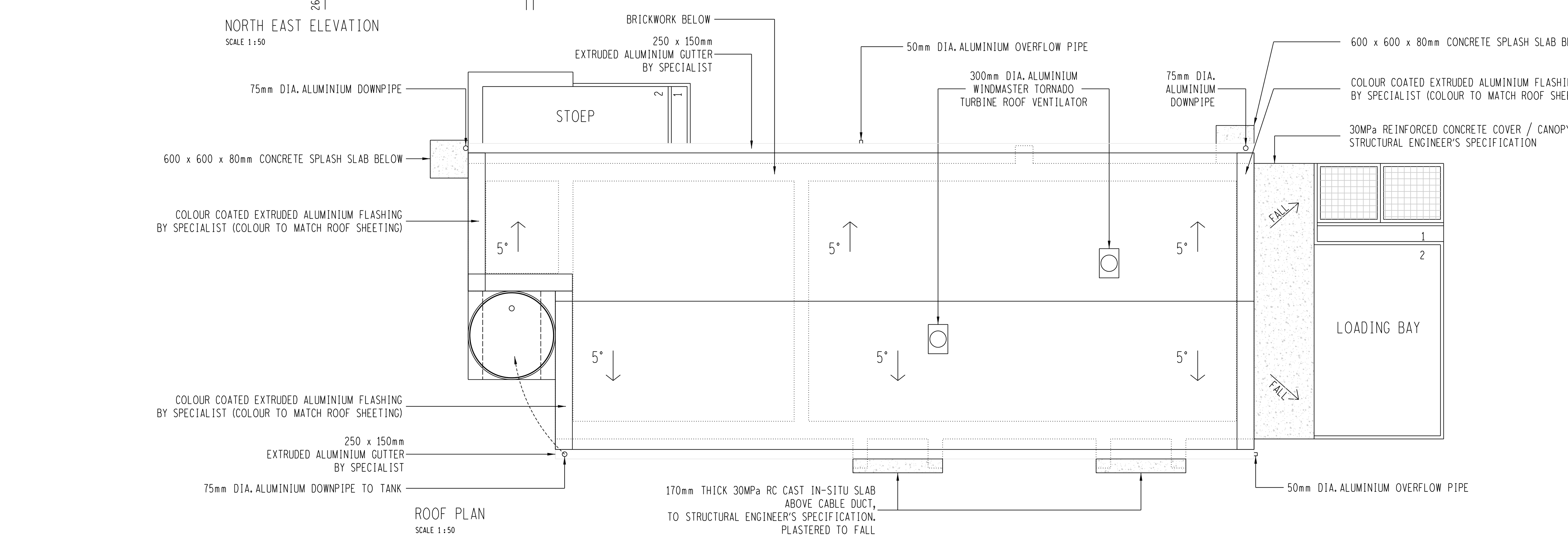
YSTERVARK SUBSTATION

RELAY HOUSE BUILDING
GROUND PLAN & DETAILS

DRAWING	SET	SHEET	REVISION
D-WC-8118	18	01	00

A1L





NOTES:

PLEASE REFER TO SHEET 01 FOR NOTES APPLICABLE TO THIS SHEET AS WELL.

ADDITIONAL NOTES REFERRING TO ROOF STRUCTURE:

ROOF COVERING:
SAFINTRA OR SIMILAR APPROVED 0.80mm THICK 700mm COVER "SAFLOK 700" ALUMINIUM INTERLOCKING ROOF SHEETING. CONCEALED FIXED. WITH CRANKED RIDGE AND BULLNOSE CRANKED EAVES. ROOF PITCH AT 5°. COLOUR DARK BROWN.

ROOF TRUSSES:
114 x 38mm RAFTERS TO BE FIXED TO WALLPLATES & TIED DOWN WITH HOOP IRON DESIGN AND SUPPLY BY OTHERS.

WALLPLATES:
114 x 38mm FIXED MIN. 600mm INTO BRICKWORK WITH GALV. HOOP IRON STRAPS

SISALATION:
FR430 FIRE RETARDENT ALUMINIUM FOIL INSULATION, INSTALLED AS PER MANUFACTURER'S SPECIFICATION. INDUSTRIAL SINGLE LAYER DOUBLE SIDED RADIANT BARRIER LAID ON 50mm THICK "FACTORYLITE" THERMAL INSULATION.

DRG NO.	REFERENCE DRAWINGS:
SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	
00	FIRST ISSUE	K.S.				IPP39344514-00003

Eskom

YSTERVARK SUBSTATION

RELAY HOUSE BUILDING
ELEVATIONS & ROOF PLAN

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

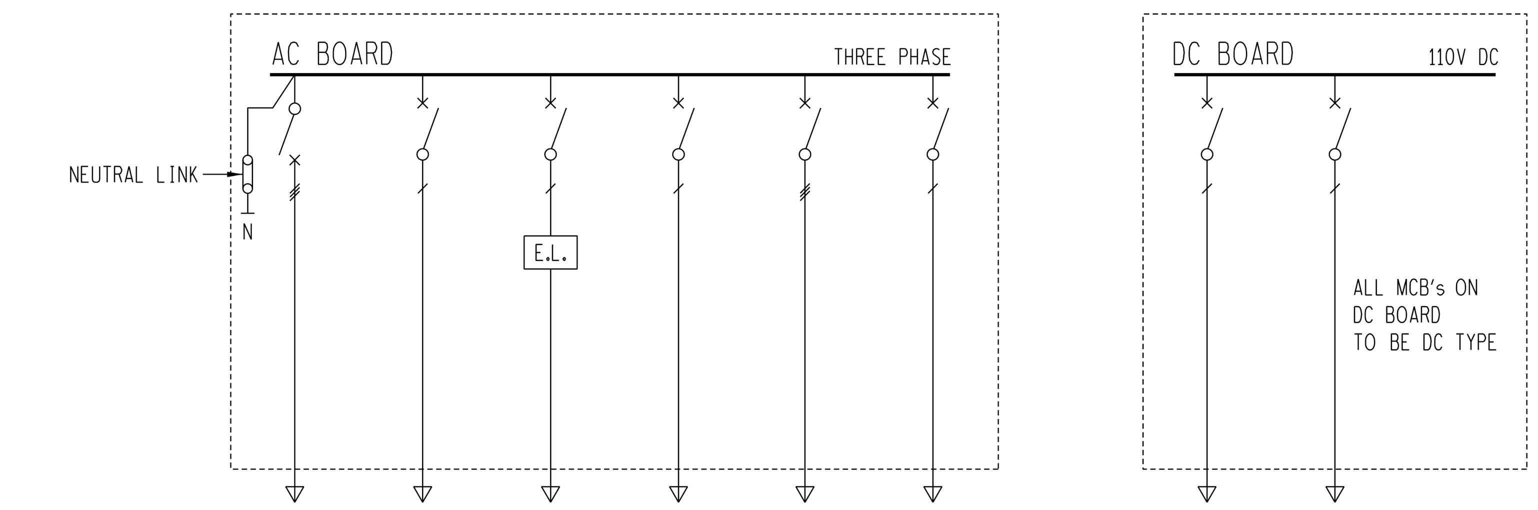
SCALE : AS SHOWN
THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: P. KOK	ACC:
DATE: 02/04/2020	DATE: / /
CHKD: P. KOK	CHKD:
DATE: 16/10/2019	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 16/10/2019	DATE: / /

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	18	02	00

A1L

DISTRIBUTION BOARDS DIAGRAM



LABEL	INCOMER	LIGHTS	SOCKET OUTLETS	WATER TANK PUMP	FAN SUPPLY	BATTERY ROOM	SPARE x 1
CIRCUIT No.		1	2	3	4	5	
PHASE ALLOCATION	R-W-B	R	W	B	R-W-B	R	
CONDUCTOR - mm²		2 x 2.5mm² & 1.25mm² EARTH	2 x 4.0mm² & 2.5mm² EARTH	TBC	3 x 4mm² & 2.5mm² EARTH	2 x 2.5mm² & 1.25mm² EARTH	
CONDUIT - DIA.	CABLE BY ESKOM	20mm DIA.	AS CIR.1	TBC	20mm DIA.	20mm DIA.	
M.C.B. RATING - AMPS	60	10	20	TBC	10	10	

INCOMER	DC LIGHTS	
	2 x 1.5mm² & 2.5mm² EARTH	
CABLE BY ESKOM		
10	5	

NOTE:
CIRCUIT No. 3 DETAILS DEPENDENT ON WATER TANK PUMP DETAILS - TBC.

DC LIGHTING

FITTINGS SYMBOL (◉) ARE THE EMERGENCY FITTINGS : (SEE DIAGRAM FOR WIRING OF DC LIGHTS).

FITTINGS TO BE CONNECTED TO THE TIMER SWITCH, CONTACTOR AND DC BOARD. ESKOM TO WIRE FROM DC BOARD TO ESKOM AC/DC PANEL.

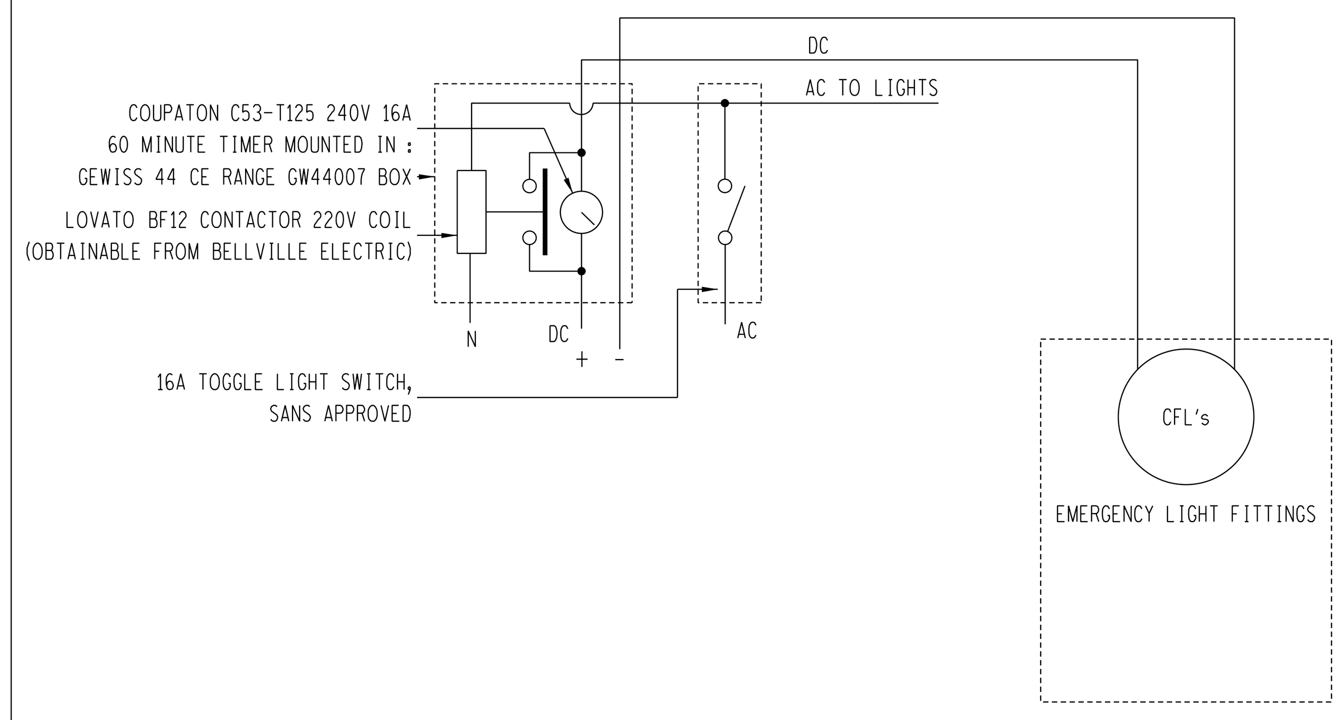


DIAGRAM SHOWING THE CONNECTION BETWEEN THE EMERGENCY LIGHT FITTING, CONTACTOR AND TIMER

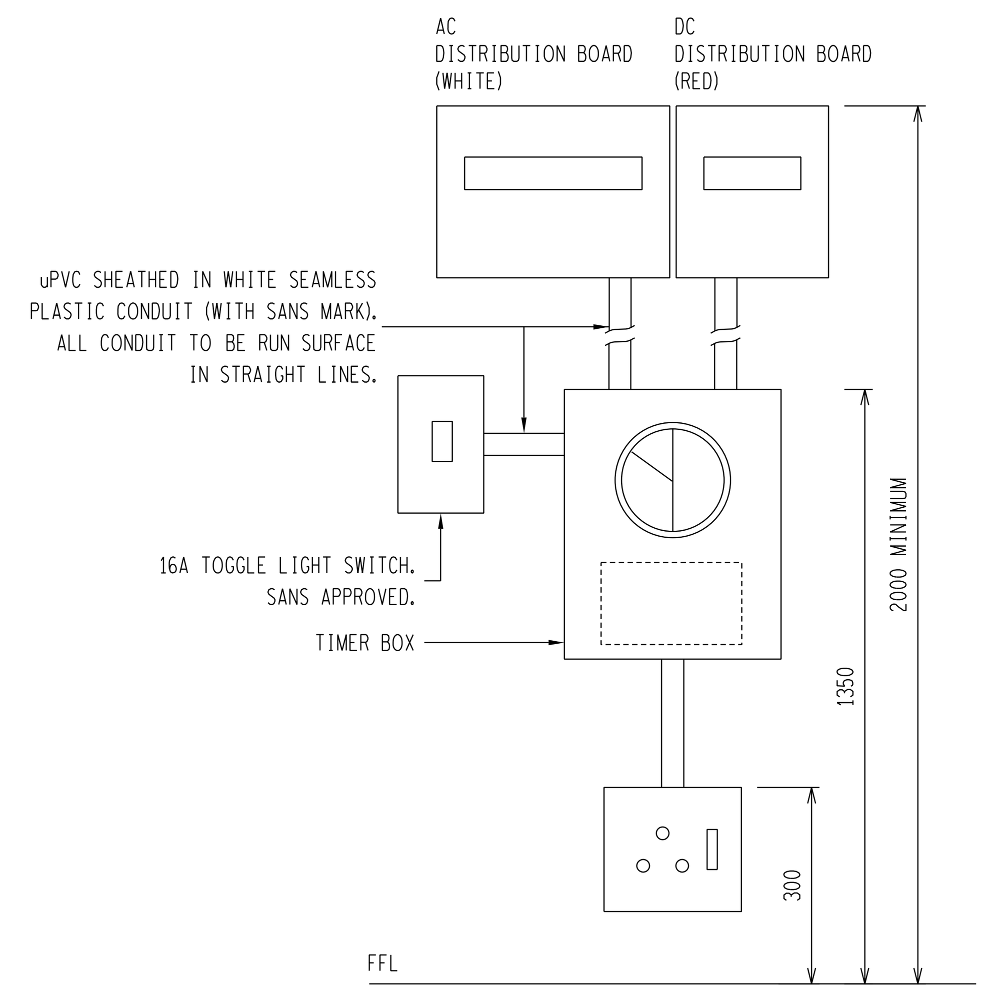


DIAGRAM SHOWING THE TIMER BOX IN COMPARISON TO THE AC LIGHT SWITCH

ELECTRICAL SPECIFICATION

GENERALLY, ALL ELECTRICAL WORK TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE LATEST REVISIONS OF SANS 10142-1-2003 THE WIRING OF PREMISES.

A. ELECTRICAL LEGEND

	54W LED R-BAY-54W-LED AS LASCON BY VOLTEX LIGHTING: FLOURECENT FITTING FIXED TO CEILING AS PER MANUFACTURER'S DETAILS				
AMOUNT REQUIRED	003	PLACEMENT	WALL		CEILING SURFACE MOUNTED ✓
Ex e	47W 4000K NORDLAND JBP-LED IP66 RATED ZONE 2 LUMINAIRE, INCLUDING FOR Ex e CERTIFICATION				
AMOUNT REQUIRED	002	PLACEMENT	WALL @ 2800mm	✓	CEILING SURFACE MOUNTED
	17.5W LED LASCON RIMINI-17.5W-LED / EYELID IP65 RATED. COLOUR WHITE.				
AMOUNT REQUIRED	002	PLACEMENT	WALL @ 2800mm	✓	CEILING SURFACE MOUNTED
	DTC CLEAR HIGH VISOR BULKHEAD FITTING BY VOLTEX. BULB : 20W TORNADO TWISTED WITH INTERGRATED BALLAST. TO BE CONNECTED TO DC BOARD AND COUPATON C53-T125 240V 16A 60 MINUTE TIMER				
AMOUNT REQUIRED	003	PLACEMENT	WALL @ 2800mm		CEILING SURFACE MOUNTED ✓
	RED : DC (EMERGENCY LIGHTS) SURFACE MOUNTED DISTRIBUTION BOARD. PLACED NEXT TO AC BOARD. TOP OF BOARD MOUNTED MIN. 2000mm ABOVE FLOOR LEVEL. TO BE CONNECTED TO DC LIGHTS AND COUPATON C53-T125 240V 16A 60 MINUTE TIMER. TO BE METAL CLAD 3 WAY SURFACE MOUNTED AS HEINEMANN WITHOUT DOOR. FRONT COVER TO ALLOW OPERATION OF DOLLIES. MCB's TO BE CLEARLY NAMED AS TO CIRCUIT AND USE. FRONT COVER TO BE PAINTED RED TO IDENTIFY THE DC USE.				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 2200mm		
	WHITE : AC (PRIMARY LIGHTS) SURFACE MOUNTED DISTRIBUTION BOARD. PLACED NEXT TO DC BOARD. TOP OF BOARD MOUNTED MIN. 2000mm ABOVE FLOOR LEVEL. TO BE CONNECTED TO AC LIGHT FITTINGS. TO BE METAL CLAD 4 WAY SURFACE MOUNTED AS HEINEMANN WITHOUT DOOR. FRONT COVER TO ALLOW OPERATION OF DOLLIES WITHOUT REMOVAL. BOARD TO BE CABELED TO ESKOM AC/DC PANEL BY ESKOM WITHOUT REMOVAL. MCB's TO BE CLEARLY NAMED AS TO CIRCUIT AND USE & TO HAVE 5kA RATING. EARTH LEAKAGE UNIT TO BE HY-MAG OR EQUAL APPROVED.				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 2200mm	✓	
W	GEWISS 9000.7519 WATERTIGHT TOGGLE TYPE SWITCH WITH RED PILOT LIGHT. SANS APPROVED				
AMOUNT REQUIRED	004	PLACEMENT	WALL @ 1350mm	✓	
	16A TOGGLE LIGHT SWITCH. SANS APPROVED				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1350mm	✓	
E	COUPATON C53-T125 240V 16A 60 MINUTE TIMER MOUNTED IN GEWISS 44 CE RANGE GW44007 BOX WITH LOVATO BF12 CONTACTOR 220V COIL (OBTAINABLE FROM BELLVILLE ELECTRIC)				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1350mm	✓	
T	TELEPHONE OUTLET WITH 25mm CONDUIT TO CABLE TRAY OVER				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1350mm	✓	
	16A SURFACE MOUNTED INDUSTRIAL SOCKET OUTLET (3 PIN ROUND)				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 300mm	✓	
	WEATHERPROOF TRIPLE-POLE ISOLATOR TO BE SIZED GREATER THAN SUPPLY BREAKER				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 2245mm	✓	
	EXTRACTOR FAN SPECIFICATIONS: VOLTAGE: 400V FREQUENCY: 50Hz PHASE: 3 INSULATION CLASS: F ENCLOSURE CLASS, MOTOR: IP44 CERTIFICATE: ZELM 05ATEX0279X EXPLOSION PROOF: II 2G c Ex e IIC T4 MINIMUM No. OF AIR CHANGES REQUIRED: 5.5 TIMES/HOUR				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 2245mm	✓	
	HYDROGEN GAS DETECTOR - MAIN CONTROL				
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1600mm	✓	
	HYDROGEN GAS DETECTOR - SENSOR				
AMOUNT REQUIRED	002	PLACEMENT	AS INDICATED ON LAYOUT		

NOTES FOR BATTERY ROOM INSTALLATION:

1. ZONE 2 INSTALLATION SHALL BE UNDERTAKEN BY A CERTIFIED MASTER ELECTRICIAN.
2. ALL CABLES / CONDUITS SHALL BE SURFACE MOUNTED.

NOTES:

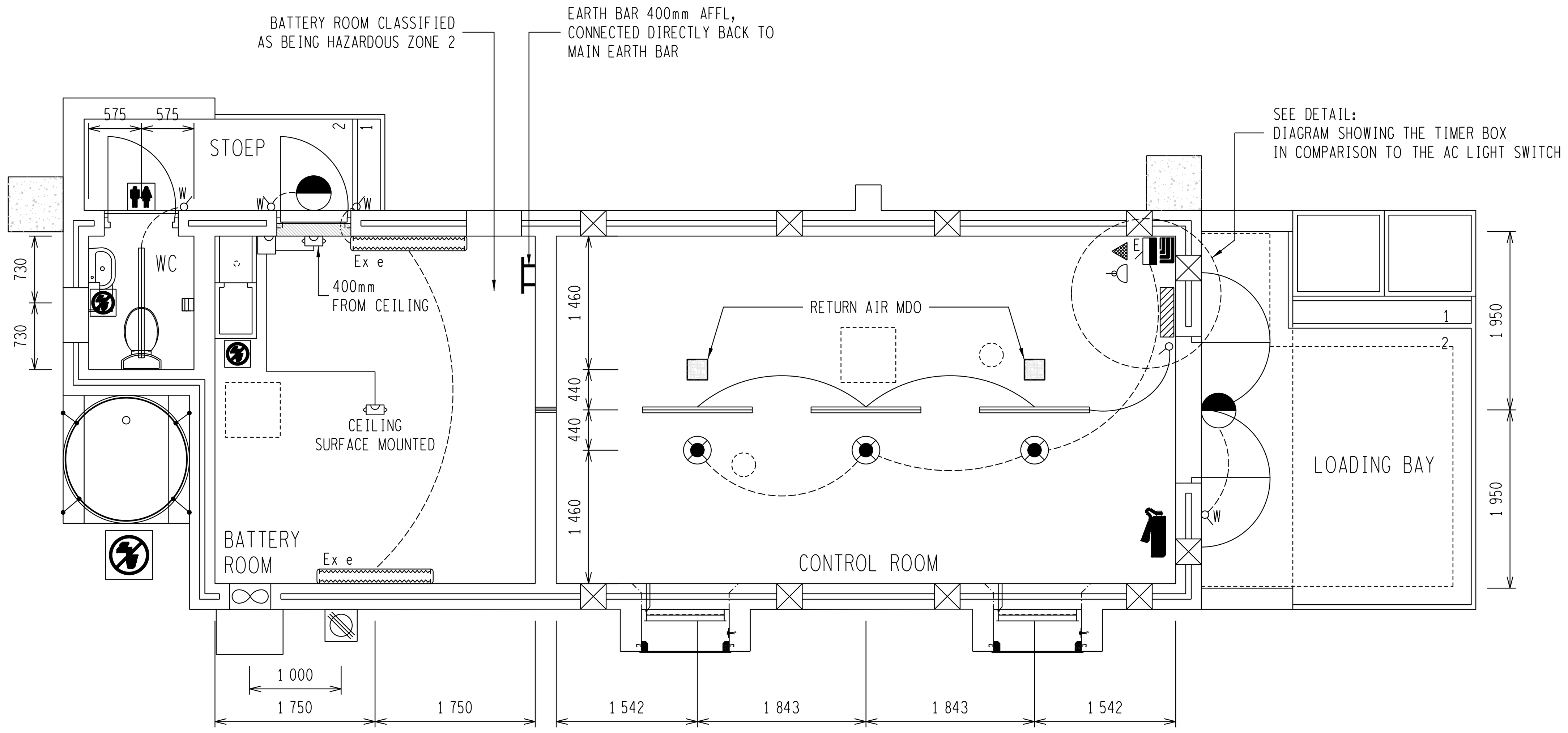
TABLE 1-SAFETY SIGNS REQUIRED FOR BATTERY ROOMS

DESCRIPTION	REQUIRED LOCATION OF SAFETY SIGN	ESKOM CODE AND DRAWING NUMBER
A) A NOTICE IDENTIFYING THE ROOM AS BEING A BATTERY ROOM AND ITS TYPE OF HAZARDOUS CLASSIFICATION (ZONE 2). B) IT CLEARLY SETS OUT THE ELEMENTARY FIRST AID PROCEDURES IN THE CASE OF EYE AND/OR SKIN CONTACT WITH AN ACID OR ALKALI. C) A NO-SMOKING PROHIBITIVE SIGN AND CORROSIVE SUBSTANCE WARNING SIGN ARE ALSO POSTED ON THE NOTICE. D) THE NOTICE ALSO DISPLAYS THAT UNAUTHORIZED ENTRY TO THE BATTERY ROOM IS PROHIBITED.	AT THE DESIGNATED ENTRANCE TO THE BATTERY ROOM.	DCSS 1 : D-DT-5022 SHEET 1
A) THIS NOTICE SHOWS THAT OPEN FLAMES ARE PROHIBITED INSIDE THE BATTERY ROOM. B) IT ALSO SHOWS THAT AN APRON, EYE PROTECTION AND GLOVES SHALL BE WORN.	ON WALL DIRECTLY OPPOSITE THE ENTRANCE TO THE BATTERY ROOM.	DCSS 3 : D-DT-5022 SHEET 3
A NOTICE INDICATING THE LOCATION OF THE EYE WASH EQUIPMENT.		GA 19 : D-DT-5023 SHEET 2
A NOTICE SHOWING THAT THE DRINKING OF WATER IS PROHIBITED (WHEN APPLICABLE).	ON WALL DIRECTLY ABOVE BATTERY ROOM SINK OR WATER CONTAINER.	PV 5 : D-DT-5023 SHEET 3
BATTERY ROOM CIVILS TO COMPLY WITH SPECIFICATION FOR BATTERY ROOMS.		DSP 34-479

LEGEND: BATTERY ROOM FITTINGS

N.B.: SUPPLIED PIPING TO BE EITHER COPPER OR POLYCOP WITH SABS MARK.

1. 1 x WHITE GLAZED DRAINER ON WALL BRACKETS ON DOOR SIDE. DRAINER TO DRAIN DIRECTLY INTO SINK.
2. HAND SHOWER TO COBRA No. 519-21, COMPLETE WITH TRIGGER ACTION CONTROL NOZZLE, WALL BRACKET, HOSE & CP WALL MOUNTED ELBOW ACTION TAP.
3. WALL MOUNTED ELBOW ACTION TAP WITH THREADED SPOUT.
4. WHITE GLAZED 600 x 400 x 200mm LABORATORY SINK AS VAAL CODE 2360 OR EQUALLY APPROVED, COMPLETE WITH WALL BRACKETS, PLUG & CHAIN. 38mm DIA. ACID RESISTANT WASTEPIPE.
5. PVS P-TRAP.
6. 38mm DIA. ACID RESISTANT WASTEPIPE TO DISCHARGE WASTE WATER OUTSIDE, SUPPORTED WITH HALVED PIPE HOLDER.



B. MISCELLANEOUS LEGEND

	9kg SABS APPROVED PORTABLE FIRE EXTINGUISHER DRY POWDER TYPE (STORED PRESSURE) CYLINDRICAL SHAPED SUITABLE FOR FIGHTING FIRES OF CLASS ABC (SANS 1910)						
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1460mm ✓				
	UNISEX TOILET SIGNAGE						
AMOUNT REQUIRED	001	PLACEMENT	WALL @ 1460mm ✓				
	NON-POTABLE WATER SIGNAGE						
AMOUNT REQUIRED	003	PLACEMENT	WALL @ 1460mm ✓				

DRG NO.	REFERENCE DRAWINGS:
SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE	K.S.				153272156-00003

SCALE 1:50

THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AECOM

CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE

AUTH: L. BOTHA DATE: 20/04/2020 | ACC: DATE: / /

CHKD: A. MARAIS DATE: 12/09/2019 | CHKD: DATE: / /

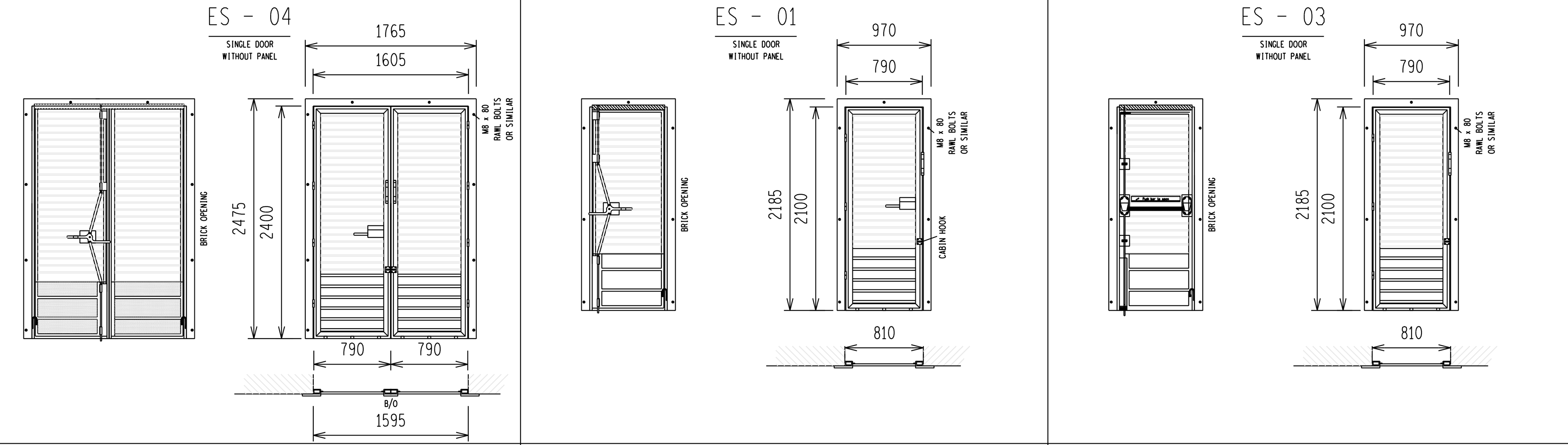
DRAWN: K. STEYNBERG DATE: 12/09/2019 | DRAWN: DATE: / /

YSTERVARK SUBSTATION

RELAY HOUSE BUILDING
POWER, LIGHTING & BASIC SIGNAGE LAYOUT

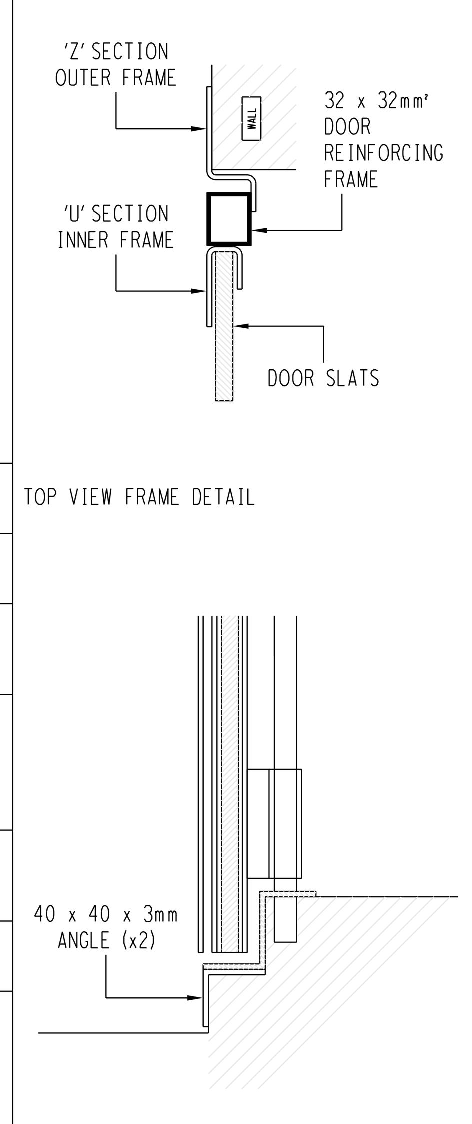
	SET	SHEET	REVISION
D-WC-8118	18	03	00

A1L



DOOR ELEVATION		(see elevations above)		
DOOR NUMBER	D1	D2	D3	
POSITION	CONTROL ROOM	WC	BATTERY ROOM	
FRAME	WELDED GALVANISED MILD STEEL FRAME COMPLETE WITH BUILDING IN LUGS.	WELDED GALVANISED MILD STEEL FRAME COMPLETE WITH BUILDING IN LUGS.	WELDED GALVANISED MILD STEEL FRAME COMPLETE WITH BUILDING IN LUGS.
DOOR TYPE	DUAL SWING STEEL DOORS WITH LEAF DIMENSION OF 800mm. TO HAVE A TOTAL OPENING SIZE OF 2400 x 1600mm WIDTH. CURTAIN : STANDARD GALV. (Z275) 75 x 1.2mm INTERLOCKING SLATS	SINGLE SWING STEEL DOOR WITH LEAF DIMENSION OF 790mm. TO HAVE A TOTAL OPENING SIZE OF 2100 x 810mm WIDTH. CURTAIN : STANDARD GALV. (Z275) 75 x 1.2mm INTERLOCKING SLATS	SINGLE SWING STEEL DOOR WITH LEAF DIMENSION OF 790mm. TO HAVE A TOTAL OPENING SIZE OF 2100 x 810mm WIDTH. CURTAIN : STANDARD GALV. (Z275) 75 x 1.2mm INTERLOCKING SLATS
FINISH	HOT DIP GALVANISED OR FINISHED WITH COLOUR TO BE APPROVED BY ESKOM.	HOT DIP GALVANISED OR FINISHED WITH COLOUR TO BE APPROVED BY ESKOM.	HOT DIP GALVANISED OR FINISHED WITH COLOUR TO BE APPROVED BY ESKOM.
IRONMONGERY – HINGES	4 x 80mm BULLET HINGES PER DOOR LEAF	4 x 45mm BULLET HINGES PER DOOR LEAF	4 x 45mm BULLET HINGES PER DOOR LEAF
IRONMONGERY – LOCK SET / LOCK	3 POINT LOCKING SYSTEM TO LOCK INTO TOP DOOR FRAME 'L' ANGLE AND BOTTOM OF 'L'.	3 POINT LOCKING SYSTEM TO LOCK INTO TOP DOOR FRAME 'L' ANGLE AND BOTTOM OF 'L'.	UNION 801 DMG STEEL 'PANIC PROBOLT' WITH A TWO TOP AND BOTTOM LOCKING POINTS VERTICAL BAR OR BOTTOM LOCKING POINTS VERTICAL BAR OR EQUAL APPROVED.
IRONMONGERY – BOLTS	M8 x 80 RAWL BOLTS OR SIMILAR	M8 x 80 RAWL BOLTS OR SIMILAR	M8 x 80 RAWL BOLTS OR SIMILAR
MISC.	N.B. DOORS TO HAVE 30 x 6mm SELF ADHESIVE RUBBER SEALING STRIPS FIXED TO INNER EDGES OF FRAME TO PROVIDE DUST EXCLUSION		

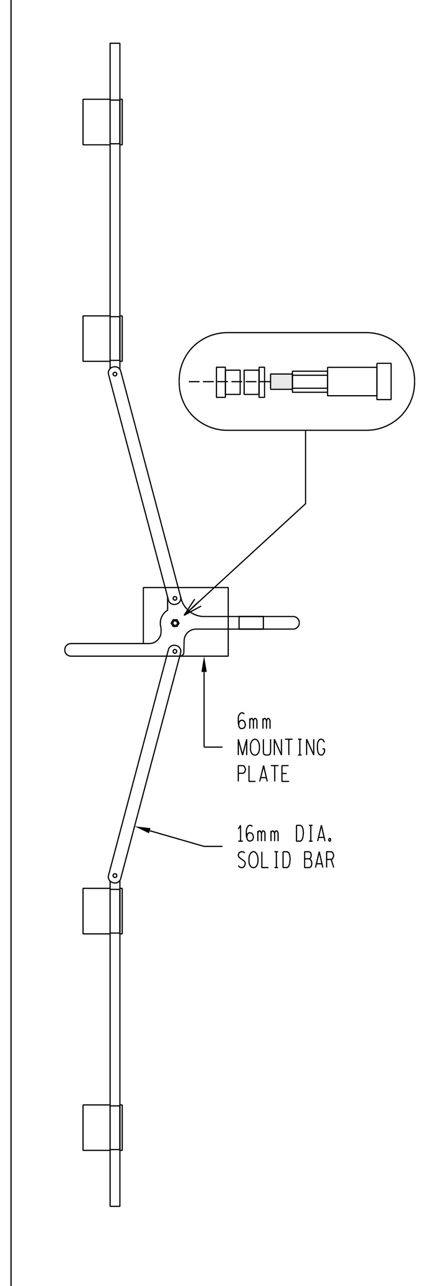
SECTION

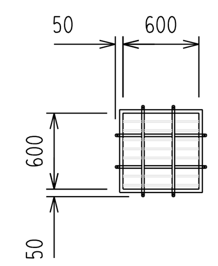


TOP VIEW FRAME DETAIL

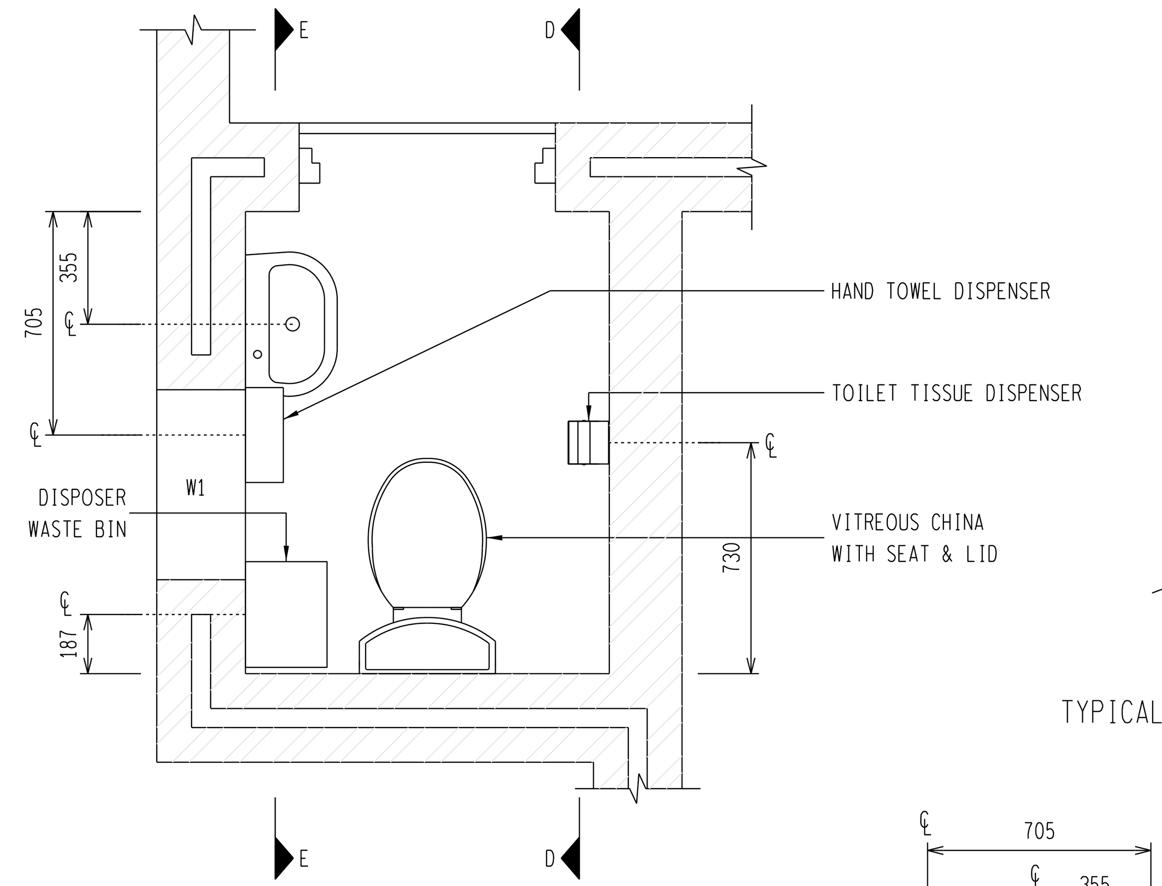
BOTTOM LOCKING DETAIL

3 POINT LOCKING SYSTEM

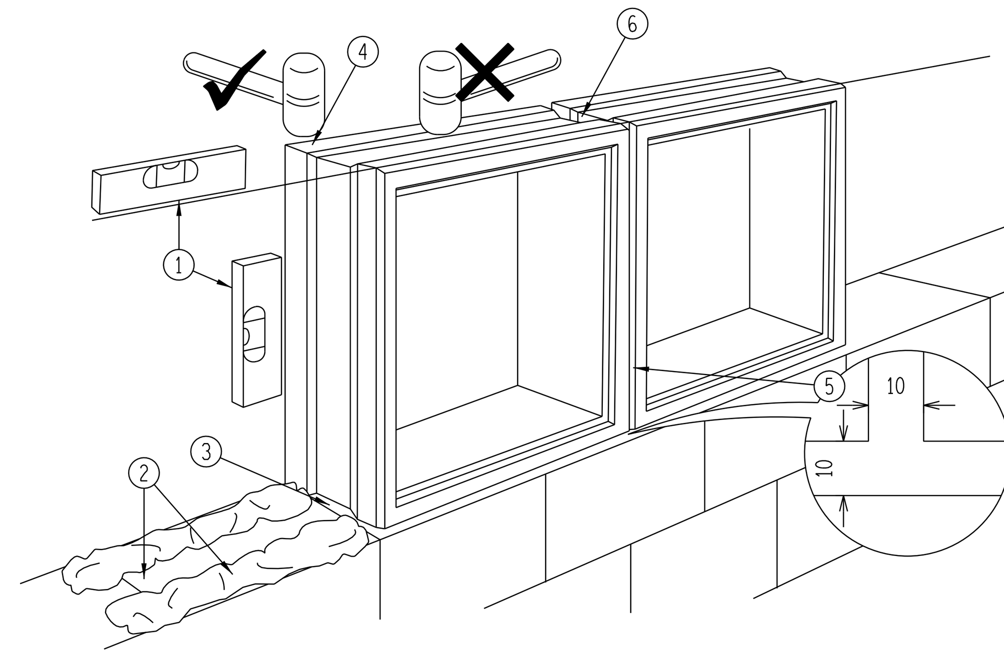




WINDOW TYPE	W1 (WINBLOK BY WINTEC)
DESCRIPTION	600 x 600 x 300mm PRECAST CONCRETE WINTEC "WINBLOK" WB66 (B) UNIT, FACTORY FITTED WITH STANDARD 20 x 6mm GALV. STEEL BURGLAR BARS BY WINTEC. THE WINBLOK UNIT IS TO COME COMPLETE WITH NATURAL ANODIZED ALUMINIUM FIXED LOUVRES, "WINLOUVRE WL (A) 66F", FITTED USING NON-ASCETIC SILICONE SEALANT. REBATES TO FACE TO EXTERNAL SKIN OF WALL.



TOILET PLAN VIEW
SCALE 1:20



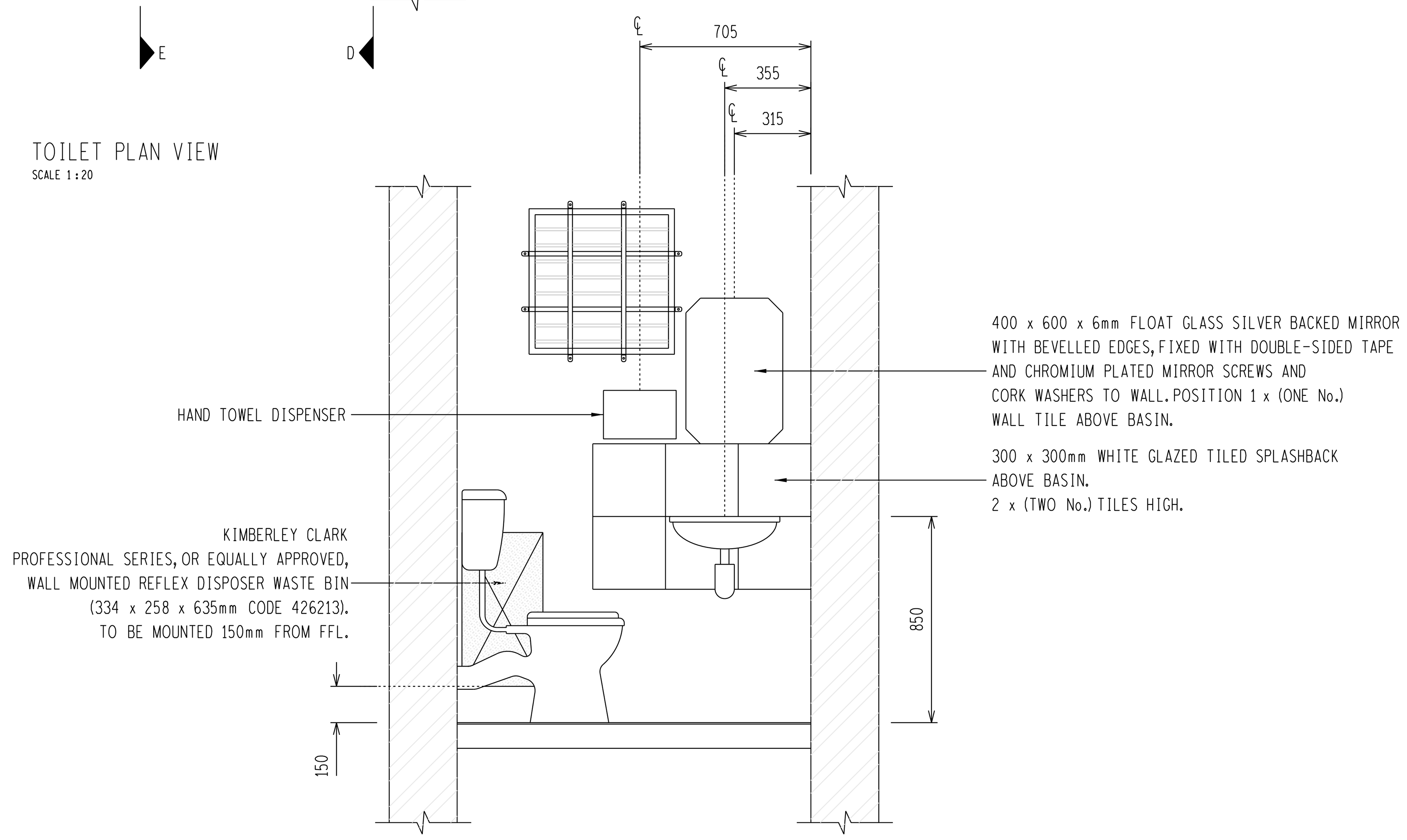
TYPICAL WINBLOK INSTALLATION DETAIL

BUILDING THE WINBLOK® IN, AS PER MANUFACTURER'S CATALOGUE

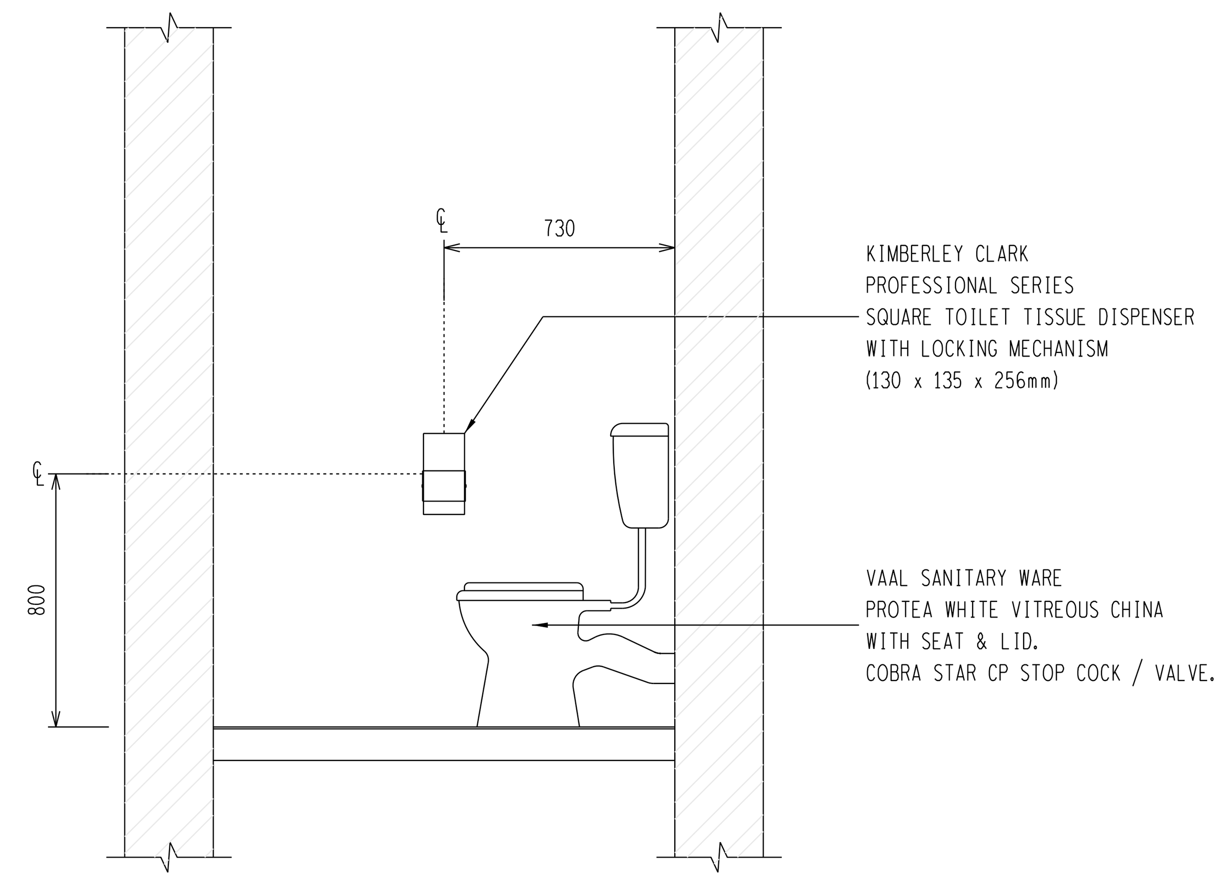
IN GENERAL, STANDARD PRACTICES FOR CONCRETE MASONRY CONSTRUCTION SHOULD BE APPLIED TO WINBLOK® CONSTRUCTION WITH PARTICULAR REFERENCE TO SHRINKAGE CONTROL JOINTS IN LARGE WINBLOK® PANELS. CLASS 1 MORTAR AS DEFINED IN CLAUSE 3.4.1 OF SABS 0164 : PART 1-1980 SHOULD BE USED FOR ALL JOINTING. THE CORRECT USAGE OF DAMP PROOF COURSES IS ESSENTIAL.

1. THE WINBLOK® MUST BE LAID PLUMB TO THE BUILDERS LINE.
2. LAY WINBLOK® ON A STIFF STRONG 1:3 MIX * MORTAR BED IN TWO CONTINUOUS STRIPS.
3. ALLOW THE MORTAR TO SQUASH OUTWARD AND INWARD OF THE REBATE.
4. A RUBBER MALLET MAY BE USED ONLY ON THE CORNERS TO TAP THE WINBLOK® DOWN TO THE LINE.
5. THE PERPENDICULAR JOINT BETWEEN WINBLOK® SURROUNDS SHOULD ALWAYS BE LEFT OPEN, WITH A JOINT SPACE BETWEEN EACH WINBLOK®, UNTIL A WHOLE ROW HAS BEEN LAID.
6. A DRY-MIX, NO-FINES, AGGREGATE (E.G. 13mm STONE) SHOULD BE POURED INTO THE CAVITY BETWEEN THE VERTICAL REBATES. THE VERTICAL JOINTS MAY THEN BE BACK GROUTED WITH MORTAR BEFORE TOOLING THE JOINTS. THE NO-FINES AGGREGATE ACTS AS A MOISTURE BARRIER BY INTERRUPTING CAPILLARY MIGRATION.

* MORTAR LAID ACROSS THE FULL WALL SURFACE MAY CAUSE PRESSURE IN THE REBATE AND FRACTURE THE BOTTOM FLANGE. NO MORTAR SHOULD BE ALLOWED TO BRIDGE THE REBATE CAVITY WALLS AND CARE SHOULD BE TAKEN TO MAINTAIN A CONTINUOUS CAVITY. MORTAR MUST BE KEPT CLEAR OF THE VERTICAL REBATES.



SECTION D-D
SCALE 1:20



SECTION E-E
SCALE 1:20

DRG NO.	REFERENCE DRAWINGS:
SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	
00	FIRST ISSUE	K.S.				IPP39344514-00003

SCALE : AS SHOWN
THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

YSTERVARK SUBSTATION

RELAY HOUSE BUILDING

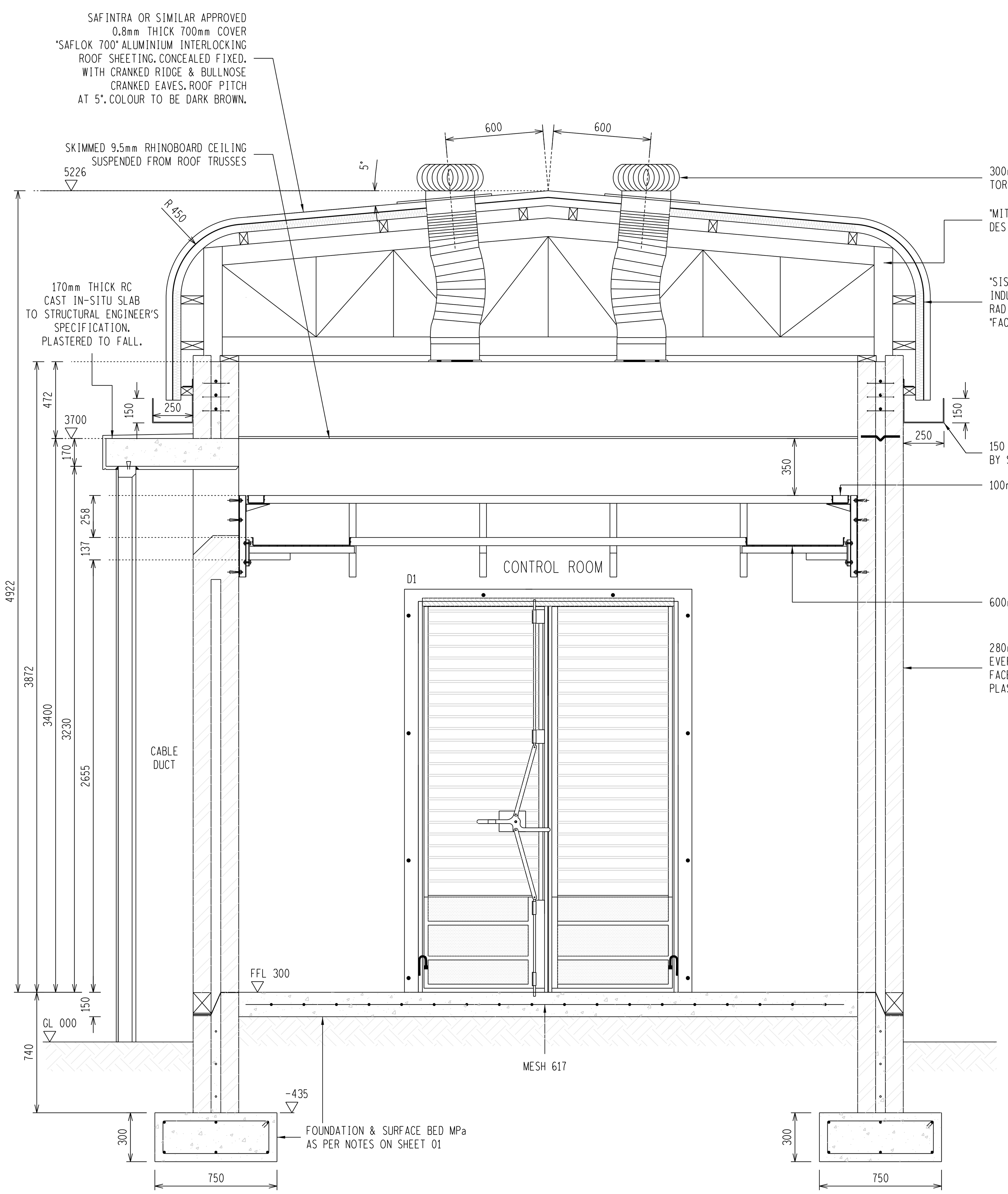
DOOR SCHEDULE & DETAILS

AUTH: P. KOK	ACC:
DATE: 20/04/2020	DATE: / /
CHKD: P. KOK	CHKD:
DATE: 16/10/2019	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 16/10/2019	DATE: / /

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	18	04	00

A1L



SECTION A-A

SCALE 1:20

SANITARY WARE - BATTERY ROOM:

1 x (ONE No.) VITREOUS CHINA WHITE GLAZED DRAINER ON WALL BRACKETS, INSTALLED ON DOOR SIDE. DRAINER TO DRAIN DIRECTLY INTO SINK.

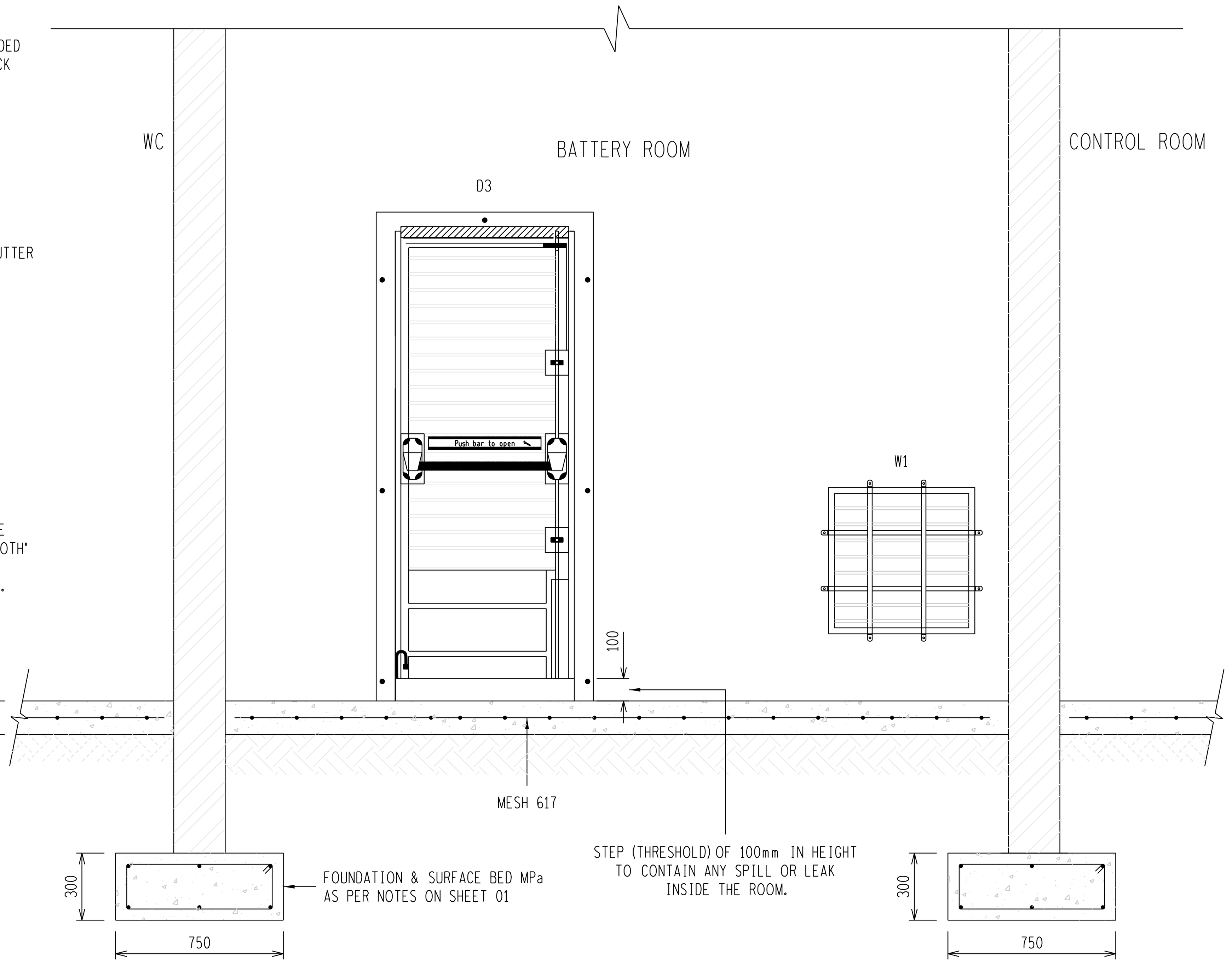
COBRA (519-21) HAND SHOWER, COMPLETE WITH TRIGGER ACTION CONTROL NOZZLE, WALL BRACKET, HOSE, CP WALL MOUNTED ELBOW ACTION TAP, OR APPROVED EQUIVALENT.

WALL MOUNTED ELBOW ACTION TAP WITH THREADED SPOUT.

VAAL (CODE 2360) VITREOUS CHINA GLAZED 600 x 400 x 200mm LABORATORY SINK, COMPLETE WITH WALL BRACKETS, FIXATION BOLTS MATCHING MANUFACTURER'S INSTRUCTIONS, PLUG AND CHAIN, 35mm ACID RESISTANT WASTE PIPE, OR APPROVED EQUIVALENT.

38mm DIA. ACID RESISTANT WASTE PIPE SUPPORTED WITH HALVED PIPE HOLDER TO DISCHARGE WASTE WATER OUTSIDE.

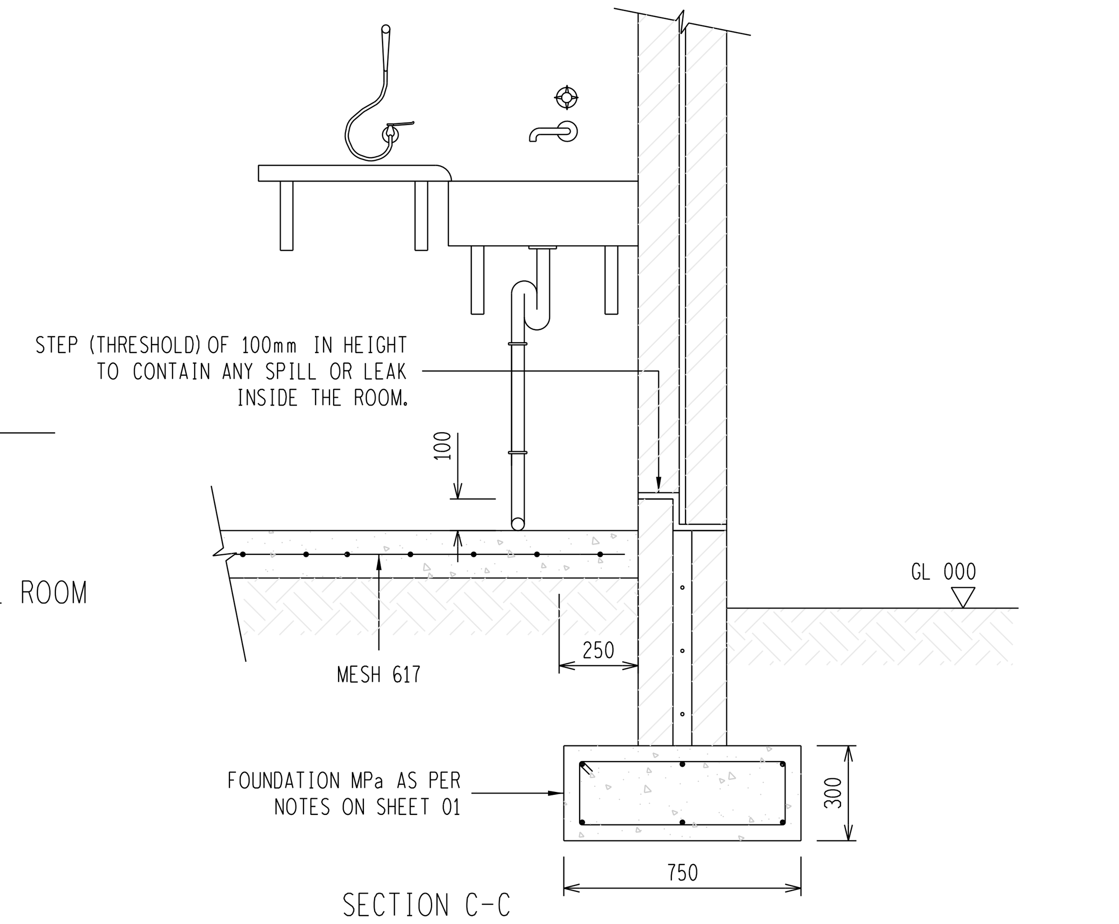
PVC P-TRAP.



SECTION B-B

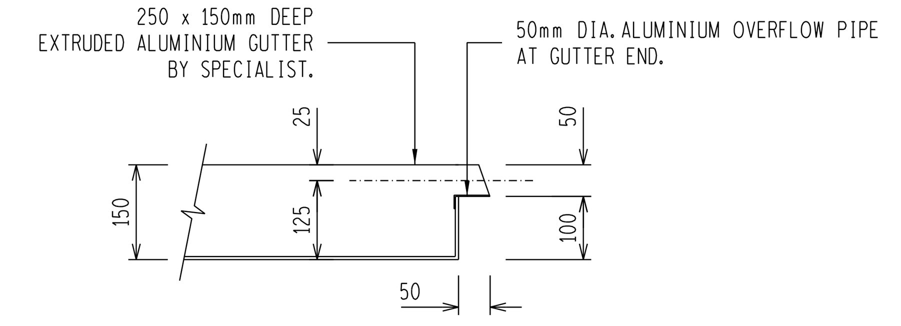
SCALE 1:20

NOTE:
REFER TO NOTES REGARDING FLOOR FINISHES, PAINT FINISHES, ROOF SHEETING, ETC. ON SHEET 01



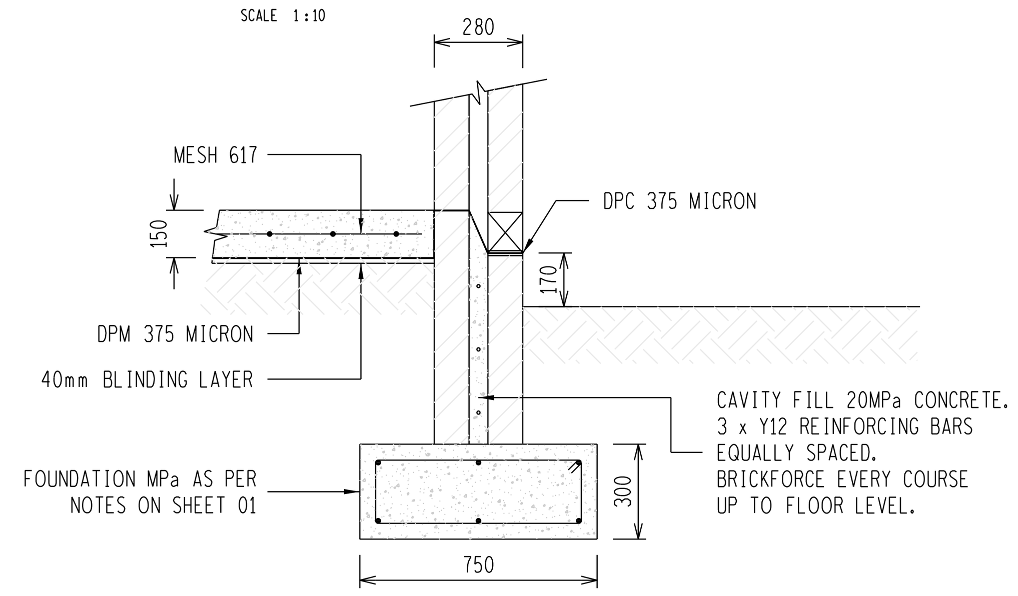
SECTION C-C

SCALE 1:20



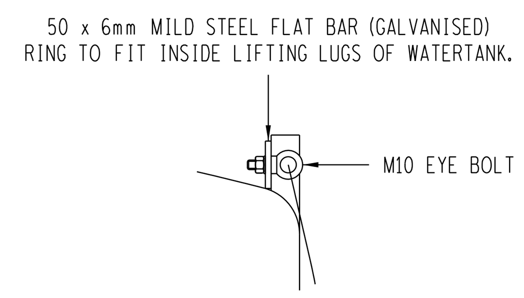
GUTTER OVERFLOW PIPE DETAIL

SCALE 1:10



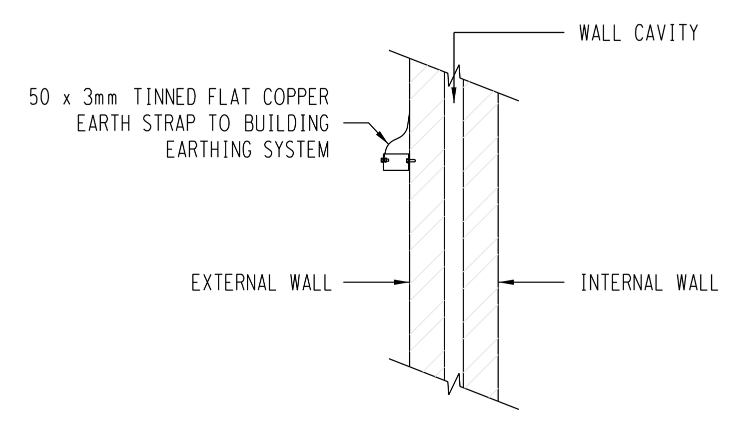
TYPICAL FLOOR / FOUNDATION SECTION

SCALE 1:20



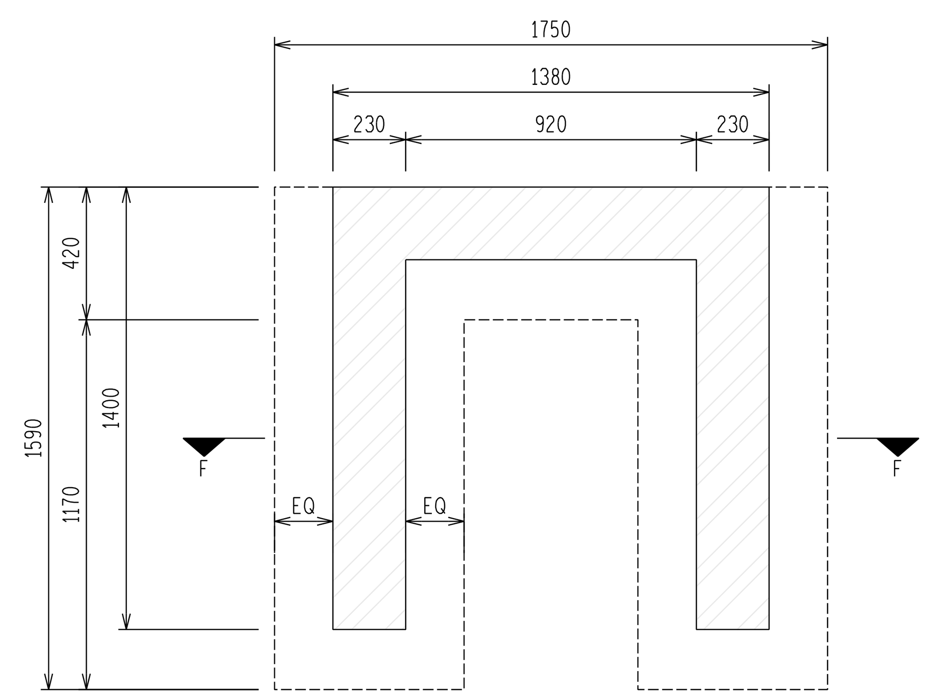
TANK SECURING DETAIL

SCALE :NTS



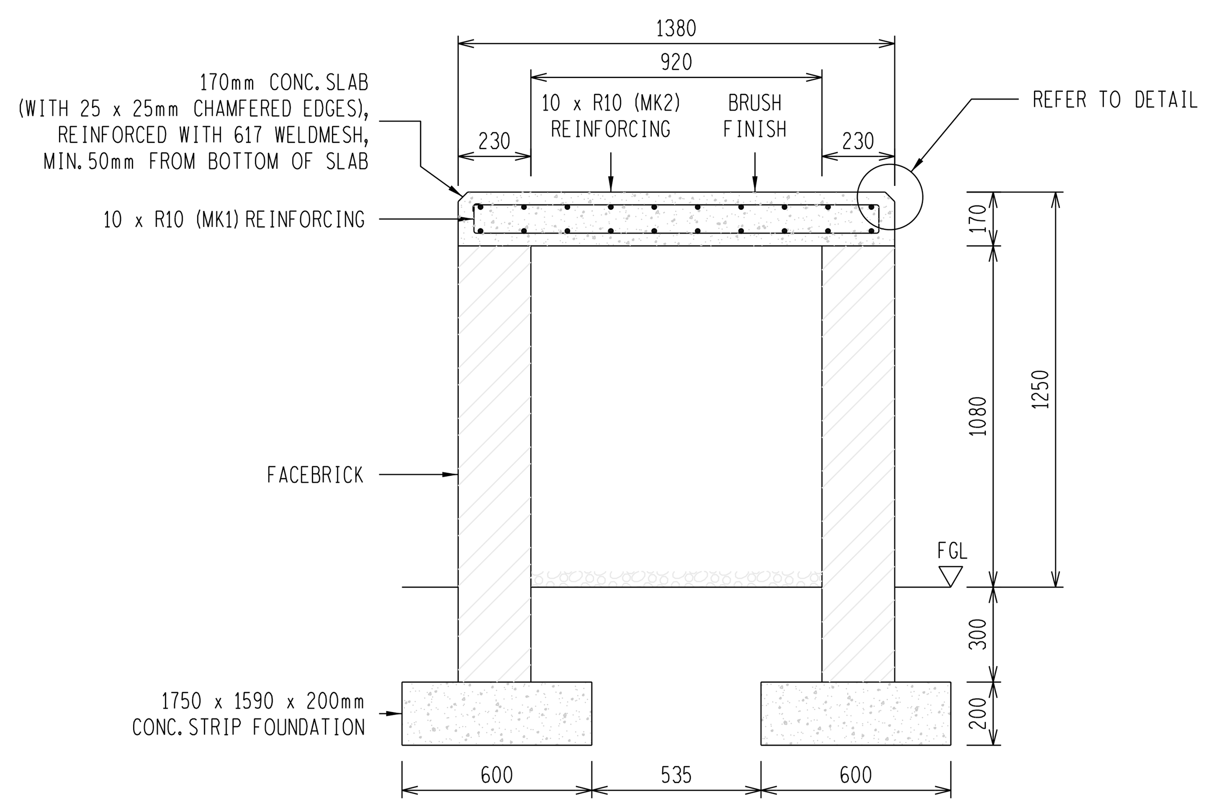
ANTENNA / BRACKET EARTHING DETAIL

SCALE 1:20



WATER TANK BASE PLAN VIEW

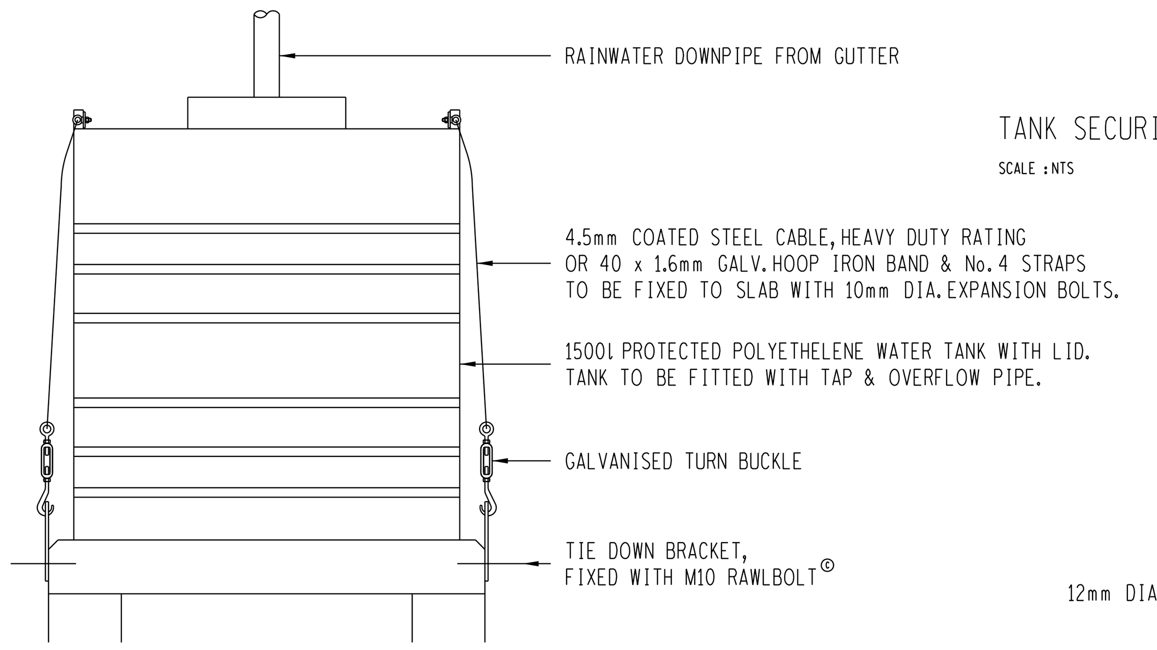
SCALE 1:20



SECTION (F-F) THROUGH WATER TANK BASE

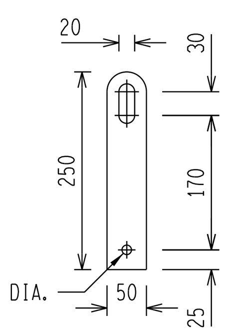
SCALE 1:20

REINFORCEMENT SCHEDULE					
MK	TYPE & SIZE	CUTTING LENGTH	SHAPE CODE	QTY	BENDING REMARKS
1	R10	2950	60	10	1280 x 90
2	R10	2900	60	10	1280 x 70



WATER TANK & STRAP DETAIL

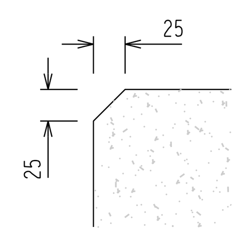
SCALE 1:20



TIE DOWN BRACKET DETAIL

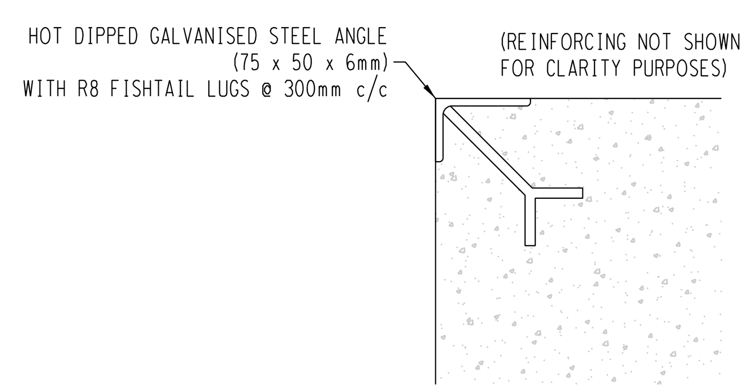
6mm THICK GALVANISED MILD STEEL (4 OFF)

SCALE 1:50



CONCRETE EDGE CORNER DETAIL FOR WATER TANK BASE

SCALE 1:5



TYPICAL CONCRETE CORNER DETAIL

SCALE 1:5

DRG NO.	REFERENCE DRAWINGS:
SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	
00	FIRST ISSUE	K.S.				IPP39344514-00003

SCALE : AS SHOWN

Eskom

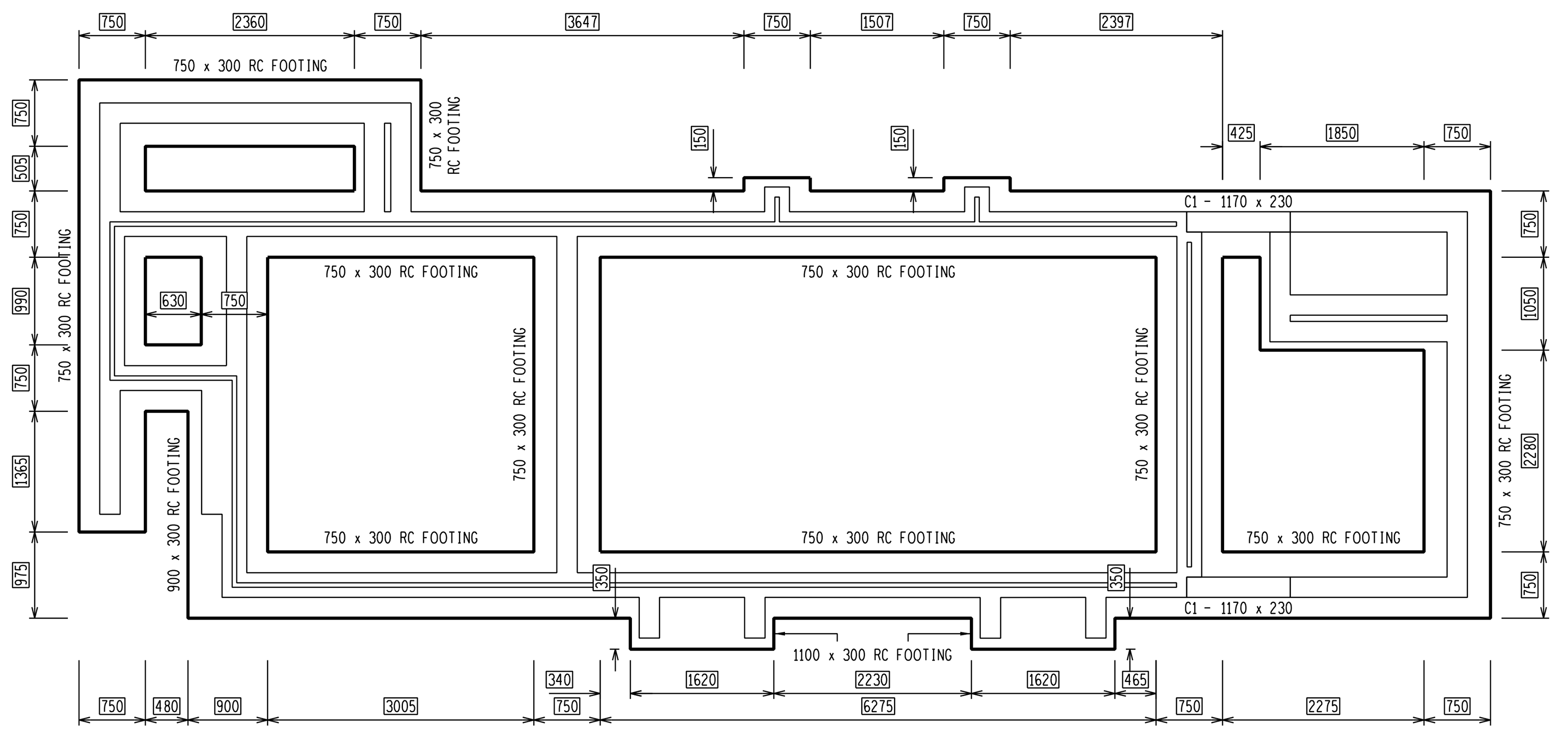
YSTERVARK SUBSTATION

RELAY HOUSE BUILDING SECTIONS & DETAILS

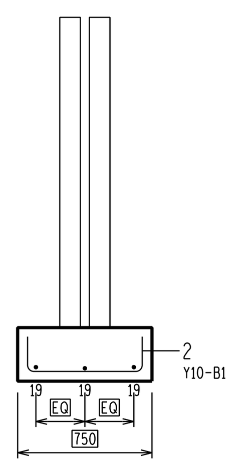
AUTH: K. STEYNBERG	ACC:
DATE: 20/04/2020	DATE: / /
CHKD: P. KOK	CHKD:
DATE: 26/02/2020	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 16/10/2019	DATE: / /

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	18	05	00

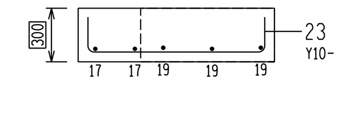
A1L



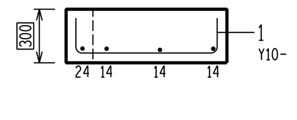
FOUNDATION LAYOUT
SCALE 1:50



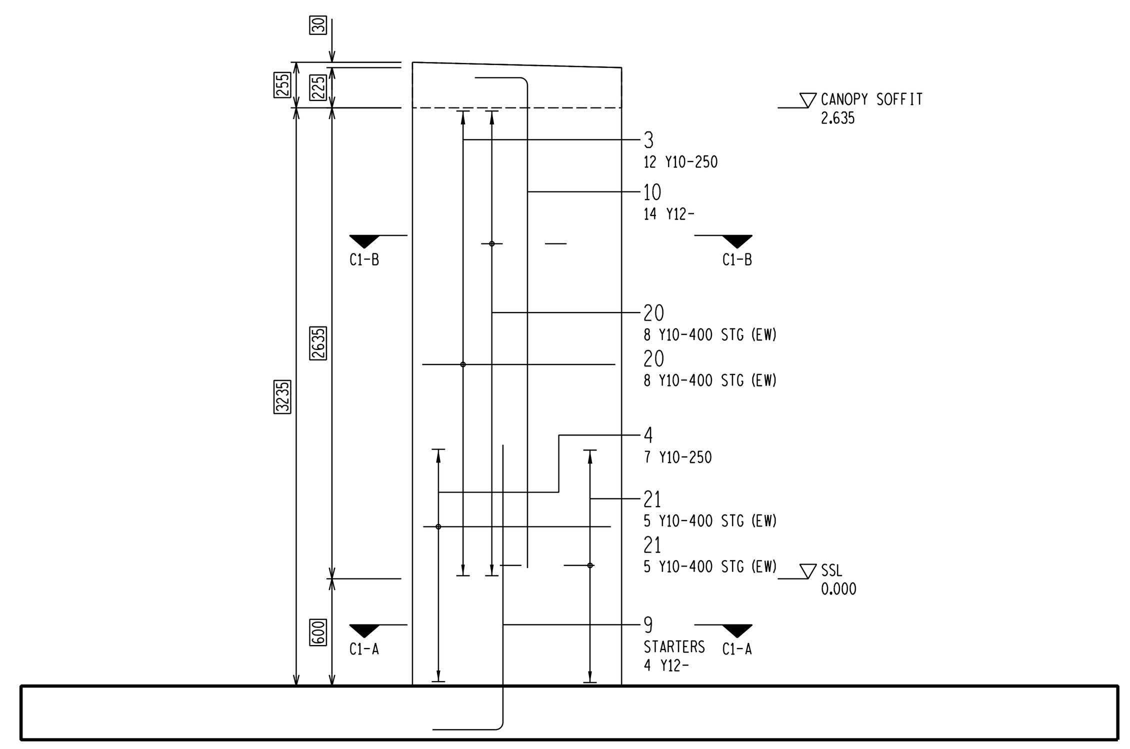
SECTION A-A
SCALE 1:25



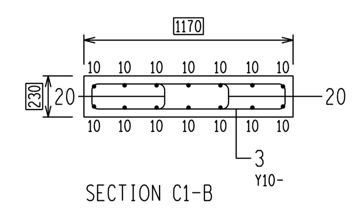
SECTION B-B
SCALE 1:25



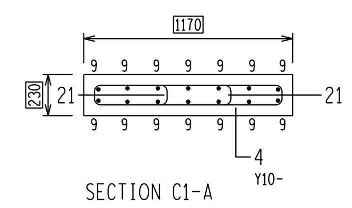
SECTION C-C
SCALE 1:25



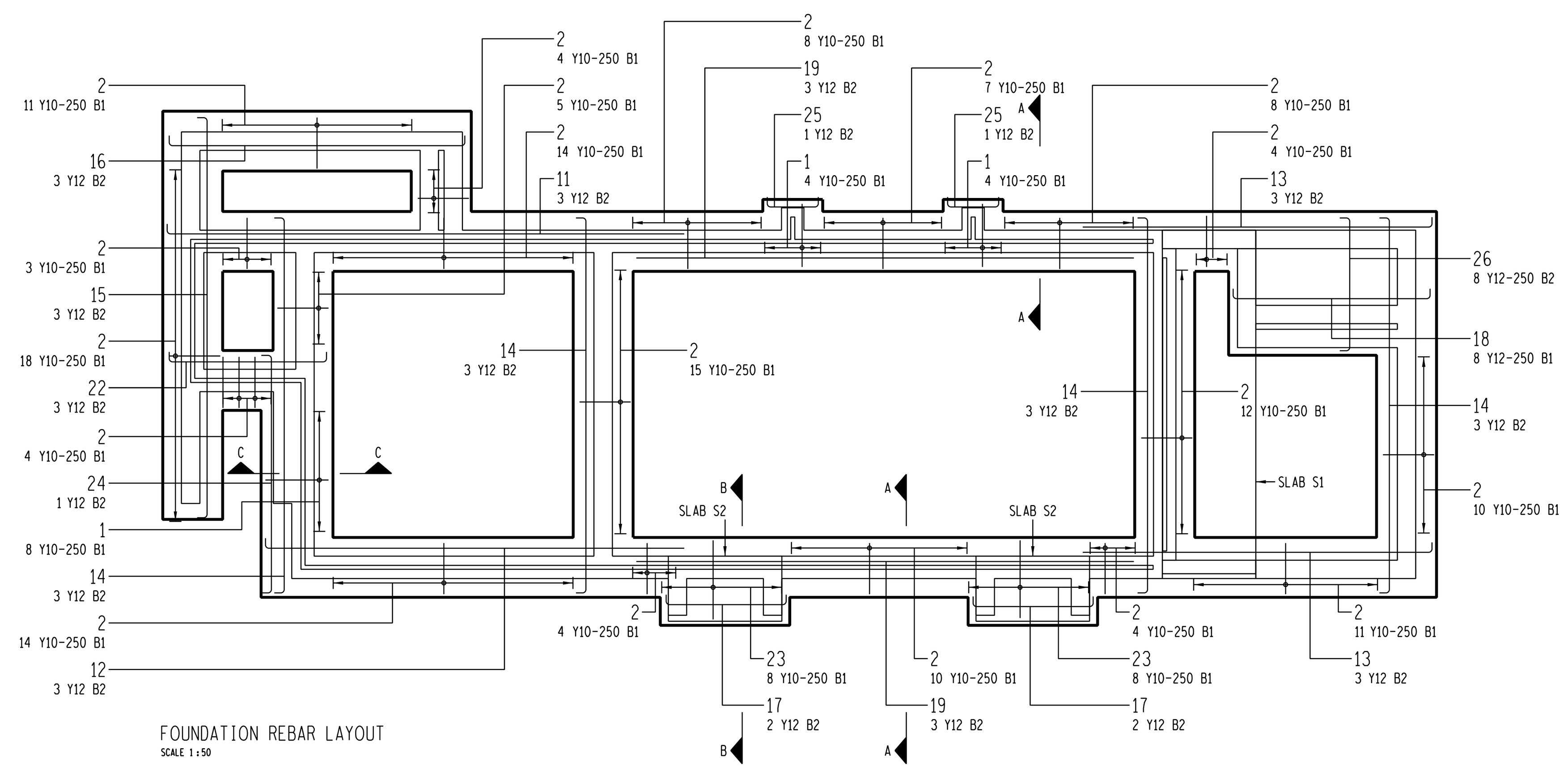
COLUMN C1 - 230 x 170
(2 OFF)
SCALE 1:25



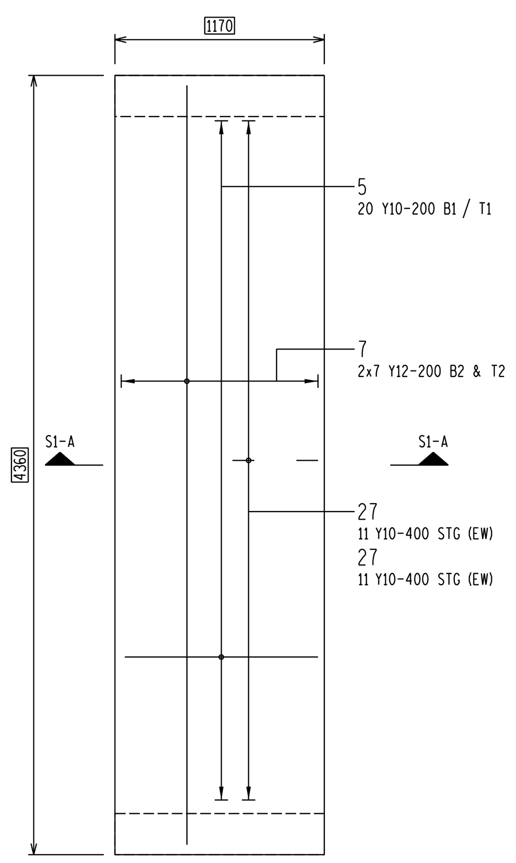
SECTION C1-B
SCALE 1:25



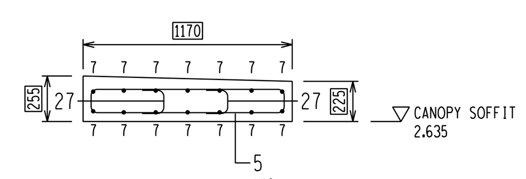
SECTION C1-A
SCALE 1:25



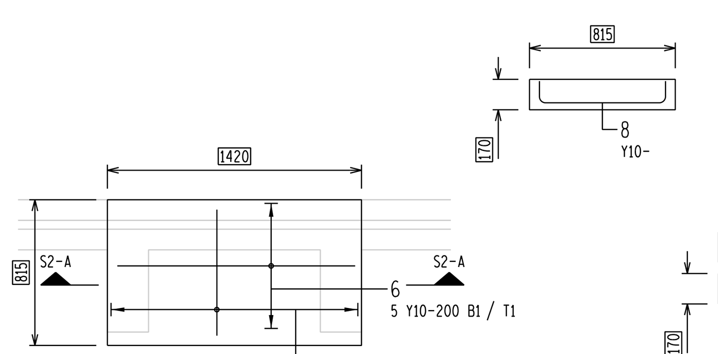
FOUNDATION REBAR LAYOUT
SCALE 1:50



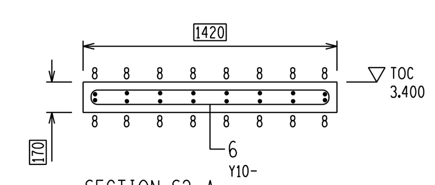
SLAB S1
(1 OFF)
SCALE 1:25



SECTION S1-A
SCALE 1:25



SLAB S2
(2 OFF)
SCALE 1:25



SECTION S2-A
SCALE 1:25

NOTES:

1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON SITE & NOTIFY THE NEC SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION.
3. REFER TO EARTHING ARRANGEMENT DETAIL DRAWINGS FOR EARTHING REQUIREMENTS OF FOUNDATION & STEELWORK.
4. ALL REINFORCEMENT STEEL SHALL BE ARC WELDED TOGETHER FOR EARTHING PURPOSES.
5. ALL EXCAVATIONS & FOUNDING LEVELS SHALL BE INSPECTED & APPROVED BY ENGINEER PRIOR TO CASTING OF CONCRETE.
6. ALL CONCRETE FOUNDATIONS SHALL BE CAST ON 15MPa BLINDING.
7. CONCRETE GRADE STRENGTH: 35MPa / 19mm STONE WITH XYPEX & ADDITIONAL WATERPROOFING MEASURES - AS PER TECHNICAL SPECIFICATIONS - 1424506-4-000-G-SP-0001.
8. ALL EXPOSED CONCRETE EDGES SHALL HAVE 25 x 25mm CHAMFER ALL ROUND.
9. COVER TO REINFORCEMENT SHALL BE 50mm MIN.
10. ALL EXPOSED HORIZONTAL CONCRETE SURFRACES SHALL BE WOOD FLOATED.
11. H.D. BOLTS SHALL NOT BE ARC WELDED TO REINFORCING STEEL ONLY BY MEANS OF CONNECTION CONDUCTOR & EXOTHERMIC WELDING.

FOUNDATION TYPES - GENERAL:

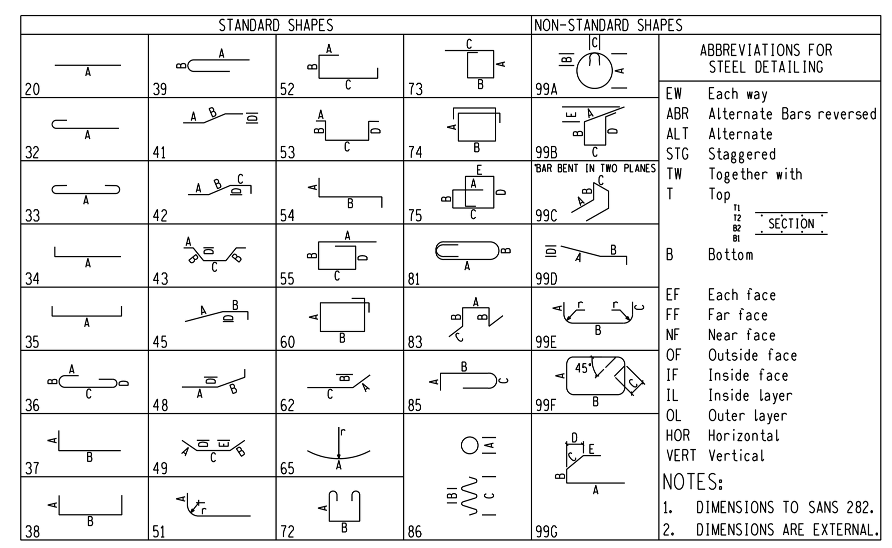
TYPE 1 : FOR COMPACT NON-COHESIVE SOILS CONSISTING OF GRAVELS AND SANDS LOCATED ABOVE THE WATER TABLE. NO REINFORCING IS REQUIRED.

TYPE 2 : FOR STIFF OR FIRM COHESIVE SOILS CONSISTING OF CLAYS AND SILTS THE FOUNDATION TO HAVE A SINGLE LAYER OF BRC WELDMESH 617 PLACED IN THE CENTRE OF THE FOUNDATION, ie 125mm FROM BOTTOM OF FOUNDATION BOTTOM.

TYPE 3 : FOR SOILS CONSISTING OF SOFT CLAYS AND SILTS OR SUBMERGED SOILS THE FOUNDATION AND THE REINFORCEMENT TO BE DESIGNED BY A REGISTERED CIVIL ENGINEER.

MEMBER		MARK	TYPE	NUMBER		LENGTH	SHAPE CODE	A (mm)	B (mm)	C (mm)	REV
NAME	No.		Y Grade450	ELEMENT	TOTAL						
C1	2	3	10	12	24	2730	74	1090	150		
		4	10	7	14	2580	74	1060	120		
		9	12	14	28	1970	37	400	1600		
		10	12	14	28	3020	37	300	2750		
		20	10	16	32	350	35	150			
		21	10	10	20	320	35	120			
RSF-01	1	1	10	16	16	1150	38	200	800	200	
		2	10	166	166	1000	38	200	650	200	
		11	12	3	3	6580	34	6480			
		12	12	3	3	5350	34	5240			
		13	12	6	6	4480	34	4380			
		14	12	12	12	4910	35	4710			
		15	12	3	3	5220	35	5020			
		16	12	3	3	3910	35	3710			
		17	12	4	4	1710	35	1510			
		18	12	8	8	2680	35	2480			
		19	12	6	6	6230	20	6230			
		22	12	3	3	2180	35	1980			
		23	10	16	16	1350	38	200	1000	200	
		24	12	1	1	3190	35	2990			
S1	1	5	10	20	20	2700	74	1090	140		
		7	12	14	14	4510	38	160	4260	160	
		27	10	22	22	340	35	140			
S2	2	6	10	5	10	3050	74	1340	90		
		8	10	16	32	920	35	720			

BAR WEIGHT SUMMARY		
Grade450	Y 10	Y 12
TOTAL LENGTH (m)	446.66	427.23
TOTAL WEIGHT (kg)	275.59	379.38



DRG NO.	REFERENCE DRAWINGS:
SHEET 06	FOUNDATION & STEEL REINFORCING LAYOUT
SHEET 05	SECTIONS & DETAILS
SHEET 04	DOOR SCHEDULE & DETAILS
SHEET 03	POWER, LIGHTING & BASIC SIGNAGE LAYOUT
SHEET 02	ELEVATIONS & ROOF PLAN
SHEET 01	GROUND PLAN & DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					IPP39344514-00003

Eskom

YSTERVARK SUBSTATION

RELAY HOUSE BUILDING
FOUNDATION & STEEL REINFORCING LAYOUT

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE : AS SHOWN

THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: P. KOK	AUTH:
DATE: 20/04/2020	DATE: / /
CHKD: P. KOK	CHKD:
DATE: 16/07/2019	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 16/07/2019	DATE: / /

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	18	06	00

A0L

9 Power Plant

9.1 Overview

The design philosophy of the Ystervark Substation is based on the following:

- The Substation will initially be fed via the existing 66 kV network. However, all HV equipment shall be rated for a 132 kV voltage level, except for the voltage transformers and surge arrestors. This is to facilitate the ease of switchover in future to the planned 132 kV network, which is to replace the existing 66 kV network. When the aforementioned is implemented in future, only the 66 kV voltage transformers and surge arrestors must be upgraded.

- Electrical and maintenance clearances shall be based on a 132 kV voltage level, as per Eskom standards.

- The Substation shall have a double busbar configuration, to allow for N-1 redundancy on the HV side.

- As the Substation will be in a heavy polluted, coastal environment, all applicable outdoor equipment shall have a 31 mm/kV creepage distance respectively.

- The initial phase of Ystervark Substation will consist of the following:

  - 2 x 132 kV feeder bays (Blouwater/Iscor 1 and 2).
  - 3 x 132 kV transformer bays (Main Intake 1, 2 and 3).
  - 1 x Control building.
  - Space allocation for two future 132 kV feeder bays.
  - Space allocation for two 132 kV transformer bays (up to 40 MVA each).
  - Space allocation for a future switch house.
  - Space allocation for the installation of future circuit breakers, if so decided by Eskom, in front of the transformer bay isolators.

The following equipment below depicts the main HV equipment that will be installed during the initial phase (refer to Figure 17 in Section 5.6):

- 3 x 132 kV, 3150 A, 40 kA Circuit breakers.
- 14 x 132 kV, 2500 A, 40 kA Hand operated isolators.
- 3 x 132 kV, 2500 A, 40 kA Motorised isolators.
- 6 x 66 kV Surge arrestors.
- 87 x 132 kV Post insulators.

- 21 x 132 kV, 2500 A, 40 kA Current transformers (6 core: 2 x protection, 2 x buszone & 2 x metering).
- 6 x 66/0.4 kV, 16 kVA Power voltage transformers.
- 6 x 66/0.11 kV, 100/50 VA Voltage transformers.
- Bull and centipede conductors.
- 120 mm x 112 mm x 4 mm 2300 A tubular busbars.

9.2 Specification

9.2.1 Fault Levels

The fault levels at Ystervark Substation, which were provided by Eskom Western Cape Operating Unit's Network Planning Department, consists of two scenarios namely: the fault levels for the initial 66 kV voltage level supply and those for the future planned 132 kV supply.

The first scenario involves the following:

- Ystervark Substation @ 66 kV, connected via 2 x 66 kV Chickadee overhead lines to Blouwater Substation with the Blouwater 66 kV busbars supplied through 3 x 80 MVA, 132/66 kV transformers.

Table 6: Scenario 1 - 66 kV Three Phase and Single Phase Fault Levels at Ystervark Substation

Busbar Name	**U_{nom} (kV)**	**I - 3 Ø (kA)**	**I - 1 Ø (kA)**
Ystervark 132 kV BB1	66	8.2	8.8

The second scenario consists of the following:

- Ystervark Substation @ 132 kV, connected via 2 x 132 kV Kingbird overhead lines to Blouwater Substation's 132 kV busbars, with the future planned Bokkom MTS supplying Blouwater Substation via 3 x 500 MVA, 400/132 kV transformers (with additional future generation feeds considered).

Table 7: Scenario 2 - 132 kV Three Phase and Single Phase Fault Levels at Ystervark Substation

Busbar Name	**U_{nom} (kV)**	**I - 3 Ø (kA)**	**I - 1 Ø (kA)**
Ystervark 132 kV BB1	132	23.2	21.4

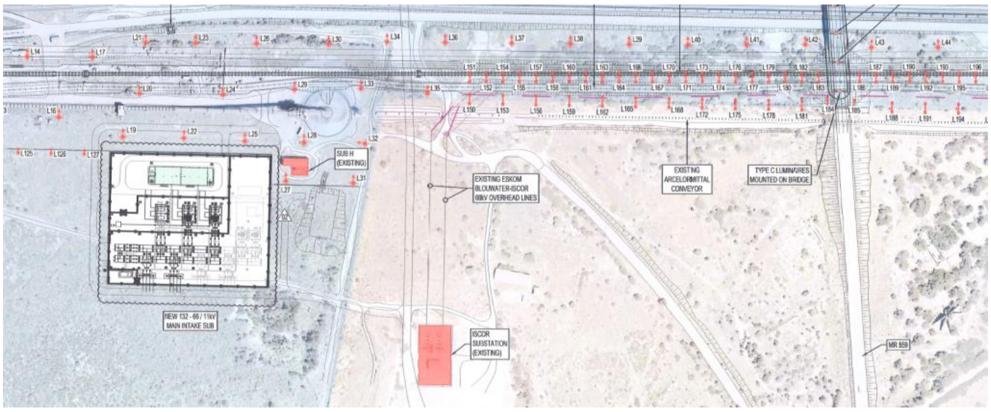
It should be noted that Eskom Network Planning recommended the use of a 30 kA (or higher) design fault level, as a result of the proximity of Ystervark Substation to the future planned Bokkom 400/132 kV MTS as well as future planned generation stations in the Saldanha area.

It is declared that for design purposes of the Ystervark Substation, a 30 kA fault level has been used.

9.2.2 Earthing

TECHNICAL MEMORANDUM

- DETAILED EARTH ELECTRODE DESIGN (SCENARIO 2) OF THE MAIN INTAKE SUBSTATION AT THE TRANSNET TIPPLER 3 PROJECT, SALDANHA -



Prepared by :

Dr Pieter H Pretorius
Principal Consultant, TERRATECH

Prepared for : Mr William Kekana
Electrical Engineer, KHATO-THENGA Joint Venture
Project: Transnet Saldanha E004 Package

Date : 9 March 2020 **Rev** : 0.4

History to the Document and Its Revisions

No	Revision	Description	Changes	Date of Issue
1	Rev 0.1	Initial report submitted for review by the Engineering Team.	First issue of document.	11 Feb 2020
2	Rev 0.1a	Inclusion of the earth electrode drawing prepared by the Engineering Team.	Addition of the earth electrode detailed drawing in Appendix E.	13 Feb 2020
3	Rev 0.1b	Update on earth tails as requested by the Engineering Team.	20 mm diameter solid round copper conductor can be used as alternative for earth tails.	18 Feb 2020
4	Rev 0.2	Update drawings as requested by the Engineering Team.	Addition of the fence earthing detailed drawing in Appendix E.	27 Feb 2020
5	Rev 0.3	Confirm electrode performance as requested by the Engineering Team.	Addition of the earth electrode drawing accommodating for foundations – includes electrode performance in Appendix F.	2 Mar 2020
6	Rev 0.4	Confirm electrode performance, with electrode modified to accommodate 4 x 250 mm diameter stormwater pipes, as requested by the Engineering Team.	Addition of the updated earth electrode drawing accommodating the stormwater pipes – includes electrode performance - covered in Appendix F.	9 Mar 2020

CONTENTS

1. INTRODUCTION

Khato-Thenga Joint Venture is currently involved in the design and construction of the Main Intake Substation, as part of the Tipler 3 Project at the Transnet Port, Saldanha. Part of the process involves the detailed design of the substation earth electrode and safety analysis.

TERRATECH, South Africa (www.terratechnology.co.za), was appointed by Khato-Thenga Joint Venture, on behalf of Transnet, to perform the earth electrode design and safety analysis. The findings and considerations related to the electrode design and safety analysis are presented in this document. This document addresses specifically the integrated electrode (Scenario 2) design.

This document should be studied in conjunction with:

- The MIS electrode design report, considering the electrode in isolation (Scenario 1) [1];
- The Corrosion Considerations reported in [2] and
- The Lightning Protection System (LPS) design covered in [3].

2. APPROACH

2.1 Scope of Work

2.1.1 Objective

The objective with this part of the study was to do the safety analysis of the electrode based on Scenario 2, integration of the Main Intake Substation (MIS) electrode with other earth electrodes on the plant. The MIS earth electrode covers the two parts of the substation: the Ystervark (Eskom) portion as well as the Transnet portion.

2.1.2 Electrodes Considered in the Numerical Model

It is noted that the integrated earthing system extends widely across the plant as shown in Drawing: Tippler 3 Materials Handling Conveyor LPS & Earthing Layout – Rev 4, Sheet 1 to 21 (Drawing has no number). This large integrated earthing system will have a significant effect on lowering the overall, integrated earth electrode resistance. It is noted that this lowering in resistance is non-linear.

Only the following interconnected electrodes were conservatively considered for the numerical modelling and safety analysis as per Drawing No 1924701-2-200-E-LA-0015-01-02AE, Iron Ore Tippler 3 Project: Tippler 3 Materials Handling Conveyor – Conveyor Earthing Block Diagram and Drawing No: 1924701-2-300-E-SL-0008-01-01AE, Iron Ore Tippler 3 Project – Bulk Power Upgrade: New Main Intake Substation Single Line Diagram (See Appendix A):

- Main Intake Substation (Connected to Substation M and Substation N);
- Substation M (Connected to CV 308 Drive Station and CV 308 Transfer Station);
- CV 308 Drive Station (Connected to CV 308 Transfer Station);
- CV 308 Transfer Station (Connected to CV 309 Drive Station)

- Substation N (Connected to CV 309 Drive Station and CV 310 Transfer Station);
- CV 309 Drive Station (Connected to CV 310 Transfer Station);
- CV 310 Transfer Station (Connected to Substation N) (This electrode was excluded from model because of limited information available on the electrode at the time of the study).

All earth connections between electrodes are made with 70 mm^2 Insulated Copper Earth Wire (ICEW). Additional earth connections between electrical equipment supported by the various earth electrodes and bonding of cable armouring to the earth electrodes were (conservatively) ignored.

2.1.3 Electrode Locations

The locations of the electrodes and earthing system outlay were guided by:

- Drawing No: 1924701-2-335-E-LA-0003-01-02AE, Iron Ore Tippler 3 Project – High Mast Lightning: Site Layout and
- Drawing No: 1924701-2-200-E-LA-0015-01-02AE, Iron Ore Tippler 3 Project: Tippler 3 Materials Handling Conveyor – Conveyor Earthing Block Diagram.

The location information of CV 310 Transfer Station was not yet available from drawings as was confirmed by KTJV (on 8 Feb 2020).

The cable route length was confirmed by e-mail from KTJV (9 Jan 2020) as

- Route from Main Intake Substation to Substation M is 1 500 m.
- Route from Main Intake Substation to Substation N is 350 m.

2.1.4 Electrode Resistances

All electrodes, other than the MIS earth electrode, were simulated as electrodes with resistance < 1 Ω (0,74 Ω) as per the drawings noted above. These electrode models involved a 50 x 50 m square electrode buried at 0,6 m in the soil structure noted in Section 2.6. Figure 1 shows the integrated earthing system employed in the numerical modelling.

2.3 Applicable Standards / Documents

The applicable standard used in the safety analysis was:

- IEEE Std 80 [4].

Integration of the earth electrode with the lightning protection system (LPS) was based on:

- IEC 62305 [5, 6, 7 and 8].

2.4 Software

The software applied in the development of the soil structure/s was:

CDEGS (**C**urrent **D**istribution, **E**lectromagnetic Fields, **G**rounding and **S**oil Structure Analysis Software), Ver 15.1.4141.

2.5 User Requirement Specification

The following User Requirement Specification (URS), shown in Table 1, was used as input to the design and safety analysis of Scenario 2 (Integrated earthing system):

Table 1: User Requirement Specification (URS) used as input to the design and safety analysis – Scenario 2.

Description	Value	Remarks / Reference
Single phase to ground fault	30 kA	
Fault clearing time	0,5 sec	
Electrode material (horizontal electrode members)	16 mm diameter solid round copper	As per initial design report [1].
Electrode material (vertical electrode rods)	20 mm diameter solid round copper x 2 m	As per initial design report [1].
Electrode burial depth	600 mm	600 mm below surface of final backfill of platform [1].
Surface covering 1	Crusher stone	Consider as option for surface covering.
Surface covering 1 thickness	15 cm	Limited to max of 15 cm as per comments from client on [1].
Surface covering 1 resistivity	3000 Ω.m	Wet crusher stone - IEEE Std 80 (2013)
Surface covering 2	Concrete Block Brick	Consider as option for surface covering.
Surface covering 2 thickness	10 cm	Typical
Surface covering 2 resistivity	100 Ω.m	Wet – As per Eskom guide.
Surface covering 3	Asphalt	Consider as option for surface covering.
Surface covering 3 thickness	10 cm	Typical
Surface covering 3 resistivity	10 000 Ω.m	
GPR limit	5 kV	As per Eskom Earthing Standard.
Weight of person for safety analysis	50 kg	IEEE Std 80 (2013)
Extra boot resistance	5 kΩ	To be captured in safety regulations of plant.
Body resistance	1000 Ω	IEEE Std 80 (2013)

Substation Operators Grid	Yes	Employ i) If Boot Resistance cannot be guaranteed through safety regulations; ii) Where metal components can be touched along areas inside the substation.
Design Criterion	For the detailed design to present a solution, the step and touch potentials must be safe and the GPR limit of 5 kV must be met.	Requirement as per teleconference with client on 7 Feb 2020.
Soil structure	See below	Based on soil resistivity measurements taken on 27 / 28 Nov 2019 and covered in the Corrosion Study report [1, 2].
Design approach	• Design for full fault current to passing into soil via the integrated earth electrode. • Allow for Scenario 2: Earth electrode integrated with electrodes of Substation M & Substation N as a minimum.	Based on set scope of work.

2.6 Soil Structure

The soil structure shown in Table 2, developed from the soil resistivity measurements and as presented in [1] and recommended from [2], was used in the electrode design and safety analysis with Scenario 2.

Table 2: Soil structure used in the electrode design and safety analysis.

Layer	Resistivity (Ω.m)	Thickness (m)
1 (Top)	245,2	1,0
2	19,8	3,2
3	21,8	19,2
4 (Bottom)	130,9	Infinite

2.7 Exclusions from the Scope of Work

Considerations related to equipment electromagnetic compatibility (EMC) fell outside the scope of work and are not included in this report.

3. FINDINGS – ELECTRODE DESIGN AND SAFETY ANALYSIS

3.1 Electrode Outlay

Figure 1 shows the MIS electrode (146,1 m x 119,7 m with 10 x 2 m vertical rods along the periphery, buried at 0,6 m depth) integrated with the five electrodes (< 1 Ω) noted. Details pertaining to the development of the integrated earth electrode are presented in Appendix B. Figure 2 shows the MIS earth electrode only.

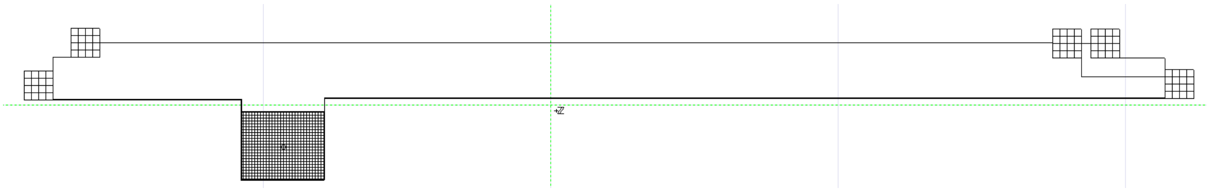
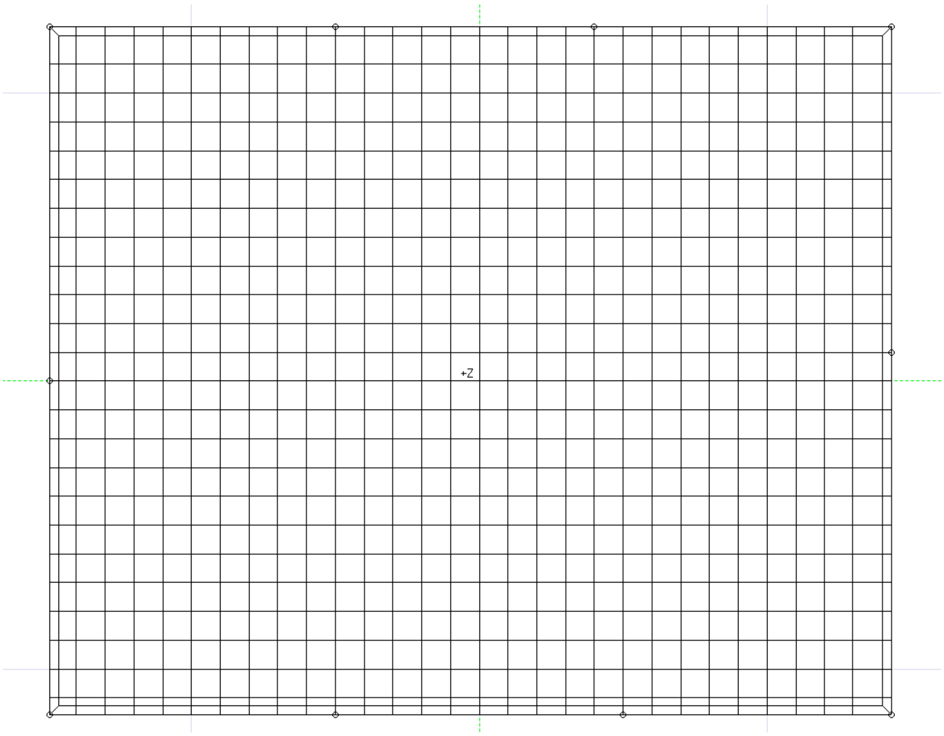


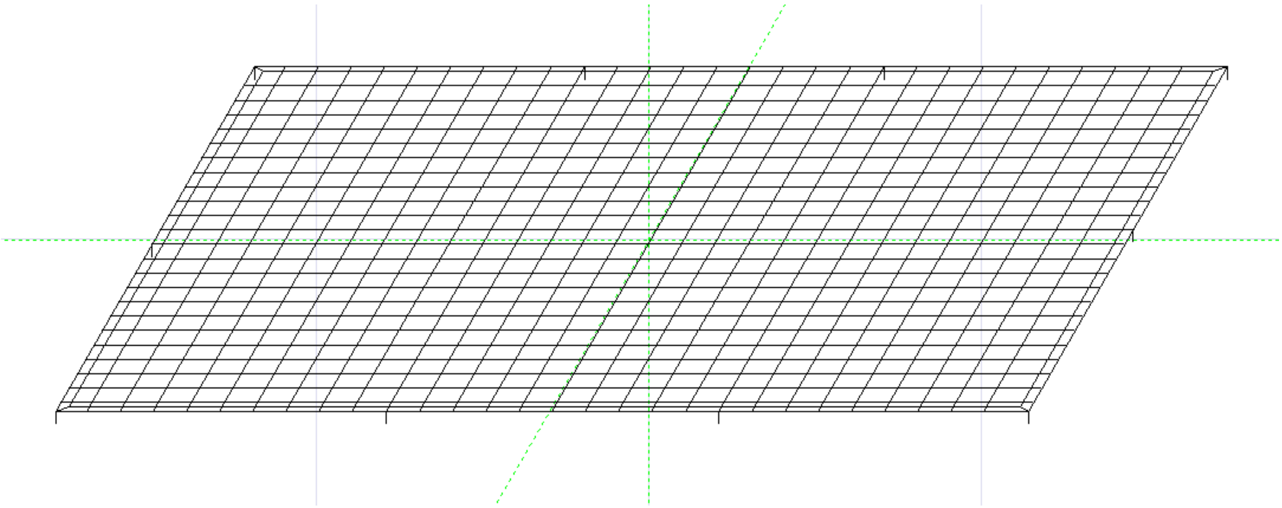
Figure 1: MIS electrode (largest electrode) integrated with the five noted electrodes and used in the design and safety analysis of Scenario 2.

3.2 Electrode Resistance Based on Earthing System Expansion

The MIS electrode used in the analysis is shown in Figure 2, as obtained from [1].



(a) Plan View.

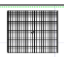
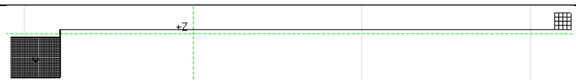
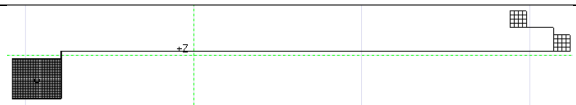
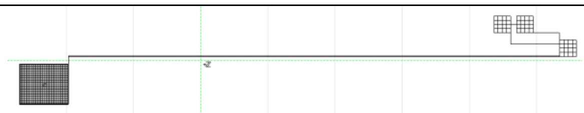
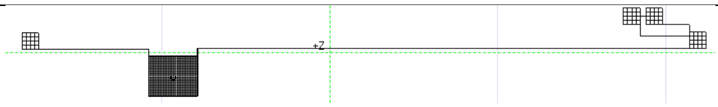
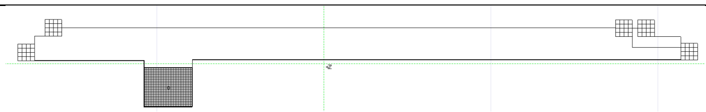


(b) Perspective View.

Figure 2: MIS earth electrode used in the analysis [1]: (a) Plan View; (b) Perspective View.

Table 3 shows the lowering of the integrated earth electrode resistance as the earthing system is expanded by integrating more individual electrodes with the MIS electrode. The integrated earth electrode resistance was calculated from the noted GPR divided by the full fault current (30 kA) injected into the electrode.

Table 3: Integrated earth electrode resistance resulting from integrating more individual electrodes with the MIS electrode.

Resistance (Ω)	Earthing System
0,218	
0,199	
0,199	
0,199	
0,170	
0,158	

By expanding the earthing system as shown in Table 3 above, starting with the MIS earth electrode, the integrated earth electrode resistance drops by 28 % from 0,22 Ω to 0,158 Ω. Electrodes closer to the MIS earth electrode having a more significant effect. With the overland conveyor, the Iscor substation and the CV 310 transfer station electrodes forming part of this integrated earthing system, the resistance is expected to drop even further. For the purposes of this (Scenario 2) analysis, only the electrodes noted above and selected for the modelling are relevant.

3.3 Safety Analysis – Based on Full Fault Current

3.3.1 Cases Considered

The following cases were considered:

- **Case 1:** Base Case - Integrated electrode involving:
    - 30 kA fault
    - 500 ms fault clearing
    - 50 kg person
    - No surface covering
    - No boot resistance

- **Case 2:** Case 1 with 15 cm crusher stone (3000 Ω.m wet);
- **Case 3:** Case 1 with 15 cm crusher stone plus 3000 Ω Boot resistance;
- **Case 4:** Case 1 with 10 cm Asphalt (10 000 Ω.m);
- **Case 5:** Case 1 with 10 cm Concrete Block Paving (100 Ω.m wet);
- **Case 6:** Case 1 with 10 cm Concrete Block Paving (100 Ω.m wet) plus 10 000 Ω Boot Resistance;
- **Case 7:** Case 1 with 15 cm crusher stone plus 80 % split factor.
- **Case 8:** Case 1 with 15 cm crusher stone (3000 Ω.m wet) plus modified electrode;

3.3.2 Summary of Safety Analysis

The details of the safety analysis are presented in Appendix C. A summary of the findings of the safety analysis for Scenario 2 is presented below in Table 4.

Table 4: Summary of safety analysis performed for Scenario 2.

Case No	Reach / Touch Voltage		Step Voltage		GPR (kV)
	Min Threshold (V)	Max Value (V)	Min Threshold (V)	Max Value (V)	
1	214	> 214	391	< 391	4,7
2	735	≈ 735*	2 476	413	4,7
3	967	< 967	3 403	413	4,7
4	1 827	1 410	6 843	413	4,7
5	185	> 185**	276	< 276	4,7
6	958	< 958	3 366	413	4,7
7	735	< 735	2 476	331	3,8
8	735	< 735	2 476	400	4,7

* Reach potential only exceeded along the peripheral corners and can easily solved by modification of the electrode at the corners. Case 2 offers a near solution. Case 8 presents the full solution for Case 2 with modified electrode.

** For the wet concrete paving bricks to offer a solution, a 10 kΩ boot resistance must be ensured.

From Table 4 the following is noted:

- Case 2 offers a near-solution and requires minor modification to the electrode corners. Case 8 presents the full solution for Case 2 with the minor modification at the electrode corners. The modified electrode is shown in Figure 3.

- Case 5 shows that everywhere concrete block paving is used and where metallic structures can be touched, operator grids need to be introduced. Alternatively, at least 10 kΩ boot resistance will be required.

- Five options with solutions are presented and include:

    - Case 3 offers a solution (Option 4).
    - Case 4 offers a solution (Option 5).
    - Case 6 offers a solution (Option 6).
    - Case 7 offers a solution (Option 7).
    - Case 8 offers a solution (Option 8). Case 8 is the preferred option.

- The maximum GPR = 4,7 kV.

- The isolated MIS electrode (as shown in Figure 3) has a calculated resistance of 0,2 Ω.

3.4 Proposed Solution

3.4.1 Electrode Configuration

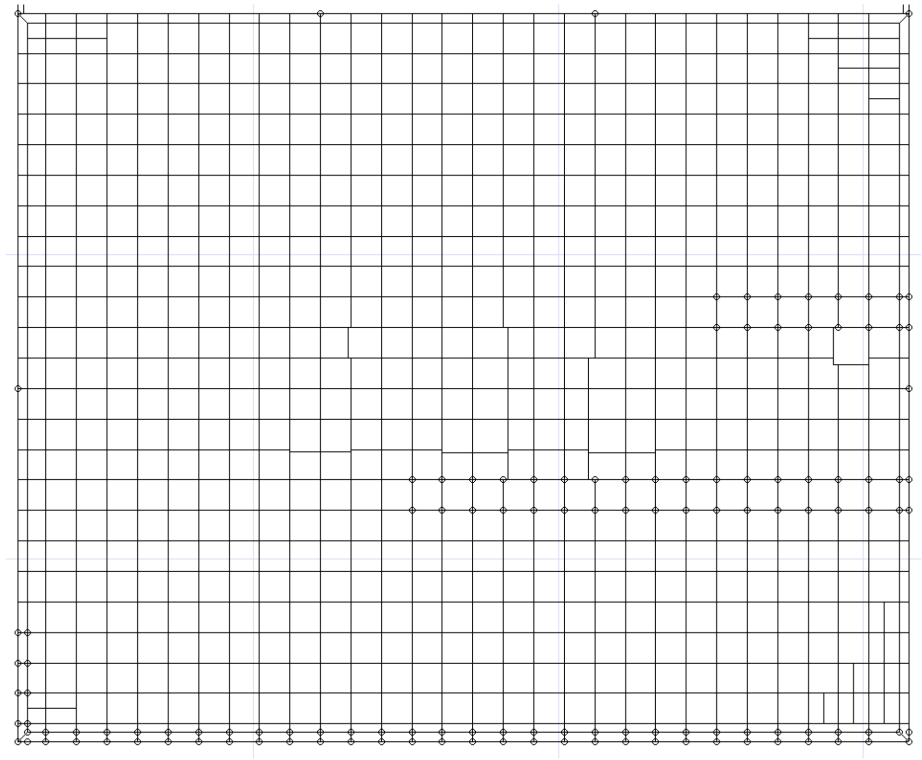
The proposed solution is based on Option 8 covered by Case 8 (10 x 2 m long 20 mm diameter rods along the electrode periphery of the modified electrode shown in Figure 3 and 15 cm thick crusher stone (3000 Ω.m wet resistivity).

Where concrete block paving is used and where metallic structures can be touched, operator grids need to be introduced.

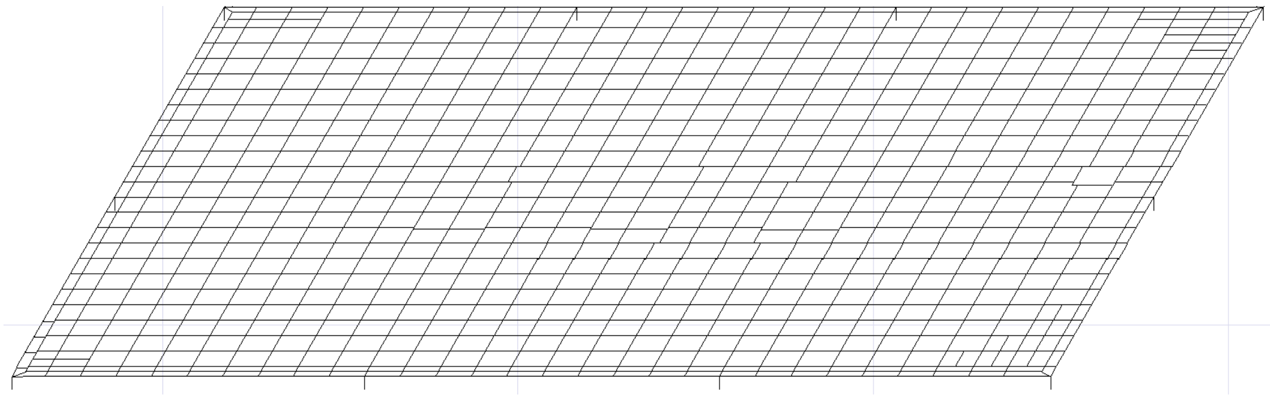
Option 8 is the preferred option with the proposed electrode shown in Figure 3.

The electrode (Option 8) was modified to accommodate for foundations and stormwater pipes. Details are presented in Appendix F.

The safety of the electrode, modified to accommodate for foundations and stormwater pipes, was confirmed and offered a solution (See Appendix F).



(a) Plan View.



(b) Perspective View.

Figure 3: Modified MIS earth electrode required for Case 8 (accommodating foundations and 4 x stormwater pipes): (a) Plan View; (b) Perspective View.

3.4.2 Electrode Performance and Specification

Based on the proposed solution and preferred option, Option 8, the following electrode performance parameters and specifications are provided as shown in Table 5:

Table 5: Proposed Electrode Performance and Specification:

Description	Value	Remarks / Reference
Single phase to ground fault	30 kA	
Fault clearing time	0,5 sec	
Electrode material (horizontal electrode members)	16 mm diameter solid round copper	Minimum diameter as per initial design report [1].
Electrode material (vertical electrode rods)	20 mm diameter solid round copper x 2 m	Minimum diameter as per initial design report [1]*
Electrode burial depth	600 mm	600 mm below surface of final backfill of platform [1].
Surface covering 1	Crusher stone	Preferred based on Option 8 (Case 8)
Surface covering 1 thickness	15 cm	
Surface covering 1 resistivity	3000 Ω.m	Wet crusher stone - IEEE Std 80 (2013)
Surface covering 2	Concrete Block Brick	Requires operator grids where metallic structures can be touched. Alternatively, boot / glove resistance of at least 10 kΩ.
Surface covering 2 thickness	10 cm	Typical
Surface covering 2 resistivity	100 Ω.m	Wet – As per Eskom guide.
GPR limit	5 kV	Max GPR calculated at 4,7 kV
Weight of person for safety analysis	50 kg	IEEE Std 80 (2013)
Extra boot / glove resistance	None	Only applicable to concrete block paving (see Case 5). Alternatively, to employ operator grids.
Body resistance	1000 Ω	IEEE Std 80 (2013)
Substation Operators Grid	Yes	Employ i) If Boot Resistance cannot be guaranteed through safety regulations; ii) Where metal components can be touched along areas inside the substation.
Design Criterion for Solution	For the detailed design to present a solution, the step and touch potentials must be safe and the GPR limit of 5 kV must be met.	For Case 8 (Option 8), the step and touch potentials are safe across the MIS electrode and the maximum GPR was calculated at 4,7 kV. The MIS electrode resistance is 0,2 Ω.
Touch / Reach Voltage (Maximum Value)	< 735 V	
Touch / Reach Voltage (Safety Threshold)	735 V	
Step Voltage (Maximum Value)	400 V	
Step Voltage (Safety Threshold)	2 476 V	

* From the kick-off meeting (22 Nov 2019), it was noted that the water table is 2,5 m below surface level (this will be confirmed by geological surveys early in 2020). The vertical rod length was selected at 2m length to allow for proper penetration into the lower resistivity soil without intrusion of the water table.

200 mm diameter holes to be drilled 2,6 m deep (considering the electrode will be buried at 600 mm depth). The 20 mm diameter vertical copper rods to be introduced into the holes and then to be backfilled with bentonite slurry mixture. It is specifically noted that the limited number of 10 x vertical rods are introduced along the periphery of the electrode in order not to affect any nearby concrete structures (as concern was expressed about the use of bentonite near concrete foundations).

Bentonite is referenced in [9] and its proposed application is in accordance with [9].

3.4.3 Electrode Integrated Components

In view of the fact that the step potentials are in essence safe for all the cases considered (see Table 4), the following recommendation is made where touch potentials are of concern, particularly when concrete block paving is employed and where metal structures can be touched – see Case 5 as an example:

To protect against touch potentials, at selected areas, substation operator grids (Figure 4) should be installed at selected locations (where touch voltages present a threat inside the substation). This may be relevant in the case: i) If the Boot / Glove Resistance cannot be guaranteed through safety regulations; ii) Where metal components can be touched along areas where concrete brick paving is employed.

Figure 4: Substation operator grids - to be installed at selected locations (where touch voltages present a threat inside the substation and where concrete brick paving is employed).

3.4.4 Electrode Earth Tails

The following specific requirements for earth tails as per [9] (Eskom, Substation Earth Grid Design Standard, Unique Identifier 240-134369472, 27 Mar 2018) are noted:

- "*Each earth tail between the structure and main earth grid shall be either 2 x 10 mm diameter annealed soft drawn round copper rods in parallel (standard Tx practice) or a single 50 x 3mm copper bar (standard Dx practice)*".

  The earth tails selected for the Main Intake Substation earth electrode are 50 x 3 mm copper strap. It is noted that this may be replaced with an insulated copper conductor with same equivalent cross-sectional area. As an alternative, 20 mm diameter, solid round copper conductor may be used for the earth tails.

- Earth tails shall be installed as per the Eskom Earthing Standard [9].
- "*No visible copper shall be present, including structure earth tails. Structures shall be earthed through the foundation holding down bolts*".
- "*All lighting and lightning masts shall be bonded to the earth grid via at least two earth tails*".

4. ADDITIONAL CONSIDERATIONS

4.1 Corrosion

Corrosion considerations were treated in [2].

4.2 Electrode Material

The following is noted (see the Bill of Materials in Appendix D:

- The electrode horizontal conductors (7,9 km) shall be single, solid, round, copper conductor with a minimum diameter of 16 mm; This is the minimum specification. Should the client prefer, this diameter can be extended to 20 mm.
- The electrode vertical conductors (10 x 2 m length) shall be single, solid round, copper conductor with a minimum diameter of 20 mm. These vertical conductors shall be installed in 200 mm diameter holes filled with Bentonite.

In addition,

- The horizontal electrode shall be installed at a depth of 600 to 650 mm below the surface of the final backfill layer.
- Earth tails shall comprise of 50 mm x 3 mm copper strap (with insulated copper conductor with same equivalent cross section, as alternative).
- To prevent against corrosion, the earth tails shall be coated with a PVC shrink sleeve. It was shown that the rise in temperature under fault conditions are unlikely to affect the shrink sleeve.
- With the electrode buried at 600 mm to 650 mm depth, the electrode conductors will pass through the concrete foundations inside the substation. This will make bonding to the structures easier where the bonding conductors (the earth tails) can be embedded within the concrete (as per [9]) without the need for insulation of the tails against potential corrosion.

4.3 Conductor Current Carrying Capacity

Conductor current carrying capacity was addressed in [1].

4.4 Earth Tail Split Factor

The details pertaining to the current split of the earth tails were addressed in [1].

4.5 Integrated Earth Electrode

The calculated earth electrode resistance of the MIS electrode in isolation is 0,2 Ω. This falls well within the requirement, for the earth electrode to have a resistance of ≤ 10 Ω [4 – 7], from a lightning perspective.

4.6 Bill of Materials

The Bill of Materials (BoM) for the proposed solution (Option 8), accommodating foundations and stormwater pipes, is presented in Appendix F, Section 13.3.

4.7 Electrode Welding

The following is noted:

- Only brazed and exothermically welded connections are acceptable in accordance with [9].

- To protect against possible corrosion, it is recommended that the connections be covered with Denzo Paste / Lectro Paste / or equivalent.

5. CONCLUDING REMARKS

5.1 Conclusions

The findings of the detailed earth electrode design and safety analysis of the Main Intake Substation, as part of the Tipler 3 Project at the Transnet Port, Saldanha, based on the requirements for Scenario 2, was addressed in this report.

The following conclusions were drawn:

- By expanding the earthing system, starting with the MIS earth electrode, the integrated earth electrode resistance drops by 28 % from 0,22 Ω to 0,158 Ω.

  Electrodes closer to the MIS earth electrode having a more significant effect. With the overland conveyor, the Iscor substation and the CV 310 transfer station electrodes forming part of this integrated earthing system, the resistance is expected to drop even further.

  For the purposes of this (Scenario 2) analysis, only the electrodes noted and selected for the modelling were relevant.

- **Scenario 2 involved the following 8 cases that were studied:**

  - **Case 1:** Base Case - Integrated electrode involving:

    30 kA fault
    500 ms fault clearing

50 kg person
No surface covering
No boot resistance

- **Case 2:** Case 1 with 15 cm crusher stone (3000 Ω.m wet);
- **Case 3:** Case 1 with 15 cm crusher stone plus 3000 Ω Boot resistance;
- **Case 4:** Case 1 with 10 cm Asphalt (10 000 Ω.m);
- **Case 5:** Case 1 with 10 cm Concrete Block Paving (100 Ω.m wet);
- **Case 6:** Case 1 with 10 cm Concrete Block Paving (100 Ω.m wet) plus 10 000 Ω Boot Resistance;
- **Case 7:** Case 1 with 15 cm crusher stone plus 80 % split factor.
- **Case 8:** Case 1 with 15 cm crusher stone (3000 Ω.m wet) plus modified electrode;

- Case 2 offered a near-solution and required minor modification to the electrode corners. Case 8 presented the full solution for Case 2 with the minor modification at the electrode corners. The modified electrode (accommodating foundations and stormwater pipes) is shown in Figure 3.

- Case 5 showed that everywhere concrete block paving is used and where metallic structures can be touched, operator grids need to be introduced. Alternatively, at least 10 kΩ boot resistance will be required for safety.

- From the eight cases considered, five options with solutions were presented and included:

  - Case 3 offered a solution (Option 4).
  - Case 4 offered a solution (Option 5).
  - Case 6 offered a solution (Option 6).
  - Case 7 offered a solution (Option 7).
  - Case 8 offered a solution (Option 8). Case 8 was the preferred option.

- The maximum calculated GPR was 4,7 kV.

- The isolated MIS electrode (as shown in Figure 3) had a calculated resistance of 0,2 Ω.

- Details pertaining to the proposed electrode and preferred solution are covered in Section 3.4 and Section 4.

- The safety of the electrode, modified to accommodate foundations and stormwater pipes, was confirmed and offered a solution (See Appendix F).

5.2 Recommendations

The following recommendations, in no specific order, are made:

- The recommendations and instructions pertaining to the proposed electrode, covered in Section 3.4 and Section 4, should be followed.

- Once the electrode is completely installed, the electrode resistance should be measured and should be compared with the target value of 0,2 Ω.

6. REFERENCES

[1] P H Pretorius, Detailed Earth Electrode Design of the Main Intake Substation at the Transnet Tippler 3 Project, Saldanha, Technical Memorandum prepared for Mr William Kekana, Electrical Engineer, KHATO-THENGA Joint Venture on behalf of Transnet Capital Projects (TCP), Rev 0.0, 13 Jan 2020.

[2] P H Pretorius, Corrosion Considerations Related to the Earth Electrode of the Main Intake Substation at the Transnet Tippler 3 Project, Saldanha, Technical Memorandum prepared for Mr William Kekana, Electrical Engineer, KHATO-THENGA Joint Venture on behalf of Transnet Capital Projects (TCP), Rev 3, 19 Dec 2019.

[3] P H Pretorius, Lightning Protection of the Main Intake Substation at the Transnet Tipler 3 Project, Saldanha, Technical Memorandum prepared for Mr William Kekana, Electrical Engineer, KHATO-THENGA Joint Venture on behalf of Transnet Capital Projects (TCP), Rev 0, 1 Jan 2020.

[4] IEEE Std 80, IEEE Guide for Safety in AC Substation Grounding, 2013.

[5] IEC 62305-1, Edition 2, Protection Against Lightning, Part 1: General Principles, 2010.

[6] IEC 62305-2, Edition 2, Protection Against Lightning, Part 2: Risk Management, 2010.

[7] IEC 62305-3, Edition 2, Protection Against Lightning, Part 3: Physical Damage to Structures and Life Hazard, 2010.

[8] IEC 62305-4, Edition 2, Protection Against Lightning, Part 4: Electrical and Electronic Systems within Structures, 2010.

[9] Eskom, Substation Earth Grid Design Standard, Unique Identifier 240-134369472, 27 Mar 2018.

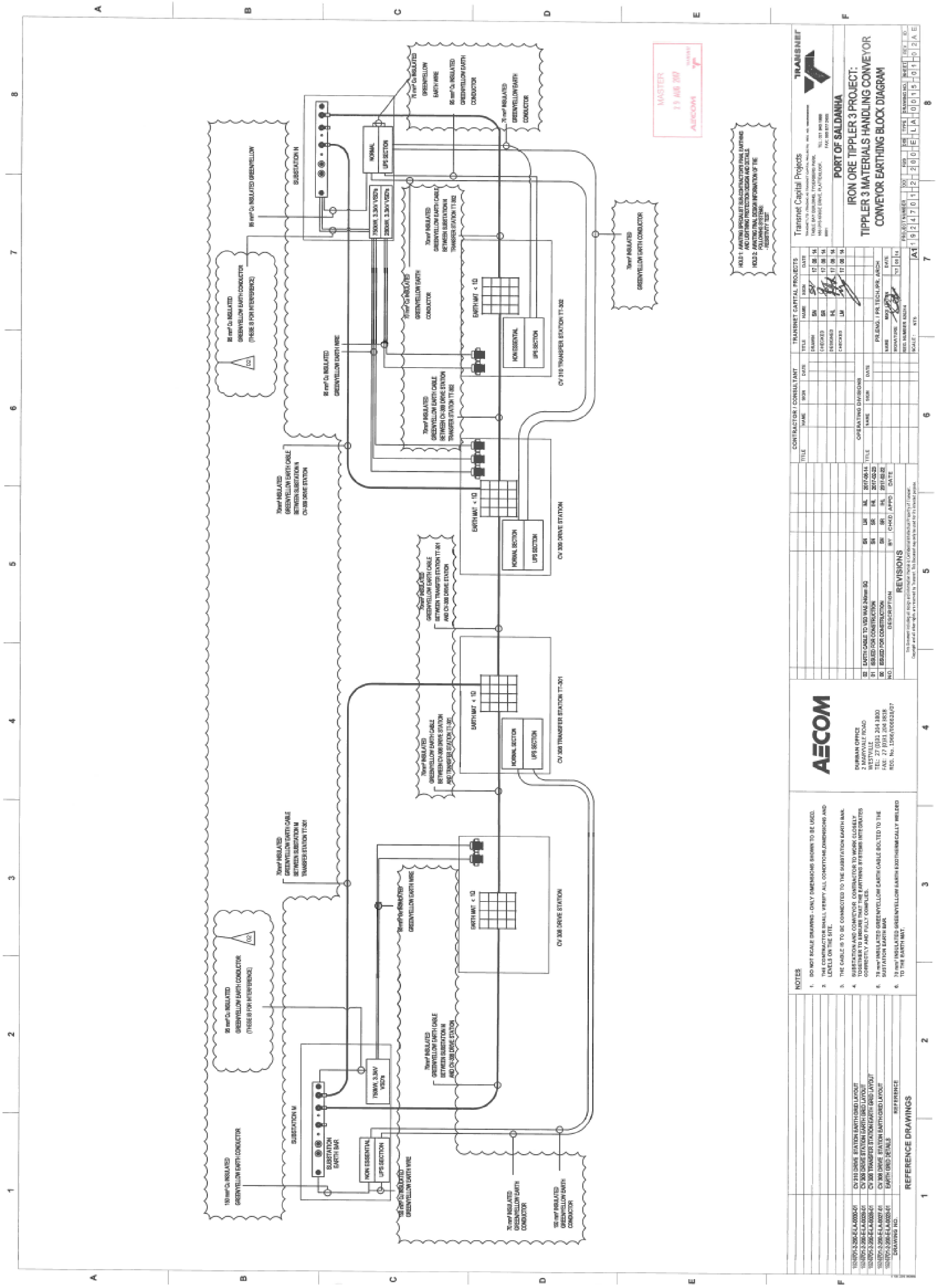
7. ACKNOWLEDGEMENT

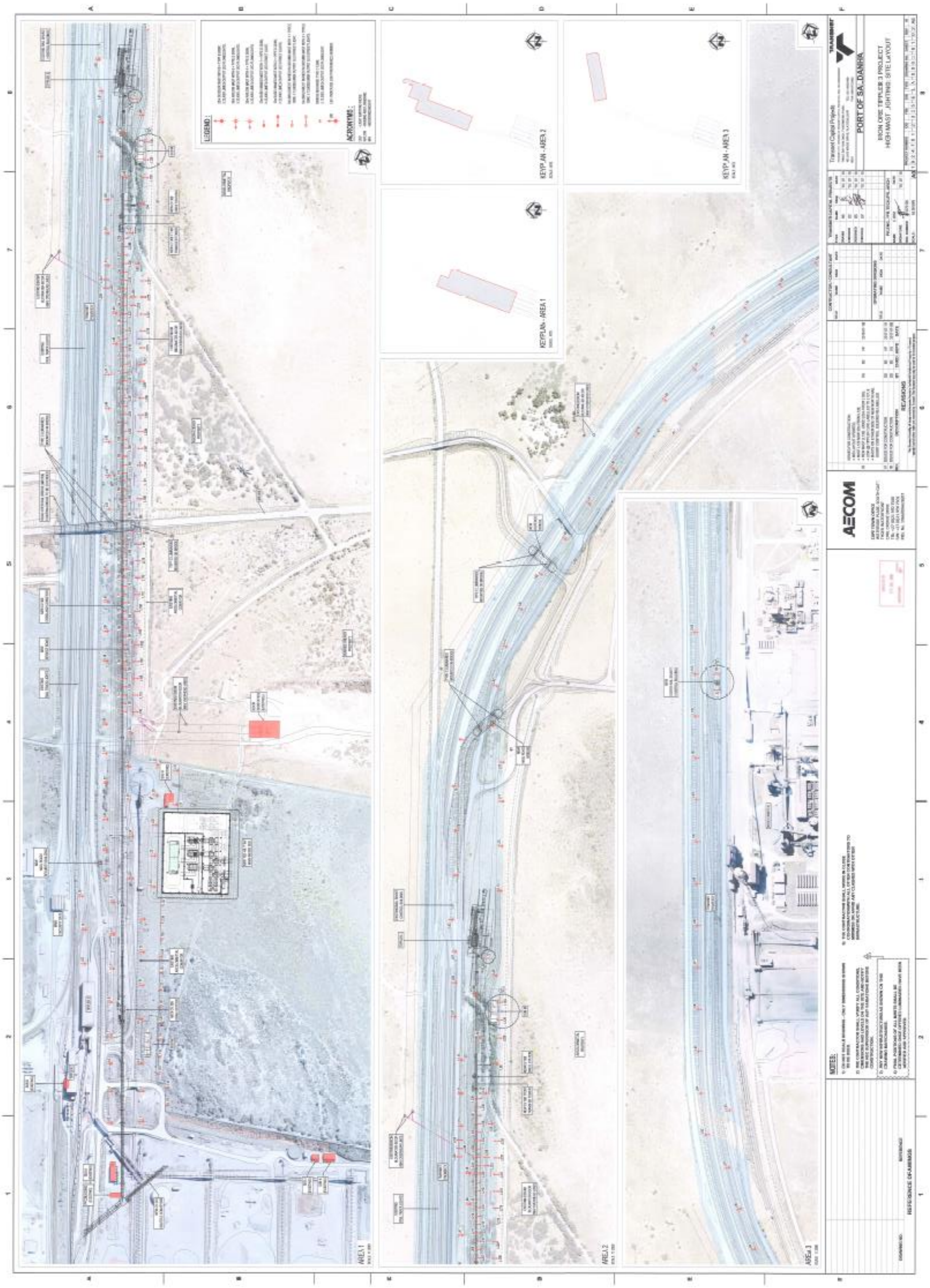
Khato-Thenga Joint Venture are acknowledged and thanked for the opportunity to participate in this electrode design and safety analysis.

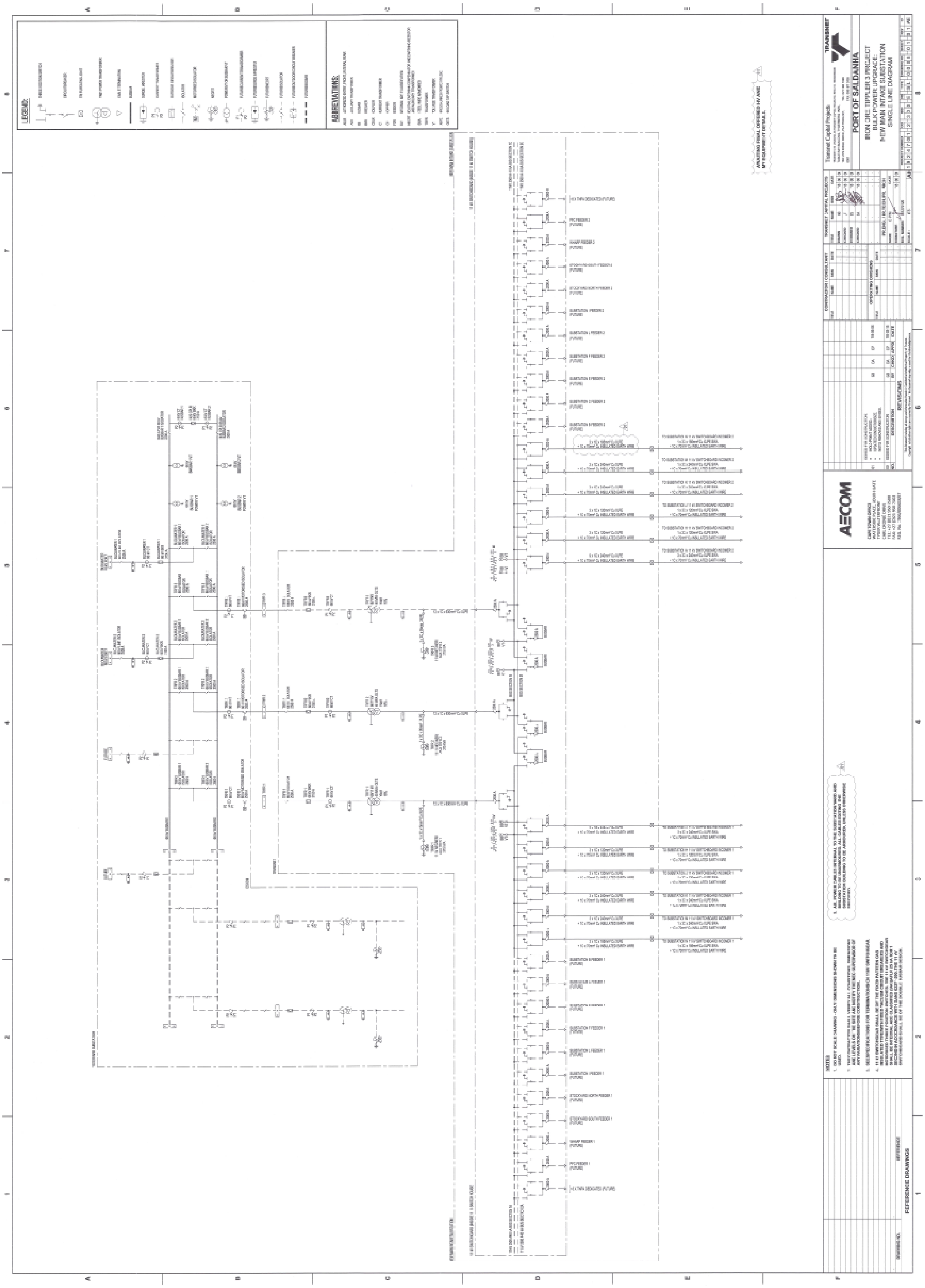
In particular, the following persons are acknowledged and thanked:-

- Mr William Kekana, Electrical Engineer, for kindly assisting on site and for sharing technical information about the project.

8. APPENDIX A – SUPPORTING INFORMATION TO DEVELOPMENT OF THE MODEL






LEGEND:
ABBREVIATIONS:
PORT OF SALDANHA
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE:
NEW MAIN INTAKE SUBSTATION
SINGLE LINE DIAGRAM
NOTES:
REVISIONS
REFERENCE DRAWINGS

9. APPENDIX B – DEVELOPMENT OF THE INTEGRATED EARTH ELECTRODE

9.1 Outlay of Integrated Earth Electrode

The outlay of the integrated earth electrode was guided by:

- Drawing No: 1924701-2-335-E-LA-0003-01-02AE, Iron Ore Tippler 3 Project – High Mast Lightning: Site Layout and
- Drawing No: 1924701-2-200-E-LA-0015-01-02AE, Iron Ore Tippler 3 Project: Tippler 3 Materials Handling Conveyor – Conveyor Earthing Block Diagram.

It is noted that the integrated earthing system extends widely across the plant as shown in Drawing: Tippler 3 Materials Handling Conveyor LPS & Earthing Layout – Rev 4, Sheet 1 to 21 (Drawing has no number). This large integrated earthing system will have a significant effect on lowering the earthing resistance but conservatively, only the following interconnected electrodes were conservatively considered for the numerical modelling and safety analysis as per Drawing No 1924701-2-200-E-LA-0015-01-02AE, Iron Ore Tippler 3 Project: Tippler 3 Materials Handling Conveyor – Conveyor Earthing Block Diagram:

- Main Intake Substation (Connected to Substation M and Substation N, each with 2 x 70 mm^2 Copper Insulated Earth Wire, as per Drawing No: 1924701-2-300-E-SL-0008-01-01AE, Iron Ore Tippler 3 Project – Bulk Power Upgrade: New Main Intake Substation Single Line Diagram);
- Substation M (Connected to CV 308 Drive Station and CV 308 Transfer Station);
- CV 308 Drive Station (Connected to CV 308 Transfer Station);
- CV 308 Transfer Station (Connected to CV 309 Drive Station);
- Substation N (Connected to CV 309 Drive Station and CV 310 Transfer Station);
- CV 309 Drive Station (Connected to CV 310 Transfer Station);
- CV 310 Transfer Station (Connected to Substation N);

All earth connections are via 70 mm^2 Copper Insulated Earth Wire. Additional earth connections between electrical equipment supported by the various earth electrodes and bonding of cable armouring to the earth electrodes were ignored.

Cable route length was confirmed by e-mail from KTJV (9 Jan 2020) as

- Route from Main Intake Substation to Substation M is 1 500 m.
- Route from Main Intake Substation to Substation N is 350 m.

9.2 Electrodes Other than the MIS Electrode

All electrodes, other than the MIS earth electrode were simulated as electrodes with resistance < 1 Ω (0,74 Ω) by means of a 50 x 50 m square electrode buried at 0,6 m in the noted soil structure – See Figure B-1.

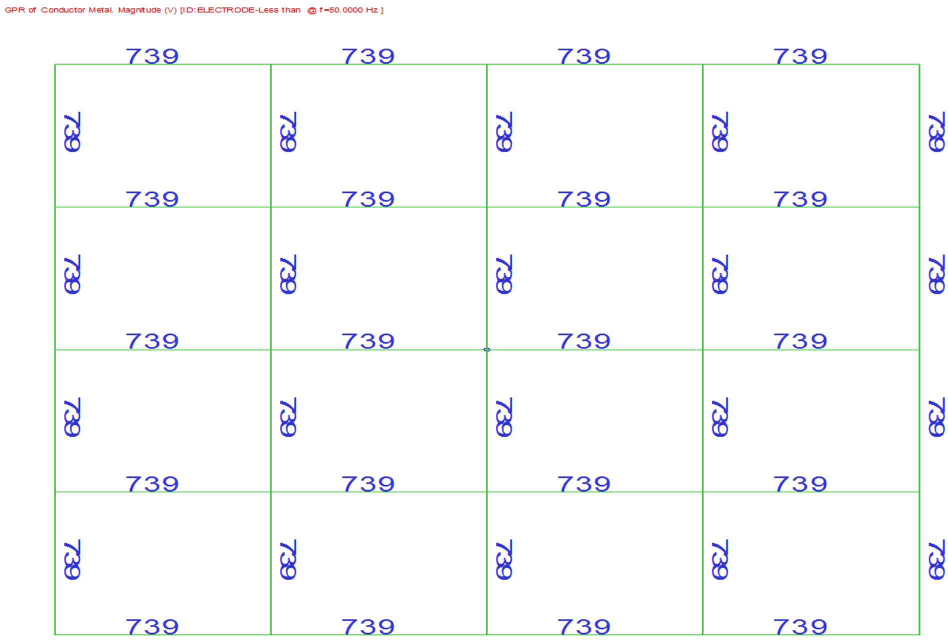


Figure B-1: Electrodes other than the MIS electrode were modelled as 0,74 Ω electrodes (The image shows the GPR at 1000 A).

9.3 Integrated Earth Electrode

Figure B-2 shows the MIS electrode integrated with 5 x smaller (< 1 Ω) electrodes.

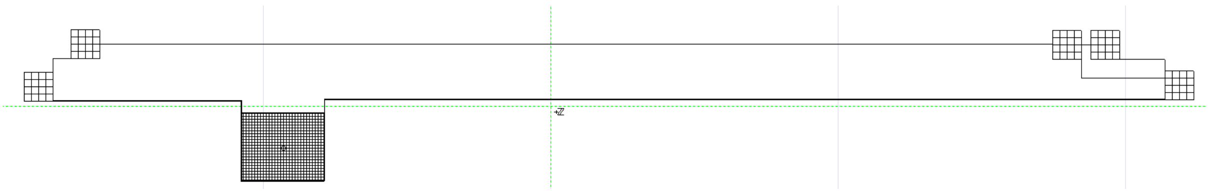


Figure B-2: The MIS electrode integrated with 5 x smaller (< 1 Ω) electrodes.

10. APPENDIX C – SAFETY ANALYSIS AT FULL FAULT CURRENT

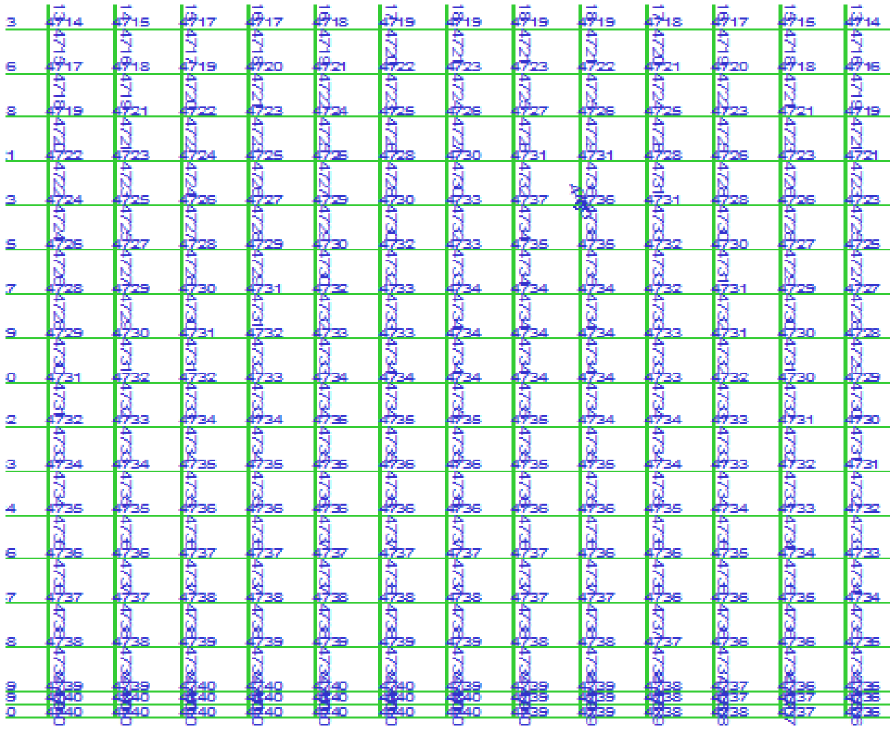
10.1 Case 1

Case 1 (the Base Case of the integrated earth electrode) involved the following:

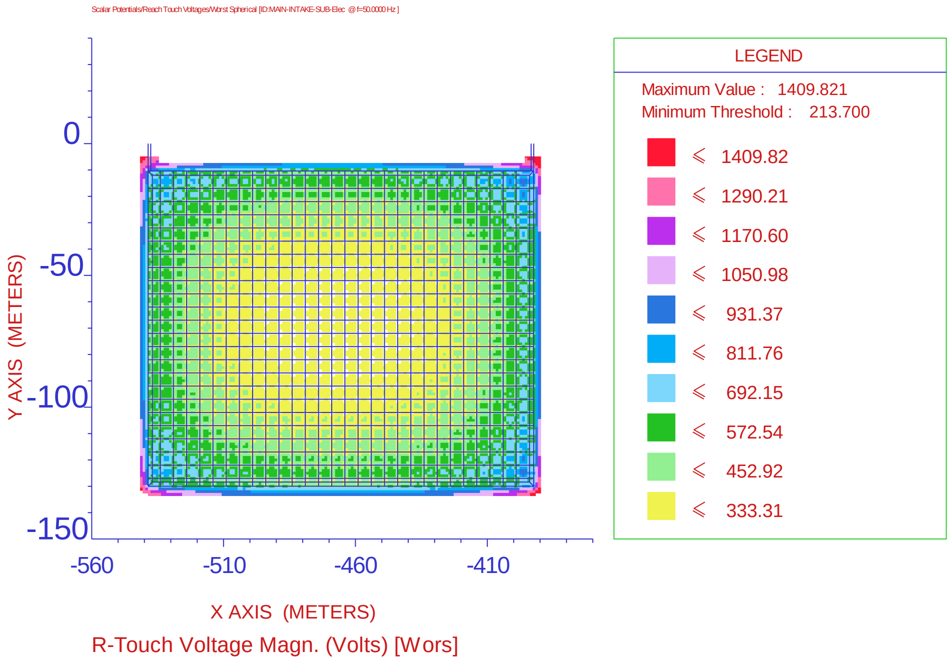
30 kA fault
500 ms fault clearing
50 kg person
Surface covering: None
Boot resistance: None
Additional aspects: None

The GPR was calculated at 4 740 V (max) as per the image below.

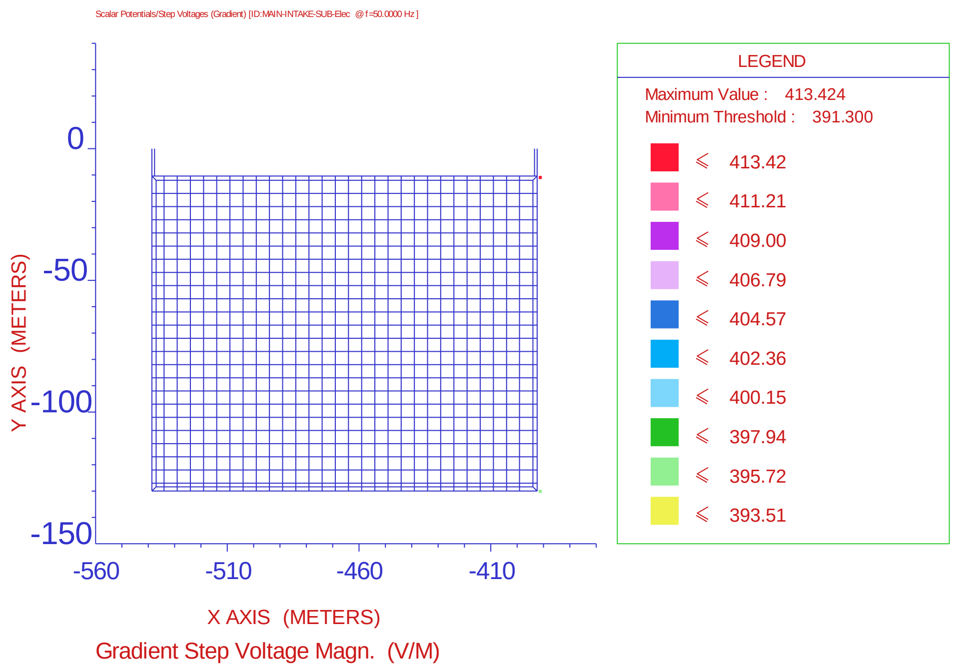
GPR.



GPR – Partial plant zoomed.



Reach Potentials.



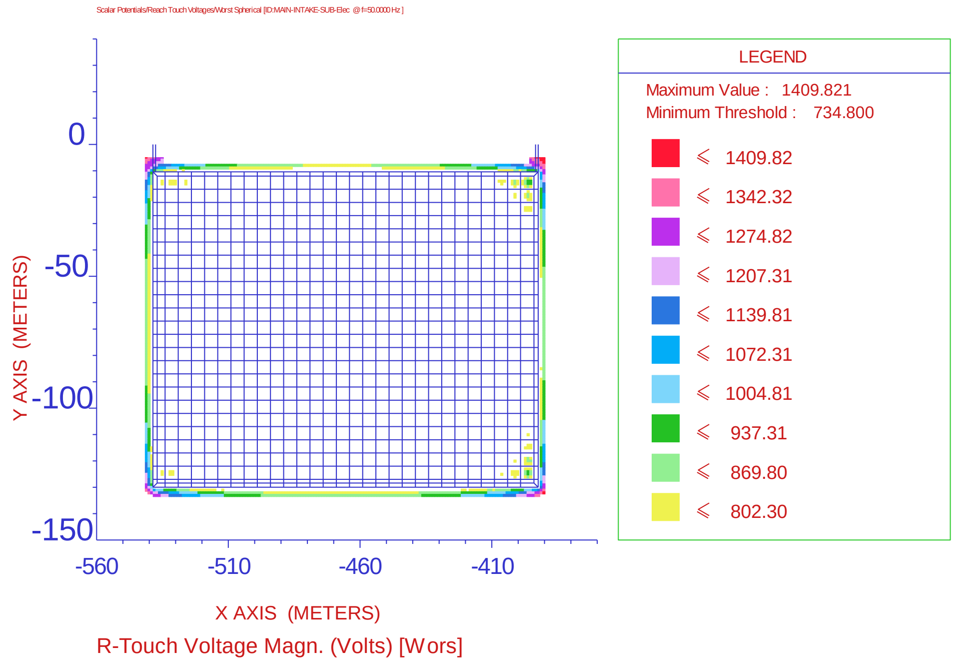
Step Potential.

10.2 Case 2

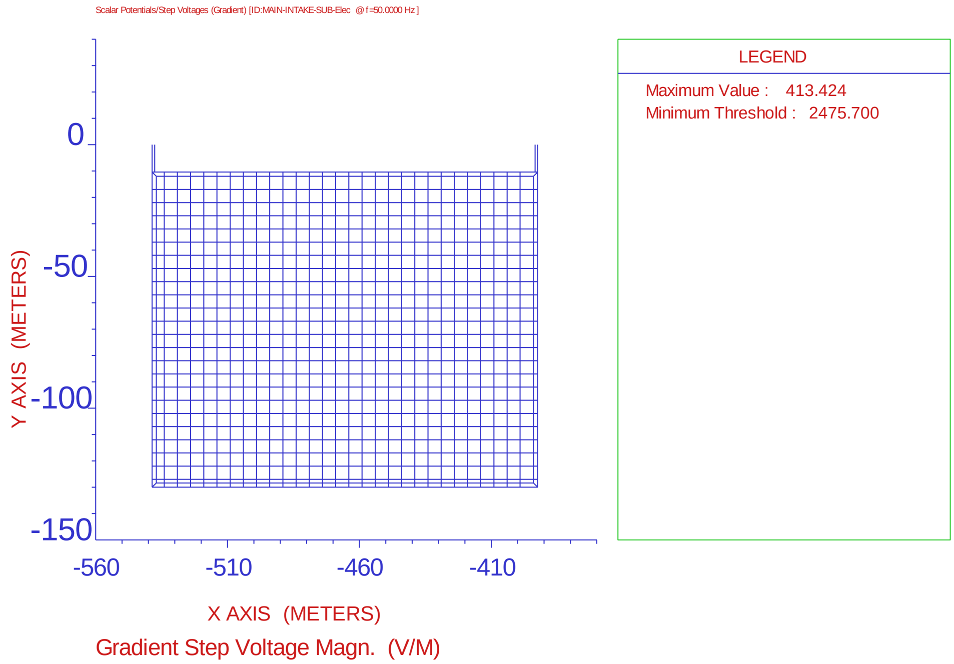
Case 2 involved the following:

30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 15 cm crusher stone (3000 Ω.m wet)
Boot resistance: None
Additional aspects: None

The GPR was calculated at 4 740 V.



Reach Voltage.



Step Voltage.

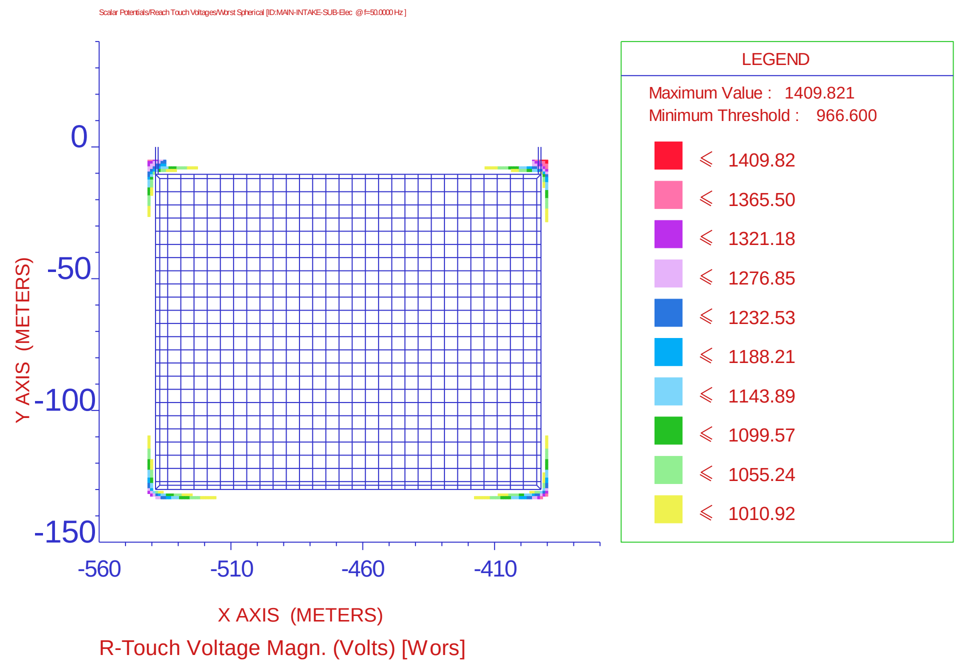
Case 2 offers a near-solution. Case 8 shows how the electrode needs to be modified for a solution.

10.3 Case 3

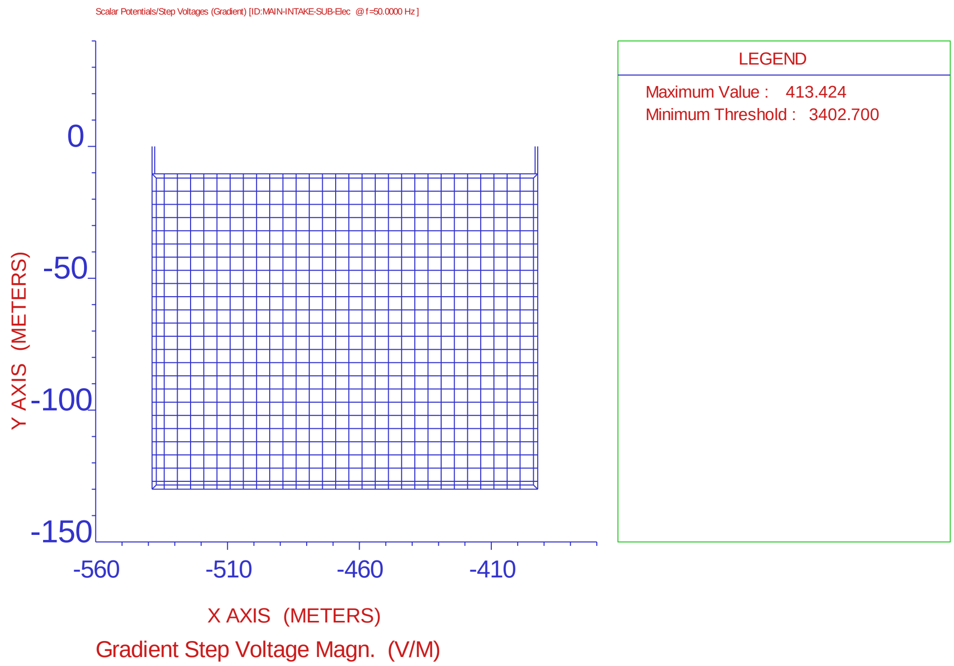
Case 3 involved the following:

30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 15 cm crusher stone (3000 Ω.m wet)
Boot resistance: 3000 Ω Boot Resistance
Additional aspects: None

The GPR was calculated at 4 740 V.



Reach Voltage.



Step Voltage.

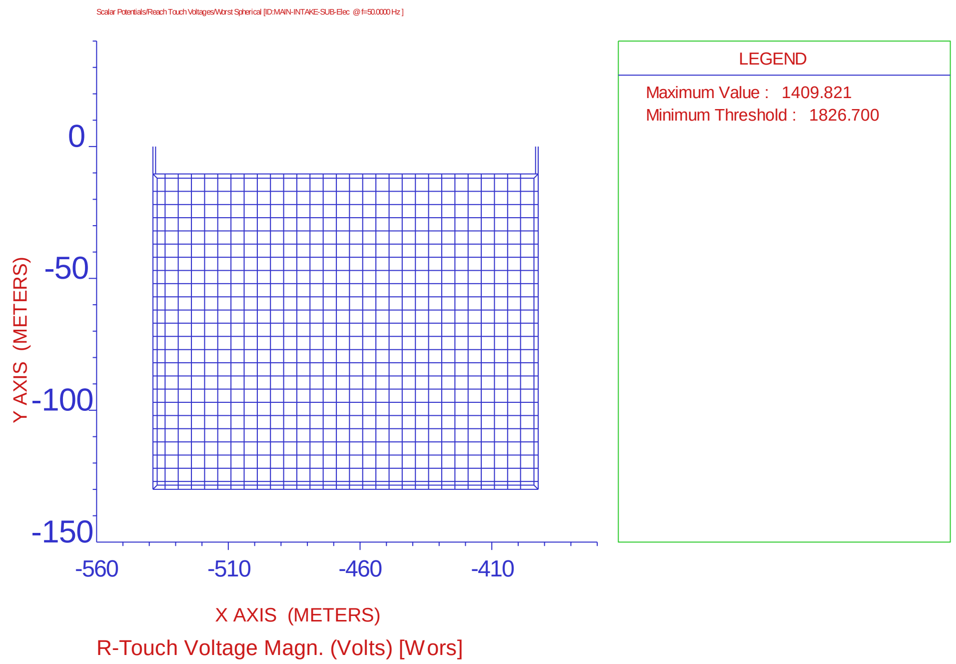
Case 3 offers a solution (Option 4).

10.4 Case 4

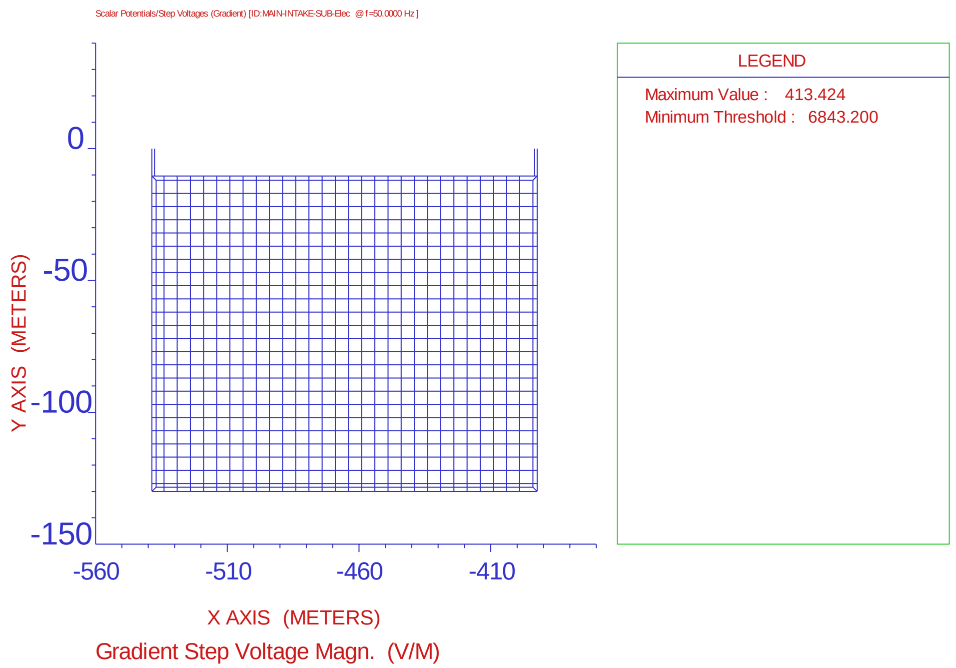
Case 4 involved the following:

30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 10 cm Asphalt (10 000 Ω.m)
Boot resistance: None
Additional aspects: None

The GPR was calculated at 4 740 V.



Reach Voltage.



Step Potential.

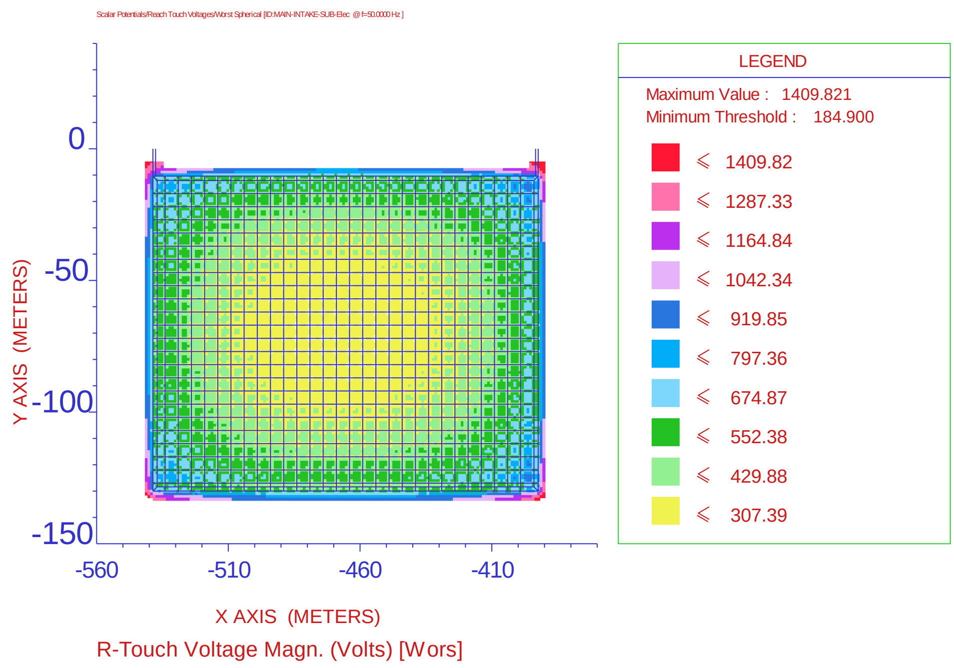
Case 4 offers a solution (Option 5).

10.5 Case 5

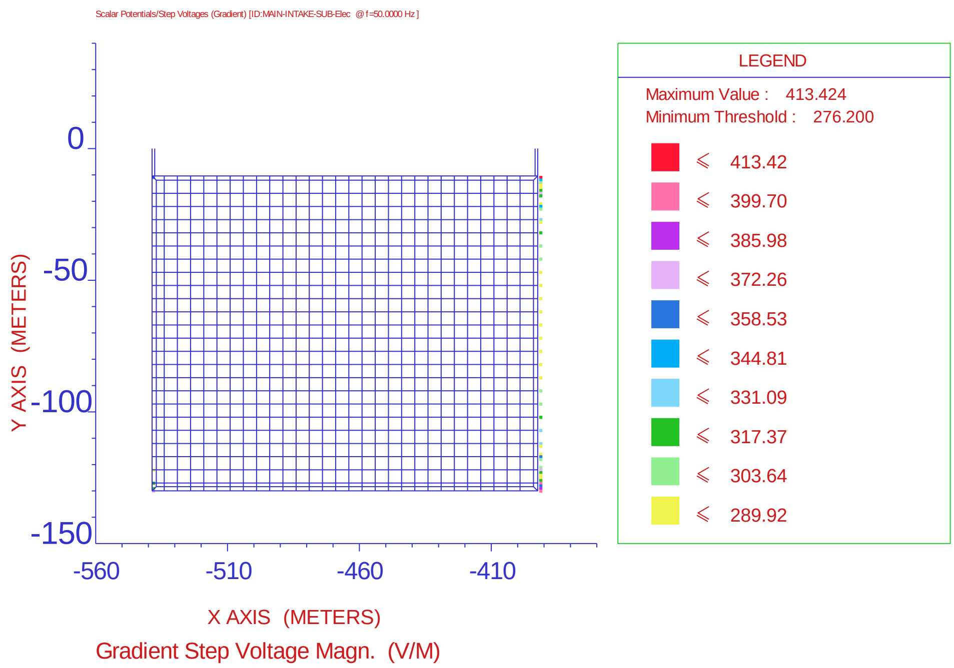
Case 5 involved the following:

30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 10 cm Concrete Block Paving (100 Ω.m wet)
Boot resistance: None
Additional aspects: None

The GPR was calculated at 4 740 V.



Reach Voltage.



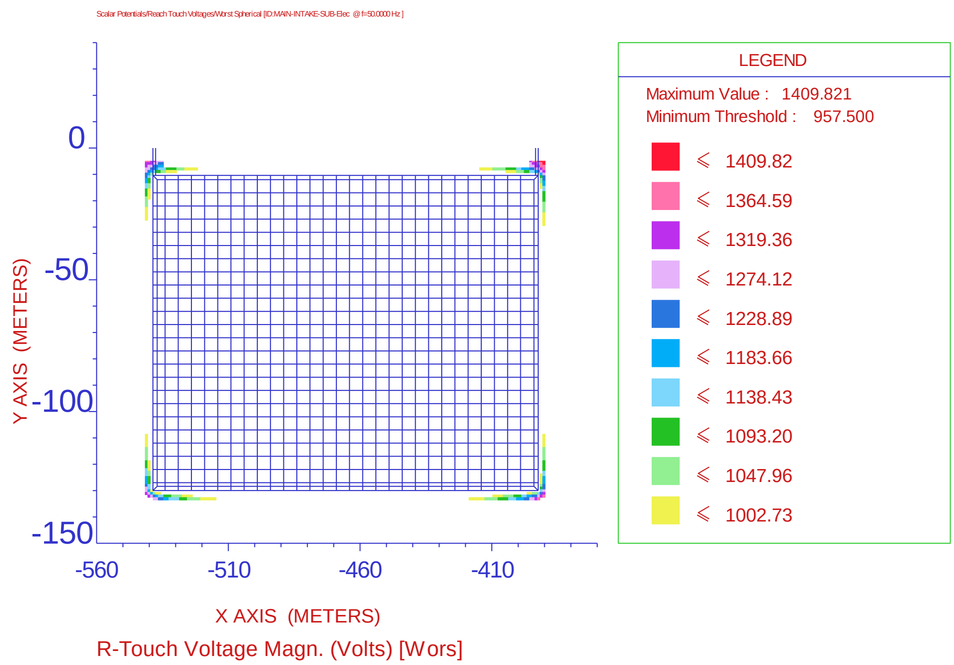
Step Voltage.

10.6 Case 6

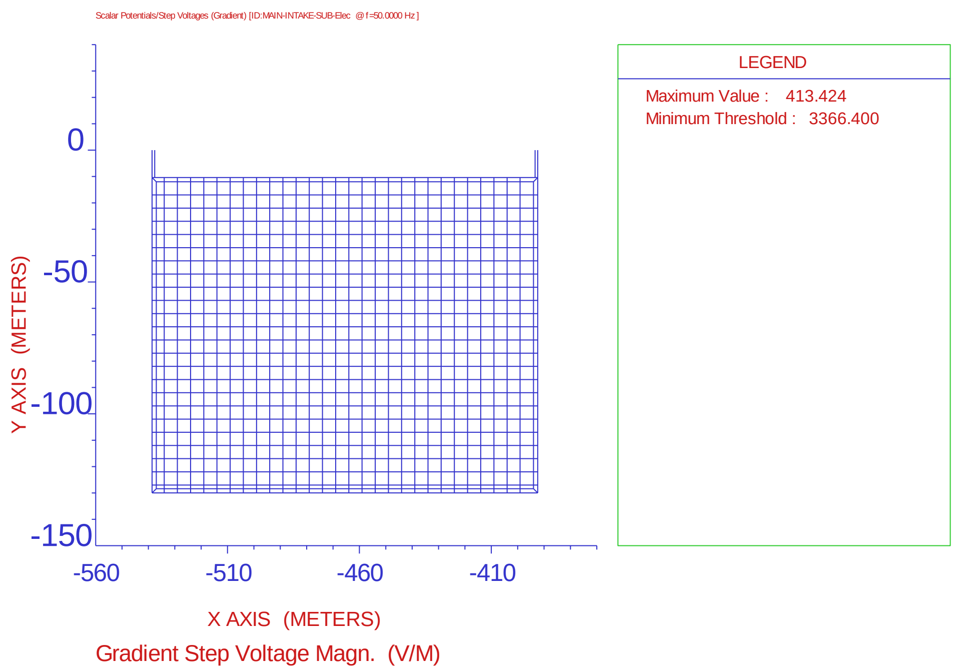
Case 6 involved the following:

30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 10 cm Concrete Block Paving (100 Ω.m wet)
Boot resistance: 10 000 Ω Boot Resistance
Additional aspects: None

The GPR was calculated at 4 740 V.



Reach Voltage.



Step Voltage.

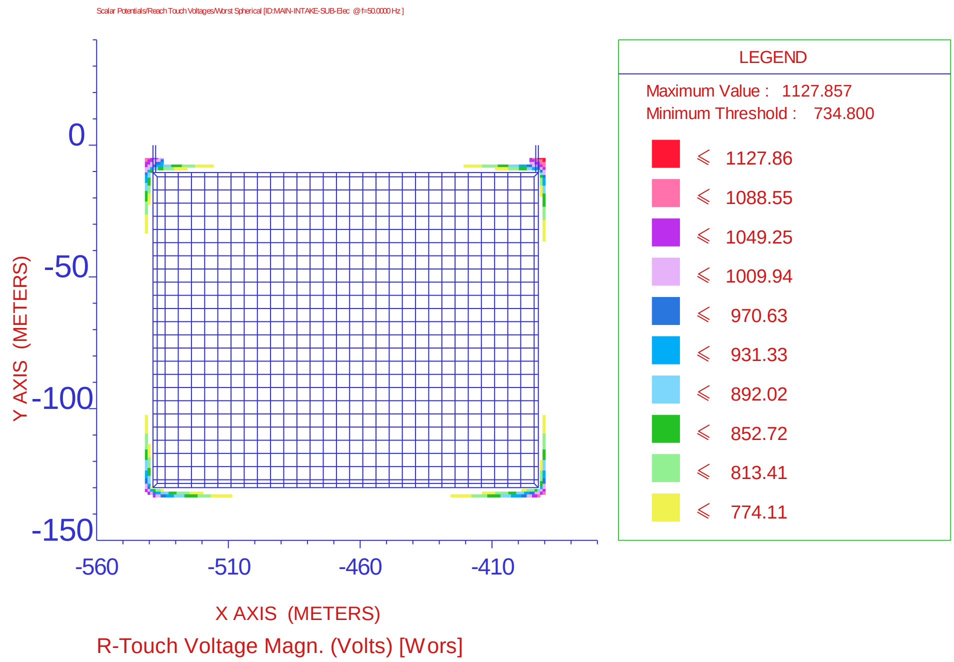
Case 6 offers a solution (Option 6).

10.7 Case 7

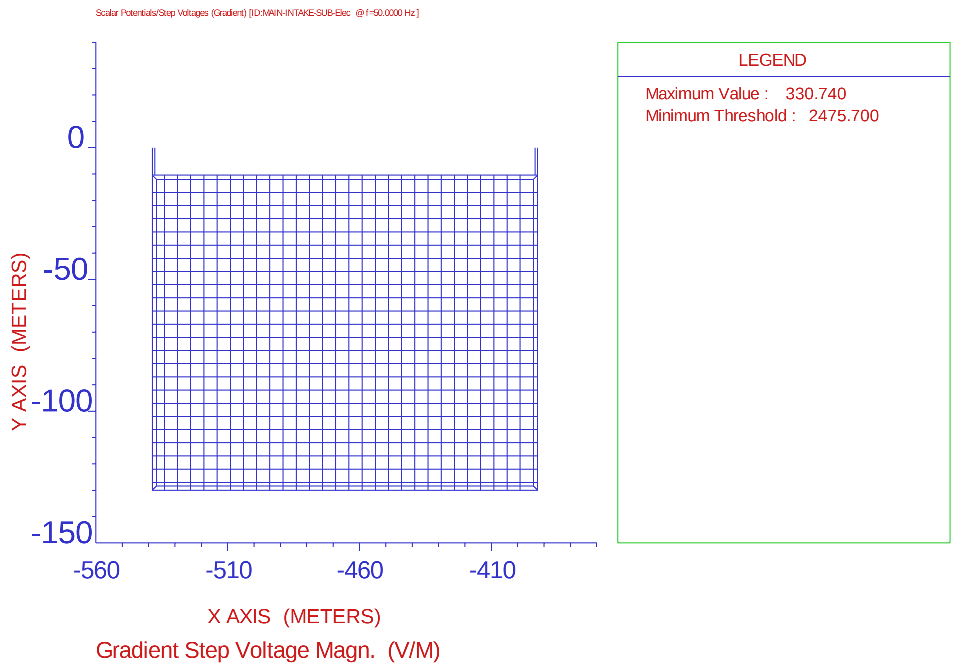
Case 7 involved the following:

24 kA fault (80 % split factor)
500 ms fault clearing
50 kg person
Surface covering: 15 cm crusher stone (3000 Ω.m wet)
Boot resistance: None
Additional aspects: 80 % split factor

The GPR was calculated at 3 792 V.



Reach Voltage.



Step Voltage.

Case 7 offers a solution (Option 7) in line with Case 3 solution.

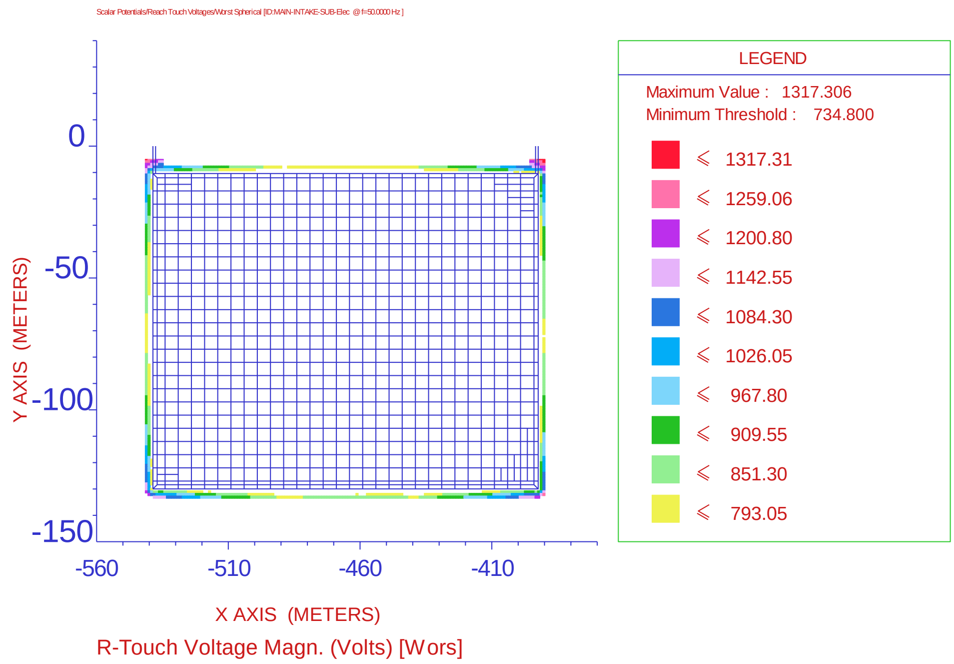
10.8 Case 8

Case 8 involved the following:

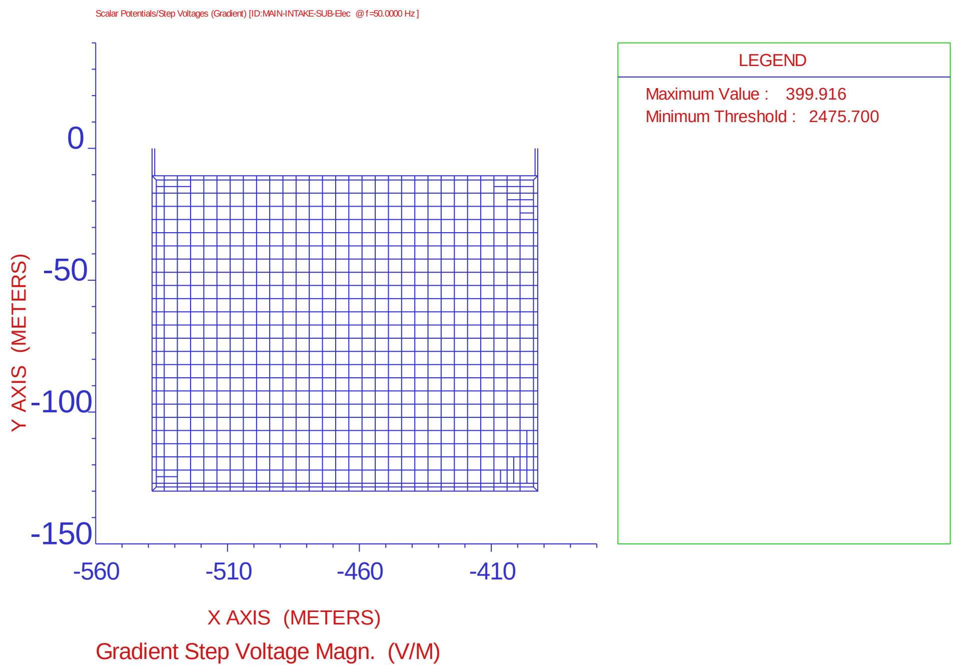
30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 15 cm crusher stone (3000 Ω.m wet)
Boot resistance: None
Additional aspects: Modified Electrode

The modified electrode is presented in Appendix D.

The GPR was calculated at 4,7 kV.



Reach Potential.



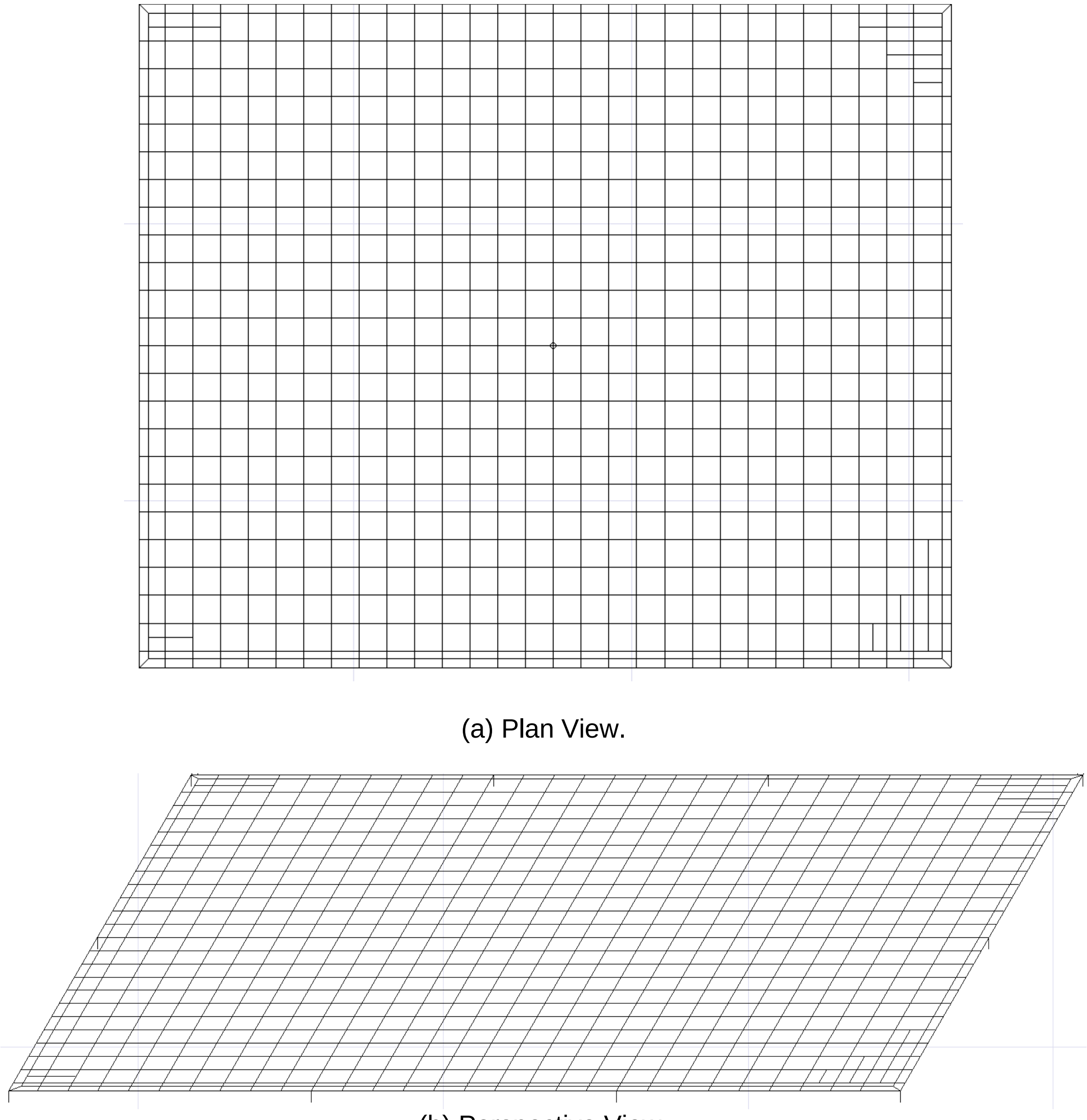
Step Potential.

Case 8 offers a solution (Option 8) – the preferred solution.

11. APPENDIX D – MODIFIED ELECTRODE

11.1 Modified Electrode

For Case 2 in Appendix C to offer a solution, the electrode needs to be modified as shown below. The modification requires additional horizontal conductors in the corners of the electrode. The Bill of Quantities is shown in Section 11.2.



(a) Plan View.

(b) Perspective View.

Figure D-1: Modified MIS earth electrode required to offer a solution for Case 2: (a) Plan View; (b) Perspective View.

11.2 Bill of Materials for the Modified Electrode

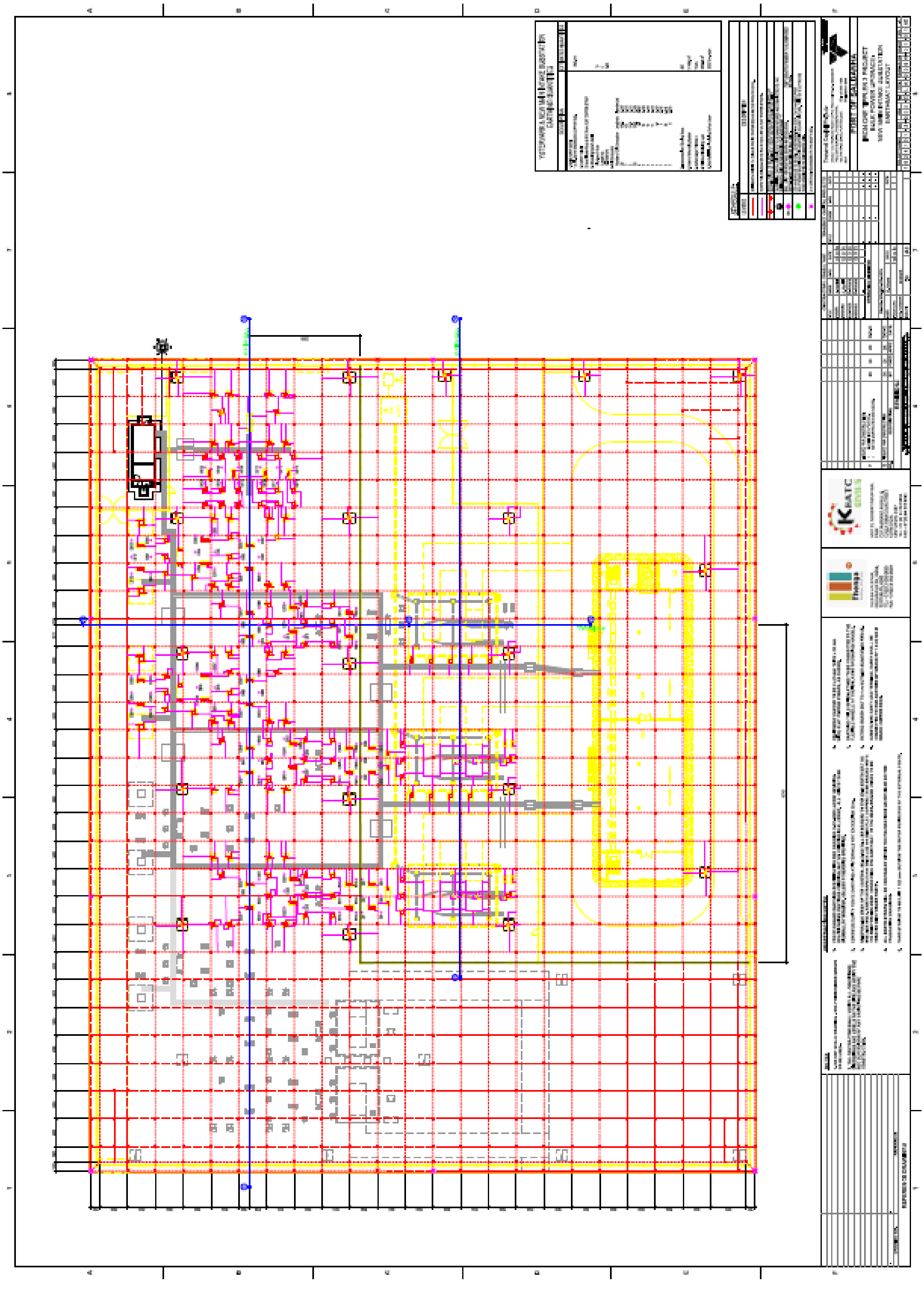
The Bill of Quantities for the modified electrode (Figure D-1) is shown below.

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++
List of Materials
Creation Date/Time:     11 Feb 2020/05:57:55
****************************************************************


Interconnection / Bonding Nodes ...................... 882
Extent of Grounding System ........................... 17485.5 (Square
Meters)
Surface Layer Thickness .............................. 15 (Centimetres)
Volume of Insulating Layer ........................... 2622.83 (Cubic meters)
Wet Resistivity of Insulating Surface Layer ........... 3000 (Ohm-m)


Grounding System Data

Number of Rods                Length (m)       Diameter (m)
----------------------------------------------------------------
10                            2                0.02


Number of Grid Conductors     Length (m)       Diameter (m)
----------------------------------------------------------------
25                            146.2            0.016
2                             143              0.016
2                             116.4            0.016
30                            119.6            0.016
4                             2.3              0.016
1                             13               0.016
1                             15               0.016
2                             10               0.016
1                             5.1              0.016
1                             8                0.016
1                             20               0.016
1                             5                0.016


Total Length of Grid Conductors (m)            Diameter (m)
----------------------------------------------------------------
7857.1                                         0.016
20                                             0.02
```

12. APPENDIX E – DETAILED EARTH ELECTRODE DRAWING

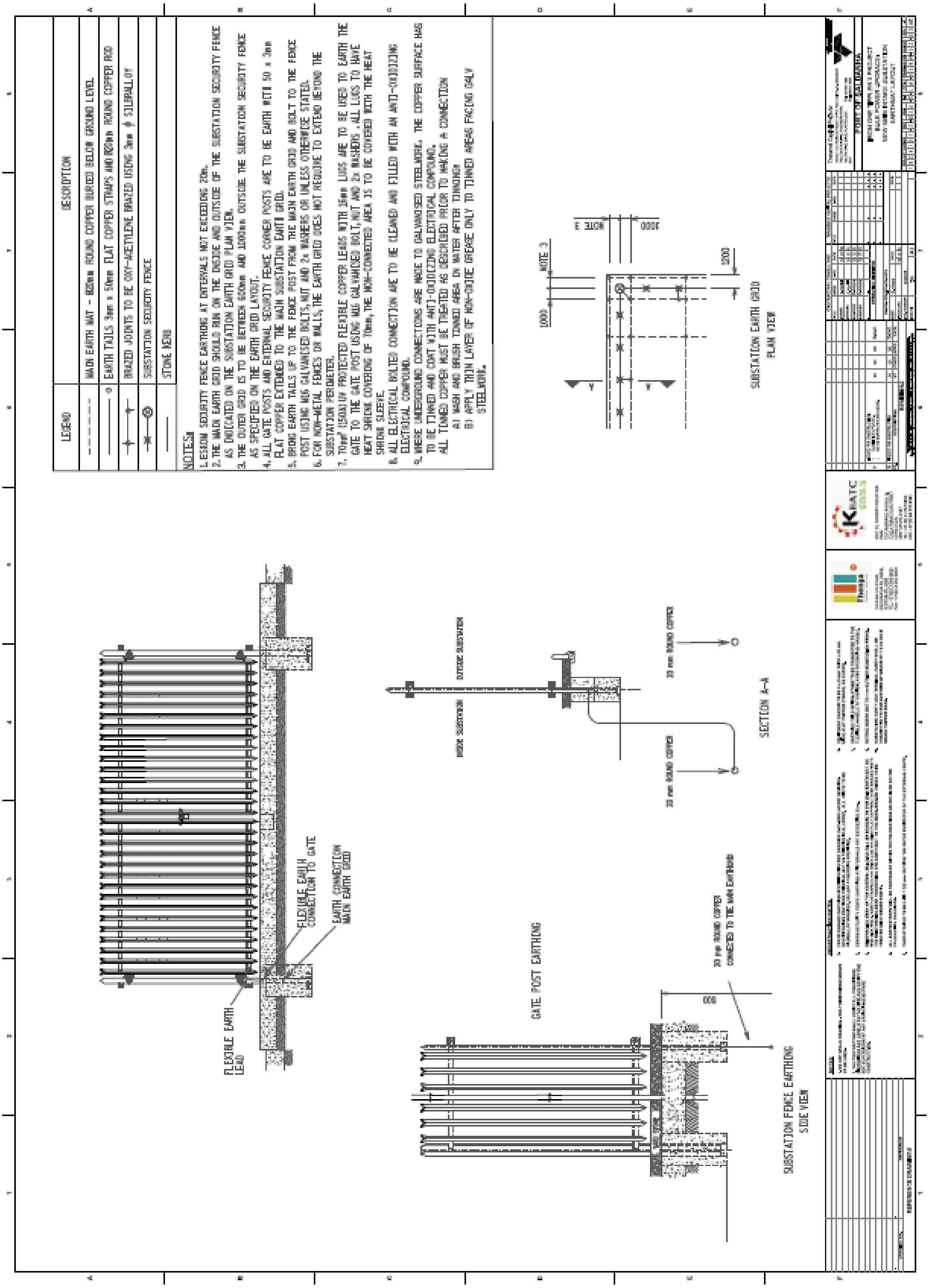
12.1 Earth Electrode Layout

Below the detailed earth electrode drawing prepared by the KTJV Engineering Team for inclusion in this report.



12.2 Fence Earthing

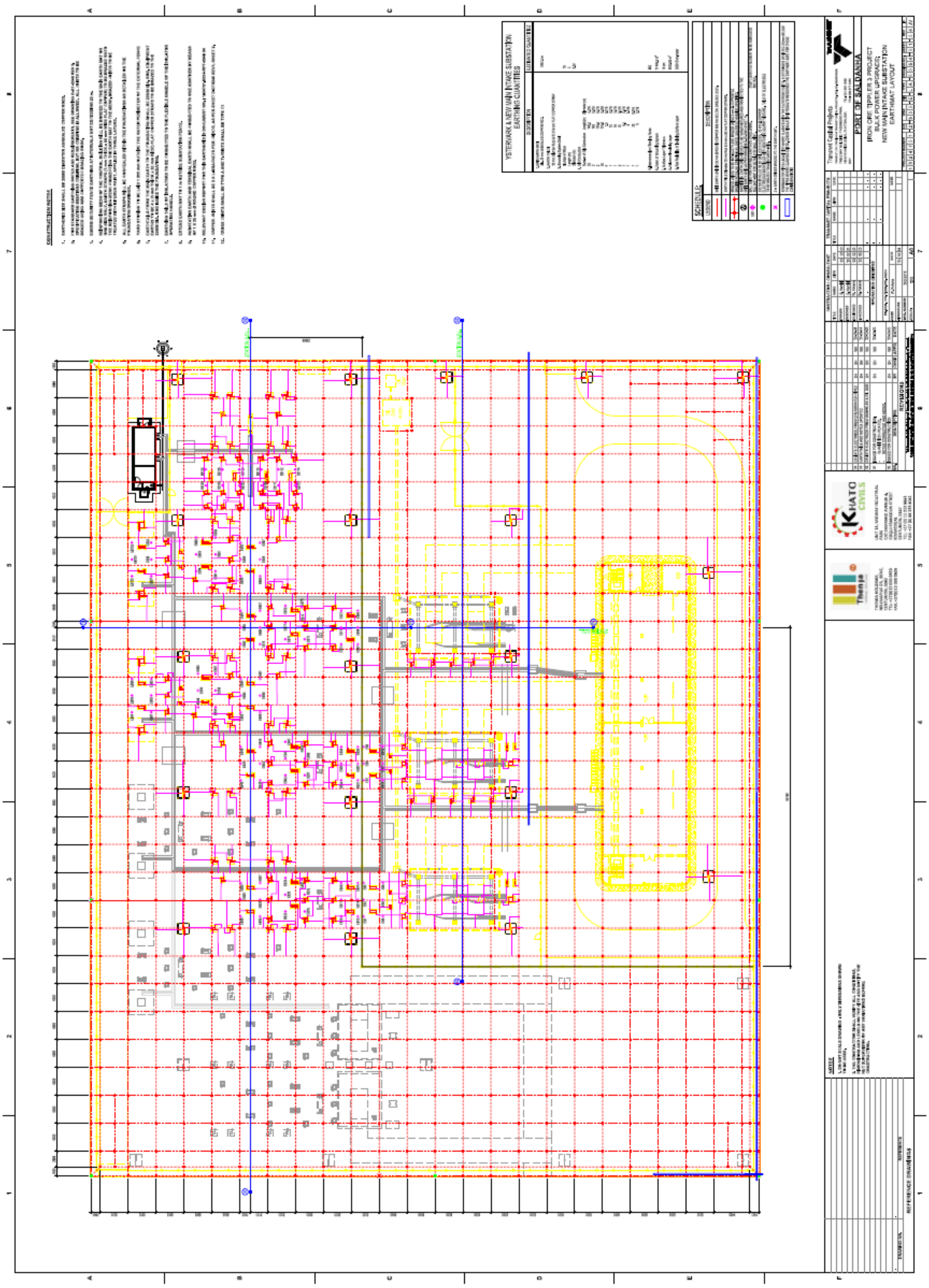
Below the detailed fence earthing drawing prepared by the KTJV Engineering Team for inclusion in this report.



13. APPENDIX F – UPDATED EARTH ELECTRODE

13.1 Updated Earth Electrode (Accommodating Foundations and Stormwater Pipes)

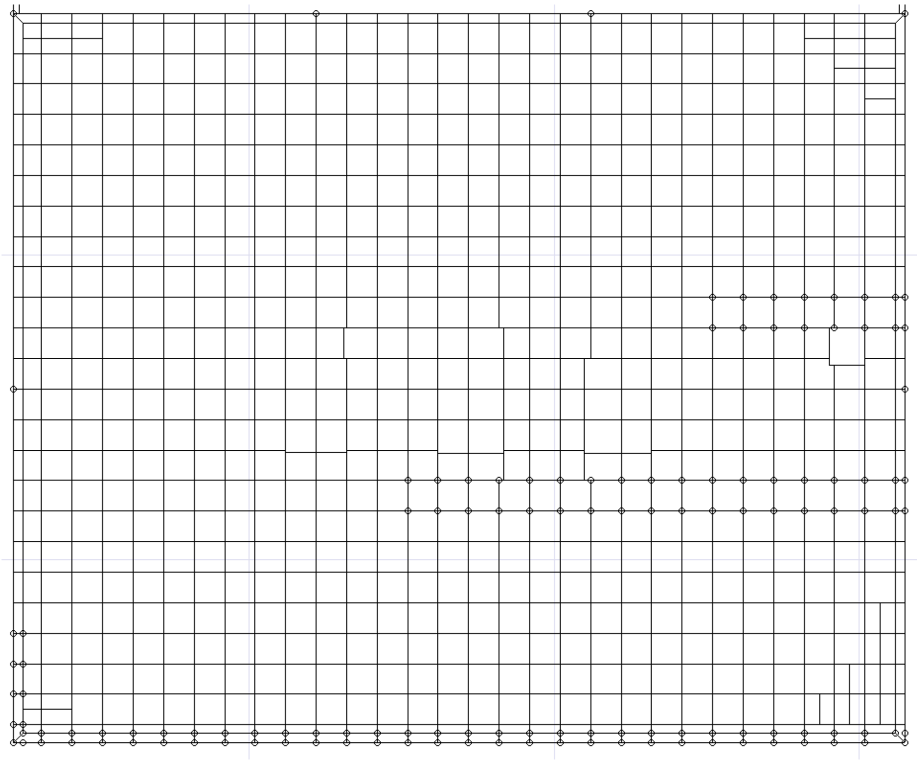
Below the detailed and updated earth electrode drawing, accommodating foundations and stormwater pipes, as prepared by the KTJV Engineering Team for inclusion in this report.



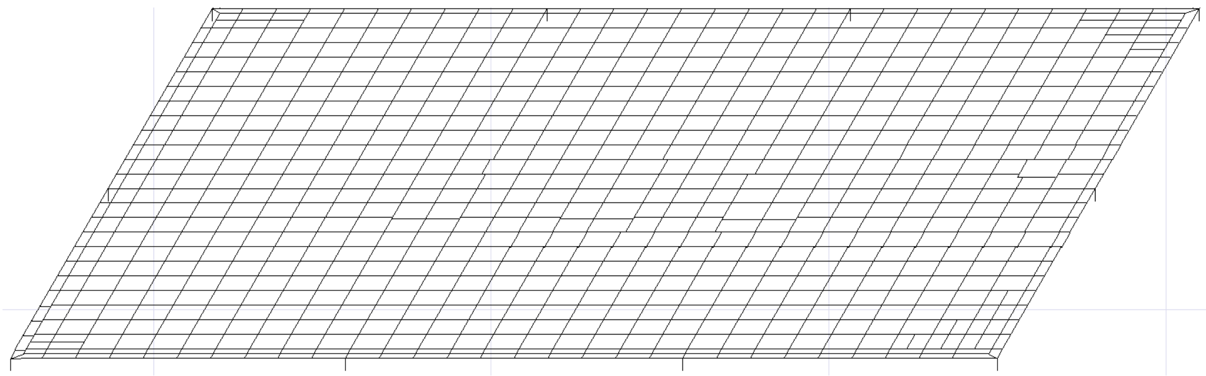
13.2 Safety Analysis – Updated Earth Electrode

13.2.1 Electrode Outlay

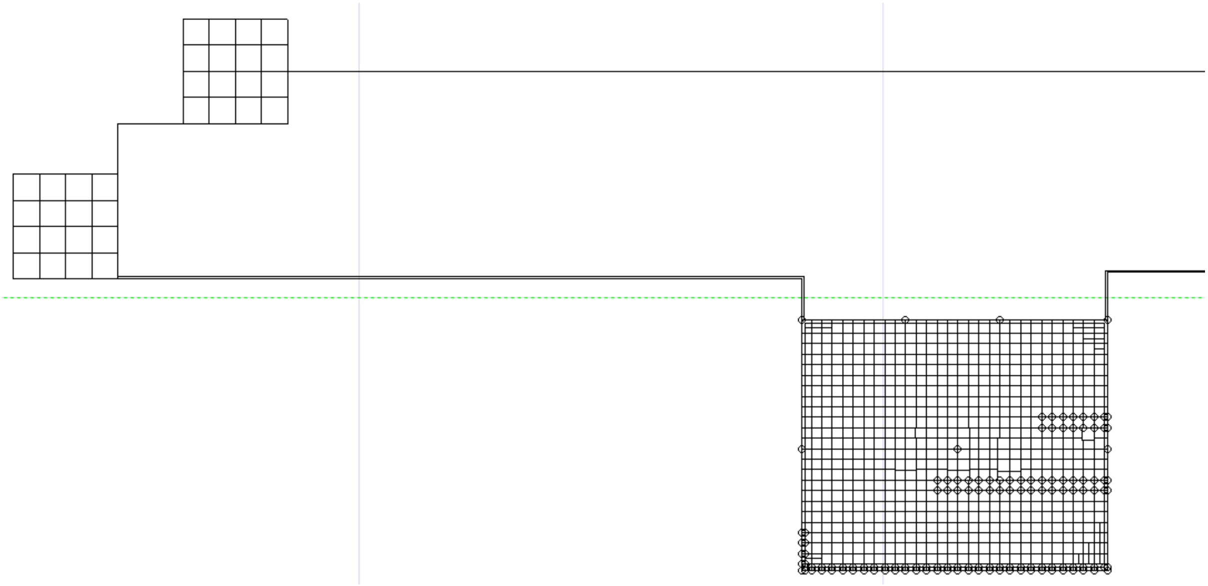
The images below reflect the electrode, accommodating for foundations and stormwater pipes, as employed in the numerical model.



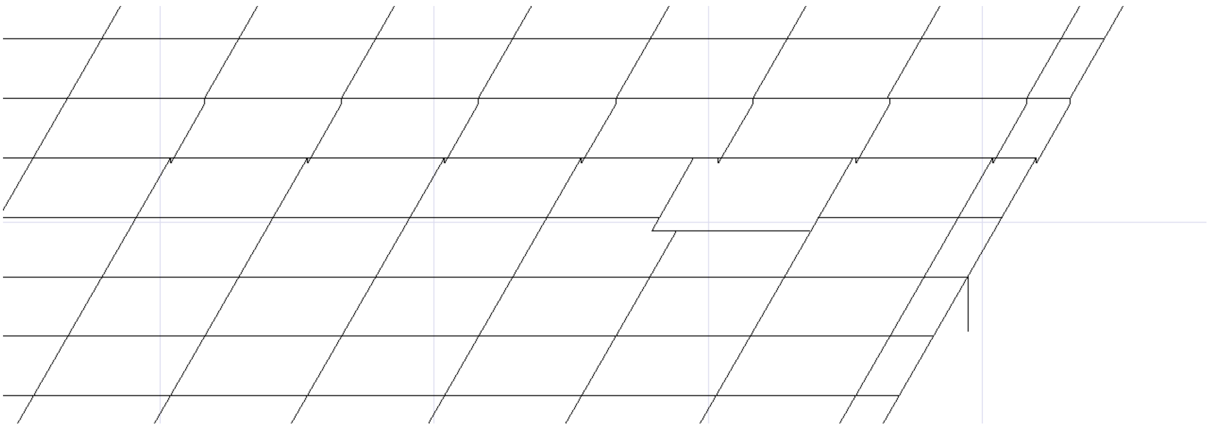
Plan View of MIS Electrode.



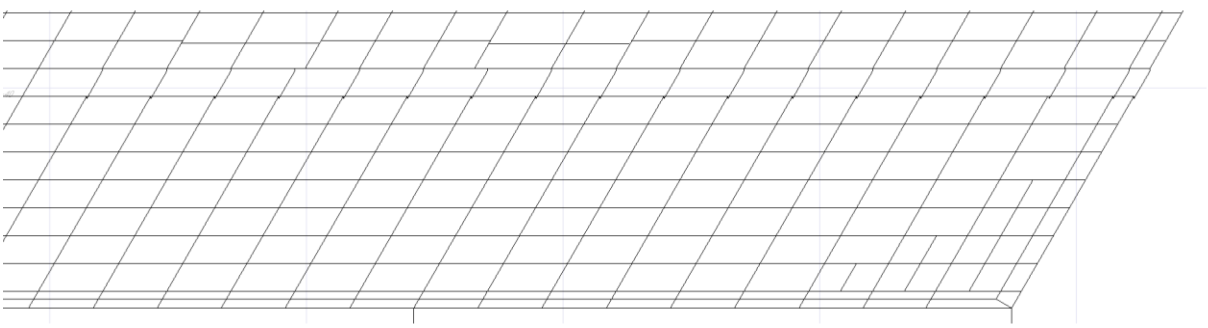
Perspective View of MIS Electrode.



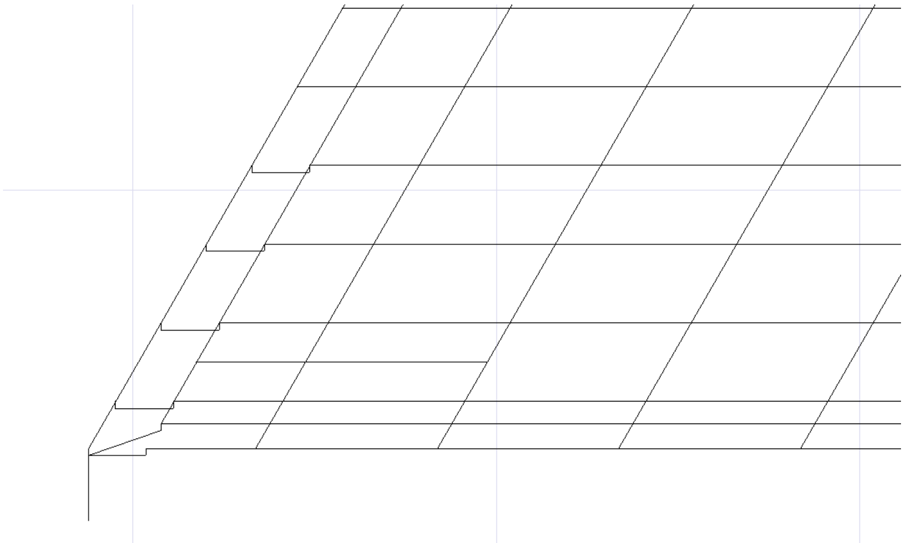
MIS electrode integrated with other electrodes (only part shown to maintain details).



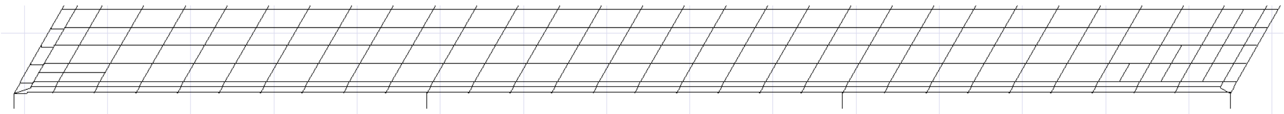
Lowered section of electrode to accommodate Pipe 1.



Lowered section of electrode to accommodate Pipe 2.



Lowered section of electrode to accommodate Pipe 3.



Lowered section of electrode to accommodate Pipe 4.

13.2.2 Safety Analysis

The safety analysis of the integrated electrode, based on the MIS electrode accommodating foundations and the stormwater pipes, is shown below:

Input used in confirming the electrode performance:

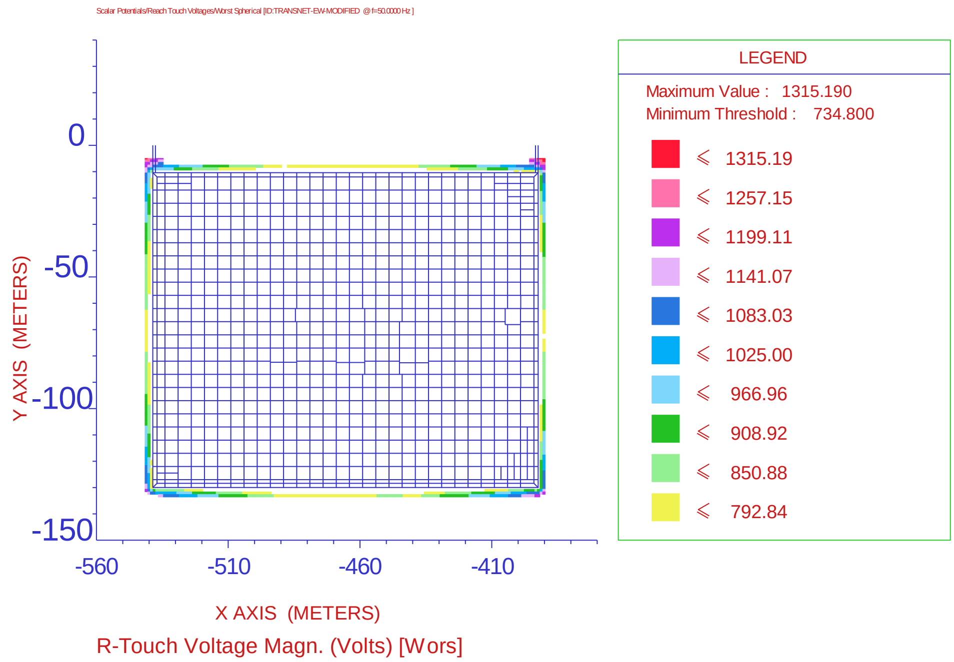
30 kA fault
500 ms fault clearing
50 kg person
Surface covering: 15 cm crusher stone (3000 Ω.m wet)
Boot resistance: None
Additional aspects: Electrode modified to accommodate foundations and 4 x stormwater pipes.

The GPR was calculated at 4,7 kV.

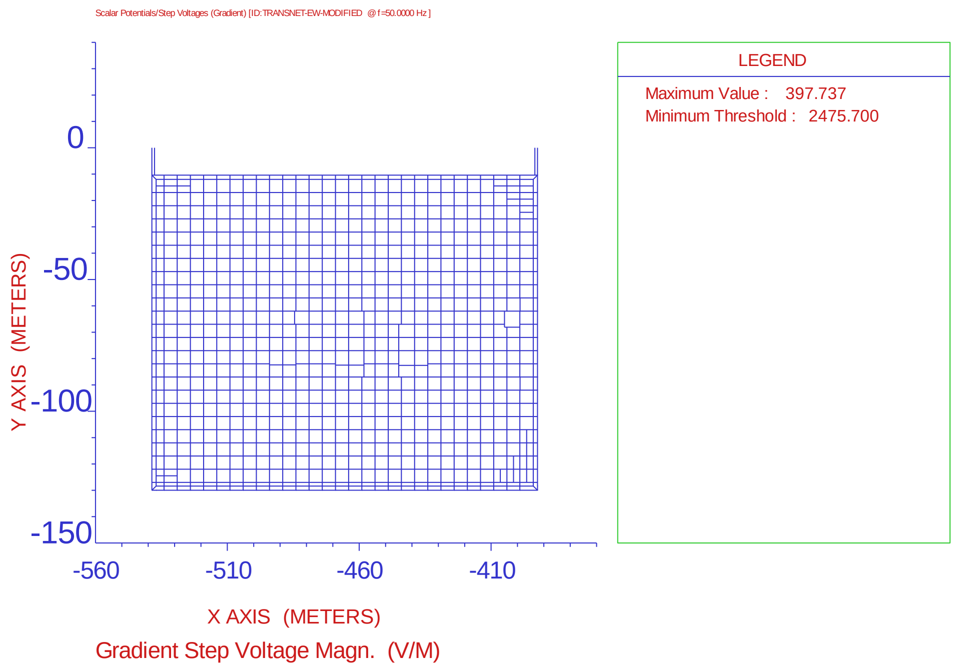
Step and touch / reach potentials are shown below:

- Reach potentials were below the minimum threshold of 735 V across the electrode.
- Maximum step potentials (400 V) were well below the minimum threshold of 2476 V.

The safety of the electrode, modified to accommodate foundations and the stormwater pipes, was confirmed and offers a solution.



Reach Potentials.



Step Potentials.

13.2.3 Raw Safety Data

The Table below summarises the safety data for the electrode accommodating foundations and stormwater pipes.

```
Report #1:

 DATE OF RUN (Start)= DAY  8 / Month  3 / Year 2020
 STARTING TIME= 20:13:44:64

 ===========< H I F R E Q    ( SYSTEM INFORMATION SUMMARY ) >===========

 Run ID......................................: TRANSNET-EW-MODIFIED+PIPES
 System of Units ............................: Metric
 Scalar Potential Field Calculations.........: YES
 Magnetic Field Calculations.................: YES
 Electric Field Calculations.................: YES
 Vector Potential Field Calculations.........: NO
 Gradient Calculations.......................: NO
 GPR Calculations............................: YES

 Number of Original Conductors ..............:   372
 Number of Frequency Values to be Analyzed...:     1
 Total Length of Conductor Network...........:   16072.     meters
 Number of Source Busses ....................:     1
 Energization Scaling Factor
             (SPLITS/FCDIST/specified)......:   1.0000

            Energization Buses
 -------------------------------------------------
    Energization |--- Energization Strength ----|
 Bus     Type       Magnitude          Angle (deg)
 --- ------------ ------------+------ ------------
   1   Lead         30000.      Amps    0.0000

 CHARACTERISTICS OF MEDIA SURROUNDING NETWORK
 ============================================
            * Multilayer Medium *
 ---------------------------------------------------------------------
  LAYER  TYPE   RESISTIVITY     RELATIVE      RELATIVE     THICKNESS
   No.          (ohm-meter)   PERMITTIVITY  PERMEABILITY    (meters)
  ----- ------ ------------- ------------- ------------- -------------
     1    Air   0.100000E+13   1.00000       1.00000        Infinite
     2   Soil    245.246       1.00000       1.00000       1.00000
     3   Soil    19.8195       1.00000       1.00000       3.23918
     4   Soil    21.8665       1.00000       1.00000       19.2217
     5   Soil    130.921       1.00000       1.00000        Infinite
1

 Case Number.................................:     1
 Frequency for This Case.....................:   50.000      Hertz

 End of Report #1


 Report #2:

 DATE OF RUN (Start)= DAY  8 / Month  3 / Year 2020
 STARTING TIME= 20:14:22:90


 >> Safety Calculations Table

 System Frequency..........................(Hertz).:  50.000
 System X/R........................................:  20.000
 Surface Layer Thickness....................(  cm ).:  15.000
```

```
Surface Layer Resistivity..................(ohm-m).:   3000
Equivalent Sub-Surface Layer Resistivity....(ohm-m).:  245.25

Body Resistance Calculation..........: IEEE Std.80-2000
Fibrillation Current Calculation.....: IEEE Std.80-2000 (50kg)
Foot Resistance Calculation..........: IEEE Std.80-2000
   User Defined Extra Foot Resistance:   0.0000     ohms

==============================================
| Fault Clearing Time  ( sec)|      0.500    |
+----------------------------+---------------+
| Decrement Factor           |        1.062  |
| Fibrillation Current (amps)|        0.164  |
| Body Resistance      (ohms)|      1000.00  |
==============================================

======================================
|         | FAULT            |        |
| SURFACE | CLEARING TIME    |        |
|  LAYER  |------------------|        |
| RESIST- |    0.500 sec.    |  FOOT  |
|  IVITY  |------------------| RESIST-|
| (OHM-M) |  STEP  |  TOUCH  |  ANCE: |
|         | VOLTAGE| VOLTAGE| 1 FOOT |
|         | (VOLTS)| (VOLTS)| (OHMS) |
======================================
|   3000.0|  2475.7|   734.8|  7511.5|
|---------+--------+--------+--------+


End of Report #2
```

13.3 Bill of Materials

The Bill of Materials is shown below.

```
****************************************************************
List of Materials
Creation Date/Time:     8 Mar 2020/20:26:52
****************************************************************



Interconnection / Bonding Nodes ...................... 1025
Extent of Grounding System ........................... 17485.5 (Square
Meters)
Surface Layer Thickness .............................. 15 (Centimeters)
Volume of Insulating Layer ........................... 2622.83 (Cubic meters)
Wet Resistivity of Insulating Surface Layer ........... 3000 (Ohm-m)





Grounding System Data
```

Number of Rods	Length (m)	Diameter (m)
1	1.8	0.02
9	2	0.02

Number of Grid Conductors	Length (m)	Diameter (m)
118	0.2	0.016
28	5	0.016
34	1.60004	0.016
16	146.2	0.016
1	143	0.016
1	134.6	0.016
1	133.7	0.016
1	44.6	0.016
1	79.6	0.016
1	128	0.016
1	116.4	0.016
11	118	0.016
2	51.6	0.016
8	76.6	0.016
1	56.6	0.016
7	46.6	0.016
1	45	0.016
4	2.26272	0.016
1	101.6	0.016
1	13	0.016
4	15	0.016
3	10	0.016
1	5.10001	0.016
1	8	0.016
2	20	0.016
1	61.4	0.016
8	25	0.016
1	66.6	0.016
1	11.6	0.016
1	6.1	0.016
1	18.9	0.016
1	6.69998	0.016
1	5.80002	0.016
1	10.8	0.016
1	13.2	0.016
1	11	0.016
1	41.6	0.016
18	36.4	0.016
5	144.6	0.016
1	2.99999	0.016

Total Length of Grid Conductors (m)	Diameter (m)
7880.55	0.016
19.8	0.02

9.2.3 HV Equipment

9.2.3.1 132 kV Outdoor Circuit Breaker

Table 8: Technical Schedule for 132 kV Outdoor Circuit Breaker

Item	Description	Specified
Eskom SAP Number(s)		0218735
PDE Drawing(s) Applicable		D-DT-6250
1	**Normal Service Conditions**	
1.1	Operation	3 pole
1.2	Installation	Outdoor
1.3	Altitude	≤ 1 800 amsl
1.4	Maximum ambient temperature	45°C
1.5	Minimum ambient temperature	- 10°C
1.6	Relative humidity	95%
1.7	Degree of protection	IP44
1.8	Pollution level	Severe (31 mm/kV specific creepage)
1.9	Rated nominal system voltage	132 kV
1.10	Rated maximum system voltage	145 kV
1.11	Rated system frequency	50 Hz
2	**Rated Insulation Levels**	
2.1	Rated power frequency withstand voltage (1 min)	
2.1.1	common value	275 kV
2.1.2	phase-to earth and between phases	275 kV
2.1.3	across open CB	275 kV
2.2	Rated lightning impulse withstand voltage (1s)	
2.2.1	common value	650 kV
2.2.2	phase-to earth and between phases	650 kV
2.2.3	across open CB	650 kV
3	**Ceramic porcelain or silicone rubber composite**	
3.1	Rated voltage	145 kV
3.2	Rated Current	3150 A

Item	Description	Specified
3.3	Rated power frequency withstand voltage	275 kV
3.4	Rated lightning impulse withstand voltage	650 kV
3.5	Partial discharge level, ≤ 5 pC	92kV
3.6	Creepage distance	≥ 31 mm/kV
4	**Current Ratings**	
4.1	Rated continuous current	3150 A
4.2	Rated short-time withstand current	40 kA
4.3	Rated short circuit duration	3 s
4.4	Rated peak making current	100 kA
4.5	Temperature rise of active parts at rated continuous current	To be provided by OEM
4.6	Temperature rise of terminals at rated continuous current	To be provided by OEM
4.7	Temperature rise of enclosure at rated continuous current	To be provided by OEM
5	**SF_6 Gas System**	
5.1	Annual SF6 leakage	< 1% per year
6	**Circuit Breaker Mechanism**	
6.1	Type	SF_6 Auto-puffer
6.2	Operating mechanism	Spring type, three-pole
6.3	Circuit-breaker mechanical endurance class	M2
6.4	Maximum number of mechanical operations for drive mechanism	10 000
6.5	Rated operating sequence according to IEC	O - 0.3s - CO - 3 min - CO
6.6	Stored switching sequence	O - CO
6.7	Classification of circuit-breaker according to its restrike performance (line- and cable charging breaking current)	C2
6.8	Maximum number of operations at rated current	5000
6.9	Short circuit breaking current	40 kA
6.10	First reference voltage	To be provided by OEM
6.11	Point of time t1	To be provided by OEM
6.12	Peak value	To be provided by OEM
6.13	Point of time t2 and t3	To be provided by OEM
6.14	Starting point td	To be provided by OEM

Item	Description	Specified
6.15	Rate of rise	To be provided by OEM
6.16	Characteristic for Short Line Fault	
6.16.1	Short line fault current	36 kA
6.16.2	Wave impedance	450 Ω
6.16.3	Peak value	194 kV
6.16.4	Rated peak factor	1.6
6.16.5	Time delay tdL	To be provided by OEM
6.16.6	Time tL to peak uL	To be provided by OEM
6.16.7	Rate of rise of transient recovery voltage	To be provided by OEM
6.16.8	Opening time	36 – 45 ms
6.16.9	Arcing time	To be provided by OEM
6.16.10	Break time	≤ 60 ms
6.16.11	Closing time	< 70 ms
6.16.12	Contact speed	To be provided by OEM
6.16.12.1	Opening	To be provided by OEM
6.16.12.2	Closing	To be provided by OEM
6.17	**Circuit-breaker operating mechanism enclosure requirements**	
6.17.1	Operating mechanisms, local control facilities and all parts requiring lubrication protected by weatherproof enclosures	Yes
6.17.2	Degree of protection for enclosures containing exposed bearings, auxiliary switches, motors and other electrical devices	IP55
6.17.3	Degree of protection for all open areas in the circuit-breaker common base frame as well as externally mounted indicating devices (where applicable)	IP2X
6.17.4	Degree of protection for all other enclosures	IP54
6.17.5	Operating mechanism enclosure, handles and fixings material	316L stainless steel/ painted aluminium
6.17.6	Maximum height to top of mechanism allows servicing from ground (U_n ≤ 132 kV)	2000 mm
6.17.7	Front access door secured with a heavy-duty locking mechanism	Yes
6.17.8	Padlocking facility shackle diameter	6 mm
6.17.9	Front access door equipped with travel stop	Yes

Item	Description	Specified
6.17.10	Rigid, corrosion resistant documentation pocket provided on inside of front access door, securely attached no protrusion through door	Yes
6.17.11	Enclosure colour	RAL 7032 or Light grey ('G29')
6.18	**Auxiliaries**	
6.18.1	Rated voltage	110 V DC
6.18.2	Rated current	5A DC
6.18.3	Operating Coils	
6.18.3.1	Rated voltage	110V DC
6.18.3.2	Rated power	200W
6.18.3.3	Operating current	2A DC
6.18.4	Circuit-breaker Motor	
6.18.4.1	Rated voltage	110V DC
6.18.4.2	Rated power	900 W
6.18.4.3	Operating current	13A DC
6.18.4.4	Starting current	20A DC
6.18.4.5	Auxiliary contacts	7 NO + 7 NC

9.2.3.2 132 kV Outdoor Isolator

Table 9: Technical Schedule for 132 kV Outdoor Isolator

Item	Description	Specified
Eskom SAP Number(s)		0527586, 0527587 & 0527588
PDE Drawing(s) Applicable		D-DT-6302
1	**System Conditions**	
1.1	System voltage	132 kV
1.2	Number of phases	3
1.3	Nominal system frequency	50Hz
1.4	System earthing	Effectively earthed
1.5	Rated supply voltage of auxiliary and control circuits	110V DC
1.6	Expected life	40 years
2	**Disconnector ratings (SANS 62271-102)**	
2.1	Rated voltage (U_r)	145 kV
2.2	Rated normal current (I_r)	2500 A
2.3	Rated short-time withstand current (I_k)	40 kA
2.4	Short-time withstand current duration (tk)	3s
2.5	Rated peak withstand current (I_p)	100 kA
2.6	Rated short-duration power frequency withstand voltage	275 kV
2.7	Rated lightning impulse withstand voltage	$\geq$ 550 kV
2.8	Mechanical endurance class	M2
2.9	Rated value of bus transfer current for DS	1600/300A or 80% of rated current
2.10	Across the isolating distance (LIWL)	630 kV
3	**Detail and type of disconnector**	
3.1	Type of disconnector required	Centre Rotate Double Break (CRDB)
4	**Mounting of disconnector**	
4.1	Mounting height (lowest part of insulation above ground level)	2500 mm
4.2	Electrical clearances - Between live portions at system voltage and earth	≥ 3700 mm
5	**Type of operation mechanism**	
5.1	Disconnector	Either motor or hand operated type
6	**Operating movement**	

Item	Description	Specified
6.1	Disconnector	Vertical
7	**Motor driven mechanism - voltage**	110V DC
8	**Main Terminals**	
8.1	Type	Pad
8.2	Material	Aluminium
8.3	Orientation: vertical or horizontal	Horizontal
9	**Insulation and Clearances**	
9.1	Insulator type designation	C6-550
9.2	Cantilever strength class	6kN
9.3	Creepage distance	31 mm/kV
9.4	Insulator material	Porcelain
10	**Insulator Test Voltage**	
10.1	Lightning impulse withstand voltage (1,2/50 µs) referred to sea level - To earth and between phases in the open position	550 kV
10.2	Power frequency withstand voltage (60 second) referred to sea level - To earth and between phases in the open position	275 kV
11	**Insulator Dimensions**	
11.1	Top flange PCD with 4 x 14mm (Plain) holes	127 mm
11.2	Bottom flange PCD with 8 X 14mm (Plain) holes	127 mm
12	**Auxiliary Switches**	
12.1	Number of Poles	16 pole
12.1.1	Type F	1
12.1.2	Type M	5
12.1.3	Type G	8
12.1.4	Type N	2
12.1.5	Type GS	2 (if required)
13	**Ratings for auxiliary switches**	
13.1	Breaking capacity (110V ≤ U_a ≤ 250V)	440 W
13.2	Class type	1
13.3	Breaking current for 110V DC	2A
13.4	Continuous current	10A

Item	Description	Specified
13.5	Short-time current for 30 second	100A
14	**Miscellaneous**	
14.1	Protection of housing, mechanism enclosures and nameplates	
14.1.1	IP rating	IP55
14.1.2	Material type	316L stainless steel/ painted aluminium
14.1.3	Nameplates and their fixings shall be weather and corrosion proof	Yes
14.1.4	Nameplate material	aluminium or stainless steel
14.2	Cubicle heating and ventilation	
14.2.1	Electrical heating - Supply voltage, 50Hz	230V
14.3	Secondary terminals, gland plate and cable connections	
14.3.1	Terminal type	Spring loaded

9.2.3.3 66 kV Outdoor Surge Arrestor

Table 10: Technical Schedule for 66 kV Outdoor Isolator

Item	Description	Specified
Eskom SAP Number(s)		0401595
PDE Drawing(s) Applicable		D-DT-6212
1	**Operating Conditions**	
1.1	Altitude	up to 1800m
1.2	Average Humidity	30 to 90
1.3	Intensity of Solar Radiation	1,1 kW/m²
1.4	IEC pollution level	Coastal HVH (31 mm/kV specific creepage)
1.5	Lightning activity	High
1.6	System earthing	Effective
1.7	System configuration	3-phase, 3-wire
1.8	Nominal system voltage (U_n)	66 kV
1.9	Maximum system voltage (U_m)	72.5 kV
1.10	Supply frequency	50 Hz
1.11	BIL of equipment to be protected	350 kV peak
2	**Electrical Characteristics of Arrester**	
2.1	Arrester classification	Station class
2.2	IEC line discharge class	Class 2
2.3	Nominal lightning discharge current (8/20µs)	10 kA
2.4	Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	3,4 kJ/kV
2.5	Minimum continuous operating voltage MCOV (U_c)	48 kV
2.6	Maximum residual voltage (U_{res}) at 10kA (8/20µs)	165 kV
3	**Arrester housing**	
3.1	Minimum external creepage distance:	2263 mm
4	**Arrester housing profile design**	
	IEC 60815 annex D parameters:	
4.1	c	≥ 20

Item	Description	Specified
4.2	s/p	≥ 0,65
4.3	Ld/d	≤ 5
4.4	P1 – P2	≥ 15
4.5	CF	≤ 3,5
4.6	PF	≥ 0,7
5	**Arrester mounting details**	
5.1	Orientation	Vertical
5.2	Method of mounting	Tripod base
5.3	PCD	110 mm - 255 mm
5.4	Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers	Yes
6	**Arrester line terminal**	
6.1	Type	Stem
6.2	Diameter	26 mm
6.3	Minimum length	100 mm
6.4	Orientation	Vertical

9.2.3.4 132 kV Outdoor Post Insulator

Table 11: Technical Schedule for 132 kV Outdoor Post Insulator

Item	Description	Specified
Eskom SAP Number(s)		0017528
PDE Drawing(s) Applicable		D-DT-6230
1	**General**	
1.1	"IEC 60273" Classification	C4-550
1.2	Specific creepage distance	31 mm/kV
2	**Insulator details**	
2.1	Insulator type	Solid core
2.2	Insulator material	Porcelain
2.3	Colour of glaze	Dark Brown
3	**Electrical Insulation Characteristics**	
3.1	Rated lightning impulse withstand voltage (peak)	550 kV
3.2	Rated short time power freq. withstand voltage, wet	230 kV r.m.s
4	**Dimensional characteristics**	
4.1	Creepage factor (l/S)	4 (31 mm/kV)
4.2	Shed profile: Plain or Alternating	Alternating
4.3	Minimum shed spacing to projection (s/p) ratio	0.65
4.4	Minimum distance between sheds of the same diameter	30 mm
4.5	Maximum creepage distance vs. clearance	5
4.6	Insulator height (across mounting flanges)	1220 ± 1mm
4.7	Maximum nominal diameter of insulating part	300mm
5	**Mechanical Properties**	
5.1	Bending (cantilever) failing load	$\geq$ 4kN
5.2	Torsion failing load	$\geq$ 3000Nm
6	**Fixing Arrangements**	
6.1	Top fitting pitch circle diameter	127mm
6.2	Top fitting - number of holes	4
6.3	Top fitting - diameter of holes	M16
6.4	Bottom fitting pitch circle diameter	127mm
6.5	Bottom fitting - number of holes	4

Item	Description	Specified
6.6	Bottom fitting - diameter of holes	M16
6.7	Flange material	Cast iron
6.8	Metal finish - minimum hot dip galvanizing thickness	100µm
6.9	Mounting bolt: Type	Grade 8.8
6.10	Confirmation of the integrity of the supplied fastening arrangement	Yes

9.2.3.5 132 kV Outdoor Current Transformer

Table 12: Technical Schedule for 132 kV Outdoor Current Transformer

Item	Description	Specified
Eskom SAP Number(s)		0180034
PDE Drawing(s) Applicable		D-DT-6190
1	**Service Conditions**	
1.1	Altitude	1800m
1.2	Climate conditions	Coastal
1.3	Ambient Temperature	- 10ºC to + 45ºC
1.4	Level of pollution that equipment will be subjected to	High
1.5	Lightning area	Yes
2	**General requirements**	
2.1	Nominal system voltage (U_n)	132 kV
2.2	Maximum system voltage (line-to-line) (U_m)	145 kV
2.3	Number of phases	1
2.4	Nominal continuous primary current	2500 A
2.5	Nominal short time current (Thermal)	40 kA
2.6	Nominal short time current (Dynamic)	64 kA
2.7	Time for which thermal applies	3s
2.8	Power frequency short-duration withstand voltage	275 kV
2.9	Lightning impulse withstand voltage	650 kV
3	**Details of CT Cores**	
3.1	Number of cores	6
3.2	Number of Metering cores	2
3.3	Number of Protection cores	2
3.4	Number of Buszone cores	2
4	**Metering Cores**	
4.1	Position of Cores	Cores 5 & 6
4.2	Nominal ratio	2400/1 MR
4.3	Rated burden	See Table 13
4.4	Accuracy class	See Table 13
5	**Protection Cores**	

Item	Description	Specified
5.1	Position of Cores	Cores 1 & 4
5.2	Nominal turns ratio	1/2400T MR
5.3	Continuous current rating	
	1) Primary	2500 A
	2) Secondary	1A
5.4	Accuracy class	PX
5.5	Rated knee-point voltage V_k	See Table 14
5.6	Magnetising current	See Table 14
5.7	Maximum total secondary winding resistance R_{ct}	See Table 14
6	**Buszone Cores**	
6.1	Position of Cores	Cores 2 & 3
6.2	Nominal turns ratio	1/1600T MR
6.3	Accuracy class	PX
6.4	Rated knee-point voltage V_k	See Table 15
6.5	Magnetising current	See Table 15
6.6	Maximum total secondary winding resistance R_{ct}	See Table 15
7	**Primary Terminal**	
7.1	Type	Stem
7.2	Orientation	Horizontal
7.3	Size	38mm

Table 13: 132 kV CT - Measurement Cores 5 and 6 Arrangement

Tapping	Ratio	Class	VA
S2 - S3	1/200T	0.2	2.5VA
S1 - S2	1/400T	0.2	5VA
S1 - S3	1/600T	0.2	1 VA
S4 - S5	1/800T	0.2	10VA
S3 - S4	1/1000T	0.2	10VA
S2 - S4	1/1200T	0.2	10VA
S1 - S4	1/1600T	0.2	10VA
S3 - S5	1/1800T	0.2	10VA
S2 - S5	1/2000T	0.2	10 VA
S1 - S5	1/2400T	0.2	10VA

Table 14: 132 kV CT - Protection Cores 1 and 4 Arrangement

Tapping	Ratio	Class	V_{knee} (min)	I_{mag} (max)	R_{ct} (Ω) @ 75°C
S2 - S3	1/200T	PX	200V	300mA	0,8
S1 - S2	1/400T	PX	400V	150mA	1,6
S1 - S3	1/600T	PX	600V	100mA	2,4
S4 - S5	1/800T	PX	800V	75mA	3,2
S3 - S4	1/1000T	PX	1000V	60mA	4,0
S2 - S4	1/1200T	PX	1200V	50mA	4,8
S1 - S4	1/1600T	PX	1600V	38mA	6,4
S3 - S5	1/1800T	PX	1800V	33mA	7,2
S2 - S5	1/2000T	PX	2000V	30mA	8,0
S1 - S5	1/2400T	PX	2400V	25mA	9,6

Table 15: 132 kV CT - Buszone Cores 2 and 3 Arrangement

Tapping	Ratio	Class	V_{knee} (min)	I_{mag} (max)	R_{ct} (Ω) @ 75°C
S1 - S2	1/1000T	PX	550V	50mA	2
S1 - S3	1/1200T	PX	660V	42mA	2,4
S1 - S4	1/1600T	PX	880V	31mA	3,2

9.2.3.6 66 kV Power Voltage Transformer

Table 16: Technical Schedule for 66 kV Outdoor Power Voltage Transformer

Item	Description	Specified
Eskom SAP Number(s)		0632985
PDE Drawing(s) Applicable		D-DT-6315
1	**Service Conditions**	
1.1	Altitude	1800m
1.2	Climate conditions	Coastal
1.3	Ambient Temperature	-10°C to +50°C
1.4	Relative humidity	95%
1.5	Level of pollution that equipment will be subjected to	Very Heavy
1.6	Lightning area	Yes
2	**General requirements**	
2.1	Nominal system voltage (U_n)	66 kV
2.2	Maximum system voltage (line-to-line) (U_m)	72.5kV
2.3	Frequency	50Hz
2.4	Number of single phase Voltage Transformers per set	3
2.5	Rated Burden per Phase	16 kVA
2.6	Voltage Factor	1,2
2.7	Primary Voltage (kV)	66 / √3
2.8	Secondary Voltage (V)	400 / √3 (230)
2.9	Power frequency short-duration withstand voltage	140 kV
2.10	Lightning impulse withstand voltage	325 kV
2.11	Power Winding required	Yes
3	**Creepage distance**	
3.1	Minimum creepage distance for other than medium pollution (IEC 60815)	31 mm/kV
4	**Secondary Protection**	
4.1	Method	MCCB
4.2	Current rating of MCCB	To be provided by OEM
4.3	Maximum permissible duration of secondary short circuit current	1s

Item	Description	Specified
5	**Primary Terminal**	
5.1	Type	Stem
5.2	Orientation	Vertical
5.3	Size	26mm

9.2.3.7 66 kV Outdoor Voltage Transformer

Table 17: Technical Schedule for 66 kV Outdoor Voltage Transformer

Item	Description	Specified
Eskom SAP Number(s)		0180091
PDE Drawing(s) Applicable		D-DT-6176
1	**Service Conditions**	
1.1	Altitude	1800m
1.2	Climate conditions	Coastal
1.3	Ambient Temperature	- 10°C to + 45°C
1.4	Level of pollution that equipment will be subjected to	Very High
1.5	Lightning area	Yes
2	**General requirements**	
2.1	Nominal system voltage (U_n)	66 kV
2.2	Maximum system voltage (line-to-line) (U_m)	72.5 kV
2.3	Frequency	50Hz
2.4	Number of single phase Voltage Transformers per set	3
2.5	Rated Burden per Phase	100/50 VA
2.6	Accuracy Class	3P/0.2
2.7	Primary Voltage	66 kV / √3
2.8	Secondary Voltage	110V / √3
2.9	Power frequency short-duration withstand voltage	140 kV
2.10	Lightning impulse withstand voltage	350 kV
2.11	Power Winding required	No
3	**Creepage distance**	
3.1	Minimum creepage distance for other than medium pollution (IEC 60815)	31 mm/kV
4	**Secondary Protection**	
4.1	Method	Fuses
4.2	Current rating of fuses	To be provided by OEM
4.3	Maximum permissible duration of secondary short circuit current	1s
5	**Primary Terminal**	

Item	Description	Specified
5.1	Type	Stem
5.2	Orientation	Vertical
5.3	Size	26mm

9.2.3.8 Clamps

Table 18: Clamp Technical Schedule

Type	PDE Drawing(s) Applicable	Eskom SAP Number(s)	Description
ETC-A	D-DT-6010	0401758	Clamp, 23.5mm - 26.5mm 0 DEG
ETC-C	D-DT-6010	0401754	Clamp, 26.5mm - 26.5mm 0 DEG
ETC-J	D-DT-6010	0401768	Clamp, 38.3mm - 26.5mm 0 DEG
EPC-A	D-DT-6018	0401580	Clamp, Palm 26.5mm 0 DEG
EPC-B	D-DT-6018	0400420	Clamp, Palm 26.5mm 45 DEG
EPC-C	D-DT-6018	0560891	Clamp, Palm 26.5mm 90 DEG
EPC-26	D-DT-6115	0401653	Bolted Earth Peg Clamp 26.5mm
EPC-38	D-DT-6115	0401655	Bolted Earth Peg Clamp 38.3mm
EPT-A	D-DT-6004	0590147	Clamp, Bolted/Palm 26.5mm
EX-B	D-DT-6002	0401584	Clamp, Bolted 26mm – 26.5mm
EXC-B	D-DT-6006	0401766	Clamp, B/Comp 38mm - 26.5mm 0 DEG
KCP 26/127	D-DT-6029	0401675	Clamp, Fixed Support 26.5mm PCD 127mm
ETP-IL1-H	D-DT-6119	0216098	Clamp, Tube 120mm - Conductor 26.5mm
ETP-IL2-T	D-DT-6119	0216099	Clamp, Tube 120mm - Conductor 2 x 38.3mm 90 DEG
ESC-PI-F-F	D-DT-6039	0213925	Clamp, Tube Support Fixed 120/127mm
EEC-PI-FS-F	D-DT-6093	0206329	Clamp, Tube, Expansion 120/127mm
ESC-PI-S-F	D-DT-6316	0242920	Clamp, Tube, Post Insulator Support 120/127mm
EEC-PL-C; 120/4	D-DT-6040	0206319	Clamp, Tube End Cap 120mm
EEC-DC-C; 120/4	D-DT-6040	0206320	Clamp, Tube End Cap 120mm - Conductor 26.5mm
ETP-TE-IL2-R	D-DT-6090	0206328	Clamp, Tube End 120mm - 2 x 38.3mm
EYC-B	D-DT-6013	0005663	Clamp, 2 x 38.3mm Comp - Bolted 38.3mm 0 DEG
EYC-R	D-DT-6109	0400426	Clamp, 2 x 38.3mm Comp - Palm 0 DEG
EYC-S	D-DT-6109	0401802	Clamp, 2 x 38.3mm Comp - Palm 45 DEG
EY-H	D-DT-6022	0206355	Clamp. Bolt, Stem 26mm - 2 x 38.3mm Con 0 DEG
F/SUPT	D-DT-6025	0401669	Clamp, F/SUPT 38.3mm P38/127/150 C/C
BALL JOINT	D-DT-6081	0206118	Joint, Ball Portable Earth 20kA G/S
ES-B	D-DT-6087	0402559	Spacer 150mm for 2 x 38.3mm Con

9.2.3.9 Conductors

Table 19: Technical Schedule for Bull AAC Conductor

Bull AAC Characteristics	
Eskom SAP Number(s)	0403047
PDE Drawing(s) Applicable	D-DT-3136
Conductor overall diameter (mm)	38.25
Area Total (mm²)	865.36
Aluminium wire stranding/diameter (mm)	61/4.25
Conductor linear mass (kg/km)	2400
Ultimate Tensile strength (kN)	139
Resistance DC @ 20°C (Ω/km)	0.0334
Modulus elasticity final (GPa)	57.570
Coefficient of Linear expansion (1/°C)	23×10^{-6}

Table 20: Technical Schedule for Centipede AAC Conductor

Centipede AAC Characteristics	
Eskom SAP Number(s)	0403041
PDE Drawing(s) Applicable	D-DT-3136
Conductor overall diameter (mm)	26.46
Area Total (mm²)	415.22
Aluminium wire stranding/diameter (mm)	37/3.78
Conductor linear mass (kg/km)	1150
Ultimate Tensile strength (kN)	67.2
Resistance DC @ 20°C (Ω/km)	0.0694
Modulus elasticity final (GPa)	58.6
Coefficient of Linear expansion (1/°C)	23×10^{-6}

Table 21: Technical Schedule for Busbars

Aluminium Alloy Tubular Busbar Characteristics	
Eskom SAP Number(s)	0206318
PDE Drawing(s) Applicable	D-DT-6000
Outside Diameter (mm)	120
Inside Diameter (mm)	112
Wall Thickness (mm)	4
Standard Length (m)	12 - 12.2
Current Rating (A)	2300
Support Type	Twin supports for stability, unless shown otherwise
Support Spacing (m)	12
Vibration Dampening Method	Internal centipede conductors, unless shown otherwise

9.2.4 Power Cables (LV)

Table 22: Technical Schedule for 600/1000V LV Cables (PDE Drawing D-DT-3128)

PVC Insulated, PVC Bedded, SWA, PVC Sheathed 600/1000V LV Cables						
Size (mm²)	25	16	4	2.5	2.5	2.5
No. of Cores	4	4	4	19	12	4
Eskom Cable Code	BVX4KCV	BVX4HCV	BVX4ECV	BVX19DCV	BVX12DCV	BVX4DCV
Eskom SAP Numbers	0404767	0404766	0404764	0404118	0404761	0400646
Application	Up to 1000 V					
Conductor Material	Copper (Stranded)					
Armoured	Yes					
Armour Type	Galvanised Steel Wire					
Insulation	PVC Insulated, PVC Bedded, PVC Sheathed					

9.2.5 Lighting

9.2.5.1 Operational Lighting

The Environmental Regulations for Workplaces, including Eskom standard ‘240-83382076 - Standard for Operational Floodlighting in Substations’, calls for the Substation operational lighting to have a minimum average maintained illuminance in the HV yard of 10 lux. The design for lighting in the HV yard provides for an average maintained illuminance of ± 34.4 lux.

The below figures depict the lighting calculation results, taken from Relux, in the measuring area of the HV yard only. ***Note: This does not include the future Ystervark HV feeder and transformer bays, with associated yard area.***

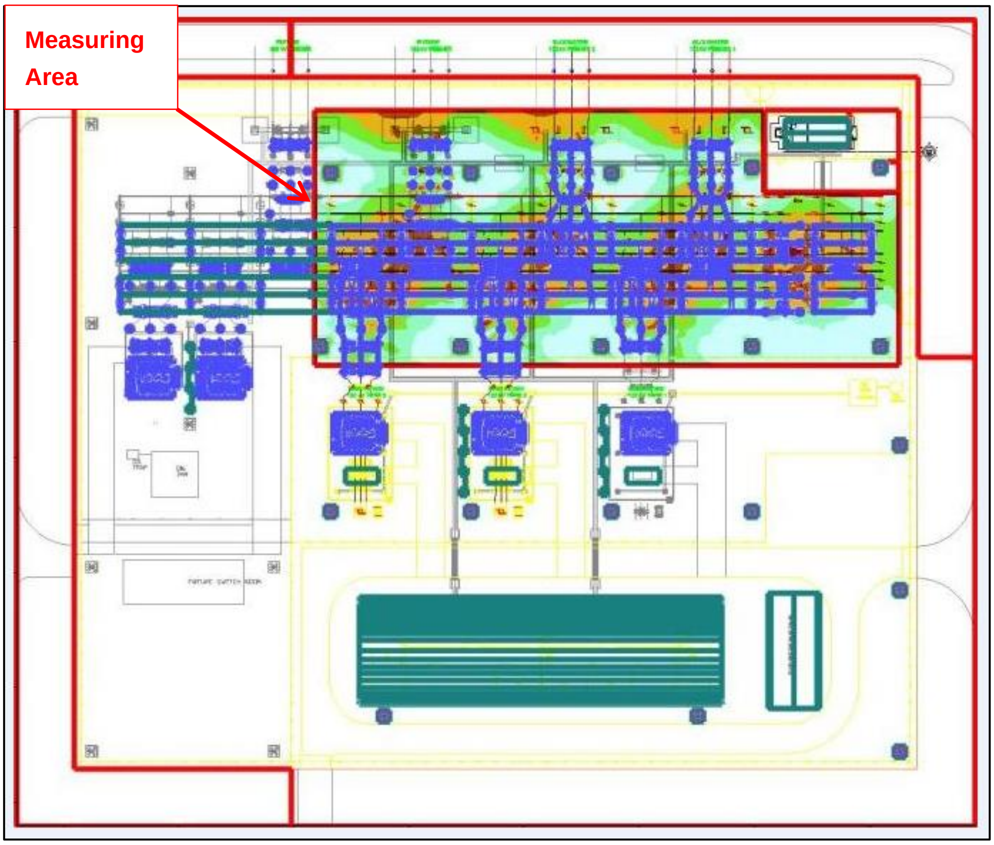


Figure 87: Ystervark Substation - HV Yard Lighting Measuring Area (With Equipment)

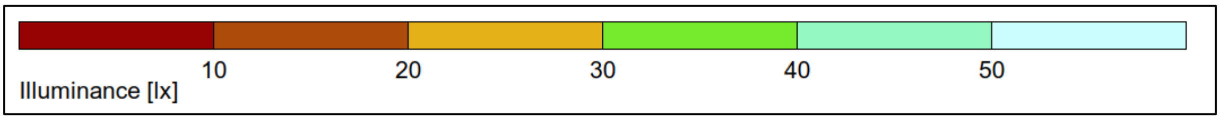


Figure 88: Ystervark Substation - HV Yard Lighting - Illuminance Colour Scale

General		
Calculation algorithm used		Direct component
Height of evaluation surface		0.10 m
photometric centre height. [m]:		12.50 m
Maintenance factor		0.70
Total luminous flux of all lamps		950400 lm
Total power		8640 W
Total power per area (23313.91 m²)		0.37 W/m²
Illuminance		
Average illuminance	Eav	34.4 lx
Minimum illuminance	Emin	3.5 lx
Maximum illuminance	Emax	65.1 lx
Uniformity Uo	Emin/Em	1:9.93 (0.1)
Diversity Ud	Emin/Emax	1:18.8 (0.05)

Figure 89: Ystervark Substation - HV Yard Lighting Calculation Results (With Equipment)

The Eskom standard for operational flood lighting in Substations requires a uniformity ratio of 5 @ 10 lux (i.e. E_{min}/E_{av} = 0.2), however the calculated results provides a uniformity ratio of 9.93 (i.e. E_{min}/E_{av} = 0.1). The aforementioned is a result of the nature of the yard equipment configuration, where in certain pockets between and around the equipment the light is < 10 lux.

This is to be expected and not seen as a cause of concern, given the fact that most light levels achieved between and around the yard equipment is ≥ 10 lux. This can be seen in the 3D pseudo graph below (refer also to the illuminance colour scale).

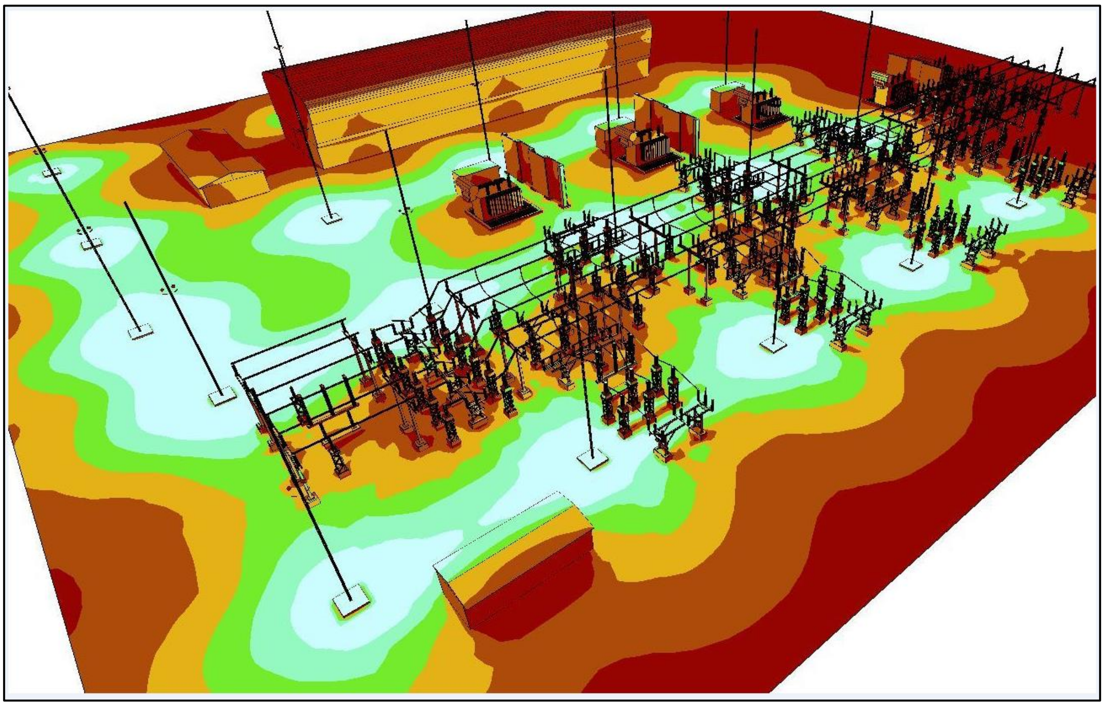


Figure 90: Ystervark Substation - 3D Pseudo Graph (With Equipment)

It should be noted that the abovementioned Eskom standard requires the operational flood lighting only for the purpose for personnel to observe obstructions & other hazards while moving within the high voltage yard at night time, and to read high voltage apparatus identification labels, mounted at heights not exceeding 2 m above the ground level.

The standard further dictates that the flood lighting installation shall not be provided for detailed inspection and/or maintenance work (i.e. task lighting) within the high voltage yard. For this purpose, the personnel shall make use of portable maintenance lighting which is to provide illumination levels in excess of 50 lux directed at the apparatus on which this work is to be carried out.

To further illustrate the abovementioned, the following figures below depict the scenario where all equipment was removed in the HV yard measuring area, and a flat surface was assumed. By nature, the average maintained illuminance and resulting uniformity ratios would be higher.

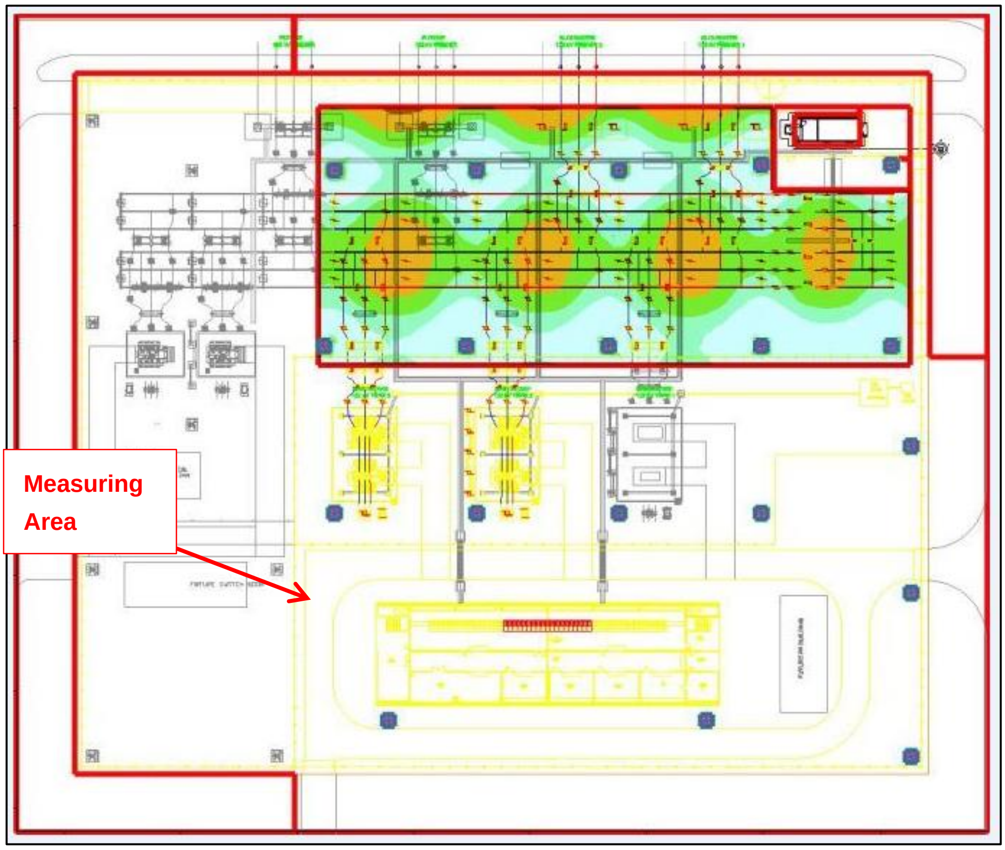


Figure 91: Ystervark Substation - HV Yard Lighting Measuring Area (Without Equipment)

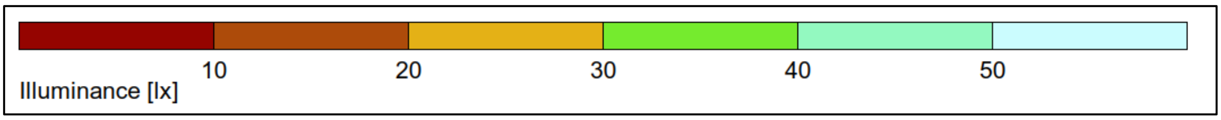


Figure 92: Ystervark Substation - HV Yard Lighting - Illuminance Colour Scale

General		
Calculation algorithm used		Direct component
Height of evaluation surface		0.10 m
photometric centre height. [m]:		12.50 m
Maintenance factor		0.70
Total luminous flux of all lamps		950400 lm
Total power		8640 W
Total power per area (23313.91 m²)		0.37 W/m²
Illuminance		
Average illuminance	Eav	40.6 lx
Minimum illuminance	Emin	17.4 lx
Maximum illuminance	Emax	65.5 lx
Uniformity Uo	Emin/Em	1:2.33 (0.43)
Diversity Ud	Emin/Emax	1:3.75 (0.27)

Figure 93: Ystervark Substation - HV Yard Lighting Calculation Results (Without Equipment)

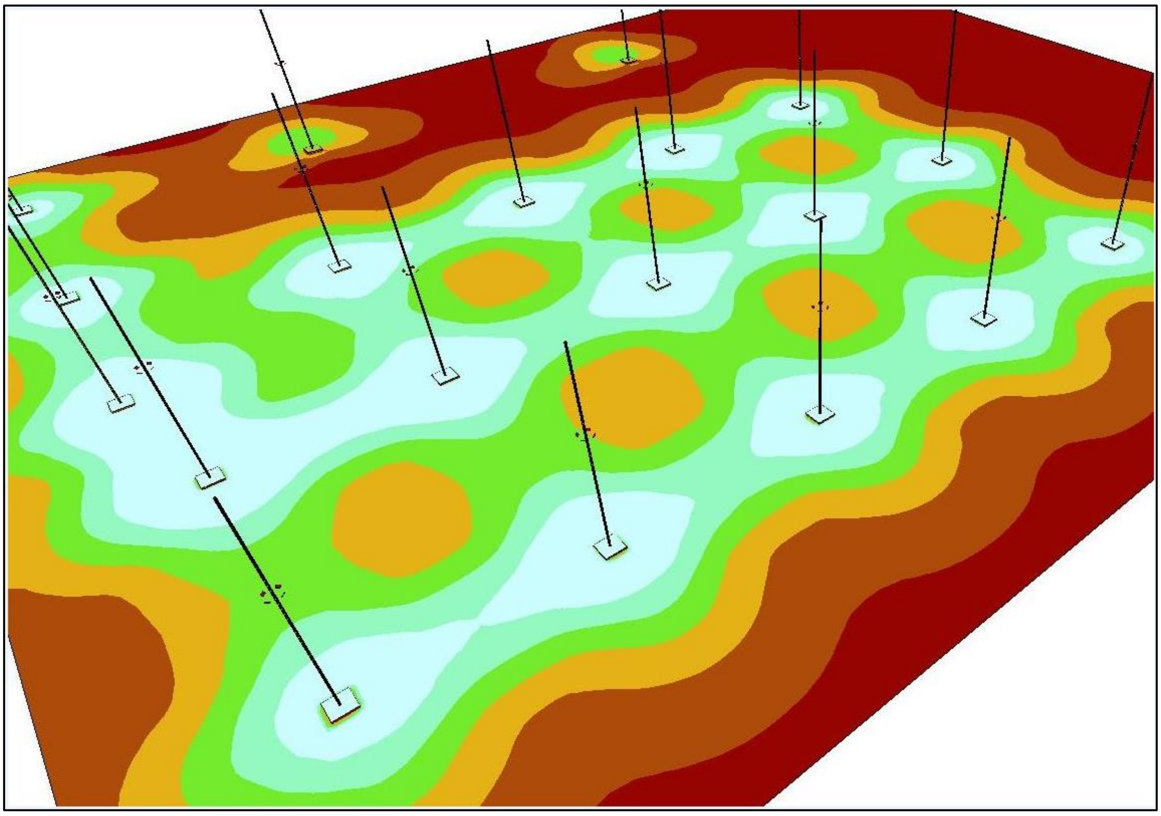


Figure 94: Ystervark Substation - 3D Pseudo Graph (Without Equipment)

The below figures depict the lighting calculation results in the measuring area around the relay house (control building) only. These results take into account the light levels obtained from the operational flood lights. External lighting on the relay house will also be installed, which will further increase the light levels around the building, however this has not been included in the calculations.

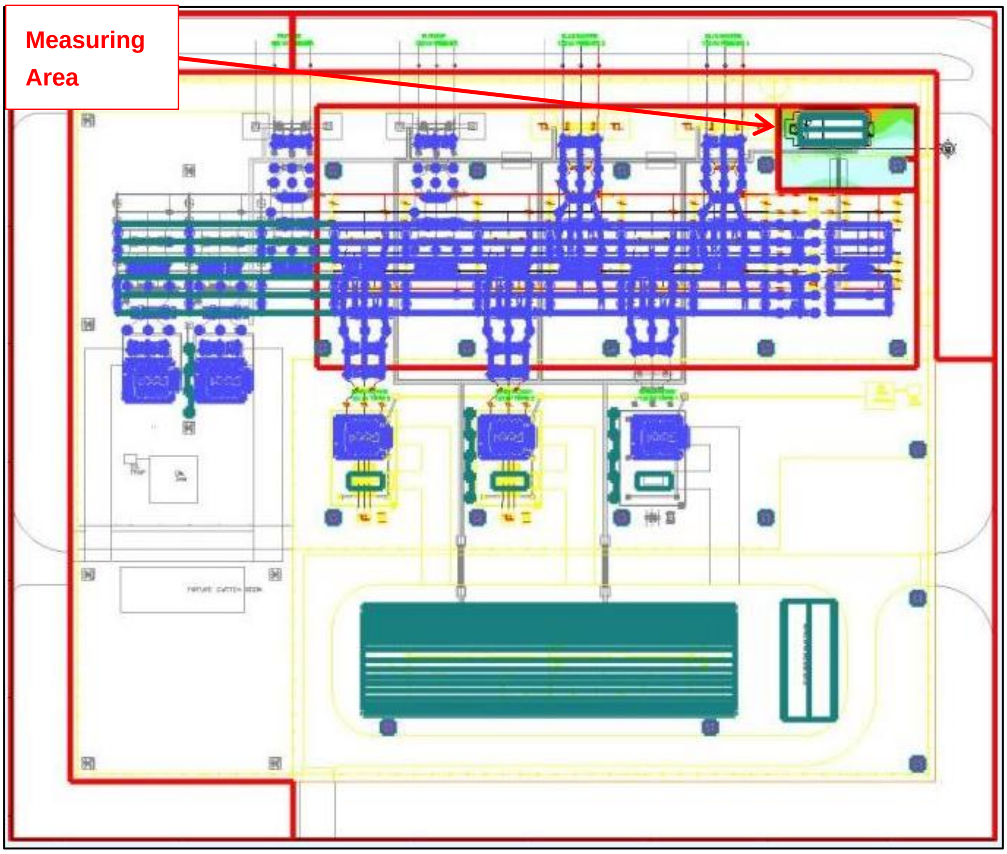


Figure 95: Ystervark Substation - Relay House Lighting Measuring Area (With Equipment)

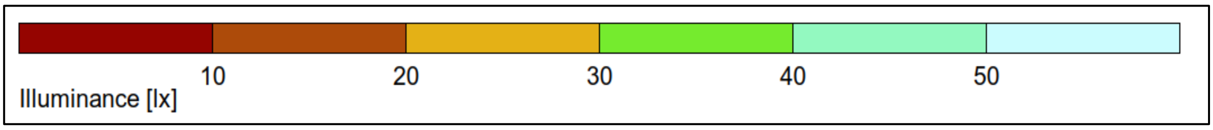


Figure 96: Ystervark Substation - Relay House - Illuminance Colour Scale

General		
Calculation algorithm used		Direct component
Height of evaluation surface		0.10 m
photometric centre height. [m]:		12.50 m
Maintenance factor		0.70
Total luminous flux of all lamps		950400 lm
Total power		8640 W
Total power per area (23313.91 m²)		0.37 W/m²
Illuminance		
Average illuminance	Eav	43.9 lx
Minimum illuminance	Emin	0 lx
Maximum illuminance	Emax	63.8 lx
Uniformity Uo	Emin/Em	1:--- (---)
Diversity Ud	Emin/Emax	1:--- (---)

Figure 97: Ystervark Substation - Relay House Lighting Calculation Results

It should be noted that the uniformity is not of consequence when evaluating the lighting around the relay house, owing to the fact that high light levels are attained around most of the building. The below figure provides a 3D illustration of the Ystervark Substation operational flood lighting.

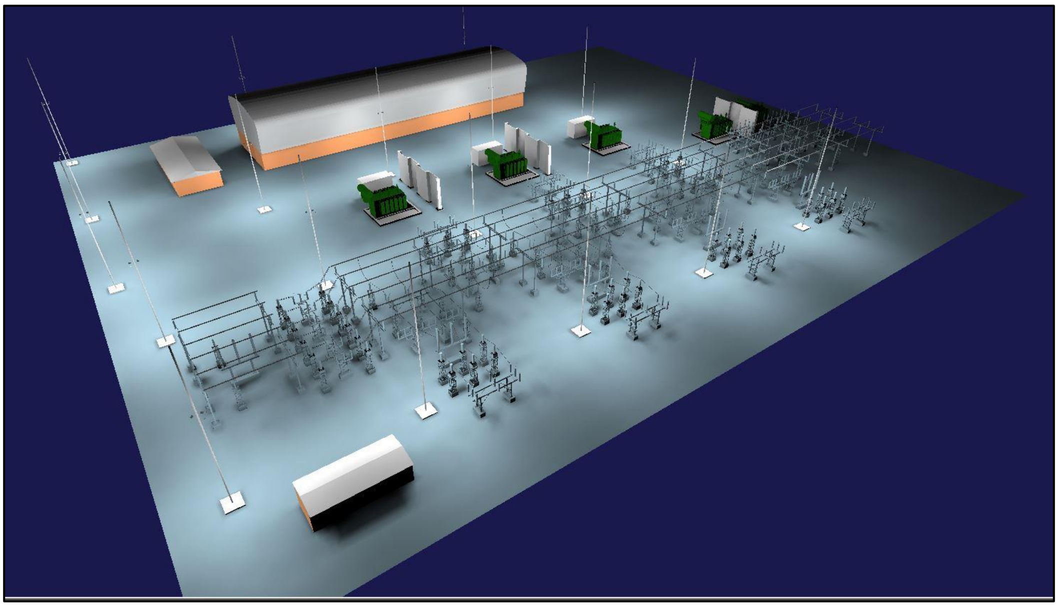


Figure 98: Ystervark Substation - Outdoor Lighting 3D Illustration

The operational flood lights will be installed at a mounting height (MH) of 12.5 m on the 21 m lighting/lightning masts, with a tilt of 45 degrees (º). The specified flood light luminaires comply largely with the Eskom standard ‘240-113163905 - LED Floodlights for Distribution Substation Applications’, however with minor differences.

The reason for this is so that the luminaires are in-line with the remaining luminaires specified for Transnet’s Main Intake Substation, especially from a light colour perspective. As a result, the technical specification for the luminaires has been included in Section 9.8. ‘Non-Standard Material Specifications’.

A more conservative maintenance factor of 0.7 has been used, for design purposes, than the Eskom standard required minimum of 0.75 for high pollution area applications. This is due to the presence of excessive iron ore dust in the region of the Substation.

9.2.5.2 Security Lighting

The purpose of the required security lighting for Ystervark Substation is as follows:

- Assist in defining boundaries and establishes territory during night time.
- Promote safety and to assist in the night defense of the premises and personnel against the threat of sabotage, vandalism, violence, illegal entry, theft and the like.

No dedicated lighting infrastructure has been allowed for the required perimeter lighting. Instead, the aforementioned lighting will be achieved via the operational flood lighting system, which due to their placement, illuminates the perimeter of Ystervark Substation.

It should be noted that most of the perimeter in the area allowed for future equipment in Ystervark Substation, will not be illuminated directly as no lighting infrastructure will be installed inside the aforementioned area for this project, however some illumination will be achieved via the spill light from the respective installed flood lights.

Furthermore, perimeter illumination in the North-Western corner of the abovementioned area for future equipment will also be achieved via the new flood lighting system that will be installed inside the Transnet property, which forms part of a different package under the Tippler 3 project.

In accordance with Eskom standard '240-139282493 - Security Lighting for Eskom Applications' and SANS 10389-2, the security lighting requirements of an establishment also needs to be determined via a security risk evaluation, from which a selection of three classes needs to be made with associated minimum lighting levels and uniformity requirements attached to them. These are as follows:

Table 23: Area and Perimeter Lighting vs Risk Class - Eskom Standard Assigned Values

Risk Class - Illuminance			
Risk Class	**Moderate**	**High**	**Extreme**
Average illuminance (lx)	5	10	15
Minimum illuminance (lx)	4	4	4
Uniformity - Minimum to average (E_{min}/E_{av})	0.2	0.2	0.2

The three risk classes are defined as follows as per SANS 10389-2:

Extreme Risk

"This is related to establishments where:

- if the threat succeeded, it would have a critical effect, i.e. stopping or seriously affecting production or supply of services completely, for a considerable period of time
- materials and equipment of strategic importance are manufactured/stored

Examples: Power stations, switchyards, ammunition sites, fuel depots, nuclear facilities, petrochemical works and national defense force establishments."

High Risk

“This is related to establishments where:

- if the threat succeeded, it would have a severe effect, i.e. while it would affect production and supply of services for a limited period, it would not bring the operation to a complete standstill

- materials and equipment that are attractive to thieves, are manufactured/stored

Examples: Police stations, embassies, water and sewage plants and large commercial and industrial establishments.”

Moderate Risk

“This is related to establishments where:

- if the threat succeeded, whilst it would have a significant effect on production or supply of services, it would not be of serious consequence and production or supply of services could be resumed almost immediately

- materials and equipment which have limited attraction to thieves, are manufactured/stored

Examples Small commercial and industrial establishments, parking areas, domestic premises and informal settlements.”

Although it can be reasoned that given the nature of the plant, and the critical operations it supplies, the risk associated to it should be classified as extreme. The Substation will however be located inside a secure Transnet property and in practice the probability of theft, vandalism, illegal entry and the like would be low.

Furthermore, discussions with both Eskom and Transnet on the matter of security have revealed that no major incidents have occurred in the past. As a result, the security risk to Ystervark Substation have been deemed as moderate, hence with the design based on the minimum lighting and uniformity values provided in the table above.

A ‘setback’ of 10m from the fence has been taken for the measuring area, in-line with the preferred distance as per SANS 10389-2, and not the abovementioned Eskom standard which only requires 6m for calculation purposes. The reason for this is to illustrate the good light levels achieved well beyond the perimeter fences.

A more conservative maintenance factor of 0.7 has been used for design purposes, than the Eskom standard required minimum of 0.75 for high pollution area applications. This is due to the presence of excessive iron ore dust in the region of the Substation.

The following figures below depict the lighting calculation results, taken from Relux, in the set measuring areas of the perimeter of Ystervark Substation.

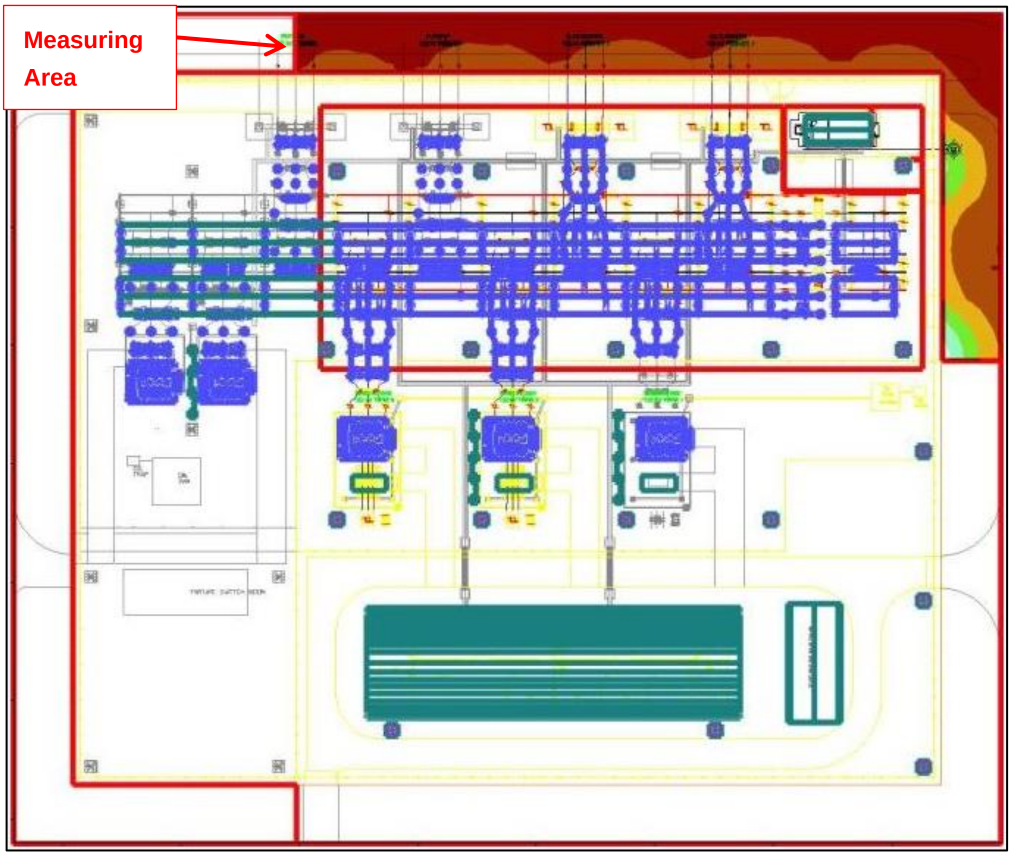


Figure 99: Ystervark Substation - Perimeter Security Lighting (Measuring Area 1)

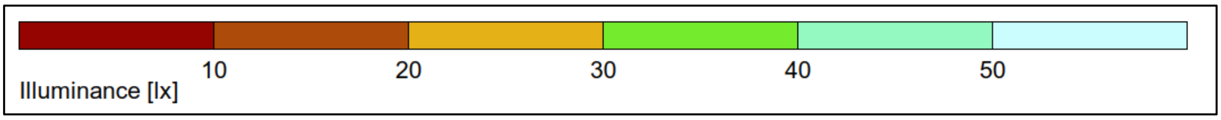


Figure 100: Ystervark Substation - Perimeter Security Lighting (Measuring Area 1) - Illuminance Colour Scale

General		
Calculation algorithm used		Direct component
Height of evaluation surface		0.10 m
photometric centre height. [m]:		12.50 m
Maintenance factor		0.70
Total luminous flux of all lamps		950400 lm
Total power		8640 W
Total power per area (23313.91 m²)		0.37 W/m²
Illuminance		
Average illuminance	Eav	11.8 lx
Minimum illuminance	Emin	3.2 lx
Maximum illuminance	Emax	45.8 lx
Uniformity Uo	Emin/Em	1:3.72 (0.27)
Diversity Ud	Emin/Emax	1:14.5 (0.07)

Figure 101: Ystervark Substation - Perimeter Security Lighting Calculation Results (Measuring Area 1)

Perimeter Measuring Area 2

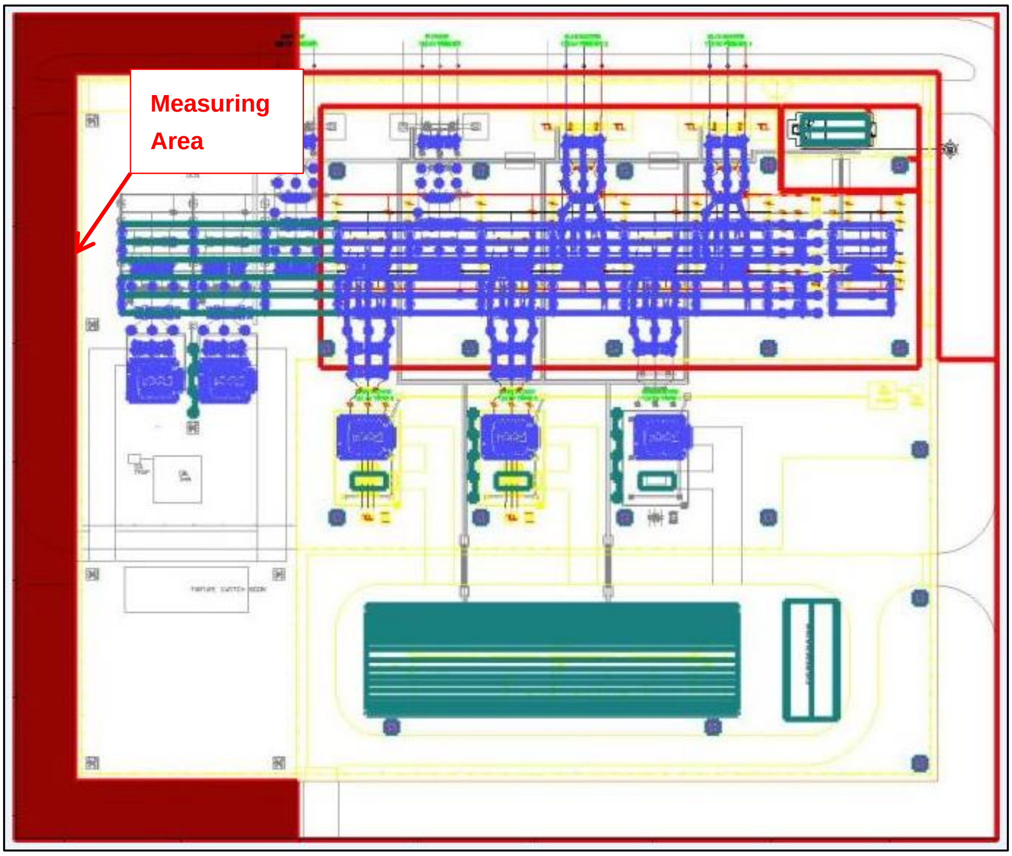


Figure 102: Ystervark Substation - Perimeter Security Lighting (Measuring Area 2)

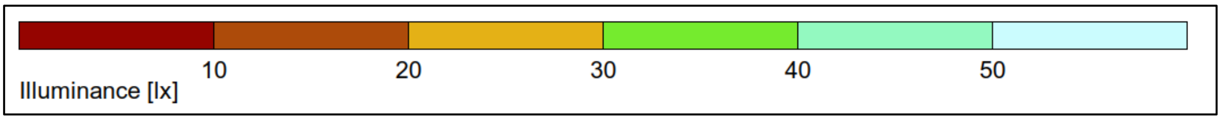


Figure 103: Ystervark Substation - Perimeter Security Lighting (Measuring Area 2) - Illuminance Colour Scale

General		
Calculation algorithm used		Direct component
Height of evaluation surface		0.10 m
photometric centre height. [m]:		12.50 m
Maintenance factor		0.70
Total luminous flux of all lamps		950400 lm
Total power		8640 W
Total power per area (23313.91 m²)		0.37 W/m²
Illuminance		
Average illuminance	Eav	1.17 lx
Minimum illuminance	Emin	0.26 lx
Maximum illuminance	Emax	6.57 lx
Uniformity Uo	Emin/Em	1:4.44 (0.23)
Diversity Ud	Emin/Emax	1:24.8 (0.04)

Figure 104: Ystervark Substation - Perimeter Security Lighting Calculation Results (Measuring Area 2)

Referring to the results obtained for the ‘Perimeter Measuring Area 1’ calculations, it can be seen that the average maintained illuminance and uniformity is higher than the minimum Eskom requirements, although the minimum illuminance is slightly lower than the specified 4 lux.

This is purely the result of the calculated area being larger (i.e. setback of 10m) compared to the area if calculated using the Eskom specified 6 m setback. Should the calculated area be reduced with a 2 m setback, the minimum illumination light level would be achieved.

9.2.5.3 Lighting Power Supply Block Diagram

For detail regarding connections refer to Yard AC Distribution Board drawings D-WC-8118 Set 151 as well as Auxiliaries Cable Block Diagram D-WC-8118 Set 159.

9.2.6 Lightning Protection

The rolling sphere method, in accordance with IEEE 998-2012 and 240-109589380, was used to obtain sufficient lightning shielding/ coverage for Ystervark Substation.

A Lightning Risk Assessment was conducted for one of the packages on the Transnet Tippler 3 project, at the Port of Saldanha, which determined that the applicable LPL Class in the area is IV.

The primary infrastructure to be utilized to achieve coverage for Ystervark Substation will be by means of 21 m lighting/lightning masts, with the assistance of the gantries for a portion of the yard. Further coverage assistance will be by means of the 21 m lighting/lightning masts inside the Transnet Main Intake Substation yard and associated switch house structure (using natural structure elements as air-terminals and sown conductors).

It is important to understand the difference between positive and negative lightning. For positive lightning the leader is generally not stepped and there are rarely multiple strikes, as well as typically only one return strike, after which a continuous current flow to discharge the cloud. For negative lightning it is the opposite.

Hence during a typical lightning strike, as the lightning downward leader approaches the ground or structure, the electric field increases to the point that the ground or structure launches an upward leader that may eventually intercept the downward leader. This is termed the “striking distance”. The larger the amount of charge carried by the lightning leader, the greater will be the distance at which this happens. The larger the charge of the leader, the larger the resulting lightning current. The striking distance is defined in IEEE 998-2012 as:

$$S = 8kI_S^{0.65} \qquad \text{(Eq. 17 of IEEE 998-2012)}$$

Where

S	is the striking distance in m
I_S	is the return stroke current in kA
k	is the coefficient to account for different striking distances to a mast, shield wire or the ground plane

IEEE 998-2012 defines the values of k as follow:

1	for strokes to wires or the ground plane
1.2	for strokes to a lightning mast

For this application, $k = 1.2$ will be used, as masts will be used for lightning protection in Ystervark Substation. Using $k = 1.2$ then determines the striking distance as:

$$S = 9.6I_S^{0.65}$$

To provide better protection for the power plant against smaller flashes, air-terminals (i.e. lighting/lightning masts) must be spaced closer together, with the sphere radius determined from the equipment ratings, as applicable, for design purposes. IEEE 998-2012 illustrates the relationship between the BIL, negative polarity critical flashover voltage and the stroke current:

$I_S = \frac{BIL \times 1.1}{(Z_S/2)} = \frac{BIL \times 2.2}{Z_S}$ and (Eq. 18 of IEEE 998-2012)

$I_S = \frac{0.94 \times CFO \times 1.1}{(Z_S/2)} = \frac{2.069 \times CFO}{Z_S}$ (Eq. 19 of IEEE 998-2012)

Where

I_S	is the allowable stroke current in kA
BIL	is the basic impulse level in kV
CFO	is the negative polarity critical flashover voltage of the insulation being considered in kV
Z_S	is the surge impedance of the conductor through which the surge is passing in Ω
1.1	is the factor to account for the reduction of stroke current terminating on a conductor as compared to zero impedance to earth

The surge impedance is derived from eq. C.1 and C.5 of IEEE 998-2012 as:

$Z_S = 60\sqrt{ln\left(\frac{2A}{R_C}\right) ln\left(\frac{2A}{r_e}\right)}$ and

$R_C \times ln\left(\frac{2A}{R_C}\right) - \frac{V_C}{E_0} = 0$

Where

A	is the bus height in m
R_C	is the Corona Radius in m
V_C	is the BIL in kV
E_0	is the limiting corona gradient, equal to 1500 kV/m

Ystervark Substation will in future be upgraded to 132 kV, and considering this the substation has been designed to 132 kV voltage levels for all equipment except the surge arrestors and the voltage transformers. Considering this, the following BIL levels are of importance in Ystervark Substation:

1. 66 kV surge arrestors and VTs: 350 kV at a height of 4.4 m; conductor size of 26.5 mm
2. 132 kV Post-insulators: 550 kV at a height of 6.5 m; conductor size of 26.5 mm

66 kV Section

The 66 kV surge arrestors are covered by the gantries and are not an area of concern. Thus, the major concern for lightning protection in the Eskom yard are the 66 kV VTs, which are located next to the bus section.

Using the 66 kV VT BIL as indicated above and eq. C.1 and C.5 of IEEE 998-2012, the surge impedance is calculated as 352 Ω.

Using the surge impedance, the critical stroke current and striking distance is calculated using eq. 18 and 17 of IEEE 998-2012 as 2.2 kA and 16 m respectively.

For three masts to effectively protect the area of concern, the following is required and calculated:

Elevation distance between mast and bus (D) = mast height – top of 66 kV VT	16.6 m
Elevation between mast and OOS (E) = S-D	-0.63 m
Horizontal distance between OOS and mast (J) = $\sqrt{S^2 - E^2}$	16 m
Distance between three masts (Q) = $2\cos\left(\pi\frac{30}{180}\right)J$	27.6 m

132 kV Section – Rest of Substation

Using the 132 kV PI BIL as indicated above and eq. C.1 and C.5 of IEEE 998-2012, the surge impedance is calculated as 327 Ω.

Using the surge impedance, the critical stroke current and striking distance is calculated using eq. 18 and 17 of IEEE 998-2012 as 3.7 kA and 22.5 m respectively.

For four masts to effectively protect the area, the following is required and calculated:

Elevation distance between mast and bus (D) = mast height – top of 132 kV PI	15 m
Elevation between mast and OOS (E) = S-D	7.47 m
Horizontal distance between OOS and mast (J) = $\sqrt{S^2 - E^2}$	21.19 m
Diagonal distance between four masts (K) = 2J	42.38 m

Refer to D-WC-8118-11-11 for the final design illustrating the coverage.

9.2.7 Substation & Yard Equipment Labels

All substation & yard equipment labels shall be in accordance with the following standards & drawings:

- 240-75660336 - Substation and network equipment label specification.
- 240-120804300 - Standard for the labelling of electrical equipment within Eskom wired networks.
- 240-62629353 - Specifications for panel labelling standard.
- D-DT-5047, D-DT-5049 & D-DT-5273.

Reference to be made to Section 9.6. 'Label Schedule' as well.

9.2.8 Substation Safety Signs / Notices

The required substation safety signs / notices shall be in accordance with the OHS ACT, including those as listed in Eskom standards '240-75660336 - Substation and network equipment label specification' & '240-56177186 - Battery room standard' and associated others, including any other statutory regulations & standards as applicable.

The following table is the list of the standard safety signs / notices which shall be provided, as taken from the abovementioned Eskom standard.

Table 24: Ystervark Substation - Safety Signs & Notices

BG Drawing Number	Sign Description	Layout Drawing Number
D-DT-6072	SIGN, ABC - UNAUTH. ENTRY/INTERF. APP	D-DT-5015
D-DT-6073	SIGN, DE - PROC. IN CASE FIRE/NO H20	D-DT-5016
D-DT-6074	SIGN, F - PROHIBITIVE (VARIOUS)	D-DT-5017
D-DT-6075	SIGN, G - HARD HAT AREA	D-DT-5018
D-DT-6112 Sht 1	SIGN, DCSS1 - BATTERY ROOM	D-DT-5022 Sht 1
D-DT-6112 Sht 2	SIGN, DCSS2 - BATTERY CABINET	D-DT-5022 Sht 2
D-DT-6112 Sht 2	SIGN, DCSS3 - COMBINED BATTERY ROOM	D-DT-5022 Sht 3
D-DT-6113 Sht 1	SIGN, GA20 - EMERGENCY SHOWER	D-DT-5023 Sht 1
D-DT-6113 Sht 2	SIGN, GA19 - EYE WASH	D-DT-5023 Sht 2
D-DT-6113 Sht 2	SIGN, PV5 - DRINKING WATER PROHIBITED	D-DT-5023 Sht 3

The quantity of signs, notices and their positions shall be in accordance with Section 3.5.10 in Eskom standard '240-71062174 - Generic Substation Design' and the following table (also included in the standard).

Table 25: Ystervark Substation - Quantity and Position of Signs & Notices at Substation

OHSA Requirement	D-DT Drawing	Additional D-DT Drawing	SAP	SAP Description	Location of Installation
-	DCSS4	-	-	-	A notice identifying the room as being a battery room and its type of hazardous classification. - At the designated entrance to the battery room
a, b, c	6072	5015	0172497	SIGN, ABC - UNAUTH. ENTRY/INTERF. APP	- Control building entrance. - First fence panel next to each gate. - First fence panel at each corner. - Intervals not exceeding 20m along the fence.
d, e	6073	5016	0172495	SIGN, DE - PROC. IN CASE FIRE/NO H20	- Each gate.
f	6074	5017	0172496	SIGN, F - PROHIBITIVE (VARIOUS)	- Each gate.
g	6075	5018	0172498	SIGN, G - HARD HAT AREA	- Each gate.

9.2.9 Relay House LV Power Supply

The relay house will be provided with a 400/230V AC, 50Hz, 3 phase supply, from the Power VT's.

It should be noted that 6 x 66/0.4 kV, 16 kVA power VT's have been allowed for, this will be the main power supply to the back-up supply coming from Transnet's Main Intake Substation. Both supplies will be fed into 2 x yard chop-over modules downgraded to 32A to prevent overloading of the Power VT's. If supply from the Power VT's is interrupted or unavailable, supply will be taken from the Transnet Main Intake Substation.

9.2.10 Substation Security Systems

Security Systems

Reference Design Document

Ystervark Substation

Design: SecTech-SDM-2.5

Contents

1. Overview

a) Ystervark substation shall have at a minimum an Intrusion Security System, monitoring all buildings via motion sensors, with site status LED's (shows armed or disarmed state), a siren, and shall control access to the motorised gate(s)

b) The Security System consist of sub-systems which could include:

   i. Building intrusion via PIR motions sensors (outdoor PIR motion sensors possible)

   ii. Indoor cameras

   iii. Outdoor sensors/cameras/radars (for detection and visuals/verification)

      i. Perimeter aligned

      ii. Or strategically placed

   iv. On-site recorder (event video recording)

   v. Remote Public Address

   vi. Automated voice deterrents with unauthorised access

   vii. Automated lighting(make use of indoor and outdoor lighting with separate triggers) deterrents with unauthorised access

   viii. All systems integrated to form a complete security solution for the entire site

c) The threat and risk assessment (TRA) will determine the required sub-systems needed. See 4(a).

d) Security technology is an evolving technology in the business; as such, the solution being implemented in the region may have been updated since this input was given. Additionally, the technology to secure a substation is very site dependent and can only be finalised with a site visit.

e) The Project Co-ordinator shall contact Albert Hendriks to arrange a site inspection and for design finalisation.

f) The BOM can only be finalised after this site inspection.

g) Budget estimations for Medium sized, Step-down Substations

   i. Very Low risk R100 000

   ii. Low Risk R190 000

   iii. Medium Risk R350 000

   iv. High Risk R500 000

   v. Very High Risk R700 000

<u>Please note that the above are only estimations, the security environment, the type of technology and contracts can change quickly.</u>

h) Security equipment layout, diagrams, drawings and site specific installation and commissioning requirements, shall be done by Eskom Security Engineers, and given to the Security Contractor for the supply, installation and commissioning of the system

i) The Security Installation shall adhere to Eskom Specification 240-91190304.

2. Fence and Gate

a) The main gate giving access to the yard shall be motorized with a Centurion **D10** or **D10 turbo** motor(s), **with safety beams** to prevent the gate from closing onto a person or vehicle.

b) A **pedestrian gate** must be part of the fence to allow access in case of gate motor failure.

3. Communications

a) The security system shall communicate via IP to the security control centre using one of the following mediums:

   i. The Eskom APN: LTE/3G/GPRS router supplied by Security contractor

   ii. Fibre backbone if installed (Share Eskom Telecoms Circuit with Substation Automation if approved)

This communications media shall be used to relay all alarms to the Eskom or 3rd party Control Centre

4. Limitations

a) Fence – This document does not specify the fencing for the site, fencing should be specified by the Project Engineer based on the Threat and Risk Assessment (TRA) and Eskom Fencing Standard

b) This document does not replace a risk assessment. A risk assessment for this site must be conducted by Eskom Security Division and signed off. The TRA will inform the security system design and installation priority.

   i. Contact details: Patiswa Rilityane
   021 915 2048
   RilityPa@eskom.co.za

5. Security Contractor

The security system shall be installed by one of Eskom's approved security contractors.

The following will be supplied, installed and commissioned by the security contractor:

a) The 42U panel and 4 Core 4mm Steel Wire Armoured (SWA) cable between Security panel and AC/DC panel

b) The Building Intrusion System

c) Indoor and Outdoor Motion sensors/cameras

d) Local security LAN and WAN equipment

e) All power distribution equipment, cables and material to power all security devices.

f) A cabinet for housing the equipment

g) Equipment and cabling to the electric gate to allow for **control** of the electric gate by the alarm controller.

h) Any additional indoor conduit needed for security cabling

6. Electrical

The following shall be the responsibility of the Electrical Contractors (design, supply and install) and shall be included in the Control Plant Design:

a) Security Equipment layout (cabinet position, security pole masts and outdoor conduit routes

b) The Substation indoor and Outdoor lighting will be turned on when the alarm is triggered. A relay/contactor must be allocated in the lighting control to allow an external trigger from the security system to activate indoor and outdoor lights separately. Manual operation is still needed.

c) The alarm system will be housed in a 600mm wide x 800mm deep x 42U cabinet. Space must be allocated in the Control room for this security panel **(supplied by security contractor)**.

d) A 220VAC MCB & 110VDC MCB must be allocated for the power supply of the security panel from the site's AC/DC panel supply

7. Design

The following will be the responsibility of the **project engineer** designing the substation:

a) Allow for sterile zones/areas on the boundaries, at least 4 metres where possible. This is very important for security equipment to operate effective. See **Figure 1.**

b) Request a risk assessment of the site from Security Division (See 4(a).), to determine the type of fence needed and any specific security requirements.

c) Ensure that space in the relay house is allocated for the security cabinet.

d) Ensure that a 220VAC MCB & 110VDC MCB has been allocated for the power supply of the security panel. **The substation batteries will have been sized to include the load from the security system.**

e) Ensure that a 220VAC MCB has been allocated for the power supply of the electric gate motor

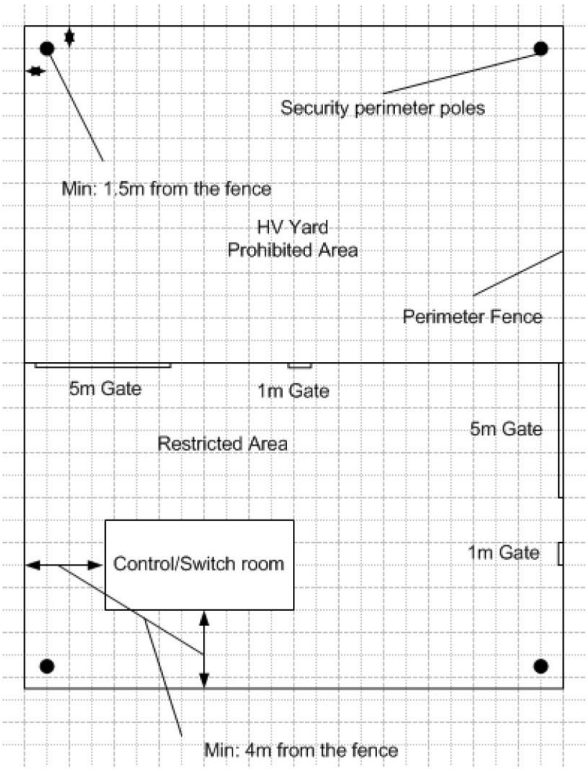


Figure 1: Sterile zone/area needed on the boundary

8. Execution

8.1. Second Risk assessment

a) At time of execution, Security Division must be contacted to determine if an updated TRA is needed (Security Risks in the area may have changed since the initial one was done). This will determine:

i. The type of fencing needed
ii. Additional sub systems or any special requirements needed for the security system

8.2. Design Finalisation and Creation of BOM

a) The security design and BOM can only be finalised after a site visit with the Eskom Security Design Engineer, Security Division and the Security Contractor.

b) Contact Albert Hendriks to arrange a site visit.

c) Site Visit prerequisites:

i. All buildings 80% completed
ii. Fence completed

d) Appointment and price negotiations between main contractor and security contractor:

i. Conduct site visit to compile site specific security requirements (Main contractor, Eskom security engineer, Eskom Security Division and security contractor)
ii. Eskom to submit Statement of Works and detailed design to security contractor. (This document is only Volume 3 inputs)
iii. The security contractor to compile BOM/BOQ from ii
iv. Eskom to approve the BOM/BOQ

e) Security equipment may have **lead times of up to 8 weeks** from date of Purchase order.

8.3. Installation

a) Installation Prerequisites:

i. Fence completed, HV Yard equipment installed
ii. All relay panels/cabinets installed

iii. Power and comms cable trays installed
iv. All switchgear installed.
v. AC/DC supply on site (preferred, but not compulsory)

b) After Security Contractor appointment, security cabinet should be prepopulated offsite.

c) Pre-populated cabinet is delivered to site

d) Cabinet and sensors installed on site

e) Security contractor does initial commissioning

f) Technical support for installation and commissioning available from Eskom Security project engineer.

8.4. Signoff & Handover

a) Sign-off by Eskom Security engineers and handover to Security Division and end user.

9.2.11 Wildlife & Asset Protection

No conductor and equipment clamp insulation covers has been allowed for at Ystervark Substation, as typically these insulation covers are only for medium voltage, and not high voltage (i.e. 66 kV or 132 kV) applications. As a result, there will be no protection for animals from electrocution when climbing/perching on live HV equipment.

However, polycarbonate/plastic type UV stabilized strap-on bird spikes as well as 'Eagle Eye' bird diverters have been included (see figures below). These items shall be installed, at strategic locations, on the gantries as well as the roof of the relay house (control building). All fixing materials for these items shall be 316L stainless steel.

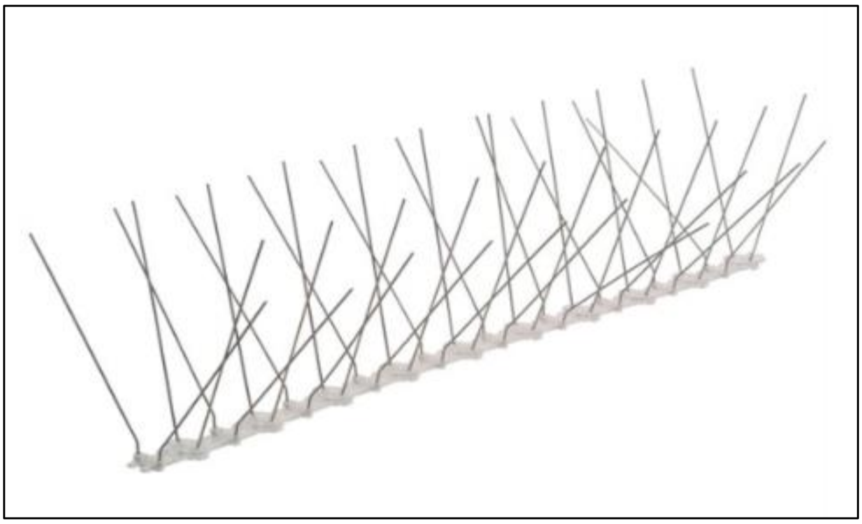


Figure 105: Typical Polycarbonate/Plastic Type UV Stabilized Strap-on Bird Spikes

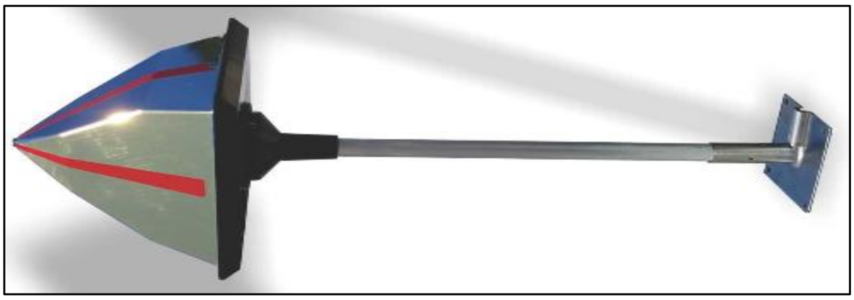


Figure 106: Typical 'Eagle Eye' Bird Diverters

Although not specified for Ystervark Substation, additional bird control equipment/methods can be considered during the construction phase of the project, such as sounder alarms and the like.

The intent is to finalise the installation of all bird control equipment on-site, in conjunction with Eskom and any other relevant parties.

9.3 Long Lead Time Bill of Materials

Table 26: Long Lead Bill of Materials

Item	Description	Reference	SAP	Quantity
1	132 kV Circuit Breaker, Post Type	D-DT-6250	0218735	3
2	132 kV Isolator - MANUAL No E/SW	D-DT-6302	0527586	3
3	132 kV Isolator - MOTORISED No E/SW	D-DT-6302	0527587	9
4	132 kV In-Line Isolator - MANUAL No E/SW	D-DT-6302	0527588	5
5	66 kV Voltage Transformers	D-DT-6176	0180091	6
6	66 kV Power Voltage Transformer	D-DT-6315	0632985	6
7	132 kV Current Trfr. 2P classX; 2M class 0.2; 2B 1/1600	D-DT-6190	0180034	21
8	Surge Arrestor 48 kV MCOV; Effec earthed	D-DT-6212	0401595	6
9	Station Post Insulator	D-DT-6230	0017528	21

9.4 Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM									
POWER PLANT									
JOB NAME			Ystervark 66 - 132 kV Substation			WCOU_BOM-18-04	REV :	0	This document is the property of Eskom
JOB NUMBER:			153272156-00003			Eskom			
BOM TYPE:			FINAL BOM & BOQ						
PREPARED BY :			Ndumiso Mabuza						
Tel No			012 421 3703						
DATE PREP. :			Friday, November 15, 2019						
HV EQUIPMENT									
QTY	SAP	REFERENCE	Rev	Voltage	DESCRIPTION				
	CIRCUIT BREAKERS					Fault Current	Stud	Current Rating	LEAD
3	0218735	D-DT-6250	10	132 kV	Circuit Breaker, Post Type	40 kA	8-hole pad	3150 A	8 mnth
	ISOLATORS					Fault Current	Stud	Current Rating	LEAD
3	0527586	D-DT-6302	2	132 kV	Isolator - MANUAL No E/SW	40 kA	8 hole pad	2500 A	6 mnth
9	0527587	D-DT-6302	2	132 kV	Isolator - MOTORISED No E/SW	40 kA	8 hole pad	2500 A	6 mnth
5	0527588	D-DT-6302	2	132 kV	In-Line Isolator - MANUAL No E/SW	40 kA	8 hole pad	2500 A	6 mnth
	VOLTAGE TRANSFORMERS					Class	Stud		LEAD
6	0180091	D-DT-6176	8	66 kV	Voltage Trfr.	100/50VA class 3P/0.2	26.0 ø		6 mnth
	Voltage Transformers (Power)								
6	0632985	D-DT-6315	0	66 kV	Power Voltage Transformer		26.0 ø		6 mnth
	CURRENT TRANSFORMERS					Fault Current	Stud	Current Rating	LEAD
21	0180034	D-DT-6190	11	132 kV	Current Trfr. 2P classX; 2M class 0.2; 2B 1/1600	40 kA	38.0 ø	2500 A	6 mnth
	SURGE ARRESTERS						Stud		LEAD
6	0401595	D-DT-6212	9	66 kV	Surge Arrestor 48kV MCOV; Effec earthed;	10kA	26.0 ø		4 mnth
	POST INSULATORS						Stud		LEAD
87	0017528	D-DT-6230	7	132 kV	Station Post Insulator	TOTAL HEIGHT = 1220	PCD 127		5 mnth

NOTE: Unless otherwise stated, all equipment creepage is 31mm/kV

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM								
POWER PLANT								
JOB NAME			Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV :	0		This document is the property of Eskom
JOB NUMBER:			153272156-00003	Eskom				
BOM TYPE:			FINAL BOM & BOQ					
PREPARED BY :			Ndumiso Mabuza					
Tel No			012 421 3703					
DATE PREP. :			Friday, November 15, 2019					
EARTHING								
QTY	SAP	REFERENCE	Rev	DESCRIPTION				
	EARTHING							
131.9 coils	0400769	D-DT-6044	4	kg Black Annealed Copper Rod (10mm^2)	Total Meters :	4396.00 m	Meters :	4396 m
62.0 coils	0400772	D-DT-6045	3	kg Flat Copper Bar (3x50mm)	Total Meters :	2066.00 m	Meters :	2066 m
198	WR00076	D-DT-5240-11	1	Sacrificial Earthmat Anode (57kg Steel Rail) - WR00076				
8800	0404191	D-DT-5240	2	Yard Stone	Total meters squared (100mm layer)	4396		

NOTE: Final earthing design is by Others and quantities in this BOM are estimates only. Please refer to the Specialist's final earthing design for final quantities.

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV :	0
JOB NUMBER:	153272156-00003	Eskom		This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Ndumiso Mabuza			
Tel No	012 421 3703			
DATE PREP. :	Friday, November 15, 2019			

CONDUCTOR

QTY	SAP	REFERENCE	Rev	DESCRIPTION	
	CONDUCTOR AND BUSBAR TUBE				
	CONDUCTOR				kg/m
285 m	0403041	D-DT-3136	13	COND, AAC CENTIPEDE 26.46D UNGRS	1.15
240 m	0403063	D-DT-3136	12	COND, AAC BULL 38.25D INSU UNGRS	2.40
	ALUMINIUM BUSBAR TUBE				kg/tube
42 m	0206318	D-DT-6000-02	4	TUBE AL 120mm OD x 4mm W THK 12m L	14.57

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV :	0
JOB NUMBER:	153272156-00003	Eskom		This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Ndumiso Mabuza			
Tel No	012 421 3703			
DATE PREP. :	Friday, November 15, 2019			

CLAMPS

QTY	SAP	REFERENCE	Rev	DESCRIPTION					
STRANDED CONDUCTOR CLAMPS									
		Bolted - Bolted							
12	0401584	D-DT-6002	6	EX-B	Cross Clamp	26mm	26.5mm	0°	
6	0206355	D-DT-6022	8	EY-H	Y/Bolt	2 x 38.3mm	26mm	0°	
2	0401669	D-DT-6025	7	C/C	Fixed Support - 2 x conductors	38.3mm P38/127/150			
31	0401675	D-DT-6029	5	KCP 26/127	Fixed Support - 1 x conductors	26.5mm, PCD 127mm			
26	0402559	D-DT-6087	7	ES-B	Conductor Spacer (Insulating)	38.3mm-150mm			
12	0401655	D-DT-6115	2	EPC-38	Peg Aluminium Bull Clamp	38.3mm			
		Bolted - Compression				Compression	Bolted	Angle	
6	0401758	D-DT-6010	10	ETC-A	T/Comp	26.5 mm	23.5 mm	0°	
10	0401754	D-DT-6010	10	ETC-C	T/Comp	26.5 mm	26.5 mm	0°	
6	0401768	D-DT-6010	10	ETC-J	T/Comp	26.5 mm	38.3 mm	0°	
12	0005663	D-DT-6013	10	EYC-B	Y/Comp	2X38.3 mm	38 mm	0°	
3	0400426	D-DT-6109	7	EYC-R	Y/Comp	2X38.3 mm	Palm	0°	
15	0401802	D-DT-6109	7	EYC-S	Y/Comp	2X38.3 mm	Palm	45°	
50	0401580	D-DT-6018	8	EPC-A	B/Comp 50x50	26.5 mm	Palm	0°	
27	0400420	D-DT-6018	8	EPC-B	B/Comp 50x50	26.5 mm	Palm	45°	
10	0560891	D-DT-6018	8	EPC-C	B/Comp 50x50	26.5 mm	Palm	90°	
TUBULAR CONDUCTOR CLAMPS									
		Bolted - Bolted				Tube	Stem		
42	0206319	D-DT-6040	5	EEC-PL-C	End Cap; Plain	120mm			
42	0206320	D-DT-6040	5	EEC-DC-C	End Cap; Damping Conductor Fixing	120mm			
12	0213925	D-DT-6039	8	ESC-PI-F-F	Support Clamp; PI Mounted; Fixed	120mm	127 mm		
6	0242920	D-DT-6316	1	ESC-PI-S-F	Support Clamp; PI Mounted; Slide	120mm	127 mm		
36	0206329	D-DT-6093	7	EEC-PI-FS-F	Expansion Clamp; PI Mounted; Fixed/Slide	120mm	127 mm		
		Bolted - Compression							
12	0206328	D-DT-6090	7	ETP-TE-IL2-R	Clamp; Tap off; Tube End; Inline; 2 Conductor	120mm	38.3mm	0°	
30	0216098	D-DT-6119	4	ETP-IL1-H	Clamp; Tap off; Inline; 1 Conductor	120mm	26.5mm		
6	0216099	D-DT-6119	4	ETP-IL2-T	Clamp; Tap off; Inline; 2 Conductor	120mm	38.3mm		

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0	This document is the property of Eskom
JOB NUMBER:	153272156-00003	Eskom		
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Ndumiso Mabuza			
Tel No	012 421 3703			
DATE PREP. :	Friday, November 15, 2019			

BUILDING ELECTRICAL

QTY	SAP	REFERENCE	Rev	DESCRIPTION	
	LIGHT FITTINGS				
3	BUY-OUT		N/A	54W LED R-BAY-54W-LED, Flourescent Light Fitting	
2	BUY-OUT		N/A	47W 4000K NORDLAND JBP-LED IP66 Rated Zone 2 Luminaire	
2	BUY-OUT		N/A	17.5W LED LASCON RIMINI-17.5W-LED, IP65 Rated, Colour White	
3	BUY-OUT		N/A	20W DTC Clear High Visor Bulkhead Fitting with Integrated Ballast	
1	BUY-OUT		N/A	DC (Emeregency Lights), Placed Next to Distribution Board	
1	BUY-OUT		N/A	AC (Primary Lights), Placed Next to Distribution Board	
	SWITCHES				
4	BUY-OUT		N/A	GEWISS 9000.7519 Watertight Toggle Type Switch With Red Pilot Light	
1	BUY-OUT		N/A	16A Toggle Light Switch	
1	BUY-OUT		N/A	Coupation C53-T125 240v 16a 50 Minute Timer Mounted In Gewiss 440077 Box	
	SOCKET OUTLETS				
1	BUY-OUT		N/A	16A Surface mounted industrial socket (3 Pin Round)	
1	BUY-OUT		N/A	Triple-pole isolator (weather proof)	
	MISCELLANEOUS EQUIPMENT				
1	BUY-OUT		N/A	400V, 3-Phase, 50Hz Extractor Fan, IP44 Rated, Insulation Class F	
1	BUY-OUT		N/A	Hydrogen Gas Detector Main Control	
2	BUY-OUT		N/A	Hydrogen Gas Detector Sensor	

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

POWER PLANT

JOB NAME	Ystervark 66 - 132 kV Substation	WCOU_BOM-18-04	REV : 0
JOB NUMBER:	153272156-00003		This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ		
PREPARED BY :	Ndumiso Mabuza		
Tel No	012 421 3703		
DATE PREP. :	Friday, November 15, 2019		

MISCELLANEOUS

QTY	SAP	REFERENCE	Rev	DESCRIPTION	
	MISCELLLANEOUS				
48	0163641	D-DT-3082	15	Stainless Steel Bolt & Nut : M12 x 65mm with 1 x flat washers & 1 x spring washer	Used for Palm clamps
24	0163715	D-DT-6097	4	Stainless Steel Bolt & Nut : M16 x 45mm	To attach CT and PI to steel
368	0404337	D-DT-3082	15	Stainless Steel Bolt & Nut : M16 x 40mm with 1 x flat washers & 1 x spring washer	To attach clamps to PI & Column earth
24	0163812	D-DT-6097	4	Stainless Steel Bolt & Nut : M16 x 75mm	To attach Post Type BKR to steel
		Signage			
15	0172497	D-DT-6072	4	Sign A,B,C, Unauthorized Entry prohibited	Label
15	0172495	D-DT-6073	5	Sign D,E Procedure in case of fire (See D-DT-5016)	Label
3	0172423	D-DT-3202	7	Electricity Danger Sign	Warning Sign
3	WR000203	D-DT-5237-14	1	Substation Name / Danger Sign Backing Plate (use for fixing onto gates and fencing)	WR000203
35	Buy Out	D-DT-5047	0	Equipment/Bay Labels	Label
35	0172393	D-DT-3049	9	Equipment/Bay Labels	Label
8	0172376	D-DT-6114	5	Red plate - Chromadek	Phase Disc
8	0172375	D-DT-6114	5	Blue plate - Chromadek	Phase Disc
8	0172377	D-DT-6114	5	White plate - Chromadek	Phase Disc
24	0172425	D-DT-6114	5	Mounting Bracket	Phase Disc
	FLOODLIGHTS				
88	0171551	D-DT-6104	3	Floodlight Lamp Holder incl fitting 400/250W HPS/MH	
88	0171536	D-DT-6105	3	230V Floodlight, Lamp High Pressure Sodium / 48000 Lumens	
	FIELD SERVICES OPERATING EQUIPMENT				
1	0172500	D-DT-6100	2	Notice pin board 1200 x 900	
1	0171861	D-DT-6102	2	Filling Cabinet - steel 2 drawer	
1	0171863	D-DT-6101	2	Steel frame chair with armrest for steel desk	
1	0171904	D-DT-6051	2	Substation desk wood	
1	0171862	D-DT-6101	2	Substation desk steel 3 drawer gray/beidge	
1	Buy Out	N/A	-	Key cabinet, according to Eskom requirements & specifications	
1	Buy Out	N/A	-	Magnetic white board, according to Eskom requirements & specifications	
1	Buy Out	N/A	-	Oil Spill Kit	
1	0179720	D-DT-6082	8	Working Earth Kit, Substations >18.5kA	
1	0164435	D-DT-6052	2	Fiberglass 3.6m Rnd/Rng single ladder	
1	0164436	D-DT-6052	2	Fiberglass 2.4m Rnd/Rng single ladder	
1	0163459	D-DT-6103	3	Barrier nets 50 x 2 Nylon	
1	0187238	D-DT-6050	3	Nylon General Master Lock; Western Region (Orange)	
1	0187245	D-DT-6050	3	Nylon Prohibited Area Lock; Western Region (Green)	
1	0187252	D-DT-6050	3	Nylon Operating Lock; Western Region (Yellow)	
1	0187259	D-DT-6050	3	Nylon Live Chamber Lock; Western Region (Black)	
1	0187266	D-DT-6050	3	Nylon TSO Master Lock; Western Region (Blue)	

9.5 Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOQ

WCOU_BOM-18-04

JOB NAME	Ystervark 66 - 132 kV Substation	LASTEST REV :	0
JOB NUMBER:	153272156-00003		
BOM TYPE:	FINAL BOM & BOQ		
PREPARED BY :	Ndumiso Mabuza		
Tel No	012 421 3703		
DATE PREP. :	Friday, November 15, 2019		

BILL OF QUANTITIES BASED ON MEW SUBSTATION BOQ rev. 11

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	POWER PLANT ACTIVITIES										
	ELECTRICAL POWER PLANT ACTIVITIES										
	132kV CIRCUIT BREAKERS										
	Take delivery, erect and bolt in position	each	3								
	132kV ISOLATORS										
	Take delivery, erect and bolt in position	each	17								
	66kV VOLTAGE TRANSFORMERS										
	Take delivery, erect and bolt in position	each	12								
	132kV CURRENT TRANSFORMERS										
	Take delivery, erect and bolt in position	each	21								
	132kV POST INSULATORS										
	Take delivery, assist erect and bolt in position	each	87								
	66kV SURGE ARRESTORS										
	Take delivery, assist erect and bolt in position	each	6								
	BUSBARS										
	Take delivery, cut to size, erect and bolt in position	meters	42								
	CLAMPS										
	Deliver, Crimp and Install EX-B Cross Clamps	each	12								
	Deliver, Crimp and Install EY-H Y/Bolt Clamps	each	6								
	Deliver, Crimp and Install C/C Fixed support clamps	each	7								
	Deliver, Crimp and Install KCP 26/127 Fixed support clamps	each	5								
	Deliver, Crimp and Install ES-B conductor spacers	each	26								
	Deliver, Crimp and Install ETC-A T/Comp Clamps	each	10								
	Deliver, Crimp and Install ETC-C T/Comp Clamps	each	10								
	Deliver, Crimp and Install ETC-J T/Comp Clamps	each	10								
	Deliver, Crimp and Install EYC-B Y/Comp Clamps	each	10								
	Deliver, Crimp and Install EYC-R Y/Comp Clamps	each	7								
	Deliver, Crimp and Install EYC-S Y/Comp Clamps	each	7								
	Deliver, Crimp and Install EPC-A B/Comp Clamps 50x50	each	8								
	Deliver, Crimp and Install EPC-B B/Comp Clamps 50x50	each	8								
	Deliver, Crimp and Install EPC-C B/Comp Clamps 50x50	each	8								
	Deliver, Crimp and Install EEC-PL-C End Cap Plain Tubular Busbar Clamp	each	42								
	Deliver, Crimp and Install EEC-DC-C End Cap Tubular Conductor Clamp	each	42								
	Deliver, Crimp and Install ESC-PI-F-F Fixed Support Clamp	each	12								
	Deliver, Crimp and Install ESC-PI-F-F Slide Support Clamp	each	6								
	Deliver, Crimp and Install EEC-PI-FS-F Expansion Support Clamp	each	36								
	Deliver, Crimp and Install ETP-TE-IL2-F0 Bolted Compression Clamp	each	12								
	Deliver, Crimp and Install ETP-H Bolted Compression Tap-off Clamp	each	30								
	Deliver, Crimp and Install ETP-T Bolted Compression Tap-off Clamp	each	12								
	FLOOD LIGHTS										
	Supply and Install (LM1-LM10)	each	40								
	LABELS										
	Supply and Install as per Label Schedule	each	40								
	SIGNS AND NOTICES										
	Supply and Install ESKOM WC/National Standard	each	30								
	LOCK AND KEY TAGS (132kV ISOLATORS										
	Supply and install	each	17								
	SHARK NETTING (50m ROLLS)										
	Supply	each	6								
	SUBSTATION LINK STICK										
	Supply	each	1								
	SUBSTATION KEY PANEL										
	Supply	each	1								
	OFFICE DESK AND CHAIR										
	Supply	each	1								
	TRANSPORT										
	Transport secondary / primary plant equipment with LDV 8 ton vehicle:	km	2000								
	MISCELLANEOUS EQUIPMENT MATERIAL										
	Supply or install equipment / material as requested.	sum	1								

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
	POWER PLANT ACTIVITIES										
	ELECTRICAL POWER PLANT ACTIVITIES										
	EARTHING										
	Supply and Install Electrical Putty 'Scotchfill' for clamps	each	**20**								
	Supply, prepare and install flexible leads (Security Gates)	each	**4**								
	Supply, prepare and install flat 50 x 3mm (132kV Current Transformers)	each	**42**								
	Supply, prepare and install 50 x 3mm (66kV Voltage Transformers)	each	**24**								
	Supply, prepare and install 50 x 3mm (132kV Isolators)	each	**36**								
	Supply, prepare and install 50 x 3mm (132kV Circuit Breakers)	each	**6**								
	Supply, prepare and install 50 x 3mm (66kV Surge Arrestors)	each	**12**								
	Supply, prepare and install 50 x 3mm (132kV Post Insulators)	each	**174**								
	Supply, prepare and install 50 x 3mm (Lightning Masts)	each	**80**								
	Supply, prepare and install 50 x 3mm (Junction Boxes)	each	**5**								
	Supply, prepare and install 1.5m x 16mm Earth Spikes	each	**198**								
	Supply, prepare and install 50 x 3mm (Control Room)	each	**2**								
	CONDUCTOR STRINGING HV										
	AAC Centipede Conductor Run Out & Hang - Single	phm	**285**								
	AAC Centipede Conductor Tension Reg. & Terminate - Single	phm	**285**								
	AAC Bull Conductor Run Out & Hang - Single	phm	**240**								
	AAC Bull Conductor Tension Reg. & Terminate - Single	phm	**240**								
	SMALL POWER AND LIGHTING	phm	**241**								
	Supply, installation, connection of electrical small power and lighting equipment includling testing and issuing of certificate of compliance (COC)	sum	**1**								

9.6 Label Schedule

WCOU NED - HV SUBSTATION LABEL SCHEDULE			
JOB NAME	YSTERVARK 66 - 132 kV SUBSTATION	LASTEST REV :	0
JOB NUMBER:	153272156-00003	Eskom	
BOM TYPE:	FINAL		
PREPARED BY :	NDUMISO MABUZA		
Tel No	012 421 3703		
DATE PREP. :	Friday, November 15, 2019		

Label Schedule

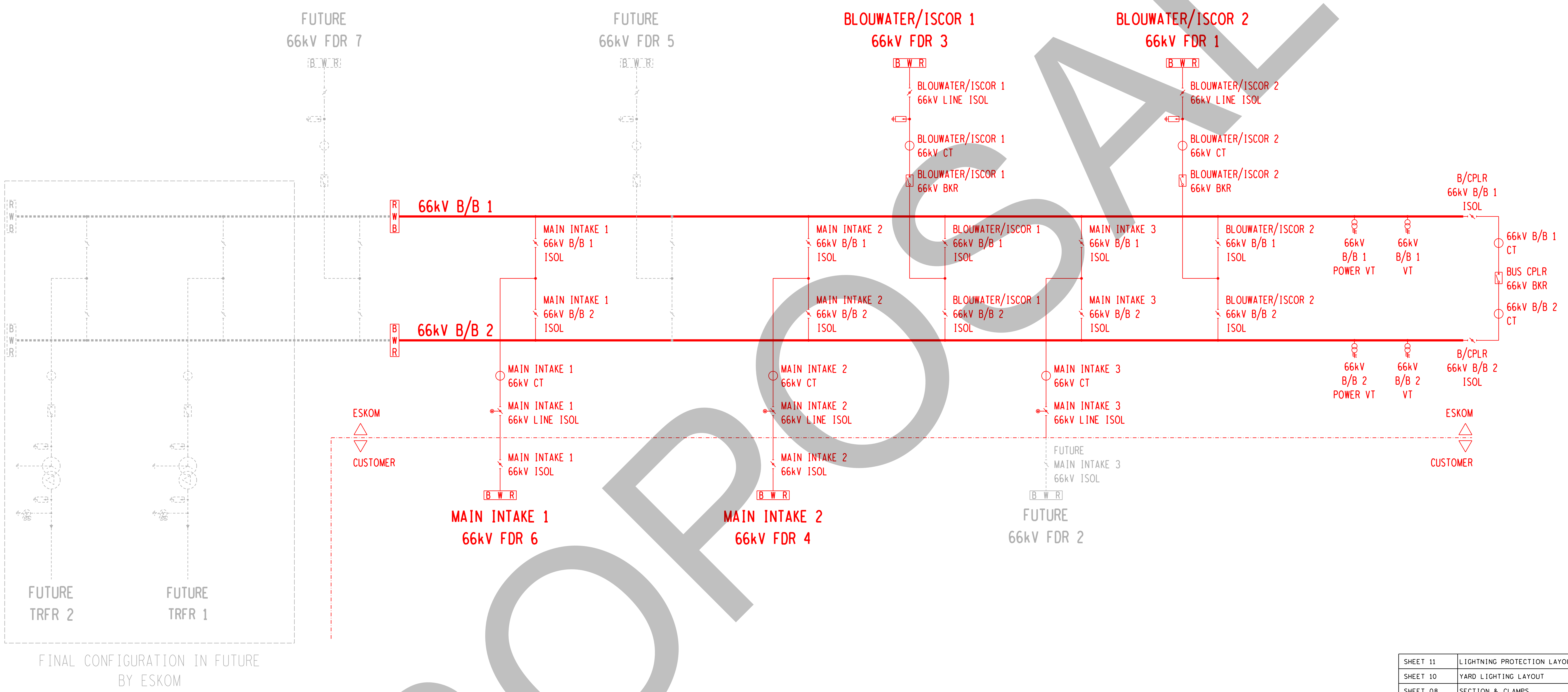
QTY	MATERIAL	REFERENCE	RevNo		LABEL NO
	SUBSTATION NAME				
2	CD	D-DT-5047-1 D-DT-5047-4	1 3	YSTERVARK 66 - 132 kV SUBSTATION	'Large' (1)
	BUSBARS				
2	FG	D-DT-5047-4 D-DT-5047-2	3 3	66 kV BUSBAR 1	2
2	FG	D-DT-5047-4 D-DT-5047-2	3 3	66 kV BUSBAR 2	2
	ISOLATORS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 1 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 2 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 1 66 kV B/B 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 1 66 kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 2 66 kV B/B 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 2 66 kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/CPLR 66 kV B/B 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/CPLR 66kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 1 66kV B/B 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 1 66 kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 2 66 kV B/B 1 ISOLATOR	2

1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 2 66 kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 3 66 kV B/B 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 3 66 kV B/B 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 1 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 1 66kV ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 2 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 2 66 kV ISOLATOR	2
	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 3 66 kV LINE ISOLATOR	2
	VOLTAGE TRANSFORMERS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 1 VT 66 kV VT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 2 VT 66 kV VT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 1 POWER VT 66 kV POWER VT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 2 POWER VT 66 kV POWER VT	2
	CURRENT TRANSFORMERS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 1 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER/ISCOR 2 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 1 CT 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	B/B 2 CT 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 1 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 2 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	MAIN INTAKE 3 66 kV CT	2

	CIRCUIT BREAKERS				
1	FG	D-DT-5047-4	3	BLOUWATER/ISCOR 1	2
		D-DT-5047-2	3	66 kV BKR	
1	FG	D-DT-5047-4	3	BLOUWATER/ISCOR 2	2
		D-DT-5047-2	3	66 kV BKR	
1	FG	D-DT-5047-4	3	BUS CPLR	2
		D-DT-5047-2	3	66 kV BKR	

9.7 Detailed Drawings

Drawing No	Drawing Name	Rev
D-WC-8118-11-01	Station Electric Diagram Proposal	00
D-WC-8118-11-02	Site Plan	00
D-WC-8118-11-04	Earth Grid Layout	00
D-WC-8118-11-05	Foundation, Fence & Trench Layout	00
D-WC-8118-11-06	Steelwork Marking Plan Layout	00
D-WC-8118-11-07	Electrical Equipment Layout	00
D-WC-8118-11-08	Sections & Clamps	00
D-WC-8118-11-10	Yard Lighting Layout	00
D-WC-8118-11-11	Lightning Protection Layout	00



DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV
STATION ELECTRIC DIAGRAM
PROPOSAL

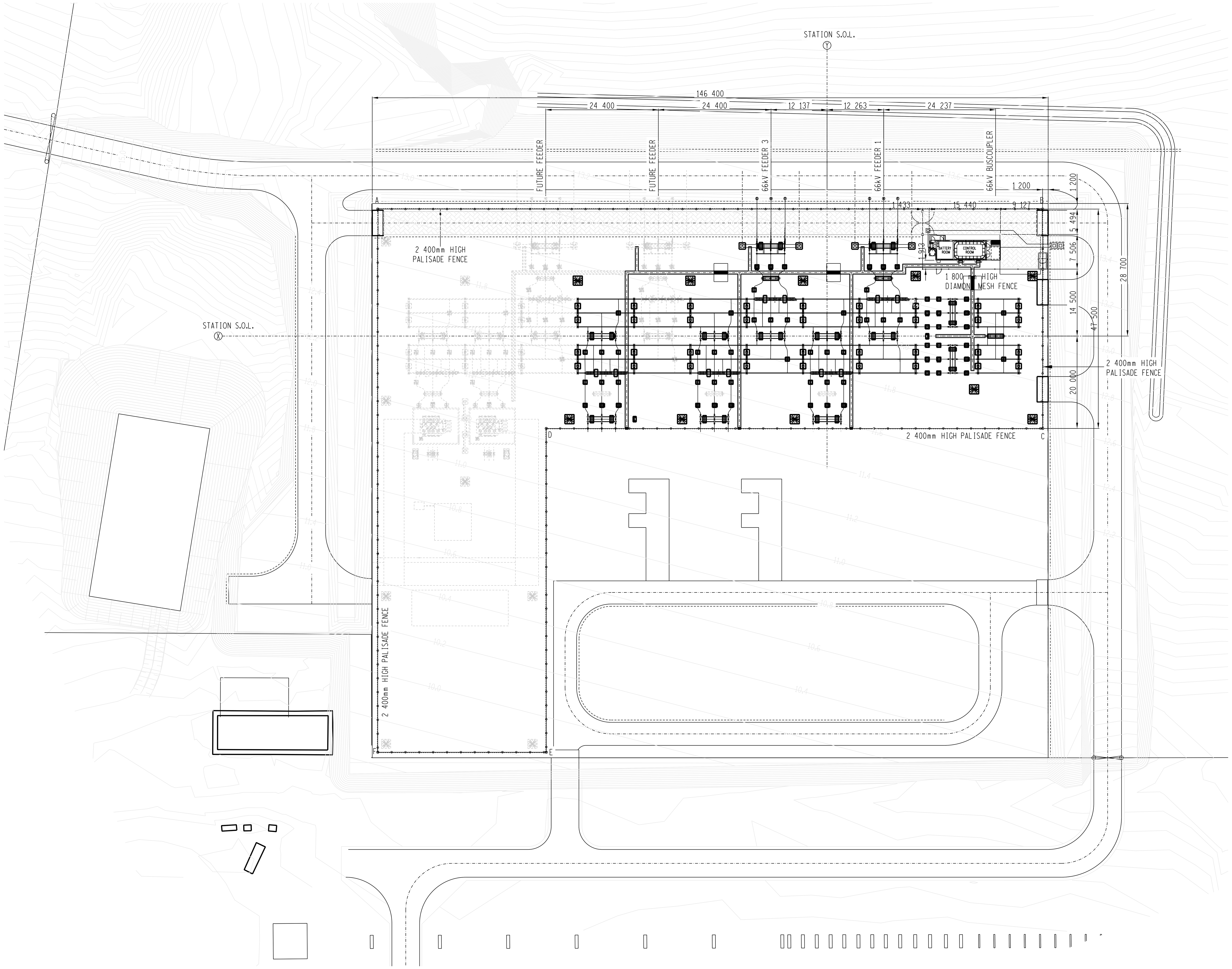
AUTH: L.M. BOTHA	ACC:		
DATE: 20/04/2020	DATE:		
CHKD: A. MARAIS	CHKD:		
DATE: 20/04/2020	DATE: / /		
DRAWN: K. STEYNBERG	DRAWN:		
DATE: 12/07/2019	DATE: / /		

DRG NO.	SET	SHEET	REVISION
D-WC-8118	11	01	00

SCALE : NTS
THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

A2L



SUBSTATION SETTING-OUT DATA

POINT	Y	X	Z
A	280.092	3652286.971	TBC
B	228.447	3652421.391	TBC
C	184.107	3652404.355	TBC
D	222.662	3652304.007	TBC
E	157.225	3652278.865	TBC
F	170.316	3652244.794	TBC

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV

SITE PLAN

AUTH: LM. BOTHA	AUTH:
DATE: 20/04/2020	DATE: / /
CHKD: A. MARAIS	CHKD:
DATE: 20/04/2020	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 12/07/2019	DATE: / /

SCALE 1:500

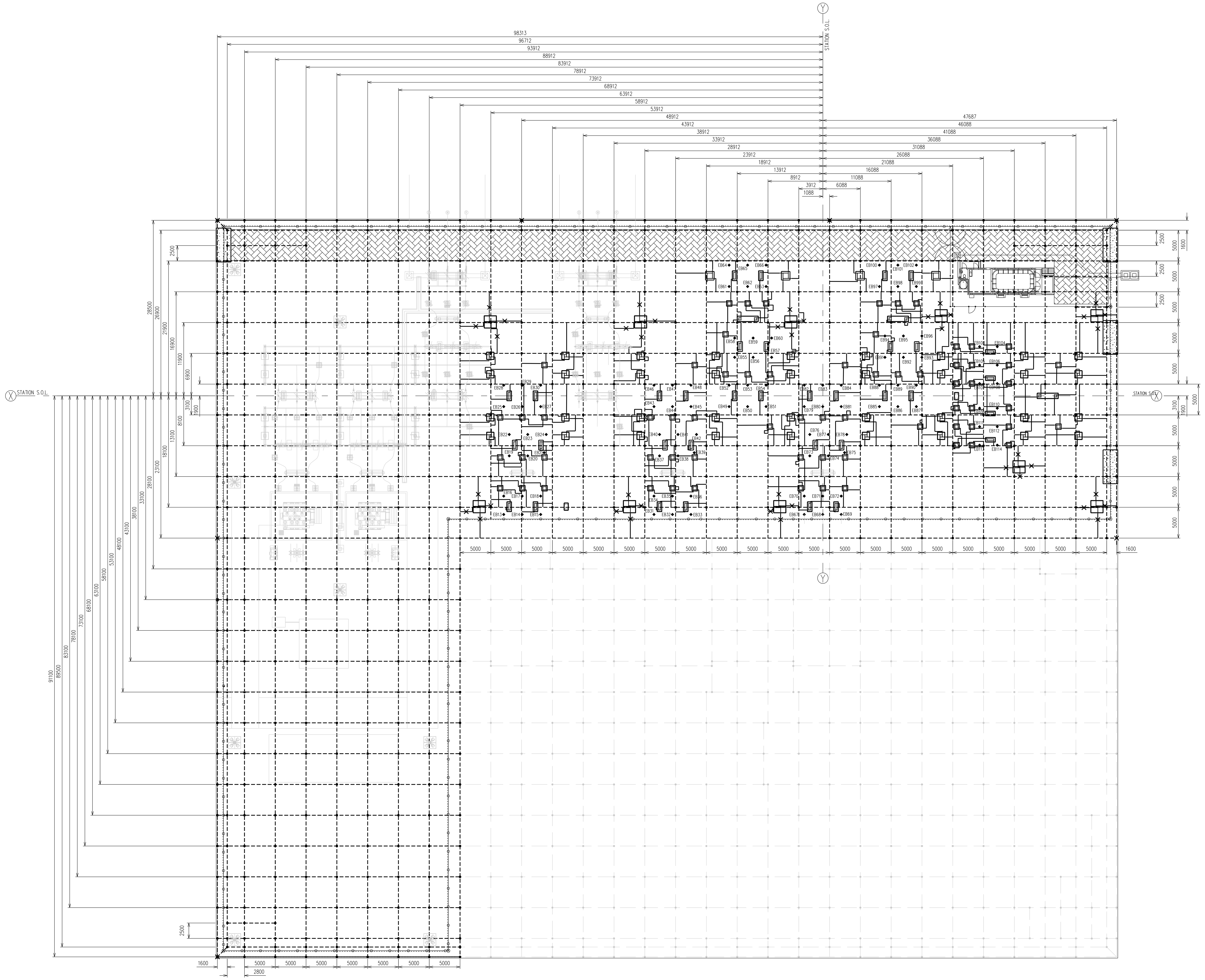
THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

D-WC-8118

SET	SHEET	REVISION
11	02	00

A1L



SCHEDULE:

SYMBOL	DESCRIPTION
— —	MAIN EARTH GRID
——	EARTH TAILS
┼ ┬	BRAZED JOINTS TO BE OXY-ACETYLENE BRAZED, USING 3mm { SILBRALLOY BRAZING RODS. NO CRIMPING ALLOWED.
EB1 ◆	BALL JOINT FOR PORTABLE EARTH ON STEELWORK. SEE D-DT-6081 FOR BALL JOINT DETAILS. "EB1" DENOTES NUMBER TO BE EMBOSSED ON TAG.
✕	2m EARTH SPIKES BRAZED TO THE EARTH GRID

NOTES:

1. THE CHANGING OF THE DRAWING FROM ACAD FORMAT TO DGN FORMAT AND THE APPLICATION OF ESKOM STANDARDS IS THE RESPONSIBILITY OF AECOM, THE CORRECTNESS AND DESIGN IS THE RESPONSIBILITY OF KTJV.

KTJV NOTES:

1. EARTHGRID SIZE SHALL BE 20MM DIAMETER ANNEALED COPPER RODS.
2. FOR STANDARD EARTHING NOTES AND REQUIREMENTS, SEE DRAWING D-DT-5240 LATEST REVISION. SPECIFICATION MENTIONS CRIMPING, BUT NO CRIMPING IS ALLOWED. ALL JOINTS TO BE BRAZED USING 3MM SILBRALLOY BRAZING RODS.
3. ESKOM SECURITY FENCE EARTHING AT INTERVALS NOT EXCEEDING 20 m.
4. REINFORCING MESH OF THE CONTROL BUILDING WILL BE BONDED TO THE MAIN EARTH MAT ON ONE SIDE ONLY. EARTH STRAPS TO BE BRAZED ONTO THE REINFORCING MESH CONNECTING THE EARTH MAT TO THE MESH. BRAZED JOINTS TO BE TREATED WITH BITUMEN PAINT, APPLIED IN THREE LAYERS.
5. ALL EARTH STRAPS WILL BE CONCEALED WITHIN THE FOUNDATIONS AS DETAILED ON THE FOUNDATION DRAWINGS.
6. YARD STONING TO BE LAID 1200 mm OUTSIDE THE OUTER PERIMETER OF THE EXTERNAL FENCE
7. EARTHTAILS FROM THE MAIN EARTH TO THE FOUNDATION SHALL BE 20MM DIA. ROD. EQUIPMENT EARTHS TO BE 4 x (3 mm THICK x 50 mm WIDE) FLAT COPPER STRAPS TO BE BRAZED TO THE 20MM DIA. ROD INSIDE THE FOUNDATION.
7. EARTHING TAILS OF ISOLATORS TO BE CONNECTED TO THE FLEXIBLE HANDLE OF THE ISOLATOR OPERATING HANDLE.
8. EXTEND EARTH MAT TO 1000 mm OUTSIDE SUBSTATION FENCE.
9. SUBSTATION EARTH AND TERMINAL EARTH SHALL BE CONNECTED TO ONE ANOTHER BY MEANS OF 1 X 20 mm Ø ROUND COPPER RODS.
10. RELEVANT DESIGN REPORT FOR THIS EARTHGRID IS DOCUMENT NO. : 1924701.E004-RPT-0048 04
12. COPPER JOINTS SHALL BE 2 X L-BRACKETS PER JOINTS, AS PER SHEET D-DT5240 SHEET 2 LATEST REVISION. CROSS JOINTS SHALL BE TYPE A AND T-JOINTS SHALL BE TYPE C1
13. WHERE ELECTRODE CROSSES UNDERGROUND SERVICES, IT SHALL BE 200MM AWAY (ABOVE OR BELOW THE SERVICES. (INDICATED IN METHOD STATEMENT 1924701.E004-MS-0050)

YSTERVARK & NEW MAIN INTAKE SUBSTATION EARTHING QUANTITIES

DESCRIPTION			ESTIMATED QUANTITIES
1. MAIN EARTH MAT: Dia. 20 mm ANNEALED COPPER ROD.			7857.1 m
2. EARTH TAILS: 20 mm Diamter Rods & 50 X 3 mm FLAT COPPER STRAP (ea)			650
3. Grounding System Data:			
Number of Rods			10
Length (m)			2
Diameter (m)			0.02
4. Grid Conductors			
Number of Grid Conductors	Length(m)	Diameter (m)	
25	146.2	0.02	
2	143	0.02	
2	116.4	0.02	
30	119.6	0.02	
4	2.3	0.02	
1	13	0.02	
1	15	0.02	
2	10	0.02	
1	5.1	0.02	
1	8	0.02	
1	20	0.02	
1	5	0.02	
5. Interconnection / Bonding Notes			882
6. Extent of Grounding System			17 485.5 m
7. Surface Layer Thickness			15 cm
8. Volume of Insulating Layer			2622.83 m
9. Wet Resistivity of Insulating Surface Layer			3000 Ohm.meter

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	SH	WK	WK	20/04/2020	153272156-00003

AUTH: W. Kekana	AUTH: __________	
DATE: 31/03/2020	DATE: __/__/____	
CHKD: W. Kekana	CHKD: __________	
DATE: 30/03/2020	DATE: __/__/____	
DRAWN: S. Hamisi	DRAWN: __________	
DATE: 27/03/2020	DATE: __/__/____	

SCALE 1 : 250_

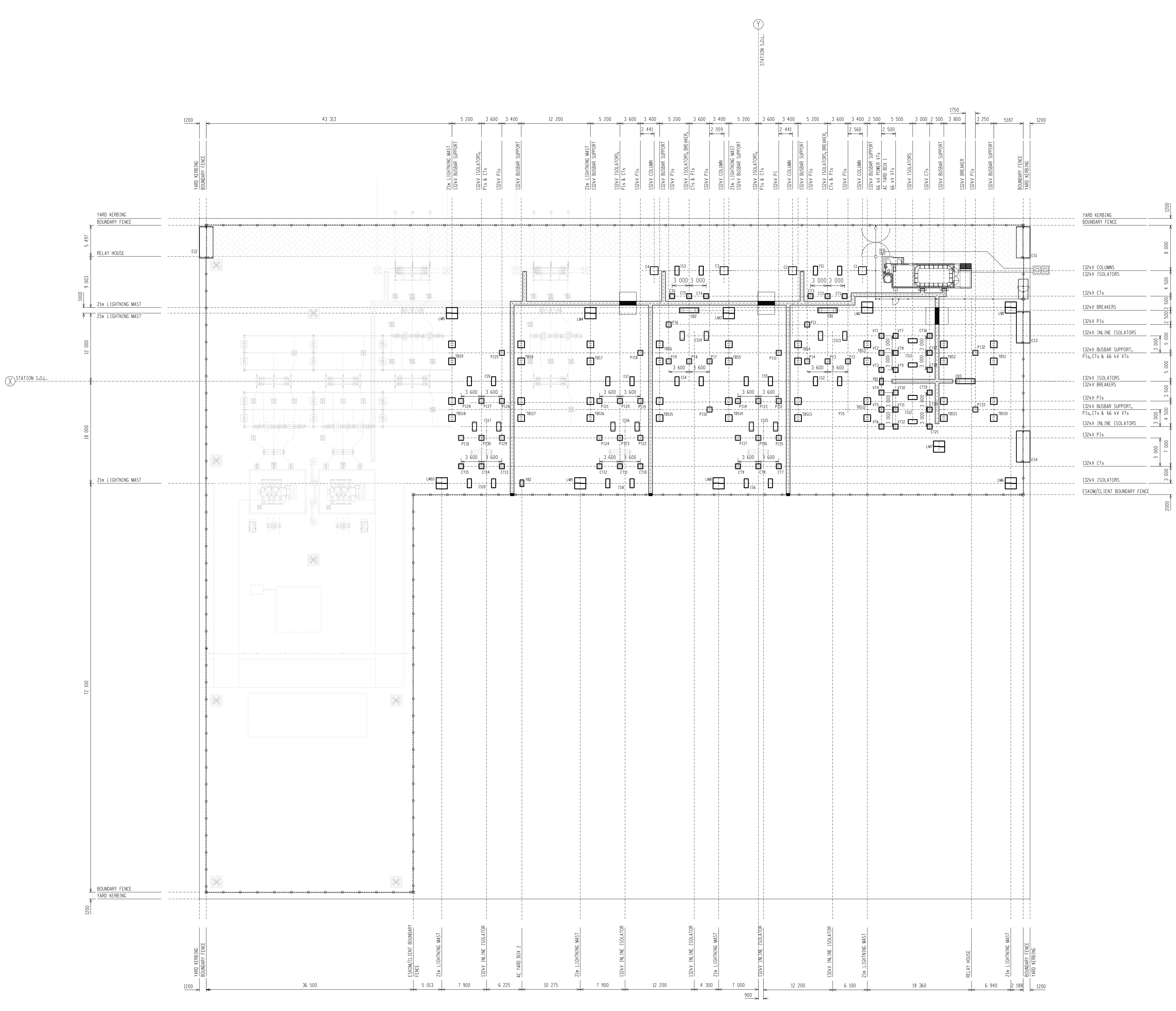
THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

YSTERVARK SUBSTATION
66kV
EARTH GRID LAYOUT

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	11	04	00

AOL



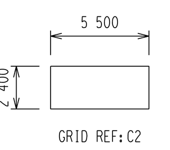
FOUNDATION SCHEDULE REV.0

MARK	DESCRIPTION	DRAWING No.	USED FOR	No. OFF	EXCAVATION VOLUME m³	CONCRETE VOLUME m³	H.D. BOLTS MASS kg
C1-4	COLUMN 132kV FND - RC4	0.54/4316 R4	132kV COLUMN	4	89,056	44,992	363,6
CT1-21	MEDIUM EQUIPMENT SUPP FND	D-DT-5206 S1A R9	132kV CTs	21	14,7	17,01	193,41
VT1-12	MEDIUM EQUIPMENT SUPP FND	D-DT-5206 S1A R9	66kV VTs	12	8,4	9,72	110,52
PI1-33	MEDIUM EQUIPMENT SUPP FND	D-DT-5206 S1A R9	132kV PIs	33	15,4	17,82	202,62
IS1-12	132kV ISOLATOR SUPP FND	D-DT-5202 S1A R14	132kV ISOLATOR	12	13,08	17,52	169,92
IS13-17	132kV ISOLATOR SUPP FND	D-DT-5202 S1A R14	132kV LINE ISOLATOR	5	5,45	7,3	70,8
CB1-3	132kV CIRCUIT BREAKER SUPP FND	D-DT-5200 S1A R9	132kV BREAKER	3	9,27	10,65	55,26
TBS1-18	132kV TWIN TUBULAR SUPP FND	D-DT-5225 S1A R3	132kV TUBULAR BUSBARS	18	13,14	17,46	321,28
LM1-10	21m LIGHTNING MAST FND	D-DT-5217 S1A R8	21m LIGHTNING MAST	10	46,0	52,0	221,8
ES1-4	GATE CONCRETE APRON	DETAIL 1	ENTRANCE SLAB	4	10,56	15,84	-
YB1-2	YARD AC DB SUPP FND	D-DT-5276 S1A R0	YARD AC DB	2	0,76	1,0	18,42
				TOTAL	255,816	211,312	1727,63

NOTES:

1. ALL WORK TO BE DONE IN ACCORDANCE WITH SANS 1200 - LATEST REVISION.
2. TOP OF EQUIPMENT FOUNDATIONS TO BE 150mm ABOVE TERRACE LEVEL.
3. H.V. YARD TO HAVE A CLEAN, HARD, SOUND CRUSHED STONE OF A 25-38mm NOMINAL SIZE, 100mm THICK LAYER. THIS SHALL BE APPLIED AFTER INSTALLATION OF ALL EQUIPMENT AND CABLES.
4. ALL FOUNDATION H.D. BOLTS TO BE ALIGNED FOR CASTING OF CONCRETE TO A TOLERANCE OF +-2mm. FOUNDATION TOLERANCE TO BE IN ACCORDANCE WITH SANS 1200 G.6 GRADE II.
5. DEPTH OF EQUIPMENT FOUNDATIONS TO BE NOT LESS THAN SHOWN ON DETAIL DRAWING AND NOT LESS THAN 300mm INTO NATURAL GROUND.
6. ALL TOP EDGES OF CONCRETE A.G.L. TO HAVE 25mm CHAMFER AT 45°.
7. STRUCTURES SHALL BE ERECTED, ALIGNED, SQUARED, PLUMBED AND LEVELLED TO AN ACCURACY SPECIFIED IN SANS 1200 H 6.2.2c)2 - CLASS II.
8. THE TUBULAR BUSBAR SHALL BE LEVEL, THEREFORE THE TOPS OF ALL BUSBAR FOUNDATIONS SHALL BE AT THE SAME HEIGHT AND A MINIMUM OF 150mm ABOVE TERRACE LEVEL.
9. WEEDKILLER SHALL BE APPLIED BEFORE AND AFTER COMPLETION OF YARD STONE SURFACING.

DETAIL 1: EQUI-POTENTIAL SLABS



GRID REF: C2

1. A 300mm THICK CONCRETE SLAB SHALL EXTEND 0,174m TO THE SIDE OF EACH GATE POST. ALL CONCRETE WORK SHALL COMPLY WITH SANS 1200 GA. MINIMUM 28 DAYS COMPRESSION STRENGTH SHALL BE 20MPa. NOMINAL AGGREGATE SIZE SHALL BE 19mm. TOP OF SLAB TO BE AT THE SAME LEVEL AS ROAD SURFACE.
2. THE REINFORCING MESH 245 SHALL BE PLACED IN THE TOP AND BOTTOM OF THE SLAB WITH A COVER OF 50mm. WHERE THE GROUND CONDITIONS ARE POOR A 50mm THICK MASS CONCRETE BLINDING LAYER SHALL BE CAST PRIOR TO THE MESH BEING PLACED. ALL REINFORCING MESH OVERLAPS SHALL HAVE AN OVERLAP OF 350mm.
3. THE SUBGRADE MATERIAL UNDER THE SLAB SHALL BE COMPACTED TO 90% MOD AASHTO MAXIMUM DENSITY.
4. THE MESH SHALL BE BONDED ON ONE SIDE ONLY TO THE MAIN EARTH GRID. TWO CONNECTIONS REQUIRED AS PER D-DT-5240.

FENCE LEGEND:

SYMBOL	DESCRIPTION
⊗	FENCE POST - CORNER EXTERNAL
⊠	FENCE POST - GATE EXTERNAL
□	FENCE POST - GATE INTERNAL
⬡	FENCE POST - STRAIN INTERNAL
○	FENCE POST - CORNER INTERNAL
	EXTERNAL FENCE - STEEL PALISADE
	INTERNAL FENCE - DIAMOND MESH

SCHEDULE:

DESCRIPTION	USED FOR	DRAWING NO.	REV
MP (FENCE)	SITE MEASURE FENCE PANELS, MARKED MP.		
FENCING	PALISADE FENCE	D-DT-5237 SHT 7A, 7B, 7C, 7D, 7E & 7F	
	1 X 5 m SLIDING PALISADE GATE (MANUAL)	D-DT-5237 SHT 7G & 7I	0
	2 X 5 m SWING PALISADE GATE	D-DT-5237 SHT 7E & 7F	2
	2 X 1 m PALISADE GATE	D-DT-5237 SHT 7E & 7F	2
	DIAMOND MESH FENCE	D-DT-5237 SHT 2A & 2B	1
TRENCH	TRENCH 750 mm WIDE	D-DT-5254 SHT 5A, 5D, 5G & 5K	0
TRENCH COVER	TRENCH COVER - 750 mm	D-DT-5254 SHT 1A	0
CABLE TRENCH RAMP	CABLE TRENCH RAMP - 750 mm	D-DT-5254 SHT 5O	0
TRENCH BRACE	TRENCH COVER SUPPORT - 750 mm	D-DT-5254 SHT 6A	0
TRENCH KERBING	TRENCH KERBING - 1000 mm	D-DT-5254 SHT 2A	0
ROAD KERBING	ROAD KERBING - 1000 mm	D-DT-5254 SHT 1B	0
STONE KERBING	STONE/YARD KERBING - 1000 mm	D-DT-5254 SHT 1C	0

NOTES:

1. ALL WORK TO BE DONE IN ACCORDANCE WITH SANS 1200 LATEST REVISION.
2. ALL FOUNDATION H.D. BOLTS TO BE ALIGNED FOR CASTING OF CONCRETE TO A TOLERANCE OF 2 mm. FOUNDATION TOLERANCE TO BE IN ACCORDANCE WITH SANS 1200 G.6 GRADE II.
3. ALL PALISADE FENCE PANELS ARE STANDARD UNLESS OTHERWISE INDICATED.
4. THE PALES TO BE USED IS TO BE THE 'CLASSIC PALISADE' D SECTION (SEE D-DT-5237 SHT 1) WITH COUNTERSUNK BOLT AND SHEAR NUT.
5. THE EXTERNAL PALISADE FENCES ARE NOT PARALLEL TO THE SETTING OUT LINES. THEREFORE THE PALISADE FENCE CORNER POSTS ARE DIFFERENT DISTANCES FROM THE SETTING OUT LINES.
6. ANTI-TUNNELING KERB TO BE INSTALLED UNDER THE PALISADE FENCE AS PER D-DT-5237.

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE 1:250

THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: LM. BOTHA	DATE: 20/04/2020	AUTH:	DATE: / /
CHKD: A. MARAIS	DATE: 20/04/2020	CHKD:	DATE: / /
DRAWN: K STEYNBERG	DATE: 12/07/2019	DRAWN:	DATE: / /

Eskom

YSTERVARK SUBSTATION
66kV
FOUNDATION, FENCE & TRENCH LAYOUT

D-WC-8118

SET	SHEET	REVISION
11	05	00

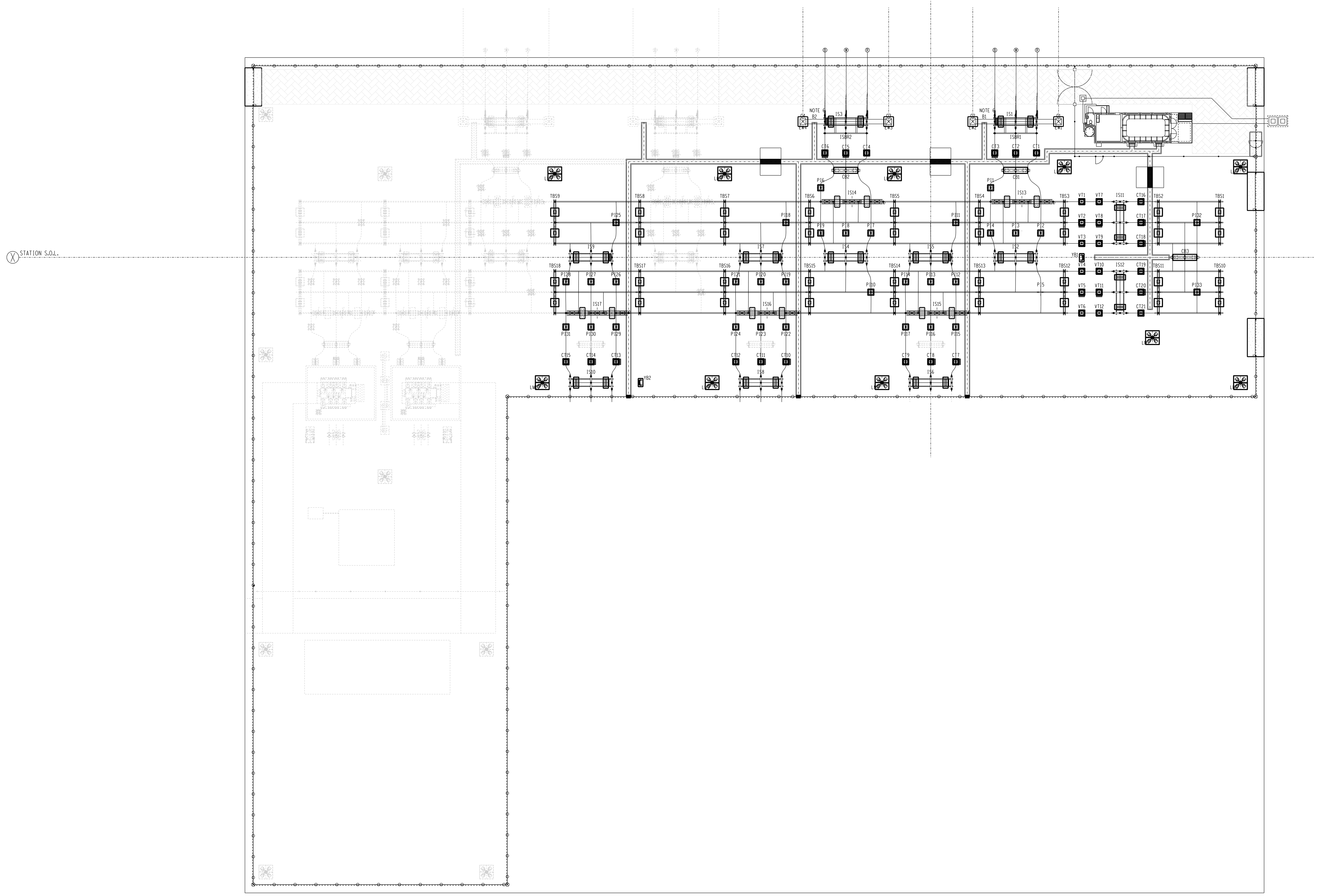
A0L

STEELWORK SCHEDULE REV.0

MARK	DESCRIPTION	DRAWING No.	REV.	SAP No.	MASS / ITEM		TOTAL No.OFF	TOTAL MASS		
					STRUCTURE	BOLTS		STRUCTURE	BOLTS	COMPLETE
C1-4	COLUMN - 132/C	D-DT-5252 S2A	3	0559307	1 149,82	41,99	4	4 599,28	167,96	4 767,24
B1-2	BEAM - 132/40/1	D-DT-5252 S2D	1	0559310	802,82	39,53	2	1 605,64	79,06	1 684,7
EW1-4	EARTH WIRE SUPP.WITH SPIKE	D-DT-5252 S2E	2	0559311	241,0	25,84	4	964,0	103,36	1 067,36
CT1-21	MEDIUM EQUIPMENT SUPP.2,5m	D-DT-5206 S2C	9	0182752	124,57	3,13	21	2 615,97	65,73	2 681,7
	MEDIUM EQUIPMENT CAP	D-DT-5206 S2H	7	0182753	54,41	1,94	21	1 142,61	40,74	1 183,35
VT1-12	MEDIUM EQUIPMENT SUPP.2,5m	D-DT-5206 S2C	9	0182752	124,57	3,13	12	1 494,84	37,56	1 532,4
	MEDIUM EQUIPMENT CAP	D-DT-5206 S2H	7	0182753	54,41	1,94	12	652,92	23,28	676,2
PI1-33	MEDIUM EQUIPMENT SUPP.2,5m	D-DT-5206 S2C	9	0182752	124,57	3,13	33	4 110,81	103,29	4 214,1
	MEDIUM EQUIPMENT CAP	D-DT-5206 S2H	7	0182753	54,41	1,94	33	1 795,53	64,02	1 859,55
CB1-3	132kV CIRCUIT BREAKER SUPP.	D-DT-5200 S2A	13	0182927	242,39	-	3	727,17	-	727,17
IS1-5,7,9,11,12	132kV ISOLATOR SUPP.(HAND)	D-DT-5202 S2A	17	0186033	548,16	14,36	9	6 577,92	172,32	6 750,24
IS6,8,10	132kV ISOLATOR SUPP.(MOT)	D-DT-5202 S2B	2	0528420	550,33	14,79	3	1 650.99	44,37	1 695,36
IS13-17	132kV LINE ISOLATOR SUPP.	D-DT-5202 S2I	2	0528427	776,42	24,32	5	3 882,1	121,6	4 003,7
ISBR1-2	SA BRACKET ON ISOLATOR	D-DT-5219 S4	4	0190412	207,95	4,22	2	415,9	8,44	424,34
TBS1-18	132kV TUBULAR BUSBAR SUPP.	D-DT-5225 S2A	6	0220125	646,54	23,32	18	11 637,72	419,76	12 057,48
LM1-10	21m LIGHTNING MAST	D-DT-5217 S7	3	0214509	754,27	2,08	10	7 542,7	20,8	7 563,5
YB1-2	YARD AC DB SUPP	D-DT-5276 S2A	1	0572427	70,23	9,21	2	140,46	18,42	158,88
					TOTAL MASS - kg			49 912,08	1 447,63	51 359,71

NOTES:

1. MANUFACTURING AND ERECTION OF SUBSTATION STEELWORK TO BE IN ACCORDANCE WITH N.W.S.1404.
2. REFER TO E.V.S.005 FOR THE ESKOM STANDARD QUALITY RELATED ITEMS AND EQUIPMENT.
3. PRIOR TO THE ERECTION OF STRUCTURAL STEEL, THE STEEL ERECTION CONTRACTOR MUST ACQUAINT HIMSELF THAT ALL FINISHED CONCRETE SURFACES ARE WITHIN THE TOLERANCE SPECIFIED IN N.W.S.1431 CLAUSE 8.4.
4. IF GROUTING UNDER STEELWORK IS REQUIRED, THE STEEL ERECTION CONTRACTOR WILL BE INFORMED BY ESKOM ACCORDINGLY.
5. STRUCTURES SHALL BE ERECTED, ALIGNED, SQUARED, PLUMBED AND LEVELLED TO AN ACCURACY SPECIFIED IN SANS 1200 H 6.2.2 c)2 - CLASS II.
6. BEAM B1 AND B2 MOUNTED AT 10.668m. REFER TO DRAWING D-DT-5252 S2A FOR STRINGER BEAM MOUNTING HEIGHT.



DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE 1:250

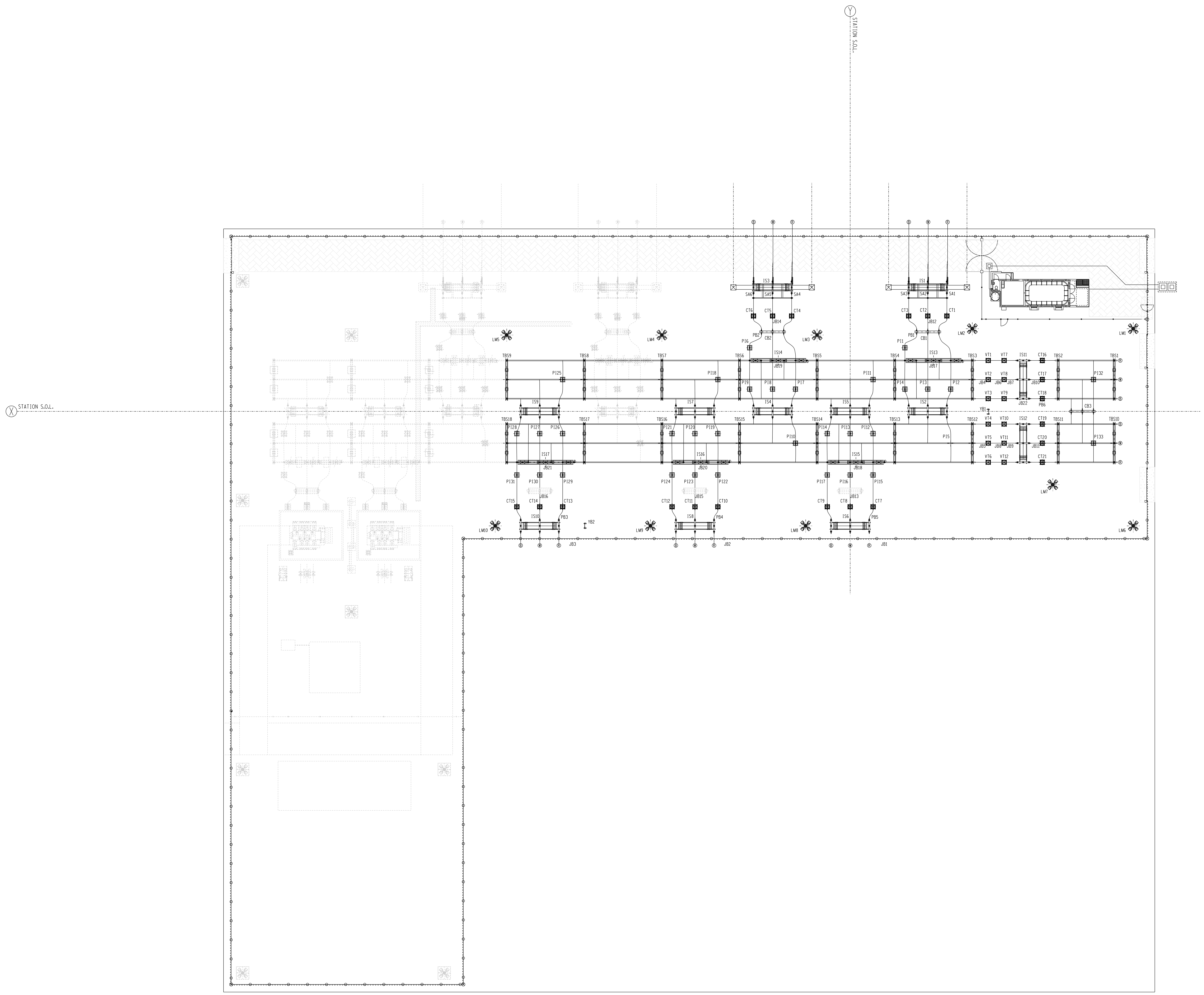
AUTH: LM. BOTHA	AUTH:
DATE: 20/04/2020	DATE: / /
CHKD: A. MARAIS	CHKD:
DATE: 20/04/2020	DATE: / /
DRAWN: K STEYNBERG	DRAWN:
DATE: 12/07/2019	DATE: / /

Eskom

YSTERVARK SUBSTATION
66kV
STEELWORK MARKING PLAN LAYOUT

DRAWING	SET	SHEET	REVISION
D-WC-8118	11	06	00

A0L



EQUIPMENT SCHEDULE REV.0A

MARK	DESCRIPTION		DRAWING No.	REV.	SAP No.	QTY	RATING
SA1-6	66kV SURGE ARRESTOR		D-DT-6212	9	0004562	6	S/CL, 66kV, MCOV: 48kV, 31mm/kV
PI1-33	132kV POST INSULATOR		D-DT-6230	7	0017528	33	132kV, 31mm/kV
IS1-5, 7, 9, 11 & 12	132kV ISOLATOR (HAND OPERATED)		D-DT-6302	2	0527587	9	132kV, 2500A, 40kA, CRDB, M/O, 31mm/kV
IS6, 8 & 10	132kV ISOLATOR (MOTORISED)		D-DT-6302	2	0527586	3	132kV, 2500A, 40kA, CRDB, M/O, 31mm/kV
IS13-17	132kV INLINE ISOLATOR (HAND OPERATED)		D-DT-6302	2	0527588	5	132kV, 2500A, 40kA, CRDB, M/O, 31mm/kV
CB1-3	132kV CIRCUIT BREAKER		D-DT-6250	10	0218735	3	132kV, 3150A, 40kA, 31mm/kV
CT1-21	132kV CURRENT TRANSFORMER		D-DT-6190	11	0180034	21	132kV, 40kA, 2P2M2B1600, 31mm/kV
VT1-6	66kV POWER VOLTAGE TRANSFORMER		D-DT-6315	0	0632985	6	66/√3kV/400/√3V, 16kVA, 31mm/kV
VT7-12	66kV VOLTAGE TRANSFORMER		D-DT-6176	8	0180091	6	66kV, 110V, 100/50VA, 31mm/kV
LM1-10	LAMPHOLDER INCLUDING FITTING		-	-	-	40	120W / 3000 KELVIN
	LAMP, FLOODLIGHT		-	-	-	40	120W / 3000 KELVIN
TBS1-18	132kV TUBULAR BUSBAR	POST INSUL. STN 132kV	D-DT-6230	7	0017528	54	132kV, 31mm/kV
		TUBE AL 120mm	D-DT-6000	4	0206318	42	120 x 4mm AL TUBE 12m
JB1-3	INTERFACE JUNCTION BOX		D-DT-9101 / 5404	3	BUY OUT	1	N/A
JB4-5	POWER VT JUNCTION BOX	METERING VT TRAY	D-DT-9101	3	0402615	2	N/A
		VRW20 JUNCTION BOX	D-DT-9101 / 5402	3	0186950	2	N/A
JB6-9	VOLTAGE TRANSFORMER JUNCTION BOX		D-DT-5405	3	0186950	2	N/A
JB10-16	CURRENT TRANSFORMER JUNCTION BOX		D-DT-5404	3	0186961	7	N/A
JB17-22	X2 B/B ISOLATOR JUNCTION BOX		D-DT-9101 / 5403	3	0185255	6	N/A
PB1-6	PLUG BOX		N/A	N/A	BUY-OUT	6	N/A
YB1-2	YARD AC DISTRIBUTION BOARD		D-DT-9200	2	0185222	2	N/A

NOTES:

1. SUBSTATION AREA TO BE CLEARED OF ALL TURF AND VEGETATION TO A DEPTH OF 150mm.
2. TOP OF EQUIPMENT FOUNDATIONS TO BE 150mm ABOVE TERRACE LEVEL.
3. PROVIDE A 200 x 80mm OPENING IN CABLE TRENCH WALL AT FLOOR LEVEL FOR CABLE ENTRIES.
4. WEEDKILLER SHALL BE APPLIED BEFORE COMPLETION OF YARD STONE SURFACING, AS PER GUIDELINE DTMG 0112.
5. SETTING OUT BEACONS X, X1, Y & Y1 TO BE PEGGED AND LEVELLED BY THE SURVEYOR.
6. ALL SITE WORKS TO BE DONE IN ACCORDANCE WITH SANS 1200 C AND D.
7. STRUCTURES SHALL BE ERECTED, ALIGNED, SQUARED, PLUMBED AND LEVELLED TO AN ACCURACY SPECIFIED IN SABS 1200 H 6.2.2.c)2 - CLASS II.

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV

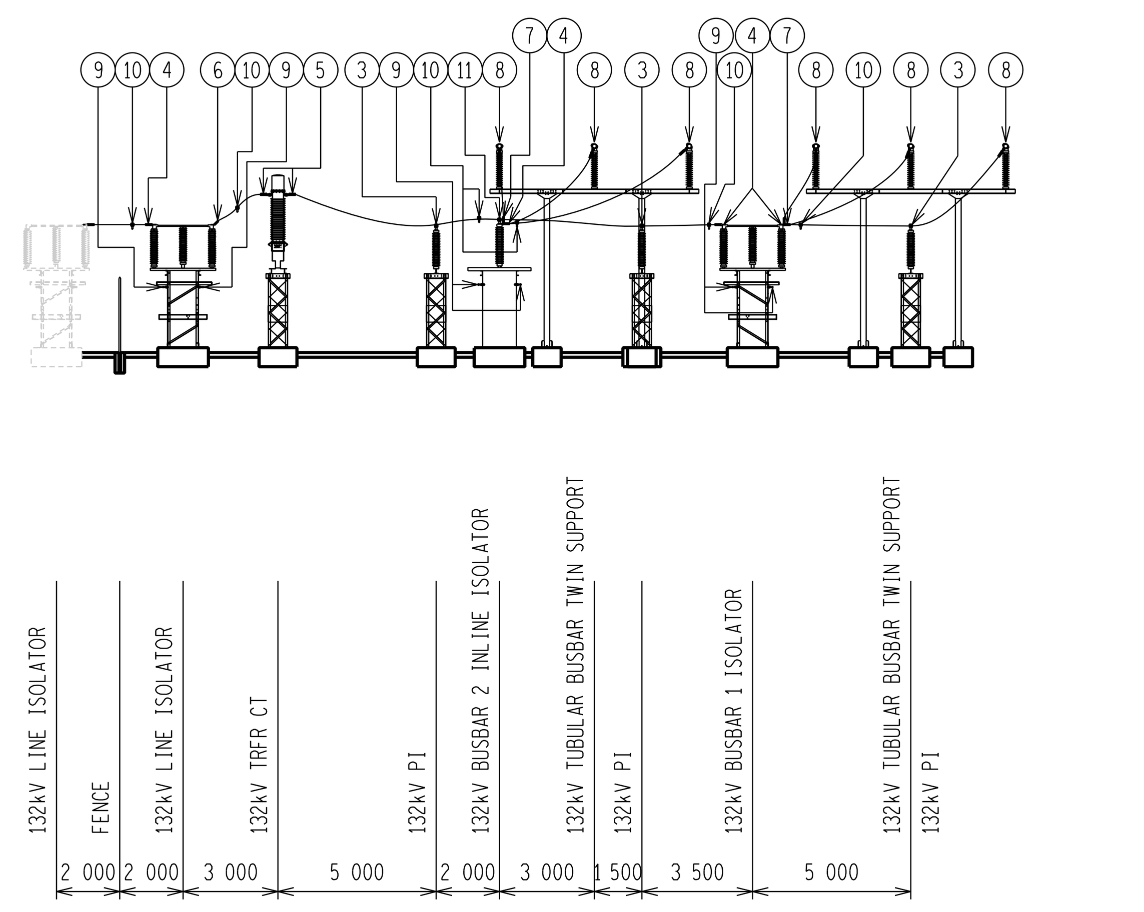
ELECTRICAL EQUIPMENT LAYOUT

AUTH: LM. BOTHA	AUTH:	SCALE 1 : 250
DATE: 20/04/2020	DATE: / /	THIS DRAWING IS THE PROPERTY OF ESKOM
CHKD: A. MARAIS	CHKD:	
DATE: 20/04/2020	DATE: / /	
DRAWN: K STEYNBERG	DRAWN:	
DATE: 12/07/2019	DATE: / /	

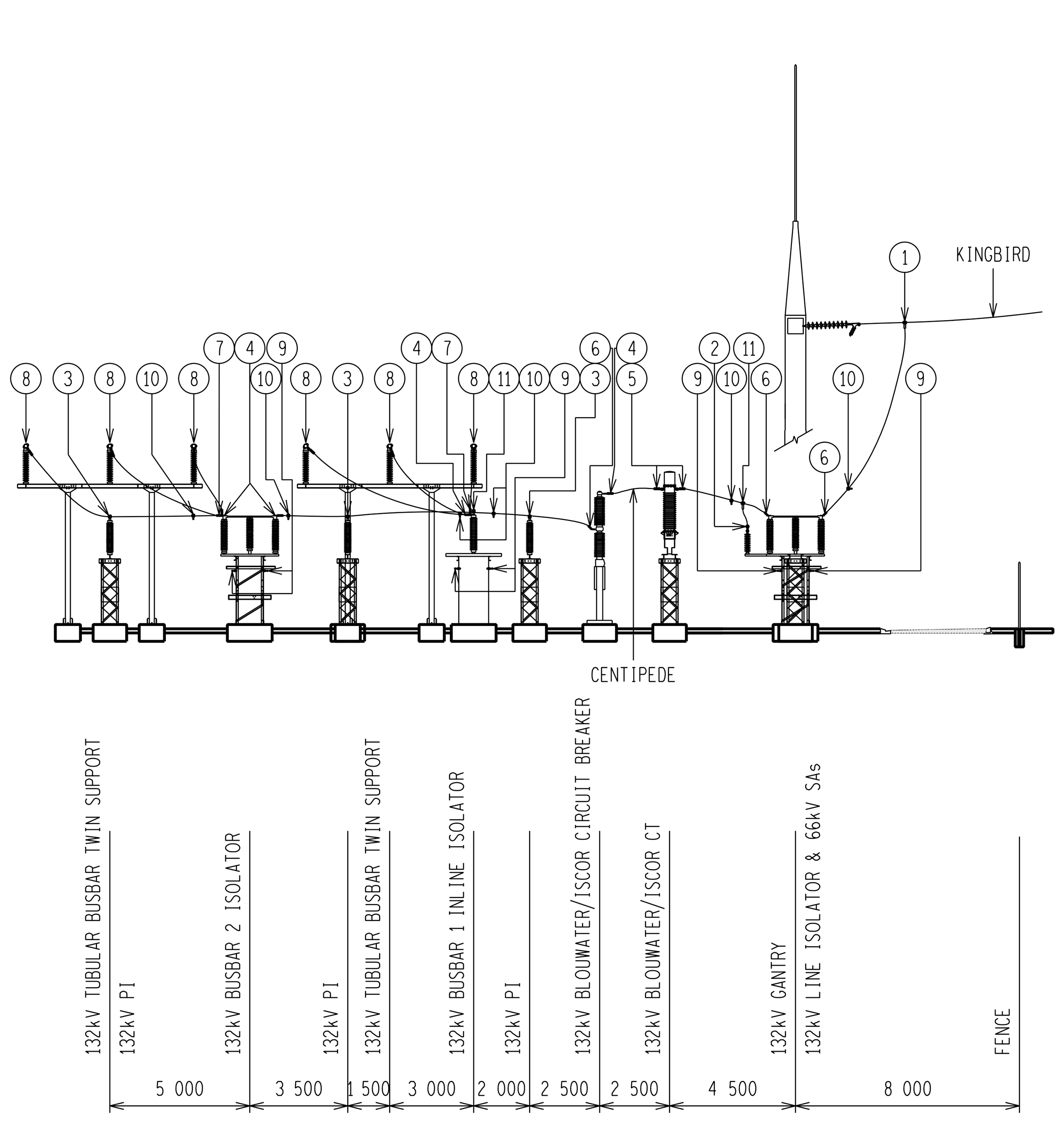
	SET	SHEET	REVISION
D-WC-8118	11	07	00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

A0L



66kV FDR 2,4 & 6



66kV FDR 1 & 3

CLAMP TOTAL SUMMARY

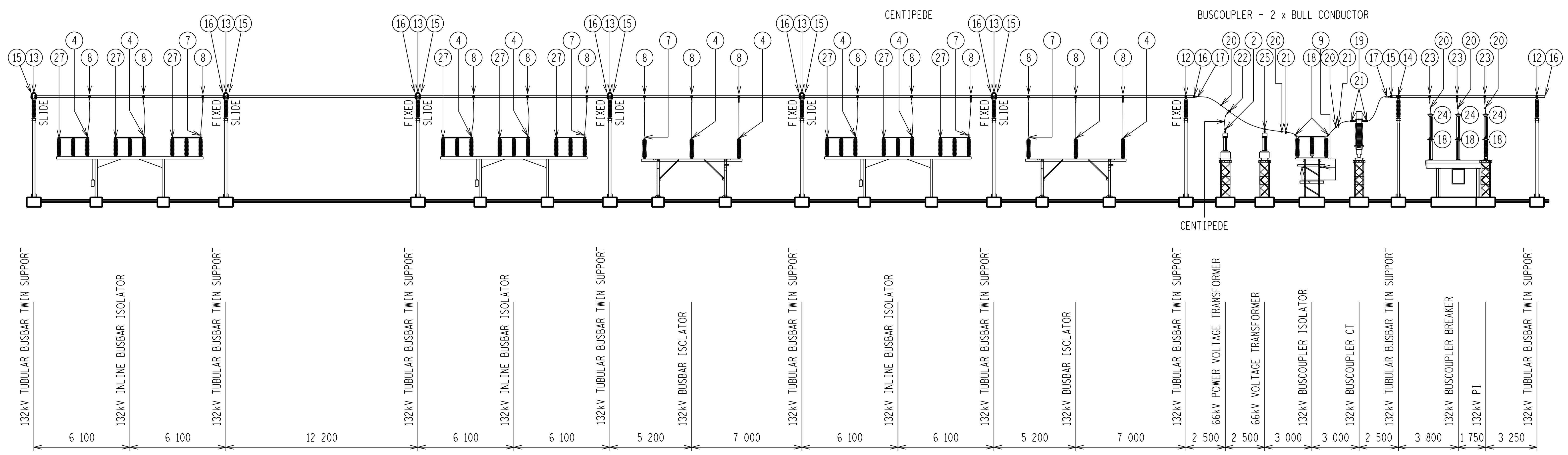
No.	DRAWING No.	SAP No.	QTY	DESCRIPTION
1	D-DT-6010	0401758	6	CLAMP, T/COMP 23,5 - 26,5mm ODG ETC-A
2	D-DT-6002	0401584	12	CLAMP, CROSS 26,5 - 26mm EX-B
3	D-DT-6029	0401675	31	CLAMP, FIX/SUPP 26,5mm KCP 26/127
4	D-DT-6018	0401580	50	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
5	D-DT-6006	0401766	30	CLAMP, B/COMP 26,5 - 38mm ODG EXC-B
6	D-DT-6018	0400420	27	CLAMP, B/COMP 26,5mm PALM 45DG EPC-B
7	D-DT-6018	0560891	10	CLAMP, EPC-C; COMP/PALM 90DG; 26,5mm
8	D-DT-6119	0216098	30	CLAMP, TUBE TAP-OFF TBTC120/C1-26 EPT-IL1-H
9	D-DT-6081	0206118	102	JOINT, BALL PORTABLE EARTH 20kA G/S
10	D-DT-6115	0401653	90	CLAMP, PEG AL CENT 26,5mm EPC-26
11	D-DT-6010	0401754	7	CLAMP, ETC-C; T/COMP; RUN 26,5 TAP 26,5
12	D-DT-6039	0213925	12	CLAMP, TUBE: ESC-PI-F-F; 120/127; FIXED
13	D-DT-6093	0206329	36	CLAMP, TUBE: EEC-PI-FS-F; 120/127; FIX/SLD
14	D-DT-6316	0242920	6	CLAMP, TUBE: ESC-PI-S-F; 120/127; SLIDE
15	D-DT-6040	0206319	42	CLAMP, TUBE: EEC-PL-C; 120/4; PLAIN END-CAP
16	D-DT-6040	0206320	42	CLAMP, TUBE: EEC-DC-C; 120/4; 26.5 CLAMP EC
17	D-DT-6090	0206328	12	CLAMP, TUBE: ETP-TE-IL2-R; 120/2x38.3 OD
18	D-DT-6109	0401802	15	CLAMP, EYC-S: COMP/PALM 45DG; 2x38,3mm
19	D-DT-6013	0005663	12	CLAMP, EYC-B; 2x38,3 COMP 38 BOLTED ODG
20	D-DT-6087	0402559	26	SPACER, ES-B; COND 2x38,3mm; 150mm CRS
21	D-DT-6115	0401655	12	CLAMP, PEG AL BULL 38,3mm EPC-38
22	D-DT-6010	0401768	6	CLAMP, ETC-J; T/COMP; RUN 38,3 TAP 26,5
23	D-DT-6119	0216099	6	CLAMP, TUBE: ETP-IL2-T; 120/2x38,3; 90DG
24	D-DT-6109	0400426	3	CLAMP, EYC-R; COMP/PALM ODG; 2x38,3mm
25	D-DT-6022	0206355	6	CLAMP, Y-BOLT 2x38,3 - 26mm ODG EY-H
26	D-DT-6025	0401669	2	CLAMP, F-SUPT 38,3 P38/127/150 D6025
27	D-DT-6004	0590147	15	CLAMP, EPT-A; RUN 26,5mm ON 4 HOLE PAD

PREPARATION OF TERMINALS, CLAMPS AND CONDUCTORS

1. WIPE THE MATING SURFACES FREE FROM GREASE AND DIRT.
2. APPLY 1mm THICK COATING OF AN ELECTRICALLY AND NON-OXIDISING HIGH TEMPERATURE GREASE TO THE SURFACES USING A NON-METALLIC SPATULA OR SIMILAR TOOL.
3. SCRUB ALL THE COATED SURFACES THOROUGHLY WITH A WIRE BRUSH WHICH HAS BEEN USED SOLELY FOR THIS PURPOSE.
4. WIPE OFF THE JOINTING COMPOUND.
5. APPLY A FRESH 2mm THICK COATING OF CONTACT GREASE PRIOR TO ATTACHING THE CLAMP.
6. ALL CLAMP BOLTS TO BE TIGHTENED TO THE ACCEPTED INITIAL TORQUE VALUES.

CLAMPS SCHEDULE

EQUIPMENT	No.	DRAWING No.	SAP No.	QTY	DESCRIPTION
132kV LINE CONNECTION	1	D-DT-6010	0401758	6	CLAMP, T/COMP 23,5 - 26,5mm ODG ETC-A
132kV LINE ISOLATOR (BLOUWATER/ISCOR 1 & 2)	6	D-DT-6018	0400420	12	CLAMP, B/COMP 26,5mm PALM 45DG EPC-B
	9	D-DT-6081	0206118	12	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	12	CLAMP, PEG AL CENT 26,5mm EPC-26
66kV SAs	2	D-DT-6002	0401584	6	CLAMP, CROSS 26,5 - 26mm EX-B
	11	D-DT-6010	0401754	7	CLAMP, ETC-C; T/COMP; RUN 26,5 TAP 26,5
132kV CT (BLOUWATER/ISCOR 1 & 2)	5	D-DT-6006	0401766	12	CLAMP, B/COMP 26,5 - 38mm ODG EXC-B
132kV CIRCUIT BREAKER (BLOUWATER/ISCOR 1 & 2)	6	D-DT-6018	0400420	6	CLAMP, B/COMP 26,5mm PALM 45DG EPC-B
	4	D-DT-6018	0401580	6	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
132kV PIs	3	D-DT-6029	0401675	2	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV B/B1 INLINE ISOLATOR (BLOUWATER/ISCOR 1 & 2)	4	D-DT-6018	0401580	4	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
	7	D-DT-6018	0560891	2	CLAMP, EPC-C; COMP/PALM 90DG; 26,5mm
	8	D-DT-6119	0216098	6	CLAMP, TUBE TAP-OFF TBTC120/C1-26 EPT-IL1-H
	9	D-DT-6081	0206118	12	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	12	CLAMP, PEG AL CENT 26,5mm EPC-26
	27	D-DT-6004	0590147	6	CLAMP, EPT-A; RUN 26,5mm ON 4 HOLE PAD
132kV PIs	3	D-DT-6029	0401675	6	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV B/B2 ISOLATOR (BLOUWATER/ISCOR 1 & 2)	4	D-DT-6018	0401580	10	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
	7	D-DT-6018	0560891	2	CLAMP, EPC-C; COMP/PALM 90DG; 26,5mm
	8	D-DT-6119	0216098	6	CLAMP, TUBE TAP-OFF TBTC120/C1-26 EPT-IL1-H
	9	D-DT-6081	0206118	12	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	12	CLAMP, PEG AL CENT 26,5mm EPC-26
132kV PIs	3	D-DT-6029	0401675	2	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV B/B1 ISOLATOR (MAIN INTAKE 1,2 & 3)	4	D-DT-6018	0401580	15	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
	7	D-DT-6018	0560891	3	CLAMP, EPC-C; COMP/PALM 90DG; 26,5mm
	8	D-DT-6119	0216098	9	CLAMP, TUBE TAP-OFF TBTC120/C1-26 EPT-IL1-H
	9	D-DT-6081	0206118	18	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	18	CLAMP, PEG AL CENT 26,5mm EPC-26
132kV PIs	3	D-DT-6029	0401675	3	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV B/B2 INLINE ISOLATOR (MAIN INTAKE 1,2 & 3)	4	D-DT-6018	0401580	6	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
	7	D-DT-6018	0560891	3	CLAMP, EPC-C; COMP/PALM 90DG; 26,5mm
	8	D-DT-6119	0216098	9	CLAMP, TUBE TAP-OFF TBTC120/C1-26 EPT-IL1-H
	9	D-DT-6081	0206118	18	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	18	CLAMP, PEG AL CENT 26,5mm EPC-26
	27	D-DT-6004	0590147	9	CLAMP, EPT-A; RUN 26,5mm ON 4 HOLE PAD
132kV PIs	3	D-DT-6029	0401675	9	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV CT (MAIN INTAKE 1,2 & 3)	5	D-DT-6006	0401766	18	CLAMP, B/COMP 26,5 - 38mm ODG EXC-B
132kV PIs (MAIN INTAKE 1,2 & 3)	3	D-DT-6029	0401675	9	CLAMP, FIX/SUPP 26,5mm KCP 26/127
132kV LINE ISOLATOR (MAIN INTAKE 1,2 & 3)	6	D-DT-6018	0400420	9	CLAMP, B/COMP 26,5mm PALM 45DG EPC-B
	4	D-DT-6018	0401580	9	CLAMP, B/COMP 26,5mm PALM ODG EPC-A
	9	D-DT-6081	0206118	18	JOINT, BALL PORTABLE EARTH 20kA G/S
	10	D-DT-6115	0401653	18	CLAMP, PEG AL CENT 26,5mm EPC-26
132kV TUBULAR BUSBAR (ALL)	12	D-DT-6039	0213925	12	CLAMP, TUBE: ESC-PI-F-F; 120/127; FIXED
	13	D-DT-6093	0206329	36	CLAMP, TUBE: EEC-PI-FS-F; 120/127; FIX/SLD
	14	D-DT-6316	0242920	6	CLAMP, TUBE: ESC-PI-S-F; 120/127; SLIDE
	15	D-DT-6040	0206319	42	CLAMP, TUBE: EEC-PL-C; 120/4; PLAIN END-CAP
	16	D-DT-6040	0206320	42	CLAMP, TUBE: EEC-DC-C; 120/4; 26.5 CLAMP EC
132kV BUSCOUPLER ISOLATOR (BUSBAR 1 & 2)	17	D-DT-6090	0206328	6	CLAMP, TUBE: ETP-TE-IL2-R; 120/2x38.3 OD
	18	D-DT-6109	0401802	12	CLAMP, EYC-S: COMP/PALM 45DG; 2x38,3mm
	20	D-DT-6087	0402559	12	SPACER, ES-B; COND 2x38,3mm; 150mm CRS
	9	D-DT-6081	0206118	12	JOINT, BALL PORTABLE EARTH 20kA G/S
	21	D-DT-6115	0401655	12	CLAMP, PEG AL BULL 38,3mm EPC-38
66kV VT (BUSBAR 1 & 2)	25	D-DT-6022	0206355	6	CLAMP, Y-BOLT 2x38,3 - 26mm ODG EY-H
66kV POWER VT	2	D-DT-6002	0401584	6	CLAMP, CROSS 26,5 - 26mm EX-B
	22	D-DT-6010	0401768	6	CLAMP, ETC-J; T/COMP; RUN 38,3 TAP 26,5
132kV BUSCOUPLER CTs	19	D-DT-6013	0005663	12	CLAMP, EYC-B; 2x38,3 COMP 38 BOLTED ODG
	17	D-DT-6090	0206328	6	CLAMP, TUBE: ETP-TE-IL2-R; 120/2x38.3 OD
	20	D-DT-6087	0402559	6	SPACER, ES-B; COND 2x38,3mm; 150mm CRS
132kV CIRCUIT BREAKER (BUSCOUPLER)	23	D-DT-6119	0216099	6	CLAMP, TUBE: ETP-IL2-T; 120/2x38,3; 90DG
	24	D-DT-6109	0400426	3	CLAMP, EYC-R; COMP/PALM ODG; 2x38,3mm
	18	D-DT-6109	0401802	3	CLAMP, EYC-S: COMP/PALM 45DG; 2x38,3mm
	20	D-DT-6087	0402559	8	SPACER, ES-B; COND 2x38,3mm; 150mm CRS
132kV PIs	26	D-DT-6025	0401669	2	CLAMP, F-SUPT 38,3 P38/127/150 C/C



66kV BUSCOUPLER AND BUSBAR 1 & 2 SECTION

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE 1:200

THIS DRAWING IS THE PROPERTY OF ESKOM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

AUTH: LM. BOTHA — DATE: 20/04/2020 | ACC: — DATE: / /
CHKD: A. MARAIS — DATE: 20/04/2020 | CHKD: — DATE: / /
DRAWN: K. STEYNBERG — DATE: 12/07/2019 | DRAWN: — DATE: / /

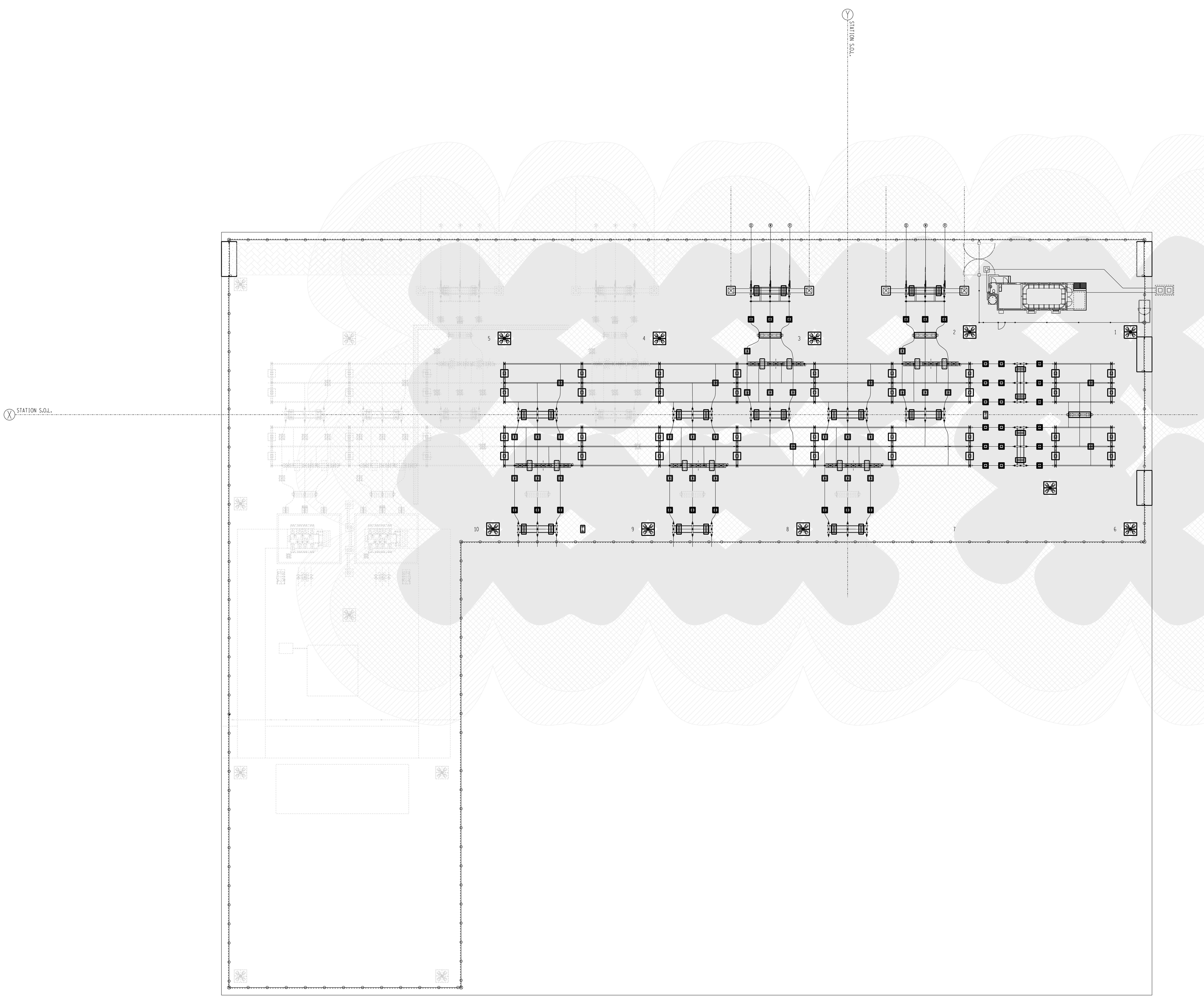
Eskom

YSTERVARK SUBSTATION
66kV

SECTIONS & CLAMPS

	SET	SHEET	REVISION
D-WC-8118	11	08	00

A1L



LEGEND

LEGEND	DESCRIPTION
	5 LUX TO 10 LUX LIGHTING ZONE
	10 LUX TO 20 LUX LIGHTING ZONE
	20 LUX AND HIGHER LIGHTING ZONE

YSTERVARK SUBSTATION SCHEDULE

MARK	DESCRIPTION
1	LM1: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
2	LM2: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
3	LM3: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
4	LM4: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
5	LM5: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
6	LM6: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
7	LM7: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
8	LM8: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
9	LM9: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST
10	LM10: 4 UNIT LAMPHOLDER / 21m HIGH LIGHTING / LIGHTNING MAST

NOTE:

1. ALL LUMINAIRES TO BE LED (120W/3000 KELVIN WITH MINIMUM LUMEN OUTPUT OF 13 200) AT 12,5m MH (45° TILT)

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE 1:250

AUTH:	LM. BOTHA	AUTH:	
DATE:	20/04/2020	DATE:	/ /
CHKD:	A. MARAIS	CHKD:	
DATE:	20/04/2020	DATE:	/ /
DRAWN:	K STEYNBERG	DRAWN:	
DATE:	12/07/2019	DATE:	/ /

Eskom

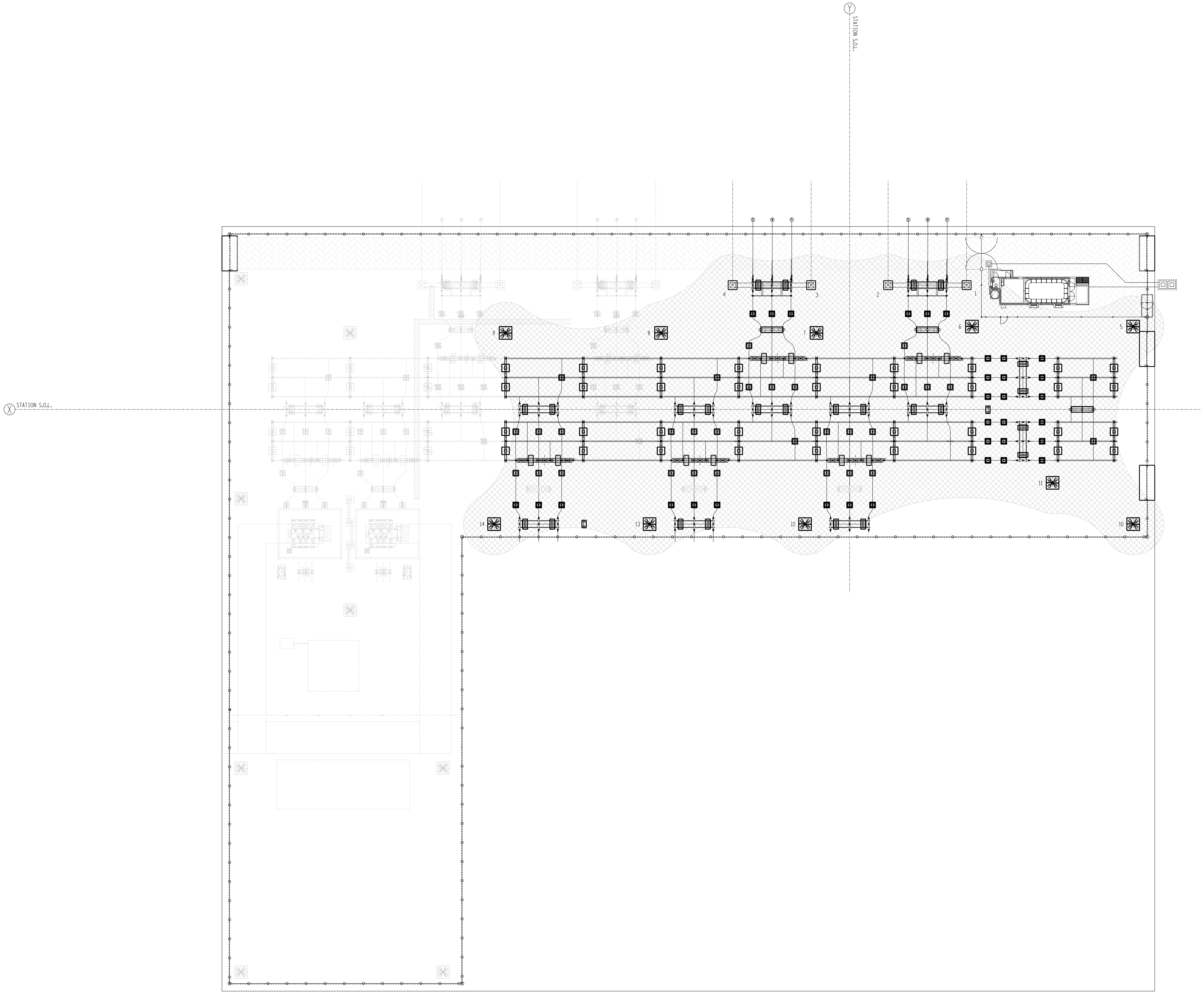
YSTERVARK SUBSTATION

66kV

YARD LIGHTING LAYOUT

	SET	SHEET	REVISION
D-WC-8118	11	10	00

A0L



LEGEND

LEGEND	DESCRIPTION
	7m HIGH EQUIPMENT LIGHTNING PROTECTION ZONE

MARK	DESCRIPTION	DRAWING No.	SHEET No.	REV. No.
1	EW1: EARTH WIRE SUPPORT WITH SPIKE	D-DT-5252	2E	2
2	EW2: EARTH WIRE SUPPORT WITH SPIKE	D-DT-5252	2E	2
3	EW3: EARTH WIRE SUPPORT WITH SPIKE	D-DT-5252	2E	2
4	EW4: EARTH WIRE SUPPORT WITH SPIKE	D-DT-5252	2E	2
5	LM1: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
6	LM2: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
7	LM3: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
8	LM4: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
9	LM5: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
10	LM6: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
11	LM7: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
12	LM8: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
13	LM9: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3
14	LM10: 21m HIGH LIGHTING / LIGHTNING MAST	D-DT-5217	7	3

NOTE:

1. ROLLING SPHERE METHOD WAS USED TO OBTAIN THE LIGHTNING COVERAGE AREA IN ACCORDANCE WITH IEEE 998-2012 & ESKOM STANDARD 240-109589380.
2. YSTERVARK 66kV SUBSTATION COMPLIES WITH LPS CLASS 1 IN ACCORDANCE WITH IEEE 998-2012 & ESKOM STANDARD 240-109589380.
3. ON 21m MAST LUMINAIRES SHALL BE MOUNTED AT 12,5m ABOVE FINISHED GROUND LEVEL.

DRG NO.	REFERENCE DRAWINGS:
SHEET 11	LIGHTNING PROTECTION LAYOUT
SHEET 10	YARD LIGHTING LAYOUT
SHEET 08	SECTION & CLAMPS
SHEET 07	ELECTRICAL EQUIPMENT LAYOUT
SHEET 06	STEELWORK MARKING PLAN LAYOUT
SHEET 05	FOUNDATION, FENCE & TRENCH LAYOUT
SHEET 04	EARTH GRID LAYOUT
SHEET 02	SITE PLAN
SHEET 01	STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS	AM	LMB	20/04/2020	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE 1:250

THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: LM. BOTHA	DATE: 20/04/2020	AUTH:	DATE: / /
CHKD: A. MARAIS	DATE: 20/04/2020	CHKD:	DATE: / /
DRAWN: K STEYNBERG	DATE: 12/07/2019	DRAWN:	DATE: / /

Eskom

YSTERVARK SUBSTATION

66kV

LIGHTNING PROTECTION LAYOUT

DRAWING	SET	SHEET	REVISION
D-WC-8118	11	11	00

A0L

9.8 Non-Standard Material Specifications

9.8.1 Luminaires

Table 27: Technical Schedule for Substation Flood Light Luminaires

Operational Flood Light Luminaires	
Light Source	LED
Wattage (W)	120
Voltage (V AC)	230
Power Factor	≥ 0.95 minimum
IP Rating	65 minimum
Impact Rating (IK)	0.7 minimum
Light Colour Temperature (K)	3000
Optics	Symmetrical Wide Beam
Luminaire Efficiency	110 - 120 lumen/watt minimum
Lumen Output (l_m)	13200 minimum
Estimated Lifetime (hr)	50000 @ L70
Rake Angle (Tilt)	45º
Operating Temperature	- 40ºC to + 45ºC minimum
Material and Finishes	Housing: Die-cast Aluminium LM6 Gasket: Heat Resistant Silicone Rubber Glass: Tempered Glass Housing Colour: Grey Aluminium RAL 9007
Incorporated Bird Spikes	Yes (Unpainted 316L stainless steel or polycarbonate type)
Fixing Materials	316L Stainless Steel
Comments	It should be noted that given the constant improvements on LED luminaires, it is foreseen that at the time the Contractor submits their offering for acceptance, those luminaires will have a luminaire efficiency of higher that 120 lumen/watt.

10 Control Plant

10.1 Specification

10.1.1 Protection Schemes

Blouwater/Iscor 1 66 kV Feeder: 4FZD3920

The ABB 4FZD3920 three pole distance/differential scheme has a RED670 relay with current differential and impedance zones, directional overcurrent and earth fault protection, breaker fail, anti-pump timer, auto-reclose with sync check functions for the main protection and a REF615 directional backup relay with overcurrent and earth-fault functions.

This scheme comes standard with the following items:

- DNP3 on RS485 for SCADA
- RED670 internal fibre teleprotection card, 1550 nm, (100 km)
- Hardwired protection not healthy alarm
- External time synch on REF615

The following ordering options will be ordered with the scheme:

- Communication cable for the RED670 & REF615
- Additional hardwired signals card
- Three-terminal differential option
- IEC 61850 remote engineering access via Ethernet, including RuggedCom RS900-HI-D-MT-MT-MT-XX (6x 10/100Tx, 3x MM Fx, ST Connectors) switches which ABB will fit into the scheme
- Voltage selection
- Swing frame panel with dual entry ability

Notes regarding the design:

1. The scheme will be installed in a separate swing frame cabinet.
2. A 132 kV three-pole breaker will be installed on this feeder.
3. No synch check line VT will be installed on this feeder.
4. A CTJB will be installed on the white phase CT steelwork.
5. An ISJB will be installed as indicated on the electrical equipment layout drawing.
6. All isolator open & closed indications must be wired to the scheme for supervisory indication. Double bit indication must be used; ‘M’ type contacts should be used for the close indication and ‘N’ type contacts should be used for the open indication.
7. Three-terminal differential protection will be used.

8. The switch(es) shall be wired into the protection scheme(s) as per the protection drawing. I.e. The RED670 protection relay(s) shall be connected to the Ethernet switch connected within the panel using multimode fibre with ST connectors and the REF615 protection relay shall be connected to the Ethernet switch using a standard RJ45 Ethernet cable.

9. Two Ethernet RJ45 links shall be connected between front panel and switch for ease of connection to the substation network.

10. The feeder IP addresses and related settings shall be supplied by the Substation Automation Control Plant design engineer(s) to the settings department to be issued with the standard settings.

11. The IEC 61850 option shall be enabled, and the regional IEC 61850 datasets loaded to allow integration to the SAS.

The Switch within the panel shall be linked to the substation automation network as detailed in the substation automation drawing “Cable Block D-WC-8118-167-03_00”.

The protection schematic diagram is shown below:

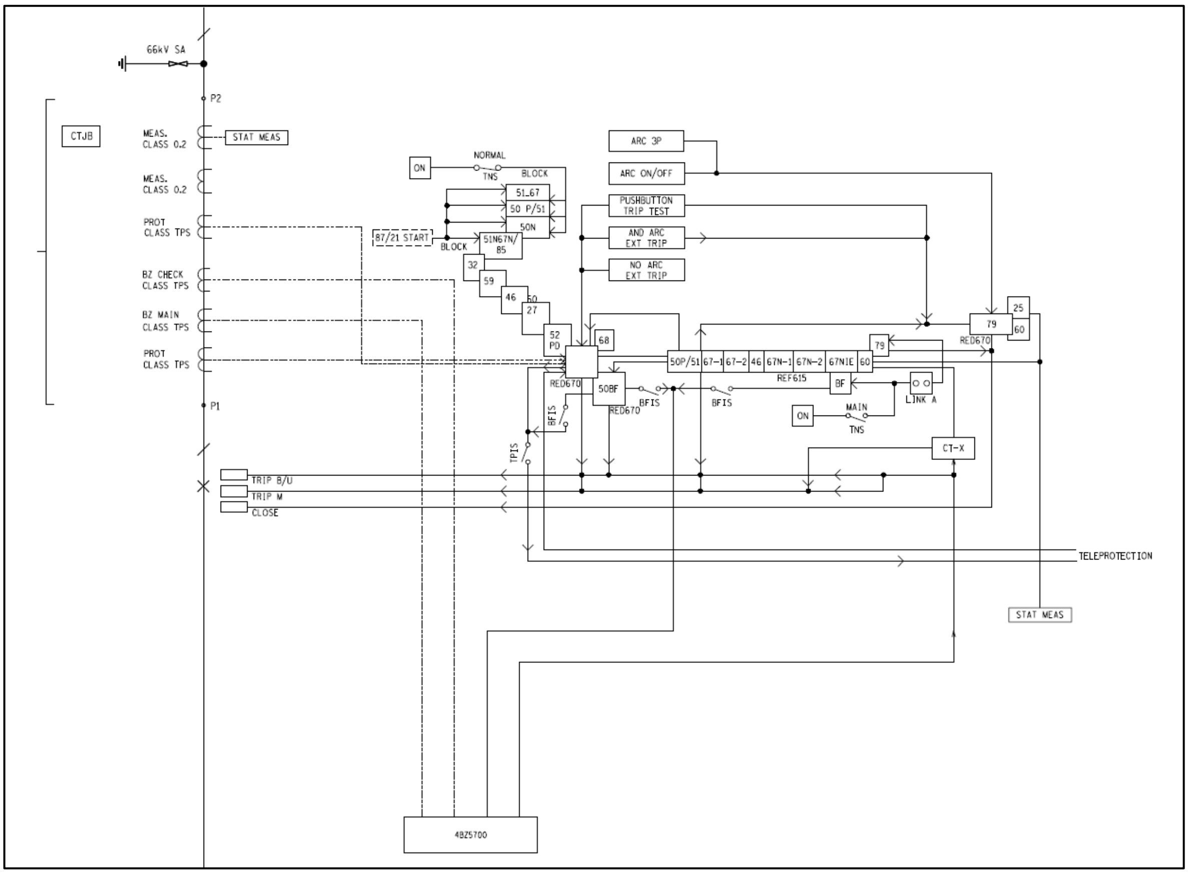


Figure 107: Protection Schematic Diagram for the 4FZD3920 Feeder Distance/Differential Protection Scheme

Blouwater/Iscor 2 66 kV Feeder: 4FZD3920

The ABB 4FZD3920 three pole distance/differential scheme has a RED670 relay with current differential and impedance zones, directional overcurrent and earth fault protection, breaker fail, anti-pump timer, auto-reclose with sync check functions for the main protection and a REF615 directional backup relay with overcurrent and earth-fault functions.

This scheme comes standard with the following items:

- DNP3 on RS485 for SCADA
- RED670 internal fibre teleprotection card, 1550 nm, (100 km)
- Hardwired protection not healthy alarm
- External time synch on REF615

The following ordering options will be ordered with the scheme:

- Communication cable for the RED670 & REF615
- Additional hardwired signals card
- Three-terminal differential option
- IEC 61850 remote engineering access via Ethernet, including RuggedCom RS900-HI-D-MT-MT-MT-XX (6x 10/100Tx, 3x MM Fx, ST Connectors) switches which ABB will fit into the scheme
- Voltage selection
- Swing frame panel with dual entry ability

Notes regarding the design:

1. The scheme will be installed in a separate swing frame cabinet.

2. A 132 kV three-pole breaker will be installed on this feeder.

3. No synch check line VT will be installed on this feeder.

4. A CTJB will be installed on the white phase CT steelwork.

5. An ISJB will be installed as indicated on the electrical equipment layout drawing.

6. All isolator open & closed indications must be wired to the scheme for supervisory indication. Double bit indication must be used; ‘M’ type contacts should be used for the close indication and ‘N’ type contacts should be used for the open indication.

7. Three-terminal differential protection will be used.

8. The switch(es) shall be wired into the protection scheme(s) as per the protection drawing. I.e. The RED670 protection relay(s) shall be connected to the Ethernet switch connected within the panel using multimode fibre with ST connectors and the REF615 protection relay shall be connected to the Ethernet switch using a standard RJ45 Ethernet cable.

9. Two Ethernet RJ45 links shall be connected between front panel and switch for ease of connection to the substation network.

10. The feeder IP addresses and related settings shall be supplied by the Substation Automation Control Plant design engineer(s) to the settings department to be issued with the standard settings.

11. The IEC 61850 option shall be enabled, and the regional IEC 61850 datasets loaded to allow integration to the SAS.

The Switch within the panel shall be linked to the substation automation network as detailed in the substation automation drawing “Cable Block D-WC-8118-167-03_00”.

The protection schematic diagram can be seen in Figure 107 above.

Main Intake 1 66 kV Feeder: 4RF1101 (Modified)

The standard 4RF1101 Rural Feeder scheme will be installed on the Customer feeder. It includes non-directional and directional overcurrent, earth fault and sensitive earth fault protection.

The scheme comes standard with the following items:

- Auto reclose and circuit breaker control
- Circuit breaker fail
- Under frequency
- 24 Digital Inputs, 24 Output Contacts
- Rear RS485 communication port supporting DNP3 for Serial SCADA
- SCADA via traditional hardwired 48V DC alarms and controls
- Wired for 1A Current Transformer rating

The scheme is suitable for 110V DC voltage supply.

The following ordering options will be ordered with the scheme:

- Swing frame panel and Crating
- Second rear RS485 communication port supporting Courier protocol for remote engineering access and including IRIG-B time synchronization input.

An additional mimic module will be included in the panel to facilitate the following:

- Indication and local control of the motorised isolator
- Indication for the Customer line isolator
- Indication and emergency tripping facility for the Customer transformer breaker
- Indication, control and interlocking for breaker fail, buszone operation and emergency trips

An additional 5U mimic module with modifications for voltage selection is required due to the double busbar setup. See drawings D-WC-8118 Set 46.

The protection schematic diagram is shown below:

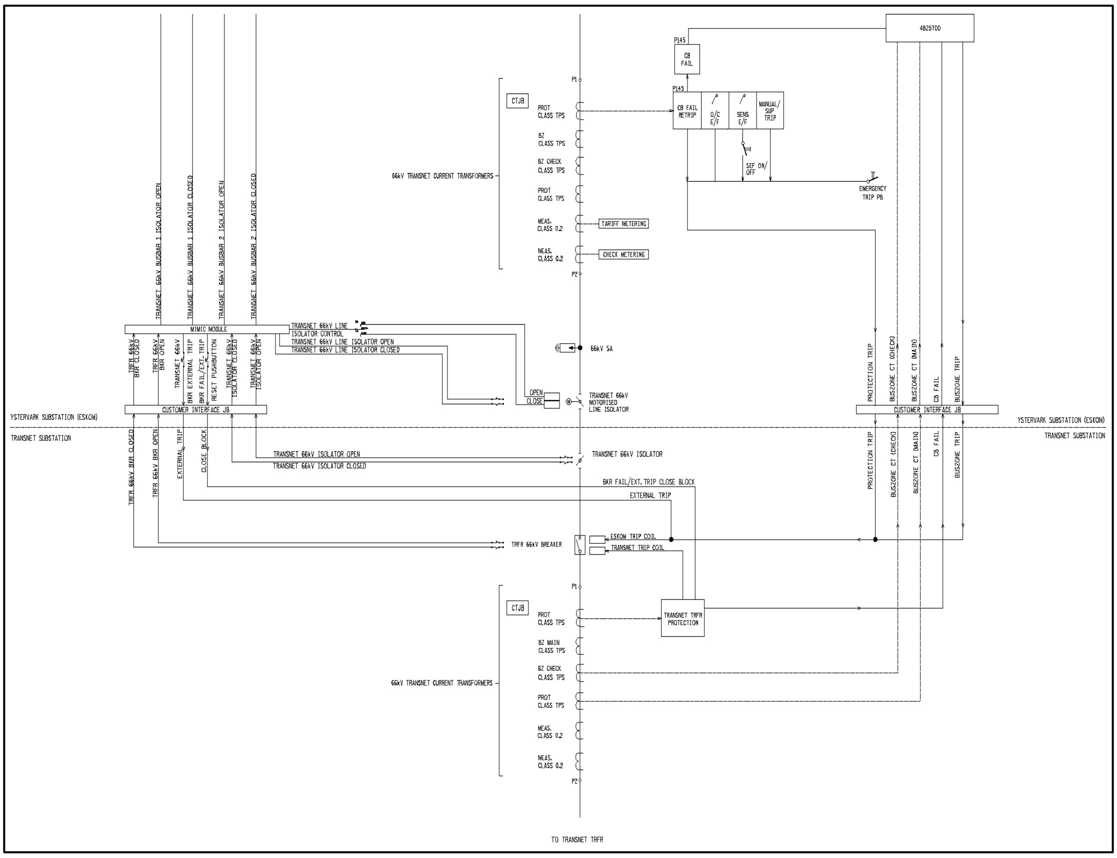


Figure 108: Protection Schematic Diagram for the 4RF1101 Rural Feeder Protection Scheme (Modified)

Main Intake 2 66 kV Feeder: 4RF1101 (Modified)

The standard 4RF1101 Rural Feeder scheme will be installed on the Customer feeder. It includes non-directional and directional overcurrent, earth fault and sensitive earth fault protection.

The scheme comes standard with the following items:

- Auto reclose and circuit breaker control
- Circuit breaker fail
- Under frequency
- 24 Digital Inputs, 24 Output Contacts
- Rear RS485 communication port supporting DNP3 for Serial SCADA
- SCADA via traditional hardwired 48V DC alarms and controls
- Wired for 1A Current Transformer rating

The scheme is suitable for 110V DC voltage supply.

The following ordering options will be ordered with the scheme:

- Swing frame panel and Crating
- Second rear RS485 communication port supporting Courier protocol for remote engineering access and including IRIG-B time synchronization input.

An additional mimic module will be included in the panel to facilitate the following:

- Indication and local control of the motorised isolator
- Indication for the Customer line isolator
- Indication and emergency tripping facility for the Customer transformer breaker
- Indication, control and interlocking for breaker fail, buszone operation and emergency trips

An additional 5U mimic module with modifications for voltage selection is required due to the double busbar setup. See drawings D-WC-8118 Set 44.

The protection schematic diagram can be seen in Figure 108 above.

Main Intake 3 66 kV Feeder: 4RF1101 (Modified)

The standard 4RF1101 Rural Feeder scheme will be installed on the Customer feeder. It includes non-directional and directional overcurrent, earth fault and sensitive earth fault protection.

The scheme comes standard with the following items:

- Auto reclose and circuit breaker control
- Circuit breaker fail
- Under frequency
- 24 Digital Inputs, 24 Output Contacts
- Rear RS485 communication port supporting DNP3 for Serial SCADA
- SCADA via traditional hardwired 48V DC alarms and controls
- Wired for 1A Current Transformer rating

The scheme is suitable for 110V DC voltage supply.

The following ordering options will be ordered with the scheme:

- Swing frame panel and Crating
- Second rear RS485 communication port supporting Courier protocol for remote engineering access and including IRIG-B time synchronization input.

An additional mimic module will be included in the panel to facilitate the following:

- Indication and local control of the motorised isolator
- Indication for the Customer line isolator
- Indication and emergency tripping facility for the Customer transformer breaker
- Indication, control and interlocking for breaker fail, buszone operation and emergency trips

An additional 5U mimic module with modifications for voltage selection is required due to the double busbar setup. See drawings D-WC-8118 Set 42.

The protection schematic diagram can be seen in Figure 108 above.

66 kV Buszone: 4BZ5700

The scheme comprises of the GE Multilin F35 protection relay with IRIG-B inputs. It is suitable for application in substations with double busbars divided into two sections with up to eight bays per section and a bus coupler bay.

The scheme comes standard with the following items:

- GE Multilin F35 protection relay with IRIG-B time synchronization input.
- 2000 Ohm, 200 Watt variable stabilizing resistors and metrosils.
- Electrically-reset trip repeat and CT bus wire shorting relays per zone.
- Test blocks, isolation switches, indication lamps, terminal back plate.
- Provision for hardwired and/or serial communication (TS485/DNP3) to SCADA.
- F35 equipped with second rear RS485 comms port for remote engineering access.
- Dual entry swing frame panel of dimensions: 2400mm high x 800mm wide x 600mm deep. Requisite blanking plates.
- Packaging for transport.
- Wired for 1A Current Transformer rating

The scheme is suitable for 110V DC voltage supply.

Notes regarding the design:

- The buszone CT circuits will utilize a 1600/1 ratio core on all the bays CT's.
- Buszone will be extended to Transnet CT's. Eskom will have a dedicated trip-coil on the Transnet breaker for buszone/external trip.
- All 66 kV feeder schemes are equipped with breaker fail functionality, which must be included in the buszone tripping input for a bay breaker failure condition.
- The check zone CT circuits must be wired directly from the CT junction boxes of the different bays.
- The scheme will be supplied with blanking plates in a separate SFC.

The protection schematic diagram is shown below:

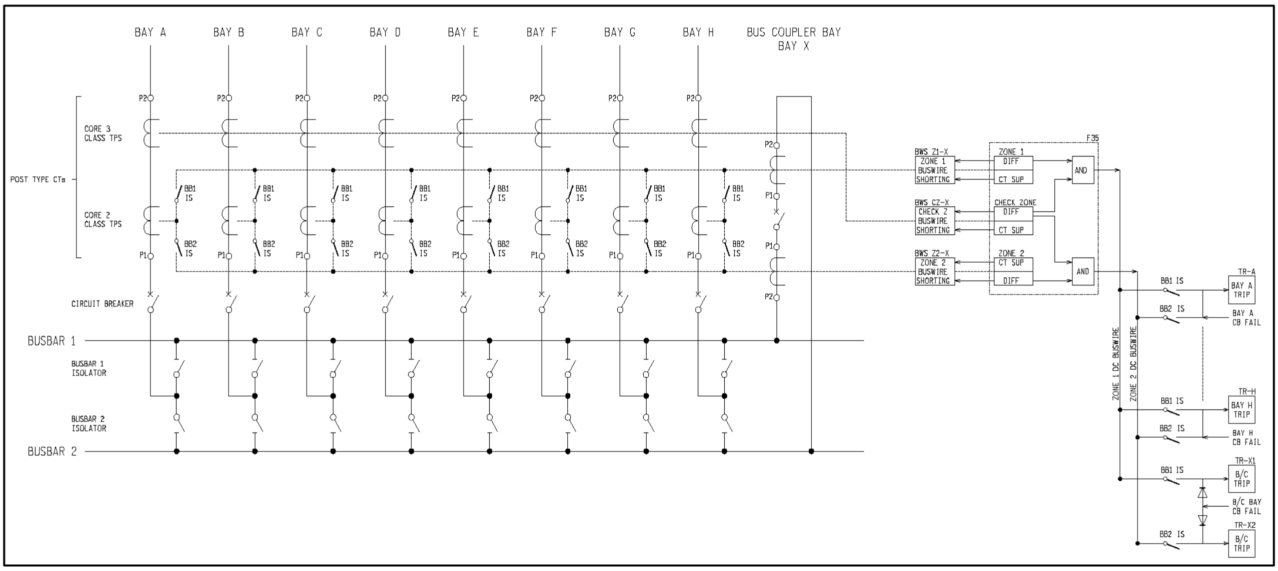


Figure 109: Protection Schematic Diagram for the 4BZ5700 Buszone Scheme

66 kV Buscoupler: 4BC1800

The 4BC1800 buscoupler protection and control scheme comprises of a MiCOM P145 relay and comes standard with directional/non-directional over current; earth fault and sensitive earth fault protection, breaker fail; auto reclose; synchronism check; trip circuit supervision and an anti-pump function.

The scheme comes standard with the following:

- MiCOM P145 protection relay including 16 digital inputs/16 outputs
- Supervisory indications and controls via serial communication only: rear RS485 supporting DNP3
- PK2 4-way CT & VT test blocks
- Hardwired PNH alarm to SCADA

The scheme will be ordered with the following optional items:

- Second rear comms port for remote engineering access and IRIG-B time synch interface
- Analogue voltmeter module
- Swing frame panel and blanking plates
- Crating for transport

Notes regarding the design:

3. CAT5E FTP Solid Core cable(s) shall be pulled between the buscoupler panel and the substation automation panel. Refer to SA drawing set “Cable Block D-WC-8118-167-03_00” (per feeder panel).
4. All CAT5E FTP Solid Core cable(s) shall be terminated with a RJ45 plug on both ends as per the EIA-T568A standard.
5. 1 x Male and 1 x Female RJ45 to DB9 converters shall be purchased to connect this device to the serial concentrating device as both devices use DB9 serial connectors.

The scheme is suitable for 110V DC voltage supply.

The protection schematic diagram is shown below:

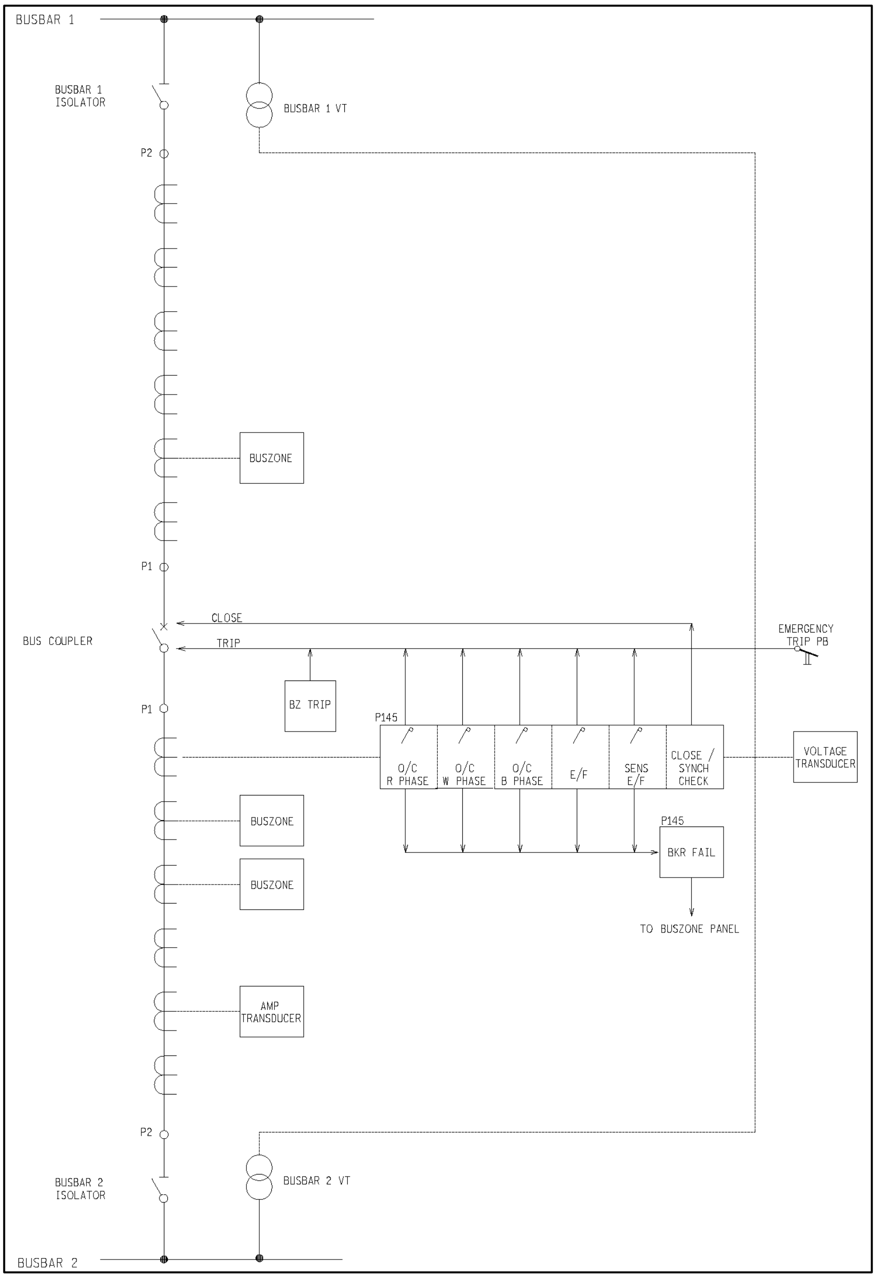


Figure 110: Protection & Control Schematic Diagram for the 4BC1800 Buscoupler Scheme

10.1.2 Junction Boxes

CT Junction Boxes

Seven CT junction boxes are required, one for each of the 66 kV feeders, and two for the buscoupler. The junction boxes are to be mounted against the white phase CT steelwork of each of the circuits.

VT Junction Boxes

Two busbar VT junction boxes and two power VT junction boxes are required. The junction boxes are to be mounted against the white phase VT steelwork of each of the circuits.

Power VT Junction Boxes

Two blank junction boxes are required for AC selection. The junction boxes are to be mounted against the white phase Power VT steelwork of each of the circuits.

Customer Interface Junction Box

The customer interface boxes will be installed in the boundary fence between the two substations.

Isolator Junction Boxes

Six isolator junction boxes with double busbar inserts are required, one for each 66 kV feeder and one for the buscoupler bay. Isolator junction boxes should be mounted in a suitable place against the steelwork in the bay.

10.1.3 Metering

Two metering panels will be installed at Ystervark substation to accommodate the Statistical and Tariff metering schemes. The following equipment will be required:

- 4 x 3MM01C metering modules with space for two meters, complete
- 2 x Landis & Gyr ZMD 1&5A Cl 0.5 meters
- 6 x Landis & Gyr ZMD 1&5A Cl 0.2 meters

Remote connection to the metering scheme will be achieved by way of TRUCOM SMARTOO GSM metering modem (D-DT 9503 Set 6) comprising the following per metering panel:

- TRUCOM SMARTOO Modem, 85V – 265V Power Supply
- 1 x GSM Cellular Patch Antenna
- 1 x 5m Coax cable

The above-mentioned metering schemes will conform to 240-56364444: Standard minimum requirements for the metering of electrical energy and demand. This philosophy also describes the application of metering equipment at locations used for purposes other than revenue collection.

Quality of Supply

Quality of supply will be installed on the Main Intake feeders by making use of a summation CT for the three feeders and using the summated value to feed to the Quality of Supply meter.

10.1.4 AC/DC Supplies

A combined AC/DC panel will be installed in the relay room to supply all AC and DC requirements. The AC/DC panel shall be in accordance with D-DT-11216 Set 19.

AC Supply

The AC distribution circuits will consist of the following modules:

- 1 x 3 Φ 400V AC module (D-DT-11216 Set 19 Sheet 6 & 7)
- 2 x 1Φ 230V AC module (14 circuits – 20A, 1 Pole MCB's) (D-DT-11217 Set 21 Sheet 8 & 9)
- AC Supply module (D-DT-11217 Set 21 Sheet 10 & 11)

The AC modules will be mounted in the AC/DC panel as shown in the drawings. An AC distribution board for the light supplies will be mounted onto the wall of the relay room as shown in the drawings.

DC Supply

A DC supply will be installed in the relay room to provide supply to all the protection, control, telecommunications and data retrieval equipment. The DC supply has been designed in accordance with 240-91190310, Sizing of batteries for substation applications.

The supply cable from the AC/DC panel to the battery charger cabinet will be PVC insulated, steel wire armored, stranded copper conductor, 4 core, 4 mm², whilst the DC supply cables between the battery cabinet and the battery charger and the battery charger and the AC/DC panel will be PVC insulated, steel wire armored, stranded copper conductor, 2 core, 16 mm² (D-DT-3128 Sheet 2 & 4).

The DC section of the AC/DC panel will comprise of the following modules in accordance with D-DT-11216:

110V 20 A Cordex Sub-Rack Battery Charger (D-DT-9243 Sheet 2), with 2 x Temperature Sensors, 2 x 10A Rectifier Modules, 1 x Sub-Rack and back plate and 1 x Controller

2 x DC Supply Module, 1 x 110V DC 60A Isolator and 10 x 110V DC 32A 2 Pole MCB's (D-DT-9203 Sheet 2)

DC Interface Module (D-DT-9203 Sheet 3) to interface between the battery charger, battery, load and standby DC Supply. The module will comprise of

- 2 x 110V DC 63A Isolators
- 1 x 110V DC 63A Battery Supply MCB
- 1 x 110V DC 63A Standby DC Supply Plug Socket

The DC modules will be mounted in the AC/DC panel as shown in the drawings. A DC distribution board will be mounted onto the wall of the relay room as shown for emergency lighting.

110V Batteries

A 110V NiCad battery bank will be installed in the battery room against the back wall as shown in the drawings. It will include 85 x Alcad Vantex VTX1 (M) 100 1.2V cells with a battery capacity of 100Ahr and will be supplied complete in a battery cabinet.

The battery calculation caters for an additional 2 x 132 kV feeders, to allow for a 12 hour standby in the event of an AC failure within the station.

Battery storage must be strictly according to the requirements of 240-87495495, and battery handling and transporting must be in accordance with 240-89797258.

Yard AC Distribution Boards

Two Yard AC distribution boards with dual selection will be installed in the yard. Two selection modules are required – one for selection between busbar 1 and 2 and the second for supply from Transnet. One to be installed in a junction box at one of the Power VT JB's.

10.1.5 Emergency Lighting within the Substation Building

Care should be taken that the LED lights procured for the Emergency lighting luminaires are suitable to be powered off 110 VDC directly.

Eskom	DC Systems Design document				
	NE&D CP Western Cape OU				
Asset name:	Ystervark S/S				
Project title:	Ystervark 66 - 132 kV Substation				Rev 0
Project No.	153272156-00003	Date:	20-Nov-19	Pages	5
Project engineer:	0		Tel:	0	
Compiled by: Christine van Schalkwyk, Senior Project Engineer DC & Auxiliary, 021 980 3130	Checked by: Christine van Schalkwyk, Senior Project Engineer DC & Auxiliary, 021 980 3130		Authorised by: Erlind Segers, NE&D Head of Projects, 021 980 3538		

INDEX Page

1. Introduction

Install:
2 x 4FZD3920
3 x 4RF1101 with mimic
1 x 4BZ5700
1 x 4BC1800
2 x ION QOS meter
1 x Substation Automation
1 x D20 RTU
6 x DC lights
1 x ADM (50V)
1 x Fox MSAP (50V)
Future:
2 x 4TC5100
2 x 4TM7101
2 x 4FZD3920

2. Scope of work

Install in the AC/DC Panel 1:
1 x 110V 20A Cordex HF, switchmode sub-rack battery charger,
2 x DC Distribution Module,
1 x DC Interface Module,
1 x 3 phase AC distribution Module,
2 x 1 phase AC Distribution Module and
1 x AC supply Module
Also install:
1 x duel Yard box in the yard between the NECRTs and
1 x converter: 110D04810/C001 - DC to DC in the Comms panel.
1 x 110V & 50V DC supply module in the Comms panel.
Also install an:
110V Alcad Vantex 85 x VTX1 (M) 100 in a battery cabinet
Future loads will push the battery size to Lead Acid - FCP 160. AC/DC panel should be able to cater for the future loads
AC/DC Panel 1: (Loads)
2 x 4FZD3920 (DC & AC)
3 x 4RF1101 with mimic (DC & AC)
1 x 4BZ5700 (DC & AC)
1 x 4BC1800 (DC & AC)
2 x ION QOS meter (DC)
1 x Metering Panel (AC)
1 x Substation Automation / Telcomms Panel (DC)
1 x D20 RTU (DC)
3 x 110V Battery Charger (AC)
1 x DC DB (DC)
1 x AC DC (3 phase AC)
Future:
2 x 4TC5100 (DC & AC)
2 x 4TM7101 (DC & AC)
2 x 4FZD3920 (DC & AC)

3. Control room layout

Refer to the Final Design Package (FDP) for the control room lay-out.

4. Installation Notes

4.1 Chargers installation

CPM DC section will be responsible for the commissioning of the new charger system in accordance with the relevant Eskom Distribution national standards and procedures.

4.2 NiCad battery installation

The CPM DC section will be responsible for thecommissioning of the NiCad battery bank in accordance with the relevant Eskom Distribution national standards and procedures. All storage records of the batteries must be provided before commissioning. Batteries to be stored no more that 12 months before either commissioning or receiving a refresher charge in accordance with 240-137465740: Standby Battery Storage and Commissioning In Eskom.

4.3 Auxiliary supplies at switching stations.

Figure 1 depicts the options for use of Power VTs in Eskom Substations. There will be 3 power VTs per line, one on each phase. The design allows for a possible 2 sets of Eskom power VTs and a possible 2 Auxiliary supplies from the IPP(s)/Customer(s). Careful design of the AC loading in shall be done to ensure optimal use of available supplies.

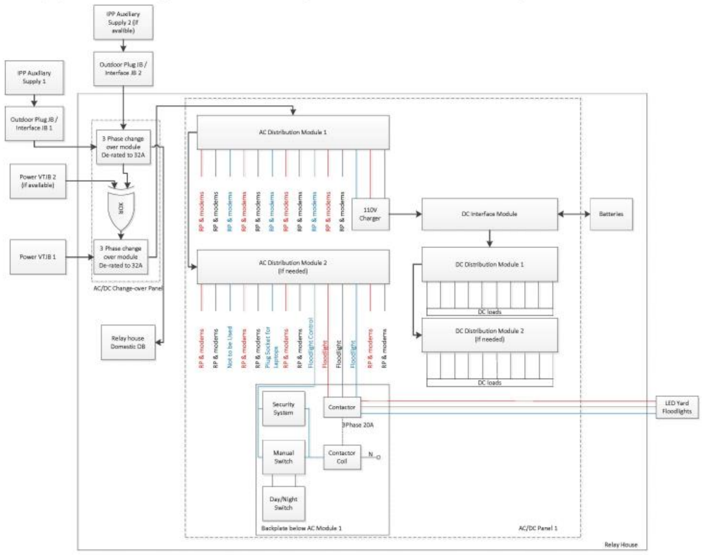


Figure 1: Power VT auxiliary supply to DC standby power system

5. DC Standby Philosophy

5.1 Substation standby times.

The battery and charger system must be rated to carry the full protection, telecommunications and tele-control load for twelve (12) hours for sites with remote supervisory.

5.2 Substation charger sizing:

The charger system must be rated to recharge the batteries to 80% capacity within 10 hours at the 10-hour rate.

6. COST

The costs of material are to be determent (TBD) from the SAP system.

Eskom	DC Systems Bill of Material				
	NE&D CP Western Cape OU				
Asset name:	Ystervark S/S				
Project title:	Ystervark 66 - 132 kV Substation				**Rev 0**
Project No.	153272156-00003	**Date:**	20-Nov-19	**Pages**	2
Project engineer:	0		**Tel:**	0	

7.1 ENC stock items

Com10, a division of ACTOM (Pty) Ltd

Liza Matejovsky
Tel: +27 11 397 5316; Fax: +27 11 397 6094; Cell: +27 78 893 7663; Email: Liza.Matejovsky@static.co.za

EQUIPMENT: SWITCHMODE BATTERY CHARGERS

SAP No.: 4600062264

Single Sub-rack Battery Chargers

Description	Line Nr	SAP Nr	Unit Price	Quantity	Price
CHARGER,BATTERY:1V11020/SR001;110 V	1100	0640913	TBD	1	TBD

Alkaline Batteries, a division of ACTOM (Pty) Ltd

5 Midley Road; Hughes Ext 10; Boksburg; 1459
Tel No's: (011) 397-5326/9; Fax: (011) 397-4806

EQUIPMENT: VENTED NICKEL CADMIUM CELLS AND BATTERY CABINETS

DNC SAP No.: 4600060895

1. Wet-charged cells

SEMI-SEALED, POCKET PLATE, MEDIUM PERFORMANCE CELLS

Description	Item	SAP Nr	Unit Price	Quantity	Price
CELL, NICD 1.2V 100AH VTX1 M100 D9308	230	0256102	TBD	85	TBD

Notes:
1) Individual cells include inter cell connectors, bolts, nuts, washers, spring washers, corrosion protection lubricant and electrolyte.
2) Cell numbers are included in the cell price.

2. Battery Cabinets

BATTERY CABINETS

Description	Item	SAP Nr	Unit Price	Quantity	Price
CAB-S-85VTX1M100C-G29 85-88 X SINGLE CELLS VTX1 M100C L=1200 X D=650 X H=2000MM	1450	631229	TBD	1	TBD

Annex B - Transport and off-loading

Prices in South African Currency (Excluding VAT)Transport to site or regional store and off-loadingTotal Mass [kg]

Total mass [Kg]	Distance one way trip [Km]	Item Nr	Unit Price	Quantity	Price
0 - 3000	1401 - 1500 Km	270	TBD	1	TBD

ANNEX G – Accessories

Accessories

Description	Item Nr	SAP Nr	Quantity	Price
BOOK,MAINT LOG NICAD BATT 90CELL D9215	120	209845	1	TBD

Com10, a division of ACTOM (Pty) Ltd

Liza Matejovsky
Tel: +27 11 397 5316; Fax: +27 11 397 6094; Cell: +27 78 893 7663; Email: Liza.Matejovsky@static.co.za

EQUIPMENT: AC-DC and DC-DC Converters

SAP No.: 4600062265

Conferter - DC-DC

Description	Item Nr	SAP Nr	Unit Price	Quantity	Price
Converter: 110D04810/C001; DC to DC	200	0636737	TBD	1	TBD

See LAP List for suppliers

AC/DC MODULES

Description	Item	SAP Nr	Unit Price	Quantity	Price
Dual control yard AC distribution board (with distribution and termination modules)	2	185222	TBD	1	TBD
3 Phase AC module	6	175664	TBD	1	TBD
1 Phase AC module	7	216215	TBD	2	TBD
DC supply module	8	216216	TBD	2	TBD
AC supply module	9	175669	TBD	1	TBD
DC interface module	10	185229	TBD	1	TBD
110V & 50V DC supply module	0	Buyout	TBD	1	TBD

Buyout - RFQ to Electromichanica

Timers, Relays and Surge Protection

Description	Item	SAP Nr	Unit Price	Quantity	Price
Phoenix Surge Arrestors - phase + N (VAL-MS 230/1+1 FM)		Buyout	TBD	1	TBD

10.1.6 Substation Automation

Substation automation equipment will be installed within the substation to facilitate Remote Access and Data Retrieval. The site shall be a Hub and the communication medium utilised shall be ADM. The Data Concentrator and all other Substation Automation equipment are installed within the substation relay room where Substation Automation is to be implemented.

- The Substation Automation equipment shall be housed in the Telecomms and Substation Automation Panel (standard 19” glass door cabinet) which will be the concentration point for all data communications.
- The Telecomms and Substation Automation Panel and all Substation Automation equipment within shall be supplied with power from a 110V DC distribution board (consisting of double pole MCB’s) in the cabinet. The distribution board itself will be supplied with power via a dedicated 110V DC line from the AC/DC panel.
- The Data Concentrator will be used to interface with all legacy equipment which communicates through RS232 or RS485 standards.
- A 5U blanking plate shall be installed as a back plate of the cabinet and will have installed on it a DIN rail and trunking for equipment and associated MCB’s and terminals. A RS900 Switch used for Ethernet Communication will also be mounted to this 5U blanking plate.

Bus Zone Protection

All GE F35 relays have a rear EIA485 port to which the Substation Automation scheme connects. The GE F35 exposes these connections on ports D1a, D2a and D3a respectively. Both CAT5E FTP Solid Core cable(s) shall be pulled between the Bus Zone scheme and the substation automation panel. Refer to SA drawing set “Cable Block - DWC-167-03”

- A CAT5E FTP Solid Core cable shall be terminated with a RJ45 plug only on the serial concentrating side and terminated directly on the backplate terminal to which the communication link has been wired.
- 1x Male RJ45 to DB9 convertor shall be purchased, to connect the serial concentrating device.
- To accommodate this device, the Data Concentrator shall be ordered with the Modbus communication protocol option.

HV Feeder(s)

Remote Access and Data Retrieval to these protection schemes is achieved through the interfaces listed on the far right of the table below.

Protection	Scheme(s)	Supplier	Relay(s)	Protocol(s)	Interface(s)
Differential/ distance protection scheme	4FZD- 3920,3940	ABB	RED670	IEC 61850	100Base-Fx (ST)
			REF615	IEC 61850	100Base-Tx (RJ45)

The interfaces listed in the table above shall be used to interface the HV feeder scheme(s) to the SAS. For the successful integration of HV Feeder schemes, the requirements itemized in this section shall apply:

- All the 4FZD-3920, 3940 schemes shall be installed with the optional Rear Mounted RuggedCom RS900-Hi 8 Port Switch (6 Galvanic/3 Fibre Ports), to link the feeder to the substation automation network.
- The switches shall be wired into the protection schemes as per the protection drawing. I.e. The RED 670 protection relays shall be connected to the Ethernet switch connected within the panel using multimode fibre with ST connectors and the REF 615 protection relay shall be connected to the Ethernet switch using a standard RJ45 Ethernet cable.
- Two Ethernet RJ45 links shall be connected between front panel and switch for ease of connection to the substation network – this requirements shall be applied for each feeder individually.
- The feeder IP addresses and related settings shall be supplied by the Substation Automation Control Plant design engineer(s) to the settings department to be issued with the standard settings.
- The IEC 61850 option shall be enabled and the regional IEC 61850 datasets loaded to allow integration to the SAS.
- The Switch within the panel shall be linked to the substation automation network as detailed in the substation automation drawing “SA Cable Block - DWC-167-03_00”.
- The Data Concentrator shall be ordered with the IEC 61850 MMS Client communication protocol option.

Customer Feeders

The Medium Voltage protection schemes catalogued in the table below are used within Eskom distribution. Remote Access and Data Retrieval to these protection schemes is achieved through the interfaces listed on the right of the table below.

Protection	Scheme(s)	Supplier	Relay(s)	Protocol(s)	Interface(s)
IPP Feeder	4RF-1101	Alstom	MiCOM P145	Courier	Serial comms RS232/RS485

The interfaces listed in the table above shall be used to interface the MV feeder schemes to the SAS. For successful integration of the MV Feeder scheme(s), the requirements itemized in this section shall be carefully followed and applied per feeder scheme.

For all MiCOM P145 relays used for MV feeder protection, the following shall apply:

- All MiCOM P145 relays shall be purchased with the second rear RS-485 communication port (SK4) supporting Courier protocol for remote engineering access.
- Applying the Substation Automation mods in the form of Microstation cells will expose this port on X3.Kr1 as a standard RJ45 socket. In all instances these cells will be used to modify the scheme.
- A CAT5E FTP Solid Core cable shall be pulled between each of these protection panels and the Telecomms and Substation Automation Panel. Refer to SA drawing set “Cable Block - DWC-167-03”.
- All the CAT5E FTP Solid Core cable shall be terminated with a RJ45 plug on both ends as per the EIA-T568A standard.
- 1x RJ45 to Male DB9 convertor shall be purchased per feeder, to connect the device to the serial concentrating device. Note that the relay end of this cable will connect directly with the RJ45 plug into the X3.Kr1 socket.
- To accommodate this device, the Data Concentrator shall be ordered with the Courier communication protocol option.

Telecontrol D20 RTU

The GE D20 Remote Terminal Unit (RTU) is the approved product used by the Eskom Distribution Business to communicate operational data to the SCADA Master. To facilitate remote access and data retrieval from the D20 RTU, the requirements itemized below shall be applied:

- Communication to the GE D20 shall be accomplished with two physical connections; one to the rear Wesmaint serial port (Note its non-standard EIA232 pinout) for remote access and either a copper Ethernet connection or serial connection to an open rear SIO port for data communication. In the latter regard the preference shall be towards an Ethernet connection.
- Two CAT5E FTP Solid Core cables shall be installed from the RTU cabinet to the Telecomms and Substation Automation Panel and terminate both ends with an RJ45 plug as per the EIA-T568A standard.
- The connection for the Wesmaint port shall require 2x RJ45 to Male DB9 convertors, and if installed the connection to the SIO port will require an additional 1x RJ45 to Male DB9 convertor and 1x RJ45 to Female DB9 convertor.
- A second DNP3 slave instance shall be setup on the D20 RTU on either the Ethernet or SIO port, whichever is catered for.
- To support this device, the Data Concentrator shall support the DNP3 over serial (and encapsulated over IP) protocol to slave devices.

Quality of Supply Meter

The ION8800 is the approved quality of supply meter used by the Eskom Distribution. The ION8800 is to be fitted with a standard RJ45 Ethernet port that is used for remote access and data retrieval. To facilitate remote access and data retrieval from the ION8800 quality of supply meter, the requirements itemized below shall be applied:

- The ION8800 quality of supply meter shall be purchased with the following:
    - Ethernet networking model option(s)
    - IEC 61850 MMS server
- A CAT5 cables shall be pulled between the Quality of Supply meter and the Substation Automation panel. Refer to SA drawing set “Cable Block - DWC-167-03”
- To support this device, the Data Concentrator shall support the IEC61850 MMS client protocol

DC Cordex Charger

The Cordex CXC charger is the approved product used by the Eskom Distribution Business. The Cordex CXC charger is fitted with a standard RJ45 Ethernet socket that is used for Remote Access and Data Retrieval.

- One CAT5 cables shall be installed between the DC cabinet and the Telecomms and Substation Automation Panel. Refer to SA drawing set “Cable Block - DWC-167-03”.
- The CAT5E FTP Solid Core cable shall be terminated with an RJ45 plug on both ends as per the EIA-T568A standard.
- To support this device, the Data Concentrator shall support the Modbus/TCP protocol.

Commissioning

The *“Substation Automation Installation Checklist document”* shall be submitted to the Substation automation group on completion of substation installation indicating all the work done and the tests performed.

10.1.7 Telecontrol

A GE D20 RTU with RS485 communication will be installed in the substation. It will cater for all the substation I/O requirements.

All protection schemes will communicate with the RTU serially via DNP3.

An IDF frame will be installed next to the RTU cabinet to allow for PNH hardwired indication and equipment/plant statuses.

The communications diagram is shown below:

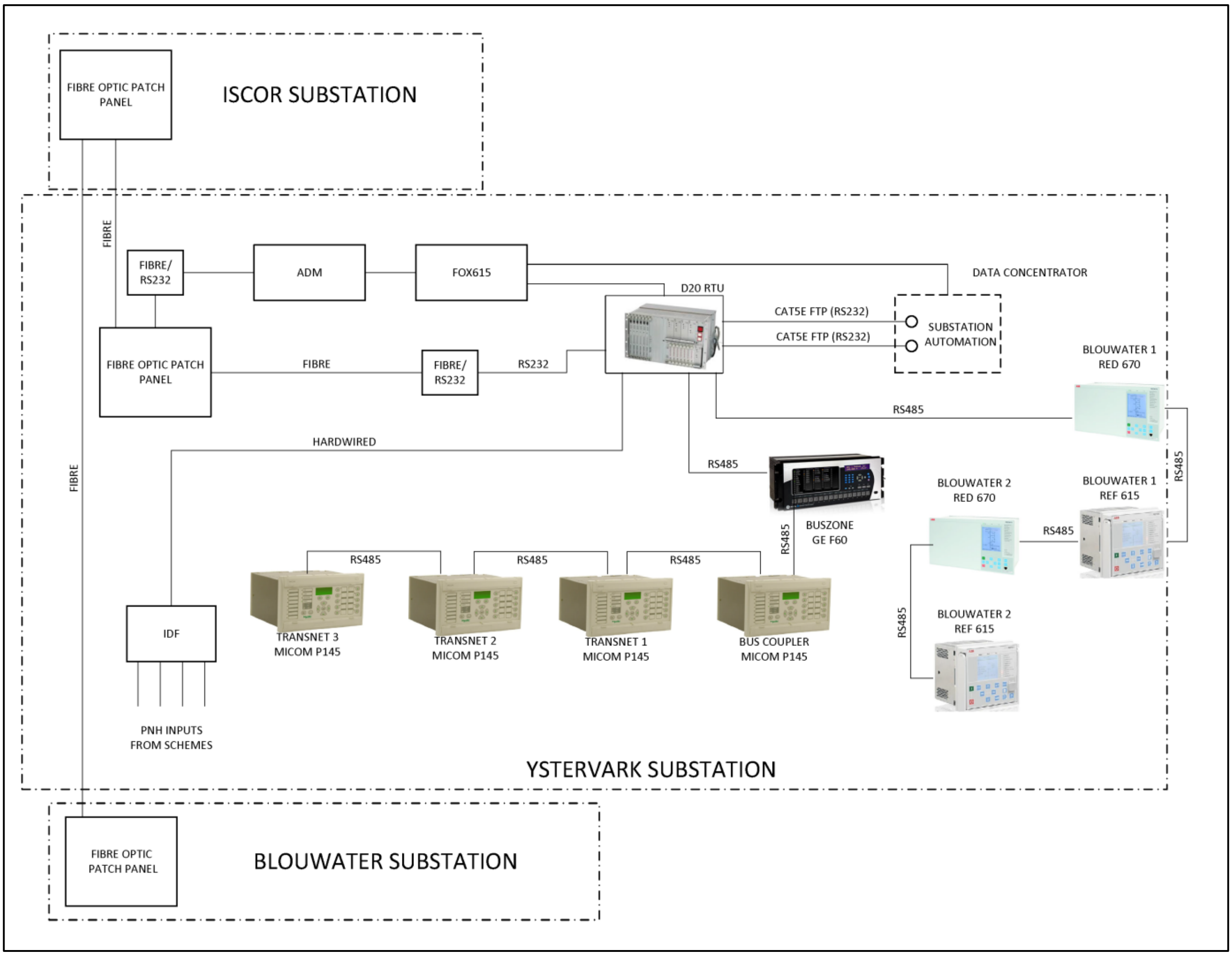


Figure 111: SCADA Communication Layout

10.1.8 Telecommunication

There is a 48-core OPGW installed on the Blouwater – Iscor 1 66kV line. An additional 48-core duct fibre will be installed between Ystervark and Iscor on the Blouwater – Iscor 2 66 kV line.

A fibre optic panel will be installed next to the telecommunications and substation automation panel. The telecommunications panel will include all equipment required for communication back to Control.

The following circuits will be required for communication from Ystervark between Blouwater, Iscor and the Control Centre:

- 2 x fibre differential teleprotection circuits between Blouwater and Ystervark substations
- 2 x fibre differential teleprotection circuits between Ystervark and Iscor substations
- 1 x Engineering Access (Substation Automation) circuit
- 1 x Telecontrol circuit for SCADA

The two existing fibre differential teleprotection circuits between Blouwater and Iscor are to remain in service, as it forms part of the three-terminal differential protection communication between Blouwater, Iscor and Ystervark.

The telecommunication equipment will be installed in the Telecommunications cabinet. The Eskom Telecommunication final design is included below. The contractor should take note of the requirements for duct fibre between the panels as well as the BoQ for the required equipment to be installed at Ystervark. It should be noted that the layout as reflected on page 24 of 26 of the Telecommunications design document on the following pages does not take this into account. The final combined layout is depicted in drawing set D-WC-8118-167.

Eskom	INPUT TO INTEGRATED TELECOMMUNICATION DESIGN	ETFM 1846

Sub Division **Eskom Telecommunications** PROJECT NUMBER: PRJ09838

Title: **PROJECT PLANNING BOOK FOR**
PROJECT NAME: Ystervark SS Comms
Site Name: Ystervark SS

Compiled By.	Functional Resp.	Authorized By.
AA Hector	MJ Jattiem	MJ Jattiem
Project Planning Engineer	**Functional Responsible Manager**	**TRC Chairperson**

Tel: (021) 980 3064
Email: Hectora@eskom.co.za

Table of Contents

Planning for: Ystervark SS Comms Unique Identifier: **ETFM 1846**
Revision: **1**
Page **3** of **26**

TRC Checklist

Eskom	Telecommunication Technical Review Committee Checklist	Template Identifier	240-65692689
		Document Identifier	xxx-xxx
		Document Revision	x.x
		Effective Date	01-Nov-15
		Eskom Telecommunications	
Project Number	Project Name	Project Revision	Date
PRJ09838	Ystervark SS Comms	0	2019/07/15
1	**Financial**		☑☒ NA
1.1	Capex Form (ETFM 0701 or ETFM 0716 or ETFM 1723)		√
1.2	Firm Quotation (ETFM 0715)		√
1.3	ETGP0635 - Revenue Calculation Sheet or Protected Income		√
1.4	ETFM1874 - Health and Safety Costing (to be used with ETFM 1723 only)		n/a
2	**Detailed Design**		
2.1	ETFM1846 - Project Planning Book		√
3	**Safety & Health**		
3.1	240-70044602 - Project Specific Baseline Risk Assessment		√
3.2	240-73419711 - SHE Specification Technical Work		X
3.3	240-101716432 - Signed Health and Safety Requirements Checklist		X
3.4	240-77433139 - Annexure A: Supplier Risk Category (for information)		X
4	**Environmental**		
4.1	TRMFM0068 - Project Screening Form		n/a
4.2	TRMFM0095 - Contractor Pre Assessment Form		n/a
4.3	TST41-120 - Environmental Procurement Requirements		n/a
4.4	Applicable EIA/BA documents (Expansion / existing projects)		n/a
4.5	ETPN1490 - Environmental Principles for EIA		n/a
5	**Quality**		
5.1	240-98255445 - Approved Project Planning Quality Checksheet		√
6	**Procurement**		
6.1	Sole Supplier Motivations (where required)		n/a
6.2	240-77471651 - Annexure C1 SHE Tender Evaluation Scoring Card - Completed (High to Medium Risk)		n/a
6.3	240-77471969 - Annexure C2 SHE Tender Evaluation Scoring Card - Completed (Low Risk)		n/a
7	**Completion**		
7.1	Acceptance Test Procedure		√
7.2	Commissioning Sheets		√
7.3	240-110412152 - Quality Assurance sheet		√
7.4	Completion Certificate (ETFM0715, ETFM0717)		n/a
Region/National	Registered Person	Signature	Date
Western Cape	Ambrose Hector		06 August 2019
TRC National/Regional	Chairperson	Signature	Date
Western Cape	Moeried Jattiem		06 August 2019

Planning for: Ystervark SS Comms Unique Identifier: **ETFM 1846**
Revision: **1**
Page **4** of **26**

SECTION 1: INTRODUCTION

1.1– Customer Request

Eskom Distribution requested Telecommunication services for Ystervark SS. The circuit requests in the URS as below:

Eskom - Telecommunications Division
Service Application Form

Ref	240-120317983
Rev	2

Customer Details

Customer	Eskom Distribution
Company & Division	Eskom Distribution
Customer Representative	Gideon Gqomfa
Customer Telephone	219 803 828
Customer Fascimile	
Customer Email Address	Gqomfag@eskom co za
Customer Business Address	60 Voortrekker Road Bellville 7530

Customer Project Details

Customer Project Name		Telecomms for Ystervark SS					
Customer Project Number							
Customer Reference Number		153272156-00003					
Preliminary Completion Date Request							
Locations							
A	Building, Floor, Room no	Ystervark SS					
	Physical Address						
	Site Co-ordinates	Latitude			32 59' 47 65" S	Longitude	18 0' 11 96" E
B	Building, Floor, Room no	Belville Regional Control					
	Physical Address						
	Site Co-ordinates	Latitude				Longitude	
C	Building, Floor, Room no	Iscor SS					
	Physical Address						
	Site Co-ordinates	Latitude				Longitude	
D	Building, Floor, Room no						
	Physical Address						
	Site Co-ordinates	Latitude				Longitude	
E	Building, Floor, Room no						
	Physical Address						
	Site Co-ordinates	Latitude				Longitude	

Service Requirements

1 Telephone (PAX circuit)

	Quantity
Business Voice	

2. Data circuits

Premium Point to Point

	Description of circuit	Division	Speed	Service Level	Site From	Site to	Interface
1	Ystervark SS SCADA	DX	9 6 kbps	Gold	A	B	RS232
2	Ystervark SS Data Retrieval	DX	2048 kbps	Bronze	A	B	IP
3							
4							
5							
6							
7							
8							

Operational Voice

	Description of circuit	Division	Speed	Service Level	Site From	Site to	Interface
1	Yslervark SS IP Phone	DX		Bronze	A	B	IP
2							
3							
4							

Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **5** of **26**

Miscellaneous Requirements	
1	This project will follow the self-build process for Telecomms equipment
2	This is a revision of previous design (PRJ09838), to cover the new standards, equipment and scope changes
3	Fibre comms will be provided between Ystervark SS and Iscor SS, and between Blouwater SS and Iscor SS (48 core - DUCT - 6,5KM)
4	BOM and Specs required, including cabinet and IP Phone, etc
5	SED, Site Plan, Control Building and FO Designs
6	50Vdc will be in the dedicated ET Cabinet

Information required by Eskom Telecommunications

To provide the customer with a complete and proper solution the following information is required

1 Site Location - A diagram showing the location of the site or suitable point form directions to the site

2 Site Layout - A diagram indicating the layout of the site Diagrams for all areas owned by the customer at the site should be provided The diagram(s) should mark areas where the customer expects to install future equipment

3 Room Layout - A diagram indicating the layout of the equipment room The diagram(s) should mark areas where the customer expects to install future equipment

4 Facilities, including 220V AC & 50V DC - At customer premises, the customer shall provide AC and/or DC as required by Eskom Telecommunications Secure floor and/or wall space may be required, including air-conditioning, anti-static carpet, racking, trunking, etc Customer to advise of current conditions and facilities available for the installation

5 Contact Personnel - The customer should provide the contact details of ALL their personnel which Eskom Telecommunications will require to contact in order to provide a full solution Examples of relevant people Eskom Telecommunications will need to contact are Person responsible for access to site, Person responsible for expansion of site, Possibly Person responsible for current project occurring at the site etc

i Name		Designation		Telephone No
Area of Responsibility				Facsimile No
ii Name		Designation		Telephone No
Area of Responsibility				Facsimile No
iii Name		Designation		Telephone No
Area of Responsibility				Facsimile No
iv Name		Designation		Telephone No
Area of Responsibility				Facsimile No
v Name		Designation		Telephone No
Area of Responsibility				Facsimile No

6 Other - Other information that the customer believes will aid Eskom Telecommunications in offering a proper solution

i
ii
iii
iv
v

Sign-off

Responsible KAM	DX Nolan Dominick, Tel 02[illegible] 980 3486, Email nolan dominick@eksom co za		
Customer Signature		**Application Date**	05/07/2019
Responsible KAM			
Customer Signature		**Application Date**	

1.2 – Introduction

Eskom Distribution requested Telecomms services for Ystervark SS. This substation will link to Blouwater SS via Iscor SS on a new Duct fibre optic cable (≈ 7km).

This project is classified as a SELF-BUILD; the contractor developer will provide a turnkey (completely built to Eskom including the telecommunication requirements / equipment). As per the Procedure for Self-build customer projects (240-61713594), the contractor developer is fully responsible for the integrated design and implementation. This document addresses some critical telecommunication design components to assist the developer. This information should be incorporated with the final integrated telecommunications design. The contractor developer will work in conjunction with ET; DX & TX to adhere to ESKOM required standards and specifications while compiling the integrated telecommunications design. The final integrated telecommunications design will be presented to the relevant Eskom technical review committees for approval.

1.3 – High Level Scope of Works

Note: Please advise Eskom Telecommunication one month ahead to commission ET equipment.

Ystervark 132kV SS:
- Procure, Install and terminate a Duct fibre cable to Iscor SS and provide test results.
- Procure and Install an SPO 1410 ADM and a Fox615 multiplexer to provision the requested cct's.
- Provide and Install a 50VDC supply to ET Comms Cabinet.

Iscor SS:
- Procure, Install and terminate a Duct fibre cable to Blouwater SS and provide test results.

Blouwater SS:
- Commission Ystervark 132kV SS 1410 ADM onto the Eskom Telecommunication Network.

Aurora MTS:
- Commission Ystervark SS Fox615 onto ET Network via the E1's.

ET SCOPE HIGH LEVEL SCOPE:
- Commission requested services for Ystervark SS to Bellville HQ.

1.4 – Stakeholders & Contact details

Responsibility	Name	Cell-phone	Office
Project Engineer	Ambrose Hector	084 574 9231	021 980 3064
Project Manager (DX)	Shantal Gordon	076 126 0785	021 983 4247
Project Manager (ET)	Thabo Majola	079 418 5567	011 871 2484
O&FS Cape Town	Deon Seal	072 391 3510	021 980 3055
NMC Representative	Wicus van Aswegen	083 555 3683	043 703 2615
Distribution TCM	Gideon Gqomfa	072 262 5329	021 980 3828
KAM	Nolan Dominick	083 793 8716	021 980 3486
TRC Chair	Moeried Jattiem	072 418 8085	021 980 3484

1.5 – Site Access (Directions, Co-ordinates)

Find site co-ordinates below: These sites can easily be reached with a 4x2 bakkie

RS / SS	Co-ordinates
Ystervark SS (DX)	32º59'47.65"S, 18º00'11.96"E
Blouwater SS (DX)	32º58'50.00"S, 18º02'34.00"E
Aurora SS (TX)	33º00'23.20"S, 18º13'58.20"E

SECTION 2: FINANCIAL

2.1 – Cost Breakdown

1. The CAPEX prepared only reflects the commissioning during ERA and the project design charges. It excludes the total cost of the equipment and the labour options for installation. These are borne by the developer.

240-139189078 Project and Turnkey Supporting Templates Rev 2 (Page 16)

SECTION 3: DETAIL DESIGN

3.1 – Design Methodology

The design meets the current design standards

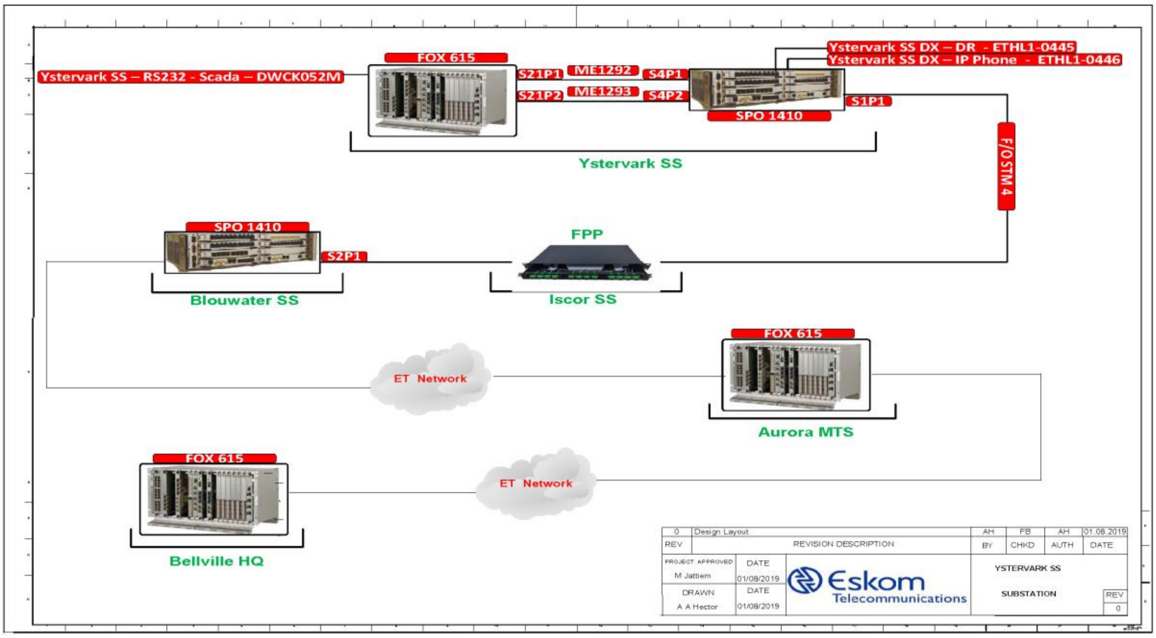
- **Ericsson SPO 1410 ADM Design Guide** - STM4 Capacity **240-59681973.**
- **MSAP Design Guide -** Fox 615 Multiplexer **240-70732272.**

3.1.1 – Fibre Optic Link Budget: Ystervark SS to Blouwater SS (Via Iscor SS).

FIBRE OPTIC BUDGET CALCULATOR - ver7							
Ystervark SS - Blouwater SS					SFP MODULE	RDH 901 20/C0213 - S4.1	
PARAMETER	WAVELENGTH	LOSS/KM	DISTANCE(KM)	LINE LOSS	LINE SPLICE LOSS	CONNECTOR & SPLICE LOSSES (End-to-End)	PATH PENALTY
INDICATOR	**1310**	0.4	7	2.8	0.125	4	0.693
	Duct	2	Total Link Loss		7.618	Additional Loss (Iscor SS)	**0.7**
Min TX (dBm)	Min RX (dBm)	Power Budget (Min)	Max TX (dBm)	Max RX (dBm)	Power Budget (Max)	Power Margin (Min)	Power Margin (Max)
-15	**-28**	13	**-8**	**-8**	0	5.383	7.618
Receiver Input Power (Min)			-22.618	Receiver Input Power (Max)			-16.318
Link Feasible in Network			Yes	Link Feasible in Network			Yes

3.2 – Network Considerations

- Below shows a high level integration diagram to achieve the requested services as per the SLA.
- Duct fibre optic cable will link Ystervark SS (Dx) to Blouwater SS (Dx) via Iscor SS (DX).



3.3 – Circuit Information Sheet

YSTERVARK 132 kV SS COMMS					
SS / RS / IPP	**CCT TYPE**	**DIVISION**	**CCT#**	**NEAR POSITION**	**REMOTE POSITION**
Ystervark SS	Scada - RS232	Bellville HQ	DWCK052M	(FOX 615) - S1P1	S5P1 (to front-end)
Ystervark SS	Ethernet	Bellville HQ	ETHL1-0445	(ADM1410) - S6P1	(S19P23) - Vlan 369
Ystervark SS	Ethernet	Bellville HQ	ETHL1-0446 0219189470	(ADM1410) - S6P10	CUCME

3.4 – DC Loading Analysis

1. The developer is responsible to design and implement DC standby systems at Ystervark SS.
2. The below Eskom Telecomms site loading requirements and DC Standby power |Systems topology standard **240-118870219** should be taken into consideration when planning for the DC power system.

Load Calculation		
Total Current drawn by Equipment (incl Growth factor)	**7.87**	**A**
ampére-hour Load per Day	**188.8**	**Ah**

3.5 – Assets Capitalization (Eskom OPS&F)

- This project will have no assets recovered from the respective sites.
- Update SAP Asset register per site as per the BOM.
- Update Workplace equipment register for each site.

SECTION 4: DETAIL SCOPE OF WORK

4.1 – Role Clarification

YSTERVARK SS - Telecommunication Role Clarification		
Planning & Design		**Comments**
Duct fibre between Ystervark SS and Iscor SS (ODF to ODF)	DX / Developer	Design, incl. SOW & BOQ signed off by Eskom
Duct fibre between Iscor SS and Blouwater SS (ODF to ODF)	DX / Developer	Design, incl. SOW & BOQ signed off by Eskom
Transport equipment	ET	Design, incl. SOW & BOQ
Multiplexor / ADM equipment (as per BOQ)	ET	Design, incl. SOW & BOQ
Integration to existing ET network	ET	Design, incl. SOW & BOQ
Standards documentation	ET	Electronic copies of applicable standards
Implementation		
Network circuit connections	ET	
Commissioning	ET	
QA	ET	
Provide signed-off equipment ATPs	DX / Developer	
As built documentation of the station	DX / Developer	
Procure equipment as per ET BOQs	DX / Developer	
Installation of ET equipment	DX / Developer	
SHEQS	DX / Developer	
Provide, install duct fibre between Ystervark SS and Iscor SS	DX / Developer	
Provide, install duct fibre between Iscor SS and Blouwater SS	DX / Developer	

4.2 – General

- Ensure compliance to all standards, specifications and procedures listed in this document.
- Refer to the equipment supplier documentation for product specific setup, installation & commissioning details.
- Ensure all equipment is pre-commissioned and tested in the workshop prior to installation on site.
- The scope of work details will not necessarily be listed in sequence of implementation.
- On project completion, ensure that all changes in this Project Documentation are **RED** lined and returned to PM.
- The work as detailed in this SOW will be considered completed once the project's Completion Certificate is signed.
- The Quality Assurance person reserves the right to instruct a job to be re-done if he feels that the quality of workmanship is of an unsatisfactory nature or that there was a total disregard of standards.

4.3 – Project Management (DX)

1. Manage the SHEQ requirements for all installations for the affected sites.
2. Witness the testing of the duct fibre optic between Ystervark SS and Iscor SS and handover test results to **Cape Town Telecomms Regional Office (CTTRO)**.
3. Witness the testing of the duct fibre optic between Iscor SS and Blouwater SS and handover test results to **Cape Town Telecomms Regional Office (CTTRO)**.
4. Obtain all signed ATPs of all installations w.r.t the ET equipment (ADMs, MSAPs) for Ystervark SS
5. Arrange a Pre-audit with the CTTRO for the installation of the Telecommunication equipment before the site is QA'd.
6. Perform a QA for the complete installation of this project, with Engineering and OPS&F.
7. Obtain a formal handover from of the affected station to the CTTRO.
8. Sign off the commissioning sheets and completion certificates.
9. Obtain a list of assets (equipment installed) with their serial numbers, for input in SAP asset register, from the contractor; use the ETFM 0859_Asset Identification Form as a guide.

10. Liaise with ET Project Manager for any services that require ET involvement on the respective sites (Procedural and Operational Support).
11. Please advise the CTTRO 1 month ahead to commission ET equipment.

4.4 – Scope of work – Ystervark 132kV SS (Contractor)

Note: *Please advise the DX Project Manager one month ahead to advise ET to commission equipment.*

Indoor Installation

Note: The below scope of works for installation and QA shall be done in accordance with the below documents. Also refer to the drawings under **section 9** and circuit information sheet **section 3.3**

Indoor Installation

- **240-132190480 Telecommunication Equipment Installation Standard.**
- **ETFM 1300 - 1410 ADM installation and Q.A. Specification (Hyperlink)**
- **MSAP ABB** Test Sheets – External Document **(Hyperlink)**
- **240-98255445 Project Planning Quality Checklist rev 3 (Hyperlink)**

1. Install the 43U cabinet as per the following standard:
   240-56362336 - Installation of a Telecoms Equipment Cabinet Standard. The cabinet is to be in position as shown the control room layout in Section 9. Cabinet must be clearly labelled as "ET Comms Cabinet". **"240-62629353-Specification for Panel Labelling Standard"**
2. Install Equipment as indicated on the drawings as in section 9.
3. Install the 24core fibre optic SC/APC patch panel in ET and the fibre cabinet – Refer to control room layout.
4. Install the 24 core duct HDD fibre cable between the two cabinets and do the splicing in the SC/APC fibre optic patch panels - **& 240-70732902 - Fibre Optic Connector**
5. Do the Fibre Optic connection in ET Cabinet using a 2m LC- SC/APC patch lead. **"240-67907017 Fibre Optic Core Allocation Standard"** and **& 240-70732902 - Fibre Optic Connector** to the 1410 ADM S1P1.
6. Terminate the E1 tributaries of the Fox 615 onto the krone of the 24 panel RJ45 patch panel.
7. Patch through the E1 tributaries between 24 panel RJ45 patch panel and ADM 1410 RJ45 patch panel for Transmission and DCN traffic as below:

LinkNumber	Description	DCN/Traffic/Mxed	LinkType	Site A	ADM Port	Fox Port	Site B	ADM Port	Fox Port
ME1292	E1 link to Aurora MTS	DCN	MSAP - E1 connection	Ystervark 132kV SS	S4P1	S21P1	Aurora MTS	S4P30	S20P5
ME1293	E1 link to Aurora MTS	Traffic	MSAP - E1 connection	Ystervark 132kV SS	S4P2	S21P2	Aurora MTS	S4P31	S21P6

8. Do the Pax line reticulation to the control room desk. Use cat5 cable and connect to S6P10 on the ADM1410. (CTTRO **staff to configure IP Phone**)

General

1. Please courier the below line items as per the BOQ for Bellville HQ to be installed to the below Eskom Office.

Site Name	Bellville HQ
Contact Person	Deon Seale - 021 980 3055
Adress	Eskom Telecommunications, 1 Bell Rosa, Belvedere Park, Tygervalley, 7530
Item	**Line item 7** - ABB-MSAP-UNIDA (Universal Data Interface - 4 Ports) (Universal Data Interface - 4 Ports) (RS232 Interface Panels)

4.5 – Scope of work – Iscor SS (Contractor)

Indoor Installation

In the fibre optic cabinet use a 1m SC/APC-SC/APC patch lead and connect patch panel labelled " Ystervark SS" and Blouwater SS patch panel **"240-67907017 Fibre Optic Core Allocation Standard" & 240-70732902 - Fibre Optic Connector**.

4.6 – Scope of work – Blouwater SS (Contractor)

Note: The below scope of works for installation should be done in accordance with the below documents. Also refer to the drawings under **section 9** and circuit information **sheet section 3.3** – Fibre to be terminated in the fibre optic cabinet.

- **240-132190480 Telecommunication Equipment Installation Standard.**
- **ETFM 1300 - 1410 ADM installation and Q.A. Specification (Hyperlink)**

Indoor Installation

1. Insert STM4 S4.1 SFP in position S2P1 in the SPO 1410 ADM.
2. Install the 24core fibre optic SC/APC patch panel in BME ET and the fibre cabinet in the Relay room
3. Install the 24 core duct HDD fibre cable between the two cabinets and do the splicing in the SC/APC fibre optic patch panels
4. Do the Fibre Optic connection in ET Cabinet using a 2m LC- SC/APC patch lead. **"240-67907017 Fibre Optic Core Allocation Standard"** and **& 240-70732902 - Fibre Optic Connector** to the 1410 ADM S2P1

4.7 – Scope of work – Aurora SS (Contractor)

Indoor Installation

Patch through the E1 tributaries between the Fox 615 mux and ADM 1664 for Transmission and DCN traffic as below

LinkNumber	Description	DCN/Traffic/Mixed	LinkType	Site A	ADM Port	Fox Port	Site B	ADM Port	Fox Port
ME1292	E1 link to Aurora MTS	DCN	MSAP - E1 connection	Ystervark 132kV SS	S4P1	S21P1	Aurora MTS	S4P30	S20P5
ME1293	E1 link to Aurora MTS	Traffic	MSAP - E1 connection	Ystervark 132kV SS	S4P2	S21P2	Aurora MTS	S4P31	S21P6

4.8 – Fibre Optics (Contractor)

1. Design, procure and install a fibre optic cable between Ystervark SS – Iscor SS (patch panel to patch panel). The testing of fibre and recording the test results based on Technology Document **240-70732888 - Fibre Optic cable system ATP**.
2. Design, procure and install a fibre optic cable between Iscor SS and Blouwater SS (patch panel to patch panel). The testing of fibre and recording the test results based on Technology Document **240-70732888 - Fibre Optic cable system ATP**.

4.9 – Scope of work – (OPS&F - CTTRO)

1. Avail a resource to witness testing of the duct fibre between Ystervark SS and Iscor SS.
2. Avail a resource to witness testing of the duct fibre between Iscor SS and Blouwater SS.
3. Receive a formal handover of the site from the contractor (Dx PM to co-ordinate the site handover).
4. Pre-audit the installation of the Telecommunication equipment before the site is QA'd.
5. Do a QA for the complete installation of this project of sites affected with Engineering and PM. - use **240-110412152 - QA Checklist**
6. Commission/circuit connections of the SPO 1410 ADM / Fox615 onto the ET Network with NMC as per table 3.3.
7. Connect the requested circuits as per the workplace tasks and run tests with NMC.
8. Sign off the commissioning sheets and completion certificates.
9. Update Workplace with Site Data.

4.8 – Project Management (Eskom Telecomms)

1. Project Manage ET SOW on the respective sites.
2. Provide a task in workplace for NMC to have the SPO 1410 ADM and FOX615 commissioned onto the network.
3. Provide a task in workplace to NMC to have all tributaries and circuits connected and configured (Fox 615 & ADM) as per Circuit Information Sheet (3.3).
4. Liaise with the below ET staff for commissioning of services requested as per Circuit Information Sheet (3.3).

   - Victor Matlala (8181 3640) to assist with commissioning of the National cct's.
   - Gerald Willemse (013 693 3126) to assist with commissioning of the Stabnac cct's.

4.9 – Civils

1. No civil work for ESKOM Telecommunications.

4.10 – Tower Specification (Contractor)

1. No tower work for Eskom Telecommunications.

4.11 – Geotechnical Analysis and Foundation (Contractor)

2. No Geotechnical Analysis or foundation work for Eskom Telecommunications.

4.12 – Technical Conformance

1. The following ET documents are the minimum applicable to this project. They can be accessed via Hyper wave ET Documentation Management Centre on Eskom's Intranet.

240-70732272	MSAP Design Guide
240-62629353	Specification for panel labelling standard
240-607 25641	Specification for standard 19 inch equipment cabinets
240-110412152	Generic QA tick sheet for projects
240-56362336	Installation of a Telecoms Equipment Cabinet Standard
240-132190480	Telecommunication Equipment Installation Standard
240-59681973	Ericsson SPO 1410 ADM Design Guide

ETFM1300	Ericsson SPO 1410 ADM Installation and QA Specification
240-70732888	Fibre Optic Cable System Acceptance Testing
240-67907017	Fibre Optic Core Allocation Standard
240-118870219	DC Standby power |Systems topology standard
240-70732902	Fibre Optic Connector
240-98255445	Project Planning Quality Checklist
	ABB test sheets
	Ericsson ATP
	Ericsson SPO1410 ADM (installation guide)

4.13 – Structural Analysis (Contractor)

1. No tower work for Eskom Telecommunications.

4.14 – NMC

1. Commission SPO 1410 ADM onto the ET Network
2. Commission Fox615 Multiplexer to the ET Network
3. Assist OPS&F team to create the E1 links and the building of cct's for the commission of requested services.
4. Connect the requested circuits as per the workplace task.
5. Confirm that requested circuits are working.

4.15 – KAM

1. Sign off the completion certificates.

SECTION 5: SHEQ

1. All work done by the ccontractor developer. SHEQ will be the responsibility of the ccontractor and will be managed by Distribution PM. This will be for the work done in Ystervark SS and Komsberg MTS.

5.1 Safety Requirements

5.1.1 – Hira

1. Completed Hira Template to be found on Hyperlink below.

 240-70044602 Ystervark SS Comms HIRA Rev 0

5.2 Environmental Compliance

1. To be done by the Ccontractor / DX

5.3 Quality Requirements

1. All the Activities must be conducted according to the Procedures, Standards, Design Guides as listed on **240-98255445**
2. All Installation, Commissioning and Acceptance Tests and Inspections must be recorded on the relevant records as listed on **240-98255445.**

Planning for: Ystervark SS Comms Unique Identifier: **ETFM 1846**
Revision: **1**
Page **16** of **26**

SECTION 6: PROCUREMENT

- BOQ for Telecommunication equipment
- The following BOQ descriptions originate from the relevant Eskom internal contract SAP line numbers. It is recommended that the contractor developer obtain quotations from the relevant suppliers and confirm with ET that the quotations do match all the required items normally bundled per SAP line number.

BILL OF QUANTITIES (BOQ)

Name	Ystervark SS Comms	Number	PRJ09838
Equipment Delivery Address	IPP OFFICE (SELF BUILT)	Number of Sites	5

Item No.	Bill of Materials (Standard Designs, Contract Items)	SAP Line Number	Material Number	Asset Class	Unit	Unit Price	Ystervark SS	Iscor SS	Blouwater SS	Aurora SS	Bellville HQ						Total Qty	Total Price
	Description (enter contract number first, then enter descriptions)																	
1	**4600054543 - MPLS: FOX 615**																	
2																		
3	SOFTWARE:ABB-MSAP-LIC;FOX **(MANAGEMENT LICENSE FEE PER NODE)**	140	253454	3	ea		1										1	
4	SHELF ASSY,ELCTR:ABBMSAP-6U;FOX;FFT **(LARGE SIZE RACK - 6U)**	180	253458	3	ea		1										1	
5	ABB-MSAP-E18 **(E1 INTERFACE - 8 PORTS)**	230	253469	3	ea		1										1	
6	ABB-MSAP-FXS (FXS & AUTO RING DOWN INTERFACE - 16)	250	253471	3	ea													
7	ABB-MSAP-UNIDA **(UNIVERSAL DATA INTERFACE - 4 PORTS)(UNIVERSAL DATA INTERFACE - 4 PORTS)(RS232 INTERFACE PANELS)**	210	253463	3	ea		1				1						2	
8	BB-MSAP-CPU (CPU;PROCESSOR)	480	569429	3	ea		1											
10																		
11	**4600056255 - ERICSSON SOUTH AFRICA (PTY)**																	
12																		
13	Product Number: CP-23740989 Product Name: SPO 1410 A-DPP (included 4 x STMn SC module, 8 x STMn module, 10 x GE mapper module, 63 x E1 module)	2410	554014	1	ea		1										1	
14	Product Number: RDH901 20/C0213 Product Name: SFP S4.1	580	249785	1	ea		1		1								2	
16	Product Number: RDH901 20/49800 Product Name: SFP GP TX	1160	249791	1	ea		5										5	
17	LICENSE:ERIC,LICENSE ADM,CONNECTION	3070	242318	1	ea		1										1	
18																		
18																		
19	**SOS (Pty) Ltd**																	
20																		
21	DC Distribution Panel Model ESK031/2/6, 2 x 10A Breakers, 10 x 6A Breakers, OP Terminals 2.5mm, Input Terminals 6mm	No Line Number	No Material Numbe	5	ea		1										1	
22																		
23	**4600057053 - PROTECTION AND CONTROL**																	
24																		
25	CABINET:0.53-30077;INTERNAL SWING FRAME (800mm*600mm) **43U (240-607 25641– Specification for standard 19 inch equipment cabinets.)**			19	ea		1										1	
27																		
28	**4600054827 WEBB INDUSTRIES**																	
29																		
30	BOLT:L49AA0049A,M6 CAGED NUT&BOLT PHILIP	520	241866	2	ea		50										50	
32	PANEL,PATCH:CDV1SRS30024;19 IN	1740	0591306	1	ea		2		2								4	
33																		
34	**4600060786 - WORLD TELCOM and Data**																	
35																		
35	Cable category 5E solid data	630	No Material Number	1	pm		30										30	
36	Earth cable green/yellow 4mm 100m roll	2780	No Material Number	1	ea		1										1	
37	Duplex patch lead LC-SC/APC 10/125 2M Ru	2040	No Material Number	1	ea		1		1								2	
38	Duplex patch lead SC/APC-SC/APC 10/125 2	2140	No Material Number	1	ea		1	1	1								3	
40	Data brush panel IU Color grey 19 inch	2640	No Material Number	1	ea		5										5	
41	Data patch panel fully populated 32 way	800	No Material Number	1	ea		1										1	
42	Alcohol swipes pk of 100	2550	No Material Number	1	ea		1										1	
43	RJ45 Connectors	3470	No Material Number	1	ea		6										6	
44	HOLDER: KRONE HINGED LABELS	No Line Number	No Material Number	1	ea		30											
45	2.5 Sqaure mm DC Black & Red Flex wire	No Line Number	No Material Number	1	pm		30										30	
46																		
47	**4600061751 - WEBB INDUSTRIES**																	
48																		
49	Smouv 60mm	520	No Material Number	1	ea		48		48								96	
50	Cable,Fibre optic:heavy duty weight;fibre	860	No Material Number	1	m		20		30								50	
51																		
50	**CISCO SYSTEMS LIMITED**																	
51																		
52	DIAL,TELEPHONE:CP-3905 ;IP	No Line Number	253530	21	ea		1										1	
53	PoE Module (DC) + In line fuse holder with red wire, fuse 0,75A and DC Plug	No Line Number	No Material Numbe	21	ea		1										1	
54	IP Phone - CUCM 11.5	No Line Number	No Material Numbe	21	ea		1										1	
55																		

SECTION 7: COMPLETION

1. All check sheets and commissioning documentation to be filled in prior to QA inspection.
2. Hand-over approval certificate should be completed as per 240-139189078.
3. A formal handover is required between contractor and Eskom Telecommunications.
4. All ATP documents for the ADM and Fox multiplexor to be received from the Transmission PM.
    - ABB Test Sheets
    - ERICSSON ATP
    - Generic QA tick sheet for projects (240-110412152)
    - Fibre Optics Test results (240-70732888)

SECTION 8: ANNEXURES

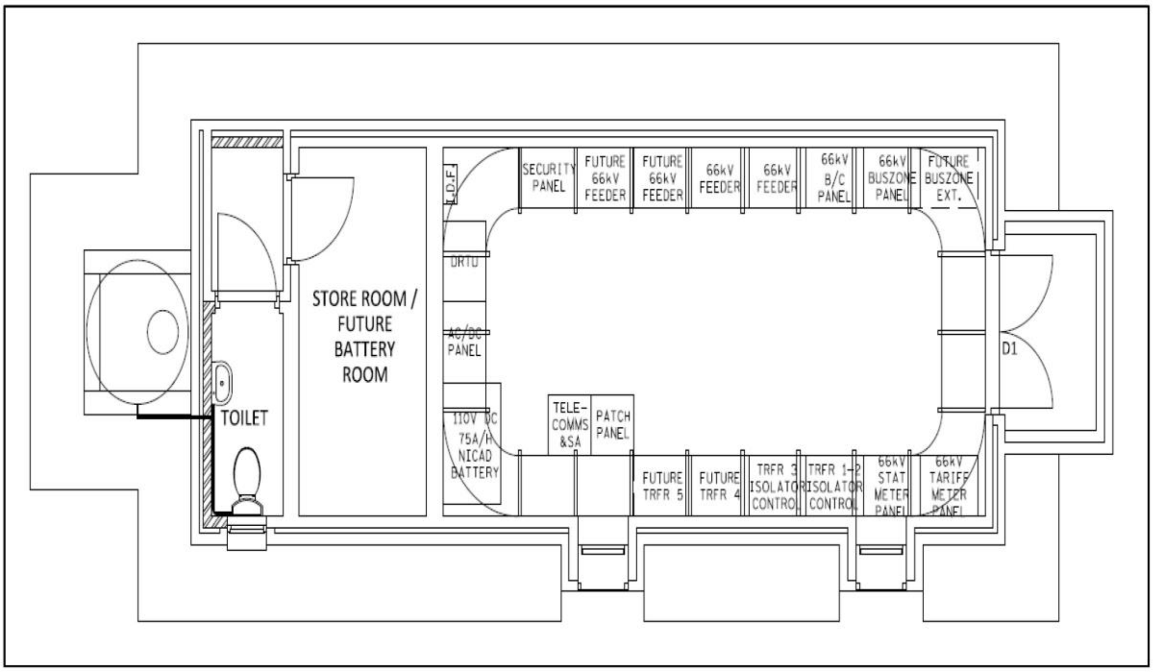
8.1 – Miscellaneous Materials

1. Contractor to supply everything needed to do installation.

SECTION 9: SITE DRAWINGS

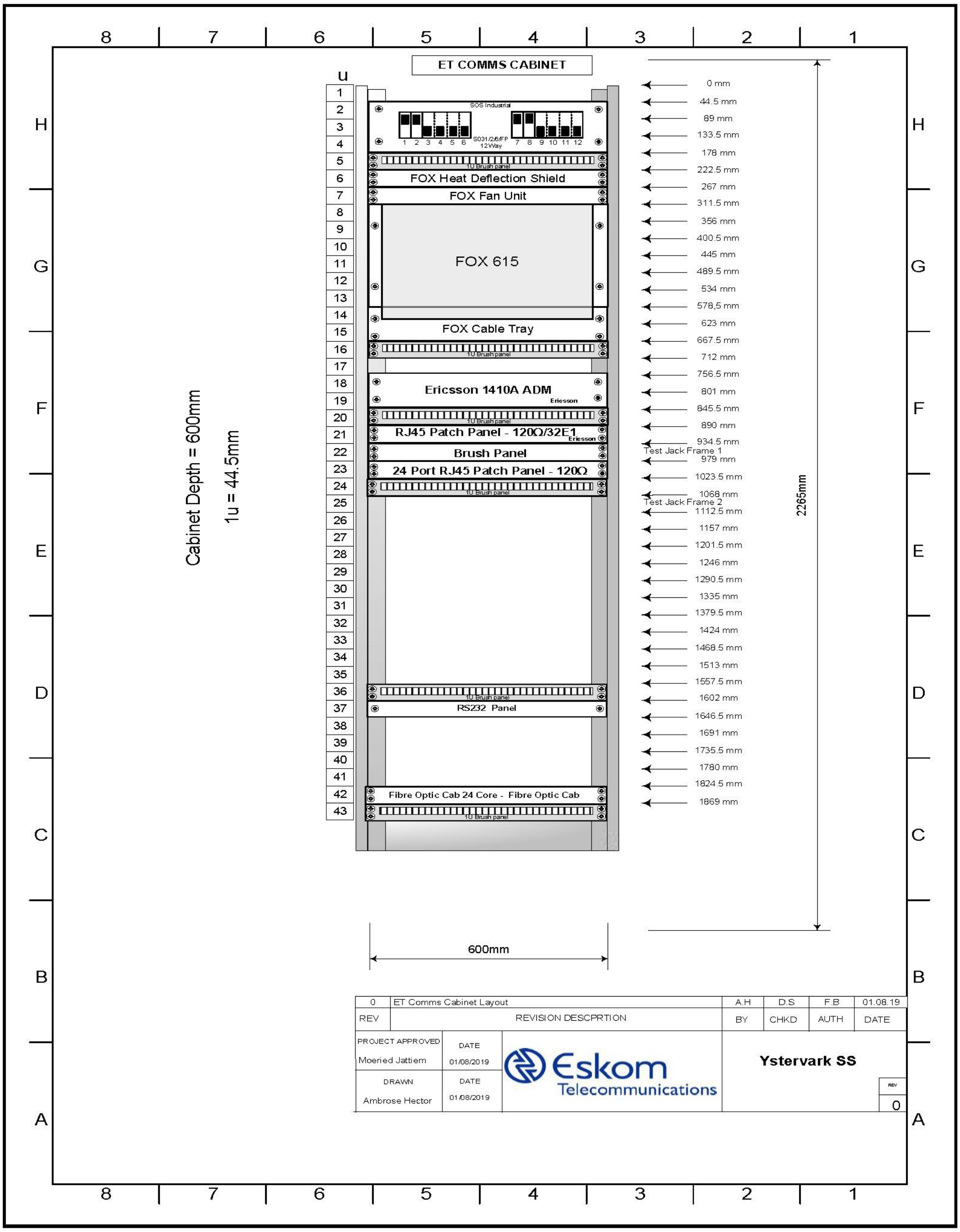
Unique Identifier: **ETFM 1846**
Revision: **1**
Page **20** of **26**

9.1 – Ystervark 132 kV SS Control Room Layout (ET Cabinet 600mmx800mm)



Unique Identifier: **ETFM 1846**
Revision: **1**
Page **21** of **26**

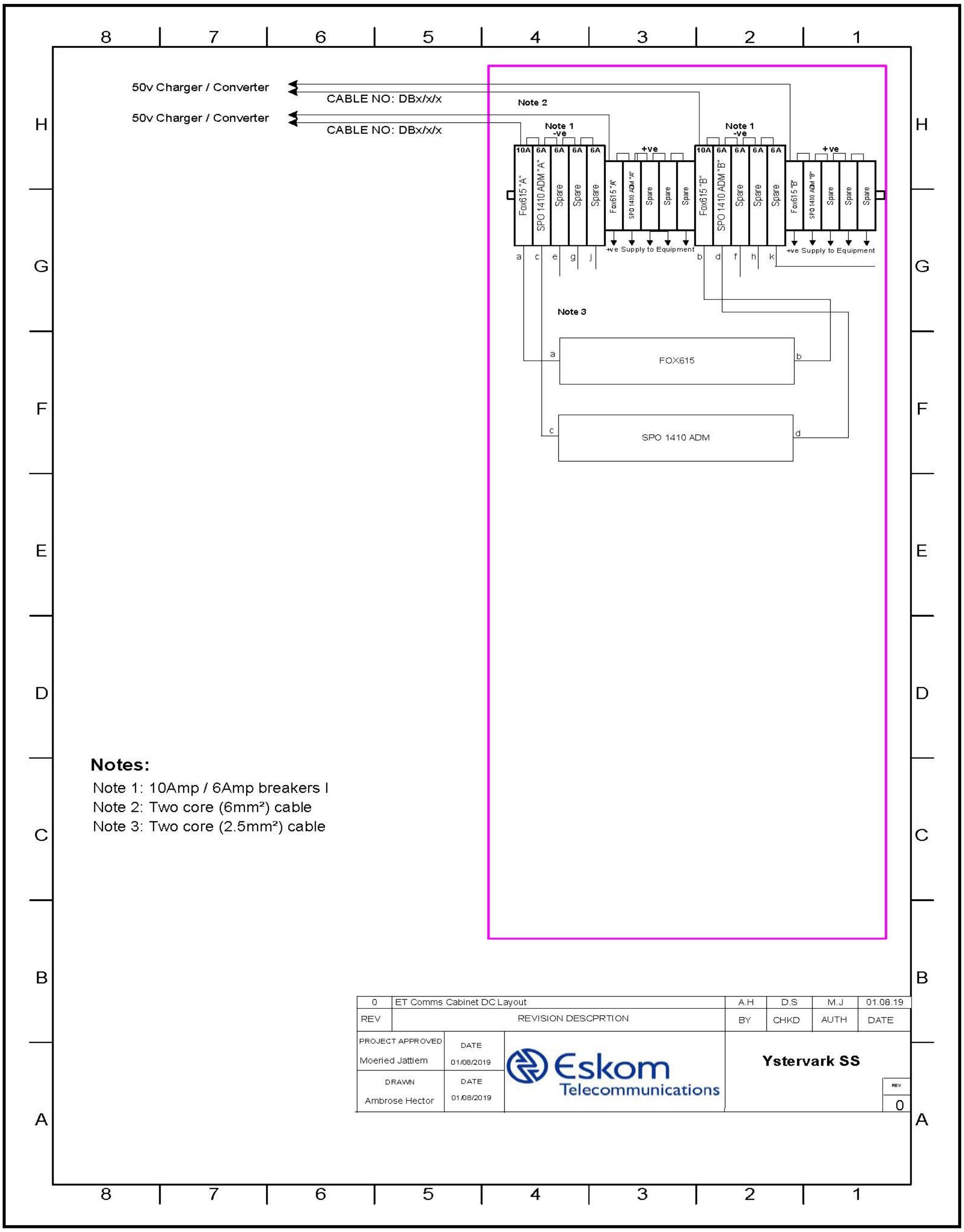
9.2 – Ystervark 132kV SS ET Comms Cabinet



Planning for: Ystervark SS Comms

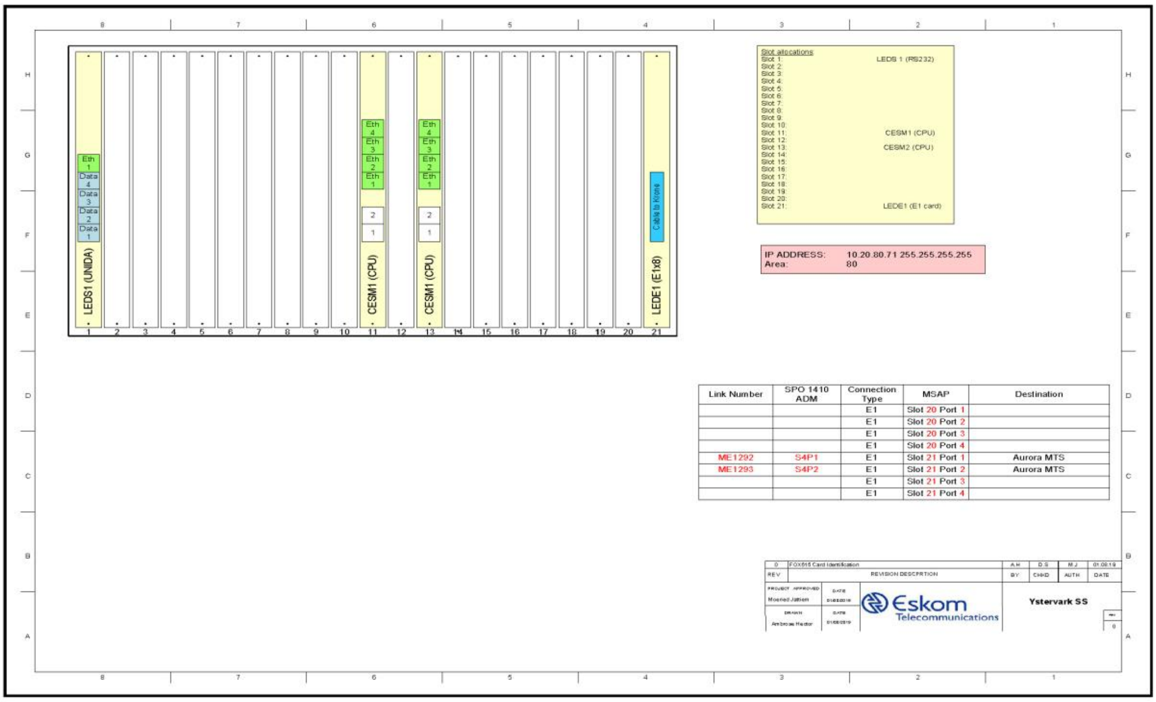
Unique Identifier: **ETFM 1846**
Revision: **1**
Page **22** of **26**

9.3 – Ystervark 132kV SS ET Comms Cabinet DC Cabling



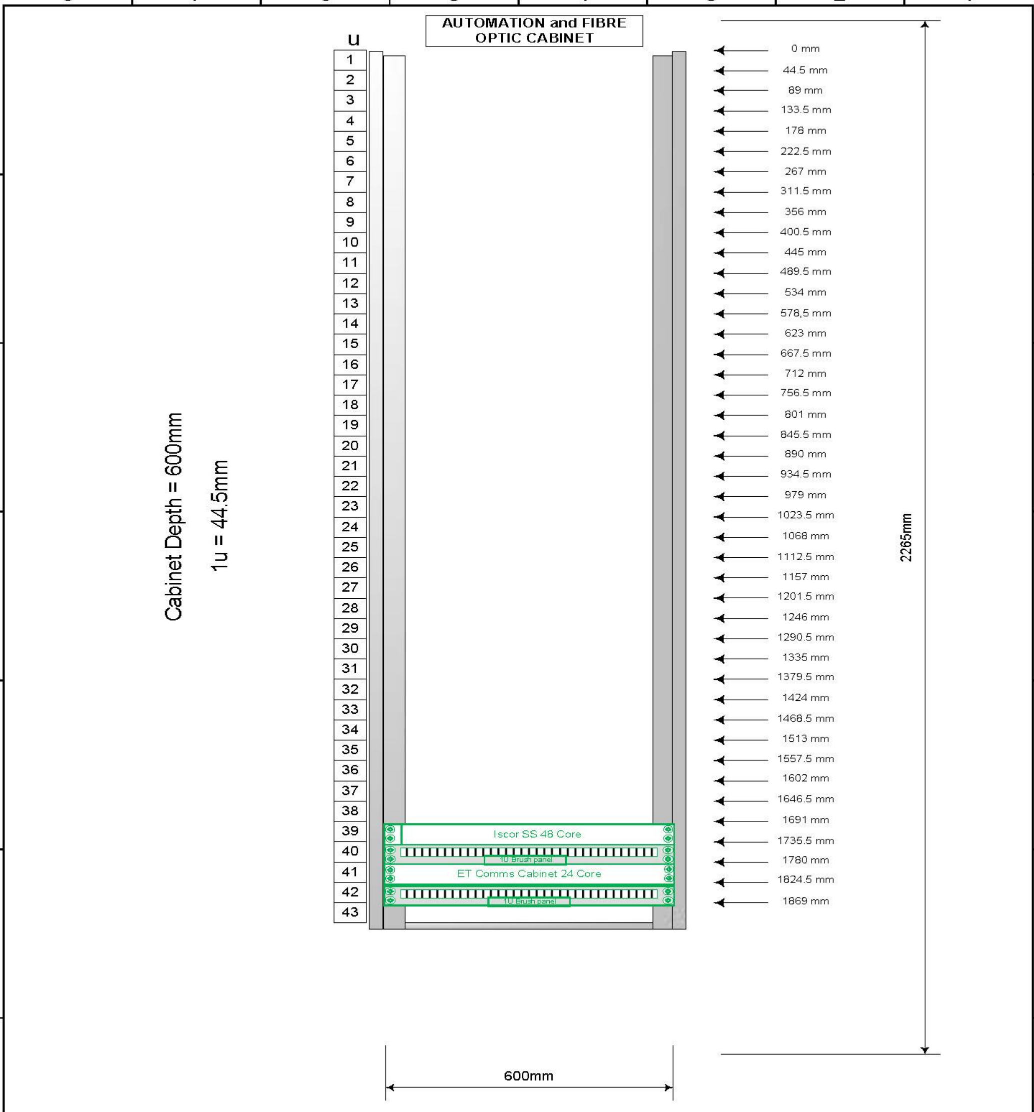
Unique Identifier: **ETFM 1846**
Revision: **1**
Page **23** of **26**

9.4 – Ystervark 132kV SS Fox 615 Face Layout



Link Number	SPO 1410 ADM	Connection Type	MSAP	Destination
		E1	Slot 20 Port 1	
		E1	Slot 20 Port 2	
		E1	Slot 20 Port 3	
		E1	Slot 20 Port 4	
ME1292	S4P1	E1	Slot 21 Port 1	Aurora MTS
ME1293	S4P2	E1	Slot 21 Port 2	Aurora MTS
		E1	Slot 21 Port 3	
		E1	Slot 21 Port 4	

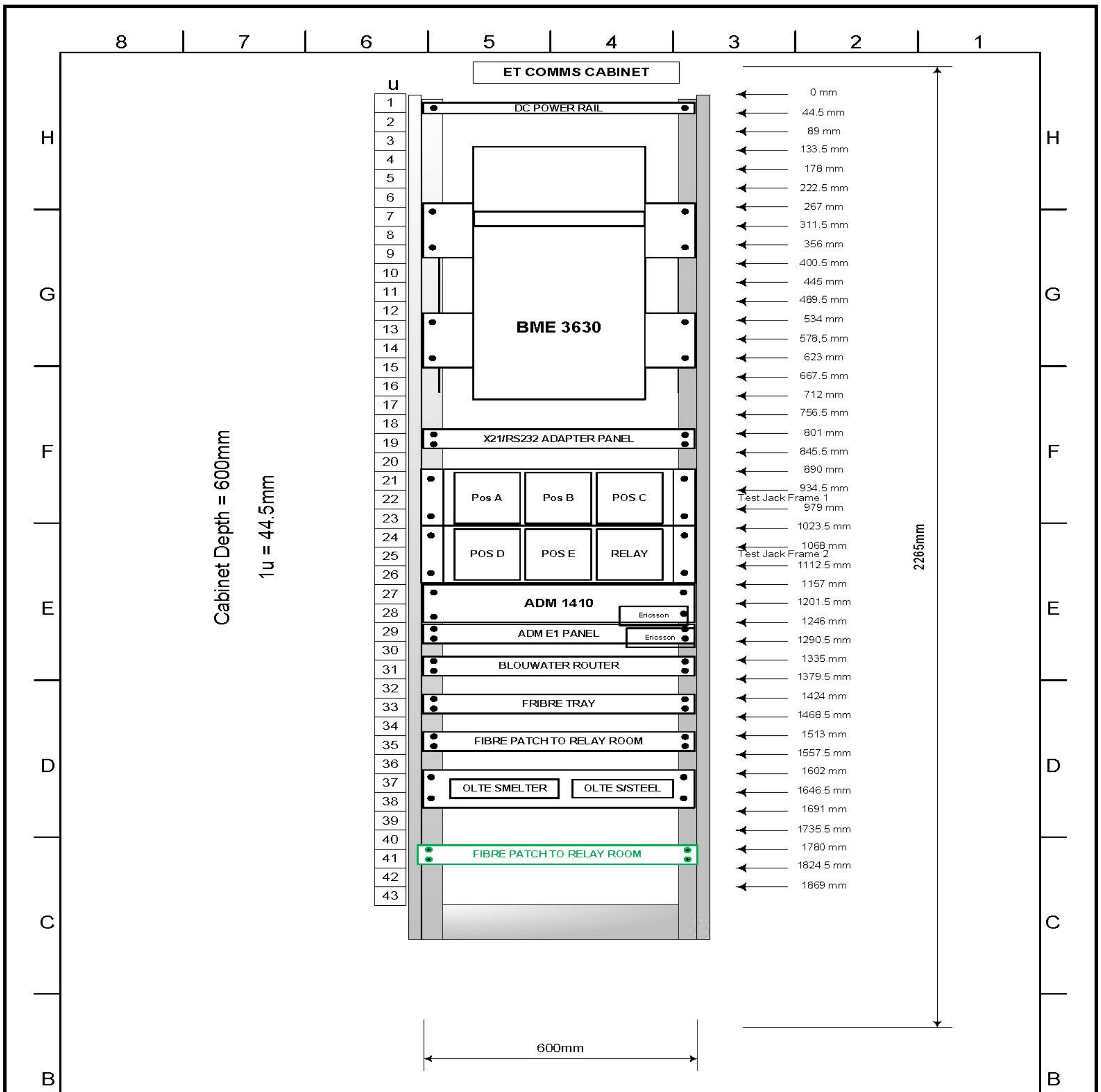
9.5 – Ystervark Fibre Comms Cabinet



0	Substation Automation and Patch Panel Layout	A.H	D.S	M.J	01.08.19
REV	REVISION DESCPRTION	BY	CHKD	AUTH	DATE

PROJECT APPROVED	DATE		
Moeried Jattiem	01/08/2019	Eskom Telecommunications	Ystervark SS
DRAWN	DATE		REV
Ambrose Hector	01/08/2019		0

9.6 – Blouwater SS Comms Cabinet

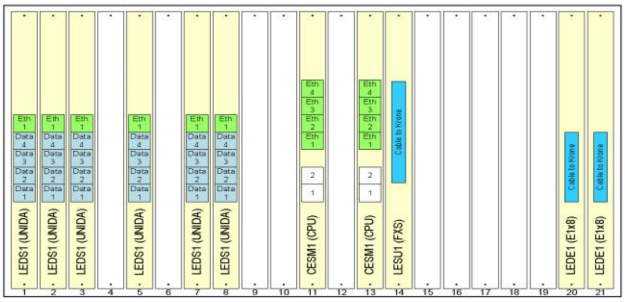


0	ET Comms Cabinet Layout	A.H	D.S	F.B	01.08.19
REV	REVISION DESCPRTION	BY	CHKD	AUTH	DATE

PROJECT APPROVED	DATE	Eskom Telecommunications	Blouwater SS
Moeried Jattiem	01/08/2019		
DRAWN	DATE		REV
Ambrose Hector	01/08/2019		0

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **26** of **26**

9.7 – Aurora MTS Fox 615 Face Layout



Slot allocations:
Slot 1: LEDS 1 (x21)
Slot 2: LEDS 1 (x21)
Slot 3: LEDS 1 (x21)
Slot 4:
Slot 5: LEDS 1 (x21)
Slot 6:
Slot 7 :LEDS 1 (x21)
Slot 8: LEDS 1 (x21)
Slot 9:
Slot 10:
Slot 11: CESM1 (CPU)
Slot 12:
Slot 13: CESM2 (CPU)
Slot 14:
Slot 15:
Slot 16:
Slot 17:
Slot 18:
Slot 19:
Slot 20: LEDE1 (E1 card)
Slot 21: LEDE1 (E1 card)

IP ADDRESS: 10.20.80.19 255.255.255.255
Area: 80

Link Number	SPO 1664 ADM	Connection Type	MSAP	Destination
ME0542		E1	Slot 20 Port 1	Koeberg SS
ME0543		E1	Slot 20 Port 2	Koeberg SS
ME0544		E1	Slot 20 Port 3	Koeberg SS
ME0426		E1	Slot 20 Port 4	Ankerlig SS
ME0257		E1	Slot 20 Port 5	Ankerlig SS
ME1292		E1	Slot 20 Port 6	Ystervark SS
		E1	Slot 20 Port 7	
		E1	Slot 20 Port 8	
ME0425		E1	Slot 21 Port 1	Juno MTS
ME0256		E1	Slot 21 Port 2	Juno MTS
ME0540		E1	Slot 21 Port 3	Juno MTS
ME0541		E1	Slot 21 Port 4	Juno MTS
ME1293		E1	Slot 21 Port 5	Ystervark SS
		E1	Slot 21 Port 6	
		E1	Slot 21 Port 7	
		E1	Slot 21 Port 8	

FOX615 Card Identification
REVISION DESCRIPTION
Eskom Telecommunications
Aurora MTS

PANEL NUMBER	PANEL NAME
1	66kV BUSZONE
2	66kV BUS COUPLER
3	66kV FEEDER 1
4	66kV FEEDER 3
5	FUTURE
6	FUTURE
7	FUTURE
8	AC/DC PANEL
9	RTU
10	IDF
11	TELECOMMS
12	PATCH PANEL & SUBSTATION AUTOMATION
13	66kV FEEDER 2
14	66kV FEEDER 4 & 6
15	STATISTICAL METERING
16	TARIFF METERING
17	QOS METERING
18	BATTERY CABINET

10.1.9 Floorplan

See arrangement below.

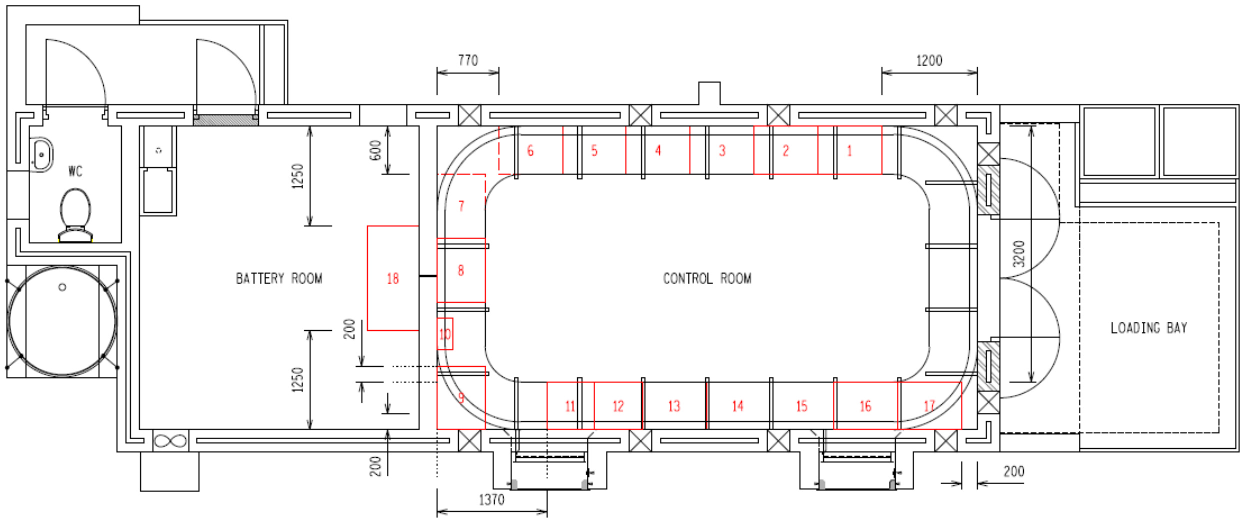


Figure 112: Panel Layout

10.2 Long Lead Time Bill of Materials

Not Applicable

10.3 Final Bill of Materials

Protection

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM				
CONTROL PLANT				
JOB NAME	Ystervark 66 - 132kV Substation			WCOU BOM-18-04 REV : 0
JOB NUMBER:	153272156-00003			This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Amanda Marais			
Tel No	Tel: 021 950 7500			
DATE PREP. :	30 August 2019			
PROTECTION				
QTY	**SAP**	**REFERENCE**	**Rev**	**DESCRIPTION**
	HV FEEDER SCHEME			
2	0248558	D-DT-9051	**0**	4FZD3920 Production unit for 110Vdc (THREE-POLE)
	HV Feeder Scheme Options			
2	0248564	D-DT-9051	**0**	Swing Frame Panel
2	0248565	D-DT-9051	**0**	Box Scheme In Wooden Crate For Shipping
2	0248585	D-DT-9051	**0**	IEC 61850 Remote Engineering Access Via Ethernet And Local Testing Option.
2	0248587	D-DT-9051	**0**	Three Terminal Diff Option
2	0248625	D-DT-9051	**0**	IEC 61850 Remote Engineering Access Ethernet Switch
10	0248574	D-DT-9051		Attenuator, in-line fibre
2	0248588	D-DT-9051	**0**	Busbar Voltage Selection Relays (Rk 251 205-An) For 4FZD3920 Schemes
	MV PROTECTION SCHEMES			
3	0583094	D-DT-9048	**3**	4RF1101 RURAL FEEDER PROTECTION SCHEME
	MV Protection Scheme Options			
2	0224951	D-DT-9048	**3**	Swing Frame Panel
3	0224955	D-DT-9048	**3**	Optional second rear commumocation port for MiCOM P145 relay
	BUS ZONE PROTECTION SCHEMES			
1	0224967	D-DT-9049	**2**	Scheme, Buszone PROT 4BZ5700 (110Vdc)
	HV BUS COUPLER/SECTION PROTECTION AND CONTROL SCHEMES			
1	0224923	D-DT-9047	**2**	4BC1800 Bus Coupler Protection & Control Scheme (Serial & Hardwired SCADA)
	Bus Coupler Protection/Control Scheme Options			
1	0225040	D-DT-9047	**2**	Crating of one 4BC1x100 protection/control scheme module for transport
1	0224955	D-DT-9048	**1**	Optional second rear communication port for MiCOM P145 relay.
1	0224937	D-DT-9047	**2**	Single phase current transducer (0 - 5mA) installed.
1	0224938	D-DT-9047	**2**	Single phase voltage transducer (0 - 5mA) installed.

Metering

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM					
CONTROL PLANT					
JOB NAME		Ystervark 66 - 132kV Substation		WCOU BOM-18-04	REV : **0**
JOB NUMBER:		153272156-00003			This document is the property of Eskom
BOM TYPE:		FINAL BOM & BOQ			
PREPARED BY :		Amanda Marais			
Tel No		Tel: 021 950 7500			
DATE PREP. :		30 August 2019			
METERING					
QTY	**SAP**	**REFERENCE**	**Rev**	**DESCRIPTION**	
	METERING MODULES				
4	0175685	D-DT-9400	**0**	3MM01C Meter Module	
	METERS				
2	0230646	D-DT-9420	**5**	3Ph ZMD 1&5A meter with B2 module	
6	0242587	D-DT-9420	**5**	ZMD 1A 3Phase Aux Meter B2	
1	0577553	-	**-**	Vecto III QoS meter	**ED BUY OUT**
	COMMS				
1	0223364	D-DT-9503	**5**	Smartoo GPRS Modem	
1	0246197	D-DT-9503	**5**	Webb ESKANT Antenna	
1	BUY OUT	N/A	-	Summation CT module as per D-WC-8118 Set 30 Sht 02, complete	

AC/DC

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM				
CONTROL PLANT				
JOB NAME	Ystervark 66 - 132kV Substation			WCOU BOM-18-04 REV : 0
JOB NUMBER:	153272156-00003			This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Amanda Marais			
Tel No	Tel: 021 950 7500			
DATE PREP. :	30 August 2019			
AC / DC				
QTY	SAP	DT reference	Rev	DESCRIPTION
	AC/DC DBs AND MODULES			
		YARD AC/DC DBs		
2	0185222	D-DT-9200	2	Dual control yard AC distribution board (With Distribution and Termination Modules)
1	0605596	-	-	Day - Night Switch
		RELAY HOUSE DBs AND AC/DC PANEL MODULES		
1	0175664	D-DT-9203	5	3 Phase AC module
2	0216215	D-DT-9203	5	1 Phase AC Module
2	0216216	D-DT-9203	5	DC Supply module
1	0175669	D-DT-9203	5	AC supply module
1	0185229	D-DT-9203	5	DC interface module
	CELLS NiCAD			
		Alkaline Batteries AlCad Vantex M Series		
85	0256102	D-DT-9308	0	M100 1.2V, 100Ah NiCad Cell
	BATTERY CABINETS NiCAD			
1	631229			CAB-S-85VTX1M100C-G29 85-88 X Single Cells VTX 1 M100C L = 1200 x D = 650 X H = 2000MM
	BATTERY CHARGERS			
		SINGLE SUB RACK CHARGERS		
1	0640913		0	110V 20A Sub-rack Battery Charger
		ACCESSORIES AND EXTRAS		
1	0209845	D-DT-9215	-	Book, Maint Log NICAD Batt 90Cell
1	BUY OUT	-	-	Phoenix Surge Arrestors - phase + N (VAL-MS 230/1 + 1 FM)
1	0636737	-	-	Converter: 110D04810/C001; DC to DC
1	BUY OUT	-	-	110-50V DC supply module

Substation Automation

Western Cape OU - Control plant design						
Substation Automation						
JOB NAME:	Ystervark S/S					
Proj. NUMBER	153272156					
PREPARED BY:	Juan					
TEL No:	0219834049					
DATE PREP:						
Integration and Data Retreival						
QTY	**SAP**	**REFERENCE**	**RevNo**	**Description**	**Price per Unit**	**Price**
			Data Concentrator Hardware			
1				Data Concentrator	R 218 500.00	R 218 500.00
			Historian			
585				Point Count	R 12.00	R 7 020.00
			Others			
1	248625			RuggedCom RS900 Switch	R 15 000.00	R 15 000.00
1				RuggedCom RS416NC-F-RM-HI-XX-3R-3R-3R-3R-TX01-TX01-XX (16 Ports)	R 24 500.00	R 24 500.00
2				Fibre to Ethernet Converter [IMC-21A-S-SC]	R 3 445.00	R 6 890.00
			Cables and Fibre			
90	0243301	Plant # 5315		Per m CAT5E FTP Solid Core	R 3.70	R 333.00
			Duplex Multimode 50/125um Fibre			
1				8m ST-ST Multimode 2-Core Fibres (Duplex fiber cable)	R 211.20	R 211.20
2				15m ST-ST Multimode 2-Core Fibres (Duplex fiber cable)	R 295.68	R 591.36
			Modems			
1				Teltonika RUT905 Modem/Router	R 3 000.00	R 3 000.00
			Power Suppy Units			
1				110V DC to 12V DC Converter [Supplier: SOS industries, Mean Well model: MDR-20-12]	R 350.00	R 350.00
1				110V DC to 5V DC Converter [Supplier: SOS industries, Mean Well model: MDR-20-05]	R 350.00	R 350.00
			Connectors and Plugs			
1				100x RJ45 Plug	R 165.00	R 165.00
1				100x RJ45 Boots	R 115.00	R 115.00
8				1x RJ45 to DB9M Converter	R 15.00	R 120.00
1				1x RJ45 to DB9F Converter	R 15.00	R 15.00
3				16A Double Pole MCB's	R 200.00	R 600.00
			Cabinet Accessories			
1	0401956			5U BLANKING PLATE	R 127.10	R 127.10
1				Brush Plates	R 100.00	R 100.00
1				20m Spragg (20mm Flexible white Tubing)	R 100.00	R 100.00
20	401414			Cage Nuts, Bolts with sealing washer 6mm	R 6.65	R 132.94
					Total Cost:	**R 278 220.60**

Telecontrol

Description	SAP No	Contract Line No.	ISTE Part No	Subsection	IST Description	Unit Price CAD	Unit Price ZAR	Units	Price CAD	Price ZAR
Power Supply	0248402	810	ISTE-10700	Power Supplies & Battery Chargers	110 VDC PSU High Power	0.00	8,241.59	1	0.00	8,241.59
Std RTU Config	559974	2260	ISTE-801007	Standard RTU Configurations	Config 07 10m VME D20 RTU, 1 D20C, 1 D20S		71,406.31	1		71,406.31
Cabinet	213366	1870	ISTE-40120	Cabinets & Subracks	PB8 800w x 600d cabinets with removable sides, swing frame, “G” rails, earth studs, louvers, 18 Holes top and bottom gland with plugs.	0.00	14,226.91	1	0.00	14,226.91
Ethernet option	0248415	920	ISTEGE-526-2110	Miscellaneous Kits	D20 EME 10Base-T Media Interface Card		1,172.10	1		1,172.10
Ethernet option	0248413	900	ISTEGE-977-0298	Miscellaneous Kits	D20 EME Internal Interconnect Cable		208.07	1		208.07
Ethernet option	248410	880	ISTEGE-526-2100	Miscellaneous Kits	D20 EME Ethernet Memory Card, 8MB		7,618.25	1		7,618.25

MOXA Kit	0250319	2000	ISTE-304300	Miscellaneous Kits	Serial Expansion Kit with MOXA		5,484.57	2		10,969.14
MOXA Kit Expansion	0250320	40	ISTTE-303355	Miscellaneous Kits	MOXA Expansion Kit		2,086.31	4		8,345.24
Cables	248456		ISTEGE-977-0089/120	Miscellaneous Kits	CABLE ASSY, D.20 (M+) 120 INCH		152.22	2		304.44
			Present Exchange rate	**5.2882**	Rand to the Canadian Dollar		Sub-total Price		**R 122,492.05**	
RS232/FO Converters	0246067	390	SEL-2830M	FO Transceivers	SEL-2830 RS232 TO 1300nm SINGLE MODE FIBRE OPTIC TRANSCEIVER FOR RANGES UP TO 80km		9,308.12	2		18,616.24

Buy-out Items

40 - way IDF frame and KRONE accessories **** **R 2,500.00**

TOTAL **R 143,608.29**

Telecommunication

Refer to section 10.1.8

Junction Boxes

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM				
CONTROL PLANT				
JOB NAME	Ystervark 66 - 132kV Substation			WCOU BOM-18-04 REV : 0
JOB NUMBER:	153272156-00003			This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Amanda Marais			
Tel No	Tel: 021 950 7500			
DATE PREP. :	30 August 2019			
JUNCTION BOXES				
QTY	**SAP**	**DT reference**	**Rev**	**DESCRIPTION**
	STANDARDISED JUNCTION BOXES 304 STAINLESS STEEL			
4	0186950	D-DT-5405	**0**	VRW20 Junction Box , with 8 circuit VT insert (Fitted) (Complete JB) 304 stainless steel option
7	0186961	D-DT-5404	**0**	VRW20 Junction Box , with 6 circuit CT insert (Fitted) (Complete JB) 304 stainless steel option
6	0185255	D-DT-5403	**0**	VRW20 Junction Box , with double busbar isolator insert CT & VT tray (Fitted) (Complete JB) 304 stainless steel option
3	BUY-OUT	-	**-**	VRW20 Customer Interface Junction Box (Fitted) (Complete JB) 304 stainless steel option
6	-	D-DT-11226	**-**	VRW20 Junction Box, with Outdoor Plug insert Type A (Fitted) (Complete JB) 304 stainless steel option
2	0186972	D-DT-5403	**0**	VRW20 Junction Box , with un-punched tray insert, painted white (Fitted) (Complete JB) 304 stainless steel option
	HIGH CORROSION PAINT OPTION AND TRANSPORT REQUIREENTS			
28	0186963		**0**	Corrosive protection for more corrosive environments to SCSSCAAP9 specification DS 133,

Frames and Blanking Plates

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM				
CONTROL PLANT				
JOB NAME	Ystervark 66 - 132kV Substation		WCOU BOM-18-04	REV : 0
JOB NUMBER:	153272156-00003			This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Amanda Marais			
Tel No	Tel: 021 950 7500			
DATE PREP. :	30 August 2019			
FRAMES				
QTY	SAP	DT reference	Rev	DESCRIPTION
	CABINETS AND BLANKING PLATES			
4	0402613	D-DT-9141	6	SWING FRAME CABINET
4	0401942	D-DT-9141	6	1U BLANKING PLATE
16	0401944	D-DT-9141	6	2U BLANKING PLATE
1	0401954	D-DT-9141	6	4U BLANKING PLATE
6	0401956	D-DT-9141	6	5U BLANKING PLATE
2	0401958	D-DT-9141	6	7U BLANKING PLATE
3	0401964	D-DT-9141	6	10U BLANKING PLATE
1	0402099	D-DT-9141	6	12U BLANKING PLATE
4	0401414	D-DT-9141	6	CAGE NUTS,BOLTS WITH SEALING WASHER 6MM

LV Cables

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM				
CONTROL PLANT				
JOB NAME			Ystervark 66 - 132kV Substation	WCOU BOM-18-04 REV : 0
JOB NUMBER:			153272156-00003	
BOM TYPE:			FINAL BOM & BOQ	This document is the property of Eskom
PREPARED BY :			Amanda Marais	
Tel No			Tel: 021 950 7500	
DATE PREP. :			30 August 2019	
LV CABLE				
QTY	SAP	REFERENCE	Rev	DESCRIPTION
	CONTROL CABLES			
1331 m	0404118	D-DT-3128	13	Cable 1kV 19c 2.5mm² Cu BVX19DCV
3663 m	0404761	D-DT-3128	13	Cable 1kV 12c 2.5mm² Cu BVX12DCV
1100 m	0400646	D-DT-3128	13	Cable 1kV 4c 2.5mm² Cu BVX4DCV
4306 m	0404764	D-DT-3128	13	Cable 1kV 4c 4.0mm² Cu BVX4ECV
605 m	0404766	D-DT-3128	13	Cable 1kV 4c 16.0mm² Cu BVX4HCV
660 m	0404767	D-DT-3128	13	Cable 1kV 4c 25.0mm² Cu BVX4KCV
1104 m	0404123	D-DT-9161	1	Cable telephone 10pr 0.5mm dia (Unarmoured)
100 m	0243301	-	-	CAT5E FTP (Shielded) Solid Core (4pair)
	CABLE GLANDS			
55	0168280	D-DT-3070	12	Gland No 3 & Shroud
114	0168279	D-DT-3070	12	Gland No 2 & Shroud
156	0168367	D-DT-3070	12	Gland No 1 & Shroud
26	0404480	D-DT-3070	12	Compression CABLE Gland No 1

PLEASE NOTE: CABLE LENGTHS ARE APPROXIMATE ONLY, ACTUAL PHYSICAL LENGTHS ARE TO BE VERIFIED ON SITE.
EXISTING CABLES TO BE REUSED WHERE POSSIBLE

Miscellaneous

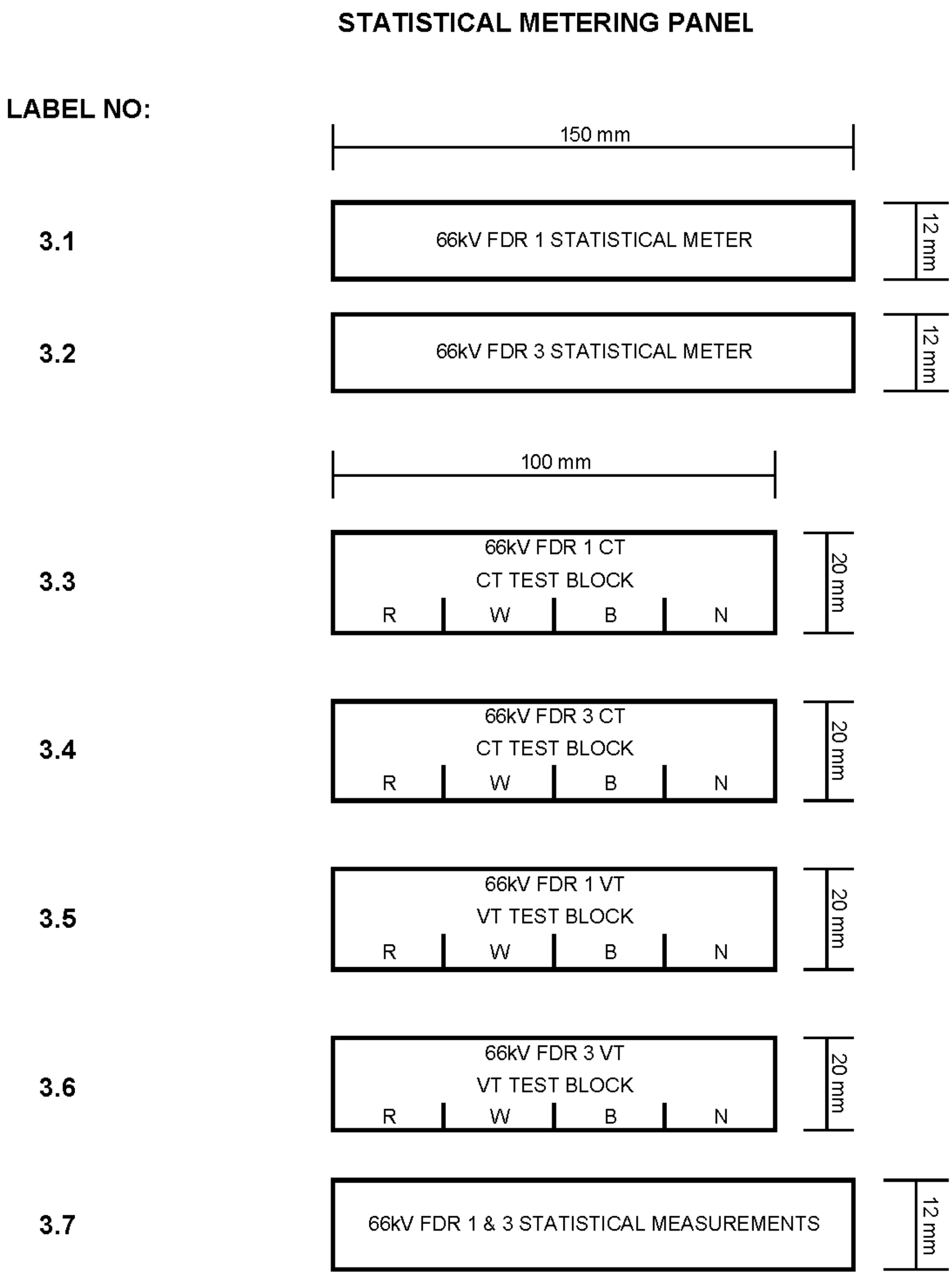
WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM								
CONTROL PLANT								
JOB NAME			Ystervark 66 - 132kV Substation		WCOU_BOM-18-04	REV :	0	This document is the property of Eskom
JOB NUMBER:			153272156-00003					
BOM TYPE:			FINAL BOM & BOQ					
PREPARED BY :			Amanda Marais					
Tel No			Tel: 021 950 7500					
DATE PREP. :			30 August 2019					
MISCELLANEOUS								
QTY	SAP	DT reference	Rev	DESCRIPTION				
1	BUY OUT	-	-	42U 600 x 800 Fx Cabinet, tempered glass door, no fans or power distribution required				
5	BUY OUT	-	-	Din Rail (suitable size)				
5	BUY OUT	-	-	MCB (2A, 5kA)				
6	BUY OUT	-	-	Voltage Selection Relays				
100m	BUY OUT	-	-	Grey insulated panel wiring (4mm²)				
100m	BUY OUT	-	-	Green/Yellow insulated earth wire (4mm²)				
300m	BUY OUT	-	-	Grey insulated panel wiring (2.5mm²)				
3	BUY OUT	-	-	Mimic Craft Semaphore Square Green/Red				
15	BUY OUT	-	-	Mimic Craft Semaphore Round Green/Red				
3	BUY OUT	-	-	Isolator Switch, Kraus & Naimer, A714-600				
3	BUY OUT	-	-	Reset Push-button, Amber, ADDA Indications				
3	BUY OUT	-	-	DC Isolator, EP102UC(C6), GE				
3	BUY OUT	-	-	Trip Repeat Relay, BFT3, 110VDC Arteche				
21	BUY OUT	-	-	MK3P5-S 110/220VDC + Base, OMRON				
9	BUY OUT	-	-	MK3P5-S 48VDC + Base, OMRON				
3	BUY OUT	-	-	MK3P5-S 230VAC + Base, OMRON				
3	BUY OUT	-	-	MCB + Aux G63(C02) + Aux, GE				
6	BUY OUT	-	-	Trip Repeat Relay, BJ8, 110VDC Arteche				
3	BUY OUT	-	-	Diode Module, 10 common, Miimic Craft				
3	BUY OUT	-	-	Diode Module, 5 common, Miimic Craft				
30	BUY OUT	-	-	8mm Spring Loaded Sliding Link Test Terminal, KULTD6, ELMEX				
150	BUY OUT	-	-	10mm Spring Loaded Test Terminal, KULT1, ELMEX				
30	BUY OUT	-	-	Terminal End Stop, SCUN, ELMEX				
30	BUY OUT	-	-	Terminal Rail Earthing Terminals, ET10, ELMEX				
4	BUY-OUT	-	-	SC/APC - FC single Mode Path Leads Ruggedised				

10.4 Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM												WCOU_BOM-18-04
JOB NAME			Ystervark 66 - 132kV Substation				LASTEST REV :	0				
JOB NUMBER:			153272156-00003									
BOM TYPE:			FINAL BOM & BOQ									
PREPARED BY :			Amanda Marais									
Tel No			Tel: 021 950 7500									
DATE PREP. :			Friday, August 30, 2019									
	BILL OF QUANTITIES				BASED ON MEW SUBSTATION BOQ			rev. 11			R 1209 per point	
					LABOUR & PLANT							
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL	
	SECONDARY PLANT ACTIVITIES											
	Electrical installations											
	Transportation of Panels	km										
	Install metering & protection panels	each	12									
	Earthing of panels	each	12									
	Install Junction Boxes/AC Yard Box	each	23									
	Installing AC/DC boards	each	2.0									
	Lay cables (< 1000V)	m	12869.0									
	Glanding of Cables (per gland) (< 1000V)	each	351.0									
	Label & Loom Cable (< 1000V)	core	176.0									
	Terminate and support cable (< 1000V)	each	351.0									

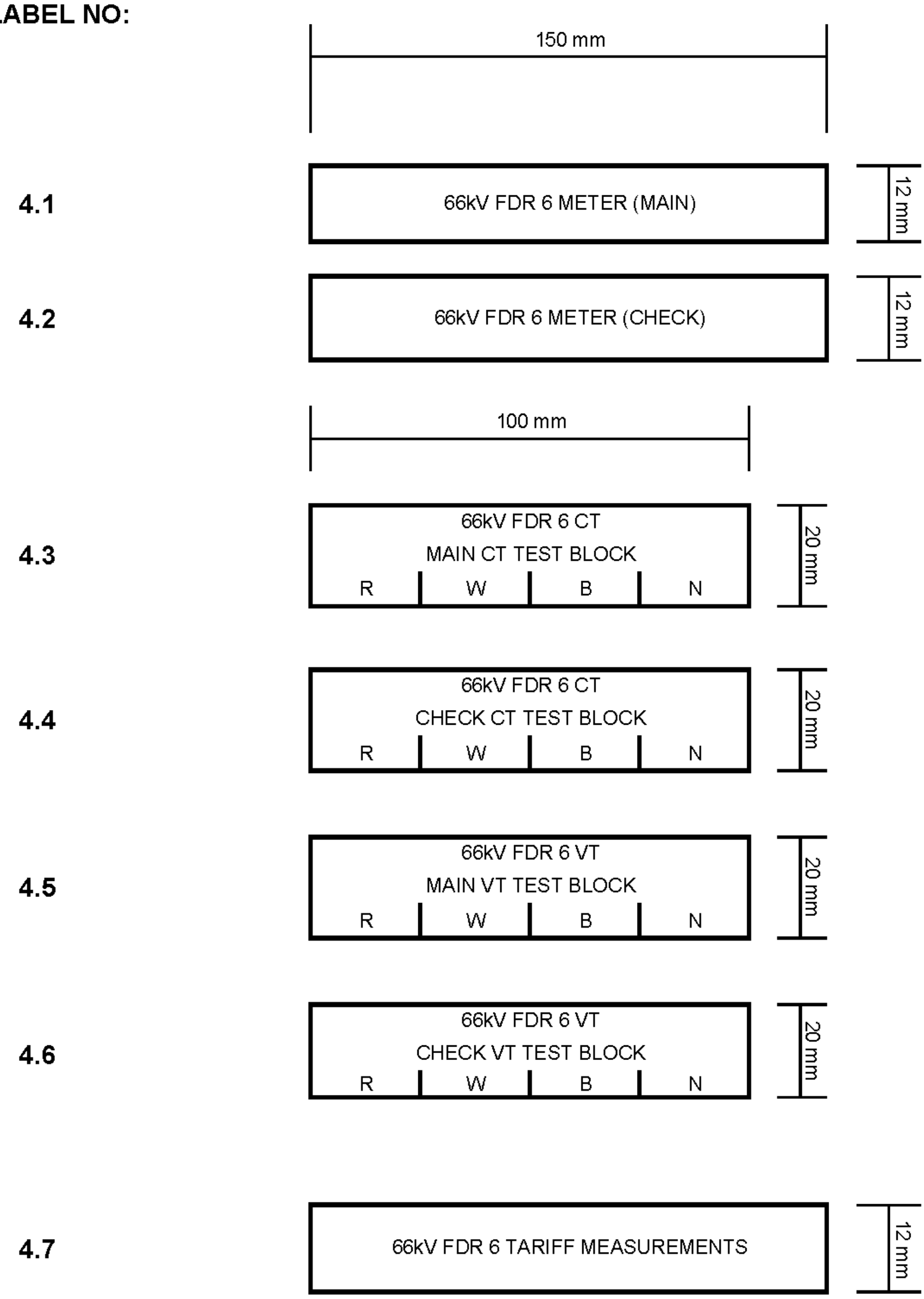
10.5 Label Schedule

10.5.1 Metering Labels



TARIFF METERING PANEL 1

LABEL NO:



LABEL NO:

150 mm

Label No	Label	Height
5.1	66kV FDR 4 METER (MAIN)	12 mm
5.2	66kV FDR 4 METER (CHECK)	12 mm

100 mm

Label No	Label	Height
5.3	66kV FDR 4 CT MAIN CT TEST BLOCK R | W | B | N	20 mm
5.4	66kV FDR 4 CT CHECK CT TEST BLOCK R | W | B | N	20 mm
5.5	66kV FDR 4 VT MAIN VT TEST BLOCK R | W | B | N	20 mm
5.6	66kV FDR 4 VT CHECK VT TEST BLOCK R | W | B | N	20 mm
5.7	66kV FDR 4 TARIFF MEASUREMENTS	12 mm

LABEL NO:

150 mm

6.1

MAIN INTAKE SUBSTATION QOS METER

12 mm

6.4

66kV FDR 2, 4 & 6 QOS CT
QOS CT TEST BLOCK

R	W	B	N

20 mm

6.5

66kV FDR 2, 4 & 6 QOS VT
QOS VT TEST BLOCK

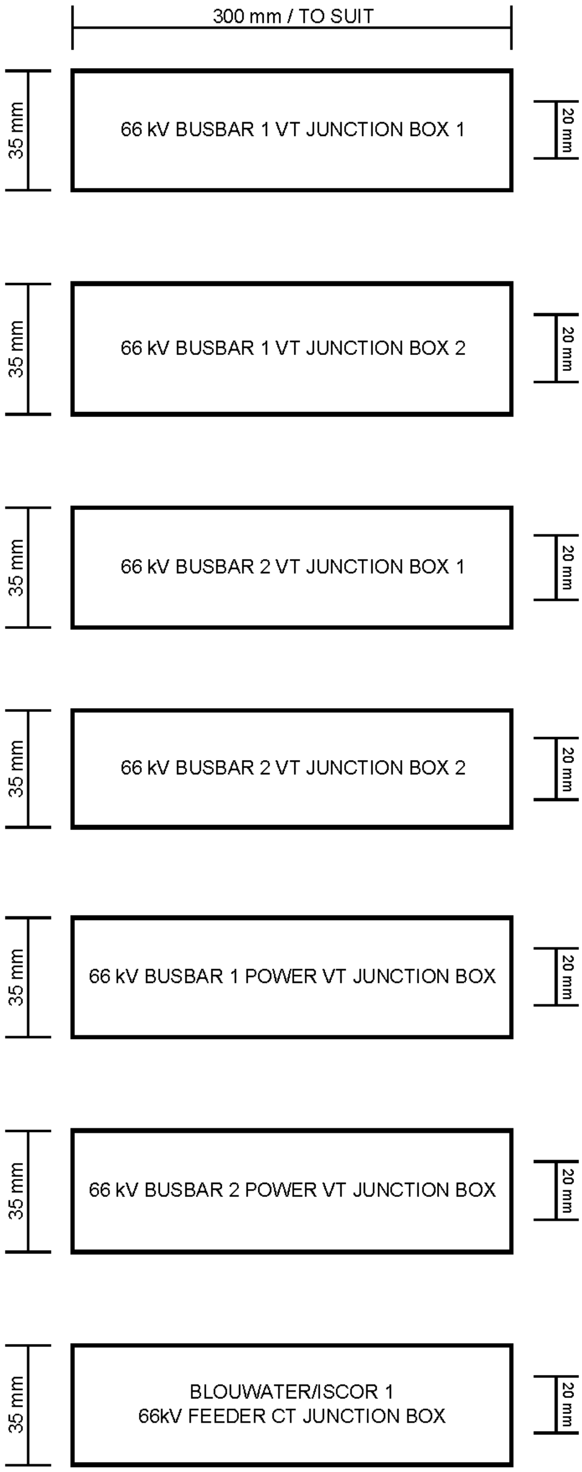
R	W	B	N

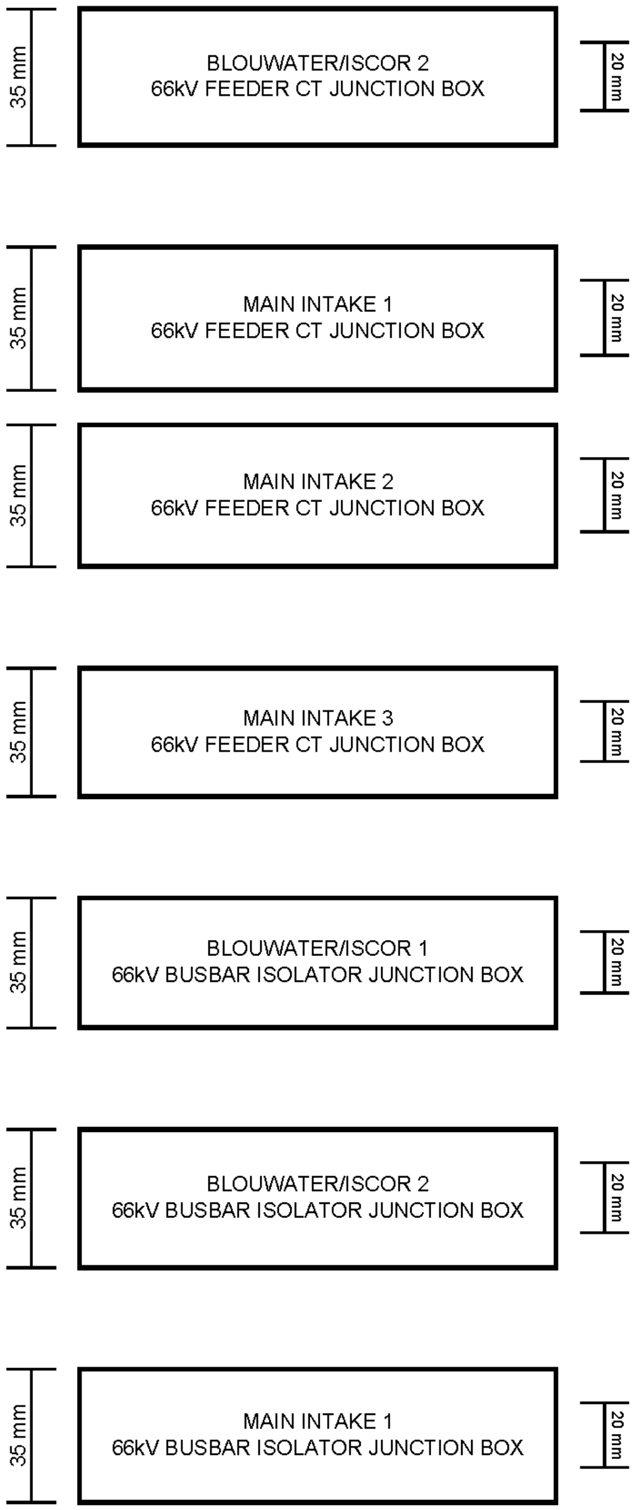
20 mm

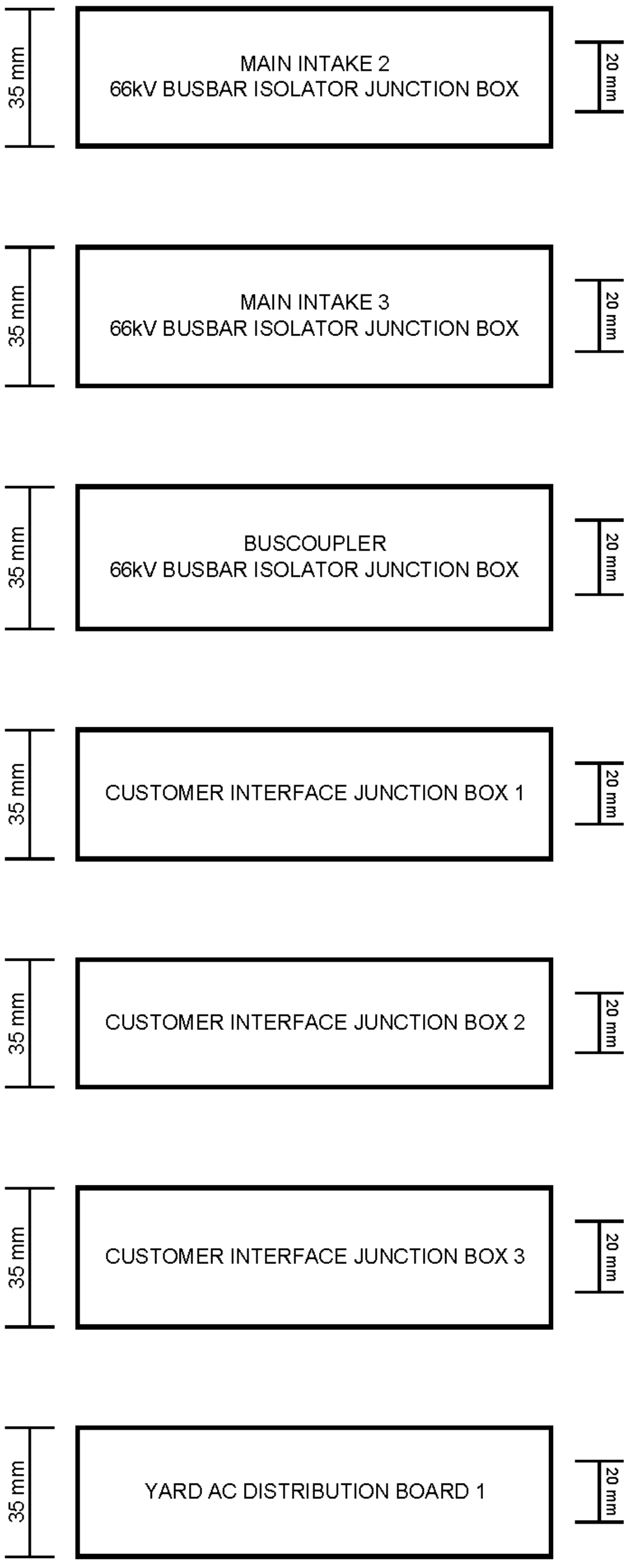
TARIFF METERING PANEL 2

LABEL NO:	Label	Size
	150 mm	
7.1	66kV FDR 2 METER (MAIN)	12 mm
7.2	66kV FDR 2 METER (CHECK)	12 mm
	100 mm	
7.3	66kV FDR 2 CT MAIN CT TEST BLOCK R | W | B | N	20 mm
7.4	66kV FDR 2 CT CHECK CT TEST BLOCK R | W | B | N	20 mm
7.5	66kV FDR 2 VT MAIN VT TEST BLOCK R | W | B | N	20 mm
7.6	66kV FDR 2 VT CHECK VT TEST BLOCK R | W | B | N	20 mm
7.2	66kV FDR 2 TARIFF MEASUREMENTS	12 mm

10.5.2 Yard Panel Labels




35 mm
BLOUWATER/ISCOR 2
66kV FEEDER CT JUNCTION BOX
20 mm
35 mm
MAIN INTAKE 1
66kV FEEDER CT JUNCTION BOX
20 mm
35 mm
MAIN INTAKE 2
66kV FEEDER CT JUNCTION BOX
20 mm
35 mm
MAIN INTAKE 3
66kV FEEDER CT JUNCTION BOX
20 mm
35 mm
BLOUWATER/ISCOR 1
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm
35 mm
BLOUWATER/ISCOR 2
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm
35 mm
MAIN INTAKE 1
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm


35 mm
MAIN INTAKE 2
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm
35 mm
MAIN INTAKE 3
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm
35 mm
BUSCOUPLER
66kV BUSBAR ISOLATOR JUNCTION BOX
20 mm
35 mm
CUSTOMER INTERFACE JUNCTION BOX 1
20 mm
35 mm
CUSTOMER INTERFACE JUNCTION BOX 2
20 mm
35 mm
CUSTOMER INTERFACE JUNCTION BOX 3
20 mm
35 mm
YARD AC DISTRIBUTION BOARD 1
20 mm


35 mm
YARD AC DISTRIBUTION BOARD 2
20 mm

10.5.3 VTJB Loads

66 kV BUSBAR 1 VTJB 1

15 mm	20 mm	50 mm

10 mm

CIRCUIT	FUNCTION	ALLOCATION
1	PROTECTION	66kV FEEDER 1 RP
2	METERING	66kV FEEDER 1 RP
3	PROTECTION	66kV FEEDER 3 RP
4	METERING	66kV FEEDER 3 RP
5	PROTECTION	66kV FEEDER 2 RP
6	METERING	66kV FEEDER 2 RP
7	PROTECTION	66kV FEEDER 4 RP
8	METERING	66kV FEEDER 4 RP

66 kV BUSBAR 1 VTJB 2

15 mm	20 mm	50 mm

10 mm

CIRCUIT	FUNCTION	ALLOCATION
1	PROTECTION	66kV FEEDER 6 RP
2	METERING	66kV FEEDER 6 RP
3	PROTECTION	66kV BUSCOUPLER RP
4	METERING	
5	PROTECTION	
6	METERING	
7	PROTECTION	
8	METERING	

66 kV BUSBAR 2 VTJB 1

15 mm	20 mm	50 mm

10 mm

CIRCUIT	FUNCTION	ALLOCATION
1	PROTECTION	66kV FEEDER 1 RP
2	METERING	66kV FEEDER 1 RP
3	PROTECTION	66kV FEEDER 3 RP
4	METERING	66kV FEEDER 3 RP
5	PROTECTION	66kV FEEDER 2 RP
6	METERING	66kV FEEDER 2 RP
7	PROTECTION	66kV FEEDER 4 RP
8	METERING	66kV FEEDER 4 RP

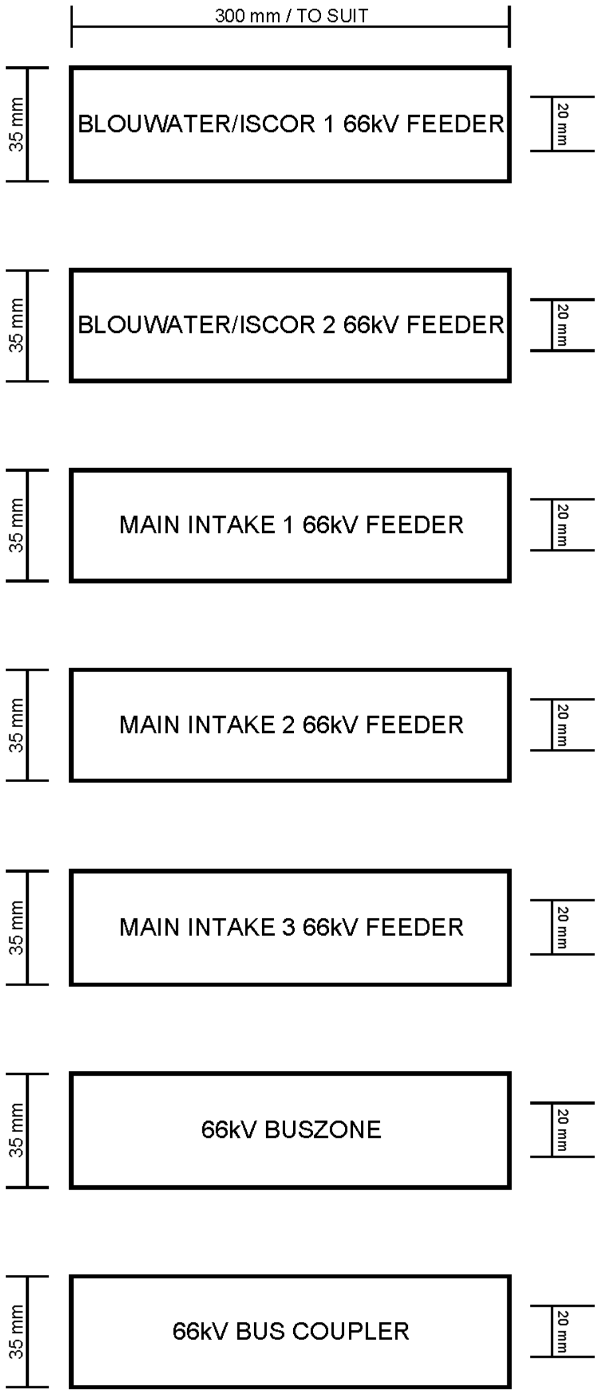
66 kV BUSBAR 2 VTJB 2

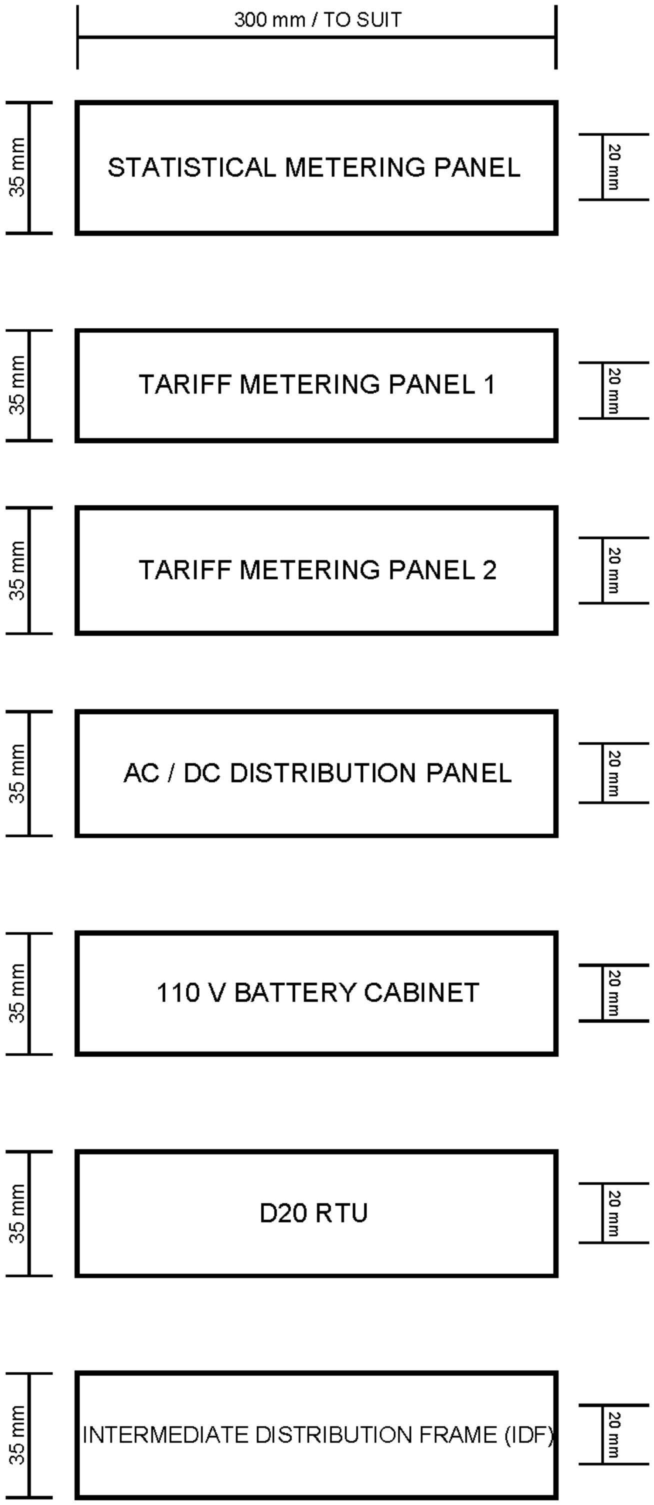
15 mm	20 mm	50 mm

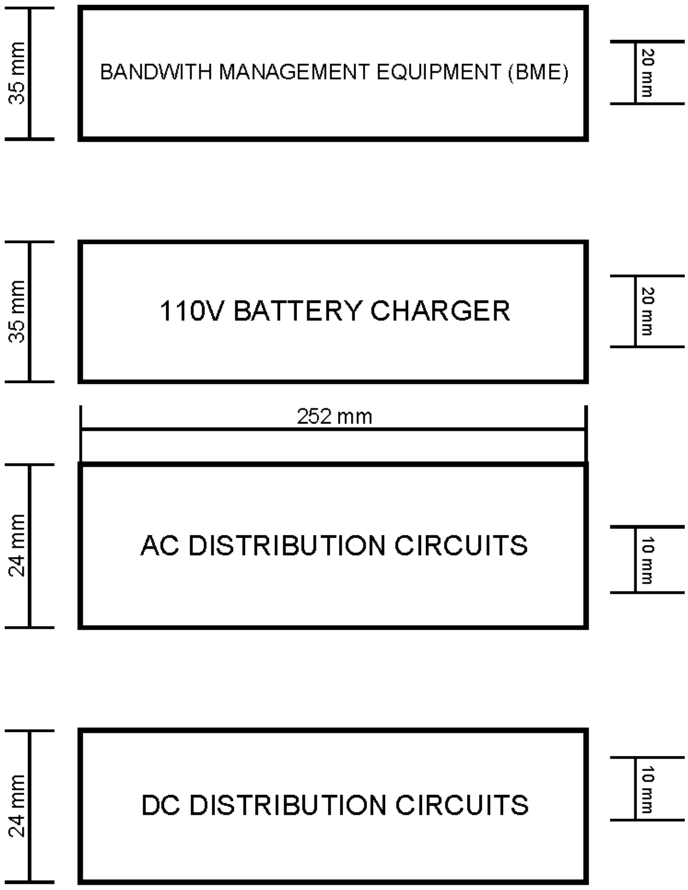
CIRCUIT	FUNCTION	ALLOCATION
1	PROTECTION	66kV FEEDER 6 RP
2	METERING	66kV FEEDER 6 RP
3	PROTECTION	66kV BUSCOUPLER RP
4	METERING	
5	PROTECTION	
6	METERING	
7	PROTECTION	
8	METERING	

10 mm

10.5.4 Panel Labels




300 mm / TO SUIT
35 mm
STATISTICAL METERING PANEL
20 mm
35 mm
TARIFF METERING PANEL 1
20 mm
35 mm
TARIFF METERING PANEL 2
20 mm
35 mm
AC / DC DISTRIBUTION PANEL
20 mm
35 mm
110 V BATTERY CABINET
20 mm
35 mm
D20 RTU
20 mm
35 mm
INTERMEDIATE DISTRIBUTION FRAME (IDF)
20 mm


35 mm
BANDWITH MANAGEMENT EQUIPMENT (BME)
20 mm
35 mm
110V BATTERY CHARGER
20 mm
252 mm
24 mm
AC DISTRIBUTION CIRCUITS
10 mm
24 mm
DC DISTRIBUTION CIRCUITS
10 mm

10.5.5 AC Labels

25 mm | 68 mm

15 mm
13 mm
80 mm

400 V 3-PHASE AC DISTRIBUTION MODULE	
ISOL (AC)	AC ISOLATOR
MCB (3A)	BUILDING DB
MCB (3B)	BATTERY ROOM FAN
MCB (3C)	
MCB (3D)	

230 V 1- PHASE AC DISTRIBUTION CIRCUITS (MODULE 1)	
MCB (1A)	66kV FEEDER 1
MCB (1B)	66kV FEEDER 2
MCB (1C)	66kV FEEDER 3
MCB (1D)	66kV FEEDER 4
MCB (1E)	
MCB (1F)	66kV FEEDER 6
MCB (1G)	
MCB (1H)	66kV BUSZONE
MCB (1J)	66kV BUS COUPLER
MCB (1K)	STATISTICAL METERING
MCB (1L)	TARIFF METERING
MCB (1M)	
MCB (1N)	
MCB (1P)	

230 V 1- PHASE AC DISTRIBUTION CIRCUITS (MODULE 2)	
MCB (2A)	
MCB (2B)	
MCB (2C)	
MCB (2D)	
MCB (2E)	
MCB (2F)	
MCB (2G)	
MCB (2H)	
MCB (2J)	
MCB (2K)	
MCB (2L)	
MCB (2M)	
MCB (2N)	
MCB (2P)	

AC YARD 1 DISTRIBUTION LEGEND	
MCB-3	AC/DC DISTRIBUTION PANEL
MCB-4	YARD FLOODLIGHTS POLE 1
MCB-5	
MCB-6	
MCB-7	
MCB-8	
MCB-9	
MCB-10	YARD PLUG BOXES
MCB-11	3 PHASE TEST SOCKET
EL	1 PHASE SOCKET OUTLETS
MCB-12	FLOODLIGHT CONTROL & DAY/NIGHT SWITCH
MCB-13	
MCB-14	

25 mm	68 mm

AC YARD 2 DISTRIBUTION LEGEND	
MCB-3	YARD AC DISTRIBUTION BOARD 1
MCB-4	
MCB-5	
MCB-6	
MCB-7	
MCB-8	
MCB-9	
MCB-10	
MCB-11	3 PHASE SOCKET
EL	1 PHASE SOCKET OUTLETS
MCB-12	FLOODLIGHT CONTROL & DAY/NIGHT SWITCH
MCB-13	
MCB-14	

10.5.6 DC Labels

25 mm 75 mm

15 mm
13 mm

110V DC DISTRIBUTION CIRCUITS (MODULE 1)	
ISOL (DC)	DC ISOLATOR
MCB (1A)	66kV FEEDER 1
MCB (1B)	66kV FEEDER 2
MCB (1C)	66kV FEEDER 3
MCB (1D)	66kV FEEDER 4
MCB (1E)	
MCB (1F)	66kV FEEDER 6
MCB (1G)	
MCB (1H)	66kV BUSZONE
MCB (1J)	66kV BUS COUPLER
MCB (1K)	EMERGENCY LIGHTS

110V DC DISTRIBUTION CIRCUITS (MODULE 2)	
ISOL (DC)	DC ISOLATOR
MCB (2A)	SUBSTATION AUTOMATION
MCB (2B)	RTU
MCB (2C)	
MCB (2D)	
MCB (2E)	
MCB (2F)	
MCB (2G)	
MCB (2H)	
MCB (2J)	
MCB (2K)	

10.6 Detailed Drawings

Drawing No	Drawing Name	Rev
D-WC-8118-21-01	Statistical Metering Panel 66kV Feeder 1 & 3 Meter Module Equipment Layout	00
D-WC-8118-21-02	Statistical Metering Panel 66kV Feeder 1 & 3 Meter Module Key Diagram	00
D-WC-8118-21-03	Statistical Metering Panel 66kV Feeder 1 & 3 Meter Module Cabling Diagram	00
D-WC-8118-23-01	66kV Feeder 2, 4 & 6 Quality of Supply Module 1 Layout	00
D-WC-8118-23-02	66kV Feeder 2, 4 & 6 Quality of Supply Module 1 AC Key Diagram	00
D-WC-8118-23-03	66kV Feeder 2, 4 & 6 Quality of Supply Module 1 Cabling Diagram	00
D-WC-8118-23-04	66kV Feeders 2, 4 & 6 Quality of Supply Module 1 Cabling Diagram	00
D-WC-8118-23-05	66kV Feeders 2, 4 & 6 Quality of Supply Module 1 Cabling Diagram	00
D-WC-8118-30-01	Tariff Metering Panel 66kV Feeder 2 Meter Module Equipment Layout	00
D-WC-8118-30-02	Tariff Metering Panel 66kV Feeder 2 Meter Module Key Diagram	00
D-WC-8118-30-03	Tariff Metering Panel 66kV Feeder 2 Meter Module Cabling Diagram	00
D-WC-8118-30-04	Tariff Metering Panel 66kV Feeder 4 Meter Module Equipment Layout	00
D-WC-8118-30-05	Tariff Metering Panel 66kV Feeder 4 Meter Module Key Diagram	00
D-WC-8118-30-06	Tariff Metering Panel 66kV Feeder 4 Meter Module Cabling Diagram	00
D-WC-8118-30-07	Tariff Metering Panel 66kV Feeder 6 Meter Module Equipment Layout	00
D-WC-8118-30-08	Tariff Metering Panel 66kV Feeder 6 Meter Module Key Diagram	00
D-WC-8118-30-09	Tariff Metering Panel 66kV Feeder 6 Meter Module Cabling Diagram	00
D-WC-8118-31-01	RTU Panel (D20) Comms Cable Block Diagram	00
D-WC-8118-31-02	RTU Panel Comms Cable Block Diagram	00
D-WC-8118-32-01	RTU Panel (D20) IDF Layout & Cables	00
D-WC-8118-41-00	66kV Feeder 1 Cover Sheet	00
D-WC-8118-41-01	66kV Feeder 1 Panel Equipment Layout	00
D-WC-8118-41-02	66kV Feeder 1 Logic Diagram	00
D-WC-8118-41-03	66kV Feeder 1 Single Line Diagram	00
D-WC-8118-41-04	66kV Feeder 1 AC Key Diagram	00
D-WC-8118-41-05	66kV Feeder 1 VT Supply Key Diagram	00
D-WC-8118-41-06	66kV Feeder 1 Main DC Key Diagram	00
D-WC-8118-41-07	66kV Feeder 1 Main DC Key Diagram	00
D-WC-8118-41-08	66kV Feeder 1Teleprotection DC Key Diagram	00
D-WC-8118-41-09	66kV Feeder 1 Back-up DC Key Diagram	00
D-WC-8118-41-10	66kV Feeder 1 Back-up DC Key Diagram	00
D-WC-8118-41-11	66kV Feeder 1 Back-up DC Key Diagram	00
D-WC-8118-41-12	66kV Feeder 1 Close DC Key Diagram	00
D-WC-8118-41-13	66kV Feeder 1 Indication DC Key Diagram	00
D-WC-8118-41-14	66kV Feeder 1 Spring Rewind and AC Key Diagram	00
D-WC-8118-41-15	66kV Feeder 1 REA and Measurements Key Diag	00
D-WC-8118-41-16	66kV Feeder 1 Supervis. Status & Control Key	00
D-WC-8118-41-17	66kV Feeder 1 Supervisory Alarms Key Diagram	00
D-WC-8118-41-18	66kV Feeder 1 Disturbance Recorder Key Diag	00
D-WC-8118-41-19	66kV Feeder 1 Protection Reference Diagram	00
D-WC-8118-41-20	66kV Feeder 1 Protection Reference Diagram	00
D-WC-8118-41-21	66kV Feeder 1 Protection Reference Diagram	00

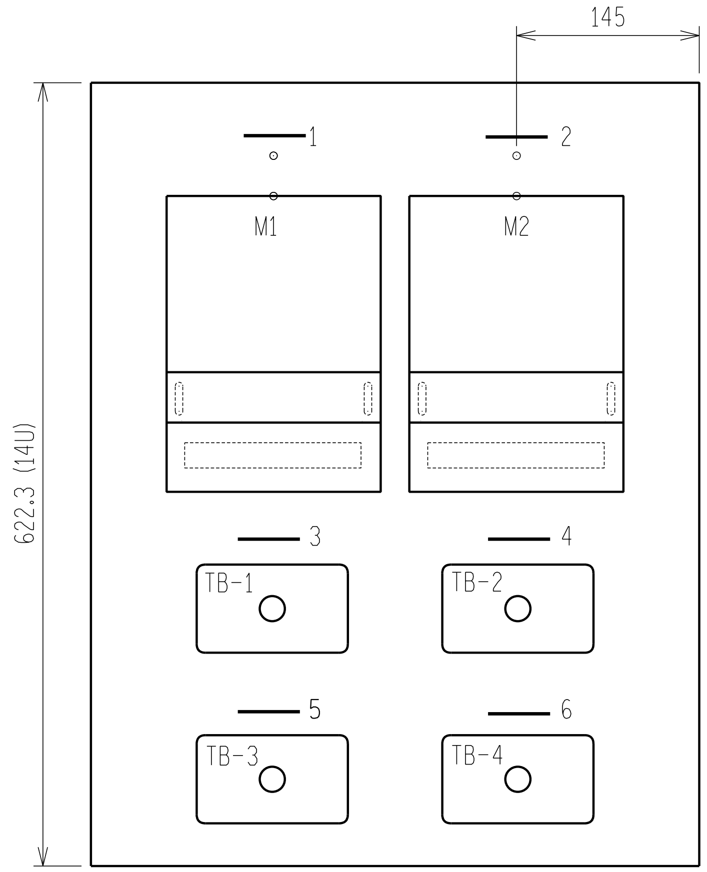
D-WC-8118-41-22	66kV Feeder 1 Panel Cabling Diagram	00
D-WC-8118-41-23	66kV Feeder 1 Panel Cabling Diagram	00
D-WC-8118-41-24	66kV Feeder 1 Panel Cabling Diagram	00
D-WC-8118-41-25	66kV Feeder 1 CTJB Cabling Diagram	00
D-WC-8118-41-26	66kV Feeder 1 Line VTJB Layout & Key Diagram	00
D-WC-8118-41-27	66kV Feeder 1 Cable Block Diagram	00
D-WC-8118-41-28	66kV Feeder 1 ISJB Cabling Diagram	00
D-WC-8118-42-00	66kV Feeder 2 Interface & Monitoring Scheme Cover Sheet	00
D-WC-8118-42-01	66kV Feeder 2 Interface & Monitoring Scheme Panel Equipment Layout	00
D-WC-8118-42-02	66kV Feeder 2 Interface & Monitoring Scheme Scheme Logic Diagram	00
D-WC-8118-42-03	66kV Feeder 2 Interface & Monitoring Scheme Single Line Diagram	00
D-WC-8118-42-04	66kV Feeder 2 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-42-05	66kV Feeder 2 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-42-06	66kV Feeder 2 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-42-07	66kV Feeder 2 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-42-08	66kV Feeder 2 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-42-09	66kV Feeder 2 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-42-10	66kV Feeder 2 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-42-11	66kV Feeder 2 Interface & Monitoring Scheme AC Supply Key & Spring Rewind Diagram	00
D-WC-8118-42-12	66kV Feeder 2 Interface & Monitoring Scheme Supervisory Alarms and Controls	00
D-WC-8118-42-13	66kV Feeder 2 Interface & Monitoring Scheme Reference Diagram	00
D-WC-8118-42-14	66kV Feeder 2 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-42-15	66kV Feeder 2 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-42-16	66kV Feeder 2 Interface & Monitoring Scheme CTJB Cabling	00
D-WC-8118-42-17	66kV Feeder 2 Interface & Monitoring Scheme Customer Interface JB	00
D-WC-8118-42-18	66kV Feeder 2 Interface & Monitoring Scheme ISJB Cable Block Diagram	00
D-WC-8118-42-19	66kV Feeder 2 Interface & Monitoring Scheme Cable Block Diagram	00
D-WC-8118-43-00	66kV Feeder 3 Cover Sheet	00
D-WC-8118-43-01	66kV Feeder 3 Panel Equipment Layout	00
D-WC-8118-43-02	66kV Feeder 3 Logic Diagram	00
D-WC-8118-43-03	66kV Feeder 3 Single Line Diagram	00
D-WC-8118-43-04	66kV Feeder 3 AC Key Diagram	00
D-WC-8118-43-05	66kV Feeder 3 VT Supply Key Diagram	00
D-WC-8118-43-06	66kV Feeder 3 Main DC Key Diagram	00
D-WC-8118-43-07	66kV Feeder 3 Main DC Key Diagram	00
D-WC-8118-43-08	66kV Feeder 3 Teleprotection DC Key Diagram	00
D-WC-8118-43-09	66kV Feeder 3 Back-up DC Key Diagram	00
D-WC-8118-43-10	66kV Feeder 3 Back-up DC Key Diagram	00
D-WC-8118-43-11	66kV Feeder 3 Back-up DC Key Diagram	00
D-WC-8118-43-12	66kV Feeder 3 Close DC Key Diagram	00
D-WC-8118-43-13	66kV Feeder 3 Indication DC Key Diagram	00
D-WC-8118-43-14	66kV Feeder 3 Spring Rewind and AC Key Diagram	00
D-WC-8118-43-15	66kV Feeder 3 REA and Measurements Key Diag	00
D-WC-8118-43-16	66kV Feeder 3 Supervis. Status & Control Key	00
D-WC-8118-43-17	66kV Feeder 3 Supervisory Alarms Key Diagram	00
D-WC-8118-43-18	66kV Feeder 3 Disturbance Recorder Key Diag	00

D-WC-8118-43-19	66kV Feeder 3 Protection Reference Diagram	00
D-WC-8118-43-20	66kV Feeder 3 Protection Reference Diagram	00
D-WC-8118-43-21	66kV Feeder 3 Protection Reference Diagram	00
D-WC-8118-43-22	66kV Feeder 3 Panel Cabling Diagram	00
D-WC-8118-43-23	66kV Feeder 3 Panel Cabling Diagram	00
D-WC-8118-43-24	66kV Feeder 3 Panel Cabling Diagram	00
D-WC-8118-43-25	66kV Feeder 3 CTJB Cabling Diagram	00
D-WC-8118-43-26	66kV Feeder 3 Line VTJB Layout & Key Diagram	00
D-WC-8118-43-27	66kV Feeder 3 Cable Block Diagram	00
D-WC-8118-43-28	66kV Feeder 3 ISJB Cabling Diagram	00
D-WC-8118-44-00	66kV Feeder 4 Interface & Monitoring Scheme Cover Sheet	00
D-WC-8118-44-01	66kV Feeder 4 Interface & Monitoring Scheme Panel Equipment Layout	00
D-WC-8118-44-02	66kV Feeder 4 Interface & Monitoring Scheme Scheme Logic Diagram	00
D-WC-8118-44-03	66kV Feeder 4 Interface & Monitoring Scheme Single Line Diagram	00
D-WC-8118-44-04	66kV Feeder 4 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-44-05	66kV Feeder 4 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-44-06	66kV Feeder 4 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-44-07	66kV Feeder 4 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-44-08	66kV Feeder 4 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-44-09	66kV Feeder 4 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-44-10	66kV Feeder 4 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-44-11	66kV Feeder 4 Interface & Monitoring Scheme AC Supply Key & Spring Rewind Diagram	00
D-WC-8118-44-12	66kV Feeder 4 Interface & Monitoring Scheme Supervisory Alarms and Controls	00
D-WC-8118-44-13	66kV Feeder 4 Interface & Monitoring Scheme Reference Diagram	00
D-WC-8118-44-14	66kV Feeder 4 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-44-15	66kV Feeder 4 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-44-16	66kV Feeder 4 Interface & Monitoring Scheme CTJB Cabling	00
D-WC-8118-44-17	66kV Feeder 4 Interface & Monitoring Scheme Customer Interface JB	00
D-WC-8118-44-18	66kV Feeder 4 Interface & Monitoring Scheme ISJB Cable Block Diagram	00
D-WC-8118-44-19	66kV Feeder 4 Interface & Monitoring Scheme Cable Block Diagram	00
D-WC-8118-46-00	66kV Feeder 6 Interface & Monitoring Scheme Cover Sheet	00
D-WC-8118-46-01	66kV Feeder 6 Interface & Monitoring Scheme Panel Equipment Layout	00
D-WC-8118-46-02	66kV Feeder 6 Interface & Monitoring Scheme Scheme Logic Diagram	00
D-WC-8118-46-03	66kV Feeder 6 Interface & Monitoring Scheme Single Line Diagram	00
D-WC-8118-46-04	66kV Feeder 6 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-46-05	66kV Feeder 6 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-46-06	66kV Feeder 6 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-46-07	66kV Feeder 6 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-46-08	66kV Feeder 6 Interface & Monitoring Scheme AC Key Diagram	00
D-WC-8118-46-09	66kV Feeder 6 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-46-10	66kV Feeder 6 Interface & Monitoring Scheme DC Key Diagram	00
D-WC-8118-46-11	66kV Feeder 6 Interface & Monitoring Scheme AC Supply Key & Spring Rewind Diagram	00
D-WC-8118-46-12	66kV Feeder 6 Interface & Monitoring Scheme Supervisory Alarms and Controls	00
D-WC-8118-46-13	66kV Feeder 6 Interface & Monitoring Scheme Reference Diagram	00

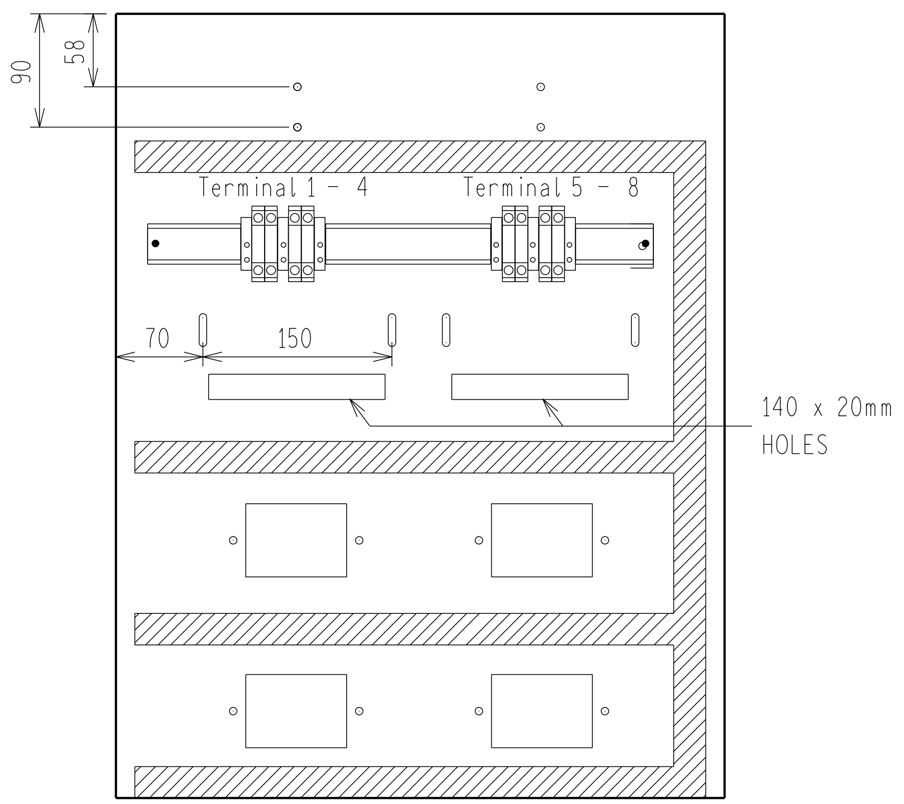
D-WC-8118-46-14	66kV Feeder 6 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-46-15	66kV Feeder 6 Interface & Monitoring Scheme Panel Cabling Diagram	00
D-WC-8118-46-16	66kV Feeder 6 Interface & Monitoring Scheme CTJB Cabling	00
D-WC-8118-46-17	66kV Feeder 6 Interface & Monitoring Scheme Customer Interface JB	00
D-WC-8118-46-18	66kV Feeder 6 Interface & Monitoring Scheme ISJB Cable Block Diagram	00
D-WC-8118-46-19	66kV Feeder 6 Interface & Monitoring Scheme Cable Block Diagram	00
D-WC-8118-48-00	66kV Busbar 1 VTJB 1 & 2 Cover Sheet	00
D-WC-8118-48-01	66kV Busbar 1 VTJB 1 & 2 VRW20 Insert VT Tray Layout	00
D-WC-8118-48-02	66kV Busbar 1 VTJB 1 & 2 VRW20 VT Insert Tray Wiring Key Diagram	00
D-WC-8118-48-03	66kV Busbar 1 VTJB 1 Cabling Diagram	00
D-WC-8118-48-04	66kV Busbar 1 VTJB 2 Cabling Diagram	00
D-WC-8118-48-05	66kV Busbar 1 VRW20 Insert Power VT Tray Layout	00
D-WC-8118-48-06	66kV Busbar 1 Power VT VRW20 VT Insert Tray Wiring Key Diagram	00
D-WC-8118-48-07	66kV Busbar 1 Power VT VTJB Cabling Diagram	00
D-WC-8118-48-08	66kV Busbar 2 VTJB 1 & 2 Cover Sheet	00
D-WC-8118-48-09	66kV Busbar 2 VTJB 1 & 2 VRW20 Insert Power VT Tray Layout	00
D-WC-8118-48-10	66kV Busbar 2 VTJB 1 & 2 VRW20 VT Insert Tray Wiring Key Diagram	00
D-WC-8118-48-11	66kV Busbar 2 VTJB 1 Cabling Diagram	00
D-WC-8118-48-12	66kV Busbar 2 VTJB 2 Cabling Diagram	00
D-WC-8118-48-13	66kV Busbar 2 VRW20 Insert Power VT Tray Layout	00
D-WC-8118-48-14	66kV Busbar 2 Power VT VRW20 VT Insert Tray Wiring Key Diagram	00
D-WC-8118-48-15	66kV Busbar 2 Power VTJB Cabling Diagram	00
D-WC-8118-49-00	66kV Bus Coupler Cover Sheet	00
D-WC-8118-49-01	66kV Bus Coupler Panel Layout Diagram	00
D-WC-8118-49-02	66kV Bus Coupler Scheme Logic Diagram	00
D-WC-8118-49-03	66kV Bus Coupler AC Key Diagram	00
D-WC-8118-49-04	66kV Bus Coupler AC Key Diagram	00
D-WC-8118-49-05	66kV Bus Coupler AC Key Diagram	00
D-WC-8118-49-06	66kV Bus Coupler DC Key Diagram	00
D-WC-8118-49-07	66kV Bus Coupler DC Key Diagram	00
D-WC-8118-49-08	66kV Bus Coupler AC Supply Key & S/Rewind Dia	00
D-WC-8118-49-09	66kV Bus Coupler Sup Alarms and Controls	00
D-WC-8118-49-10	66kV Bus Coupler Reference Diagram	00
D-WC-8118-49-11	66kV Bus Coupler Cabling Diagram	00
D-WC-8118-49-12	66kV Bus Coupler Cable Block Diagram	00
D-WC-8118-50-00	66kV Buszone Panel Cover Sheet	00
D-WC-8118-50-01	66kV Buszone Panel Cover Sheet	00
D-WC-8118-50-02	66kV Buszone Panel Front Panel Label Schedule	00
D-WC-8118-50-03	66kV Buszone Panel Scheme Logic Diagram	00
D-WC-8118-50-04	66kV Buszone Panel Relay Logic Diagram	00
D-WC-8118-50-05	66kV Buszone Panel Scheme Logic Diagram	00
D-WC-8118-50-06	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-07	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-08	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-09	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-10	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-11	66kV Buszone Panel AC Key Diagram	00
D-WC-8118-50-12	66kV Buszone Panel DC Key Diagram	00
D-WC-8118-50-13	66kV Buszone Panel DC Key Diagram	00

D-WC-8118-50-14	66kV Buszone Panel DC Key & Trip Outputs Diagram	00
D-WC-8118-50-15	66kV Buszone Panel AC & Supervisory Key Diagram	00
D-WC-8118-50-16	66kV Buszone Panel Protection Reference Diagram	00
D-WC-8118-50-17	66kV Buszone Panel Panel Cabling Diagram	00
D-WC-8118-50-18	66kV Buszone Panel Panel Cabling Diagram	00
D-WC-8118-50-19	66kV Buszone Panel Panel Cabling Diagram	00
D-WC-8118-50-20	66kV Buszone Panel Cable Block	00
D-WC-8118-151-01	Yard AC Distribution Board 1 Equipment Layout	00
D-WC-8118-151-02	Yard AC Distribution Board 1 Control Module Key Diagram	00
D-WC-8118-151-03	Yard AC Distribution Board 1 Distribution Module Key Diagram	00
D-WC-8118-151-04	Yard AC Distribution Board 1 Terminals Module Cabling Diagram	00
D-WC-8118-152-01	Yard AC Distribution Board 2 Equipment Layout	00
D-WC-8118-152-02	Yard AC Distribution Board 2 Control Module Key Diagram	00
D-WC-8118-152-03	Yard AC Distribution Board 2 Distribution Module Key Diagram	00
D-WC-8118-152-04	Yard AC Distribution Board 2 Terminals Module Cabling Diagram	00
D-WC-8118-153-00	28/20 Way AC/DC Panel Cover Sheet	00
D-WC-8118-153-01	28/20 Way AC/DC Panel Panel Equipment Layout	00
D-WC-8118-153-02	28/20 Way AC/DC Panel Panel Label Schedule	00
D-WC-8118-153-03	Modular Board Terminal Plate Arrangement	00
D-WC-8118-153-04	Main AC Incoming Module Equipment Layout	00
D-WC-8118-153-05	Main AC Incoming Module AC Key Diagram	00
D-WC-8118-153-06	28/20 Way AC/DC Panel 400V 3Ø AC Distribution Module Panel Equipment Layout	00
D-WC-8118-153-07	28/20 Way AC/DC Panel 400V 3Ø Distribution Module AC Key Diagram	00
D-WC-8118-153-08	28/20 Way AC/DC Panel 230V 1Ø AC Distribution Module 1 Equipment Layout	00
D-WC-8118-153-09	28/20 Way AC/DC Panel 230V 1Ø AC Distribution Module 1 Key Diagram	00
D-WC-8118-153-10	28/20 Way AC/DC Panel 230V 1Ø AC Distribution Module 2 Equipment Layout	00
D-WC-8118-153-11	28/20 Way AC/DC Panel 230V 1Ø AC Distribution Module 2 AC Key Diagram	00
D-WC-8118-153-12	28/20 Way AC/DC Panel AC Supply Module Equipment Layout	00
D-WC-8118-153-13	28/20 Way AC/DC Panel AC Supply Module Key Diagram	00
D-WC-8118-153-14	28/20 Way AC/DC Panel 110V/220V Subrack Charger Backplate Layout	00
D-WC-8118-153-15	28/20 Way AC/DC Panel 110V/220V Subrack Charger AC & DC Interconnections	00
D-WC-8118-153-16	28/20 Way AC/DC Panel 110V/220V Subrack Charger Alarm & Supervisory Intercon	00
D-WC-8118-153-17	28/20 Way AC/DC Panel DC Interface Module Equipment Layout	00
D-WC-8118-153-18	28/20 Way AC/DC Panel DC Interface Module Key Diagram	00
D-WC-8118-153-19	28/20 Way AC/DC Panel 110V DC Distribution Module 1 Equipment Layout	00
D-WC-8118-153-20	28/20 Way AC/DC Panel 110V DC Distribution Module 1 Key Diagram	00
D-WC-8118-153-21	28/20 Way AC/DC Panel 110V DC Distribution Module 2 Equipment Layout	00
D-WC-8118-153-22	28/20 Way AC/DC Panel 110V DC Distribution Module 2 Key Diagram	00

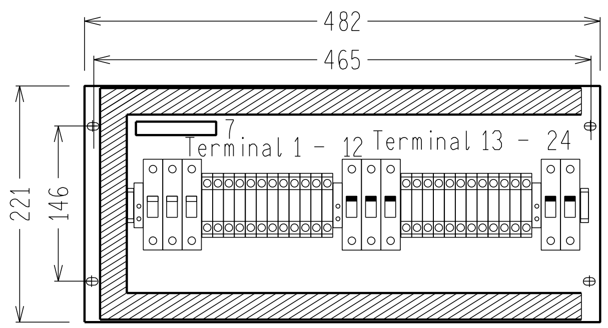
D-WC-8118-153-23	28/20 Way AC/DC Panel AC/DC Panel Cabling Diagram	00
D-WC-8118-156-01	Panel Layout & Main Label Engraving	00
D-WC-8118-156-02	Panel Layout & Main Label Engraving	00
D-WC-8118-157-01	Panel Arrangement	00
D-WC-8118-159-01	66kV Feeder 1 & 3 Cable Block Diagram	00
D-WC-8118-159-02	66kV Feeder 2, 4 & 6 Cable Block Diagram	00
D-WC-8118-159-03	Auxiliaries Cable Block Diagram	00
D-WC-8118-159-04	Auxiliaries Cable Block Diagram	00
D-WC-8118-167-00	Telecomms & Substation Automation Cover Sheet	00
D-WC-8118-167-01	Telecomms & Substation Automation Panel Equipment Layout	00
D-WC-8118-167-02	Telecomms & Substation Automation DC Converter DC Key Diagram	00
D-WC-8118-167-03	Telecomms & Substation Automation DC Distribution Module Layout	00
D-WC-8118-167-04	Telecomms & Substation Automation DC Key Diagram	00
D-WC-8118-167-05	Telecomms & Substation Automation Cabling Diagram	00
D-WC-8118-167-06	Telecomms & Substation Automation Cable Block Diagram	00
D-WC-8118-167-07	Telecomms & Substation Automation Panel Cable Entry Layout	00



EQUIPMENT PLATE - FRONT VIEW



EQUIPMENT PLATE - REAR VIEW



METER TERMINAL PLATE

LABEL No.	LABEL INSCRIPTION
1	66kV FDR 1 STATISTICAL METER
2	66kV FDR 3 STATISTICAL METER
3	AS SHOWN
4	AS SHOWN
5	AS SHOWN
6	AS SHOWN
7	66kV FDR 1 & 3 STATISTICAL MEASUREMENTS

LABEL 3 100x20mm

66kV FDR 1 CT

R | W | B | N

LABEL 4 100x20mm

66kV FDR 3 CT

R | W | B | N

LABEL 5 100x20mm

66kV FDR 1 VT

R | W | B | N

LABEL 6 100x20mm

66kV FDR 3 VT

R | W | B | N

LEGEND	DESCRIPTION	APPROVED EQUIPMENT
	MINIATURE CIRCUIT BREAKER CURVE 2, > 5kA (MCB)	MERLIN GERIN MULTI 9,5A or CBI: TYPE QF-1-D,6A
	TERMINALS: SPRING LOADED	METER TERMINAL PLATE: WEIDMULLER WDU 10 SL or ENTRELEC TYPE M 10/10.RS or ALSTOM ELMEX TYPE KULT 1 METER MODULE: WEIDMULLER WDU 6 SL or ENTRELEC TYPE M 6/8.RS or ALSTOM ELMEX TYPE KST 6WS
	END STOP	WEIDMULLER EW35/2 or ENTRELEC BAM or ALSTOM ELMEX SCUN or SCUDD or SCKN or PHOENIX CONTACT E/UK or CLIPFIX 35 or KLEMSAN KD3 or LEGRAND VIKING 3 39403
	TRUNKING	25 x 60mm TRUNKING

EQUIPMENT SCHEDULE

SYMBOLS	DESCRIPTION	MANUFACTURE	TYPE
M1 & M2	DEMAND METER 3PH4W 1A		
TB	TEST BLOCK	GEC MEASUREMENTS	PK 4
MCB	MINIATURE CIRCUIT BREAKER		

SHEET 03	CABLING DIAGRAM
SHEET 02	KEY DIAGRAM
SHEET 01	EQUIPMENT LAYOUT
DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
					/ /	
00	FIRST ISSUE				/ /	153272156-00003

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

THIS DRAWING IS THE PROPERTY OF ESKOM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

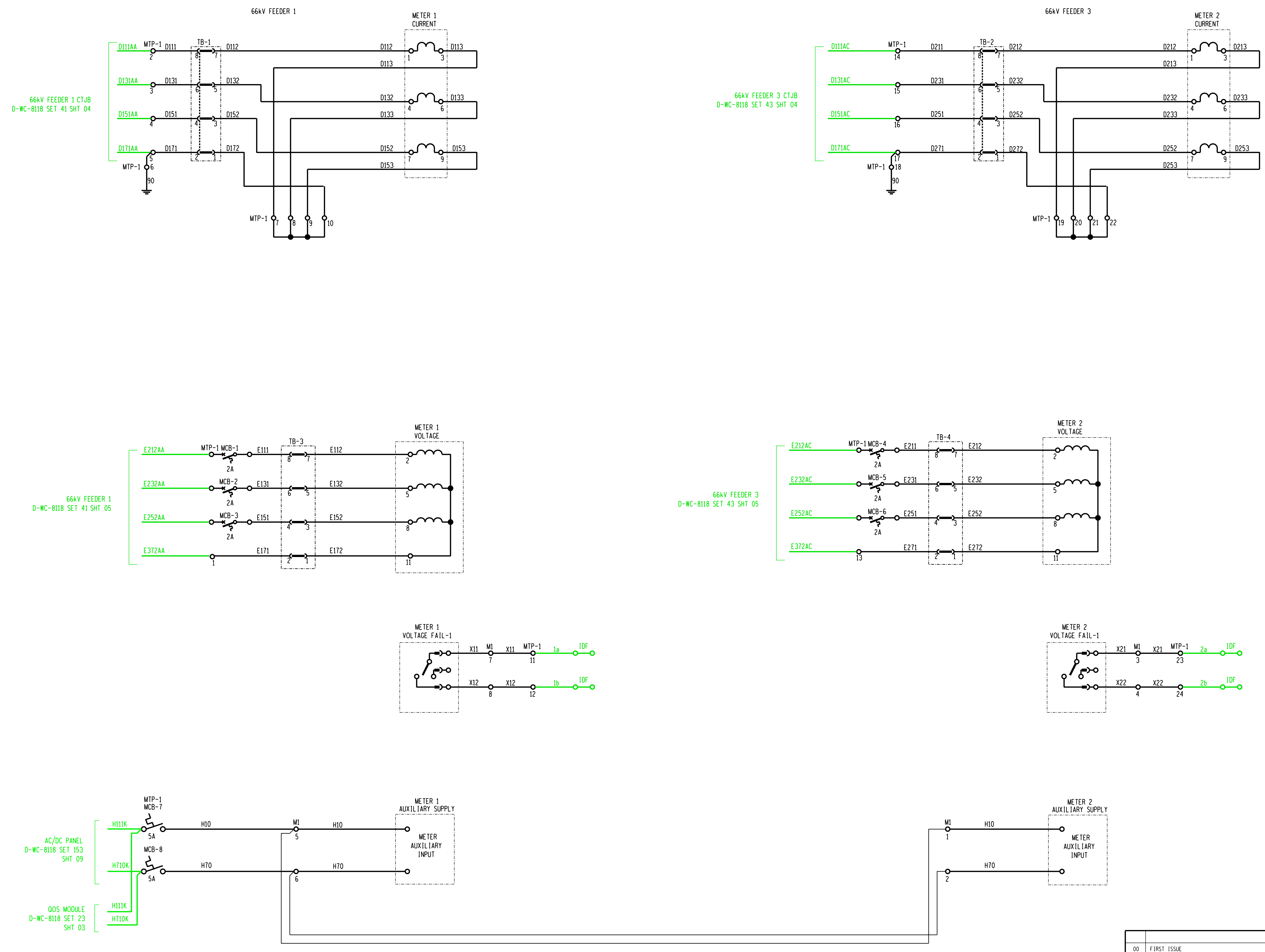
YSTERVARK SUBSTATION

STATISTICAL METERING & QOS PANEL 66kV FEEDER 1 & 3 METER MODULE EQUIPMENT LAYOUT

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	21	01	00

PANEL TYPE DESIGNATION 3MM01C Rev 02 A3L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 01 REVISION 02



LEGEND	
M1	METER INTERMEDIATE TERMINALS
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
MCB	MINIATURE CIRCUIT BREAKER

DRG. NO.	REFERENCE DRAWINGS:
SHEET 03	CABLING DIAGRAM
SHEET 02	KEY DIAGRAM
SHEET 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS
THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
STATISTICAL METERING & QOS PANEL
66kV FEEDER 1 & 3
METER MODULE KEY DIAGRAM

D-WC-8118

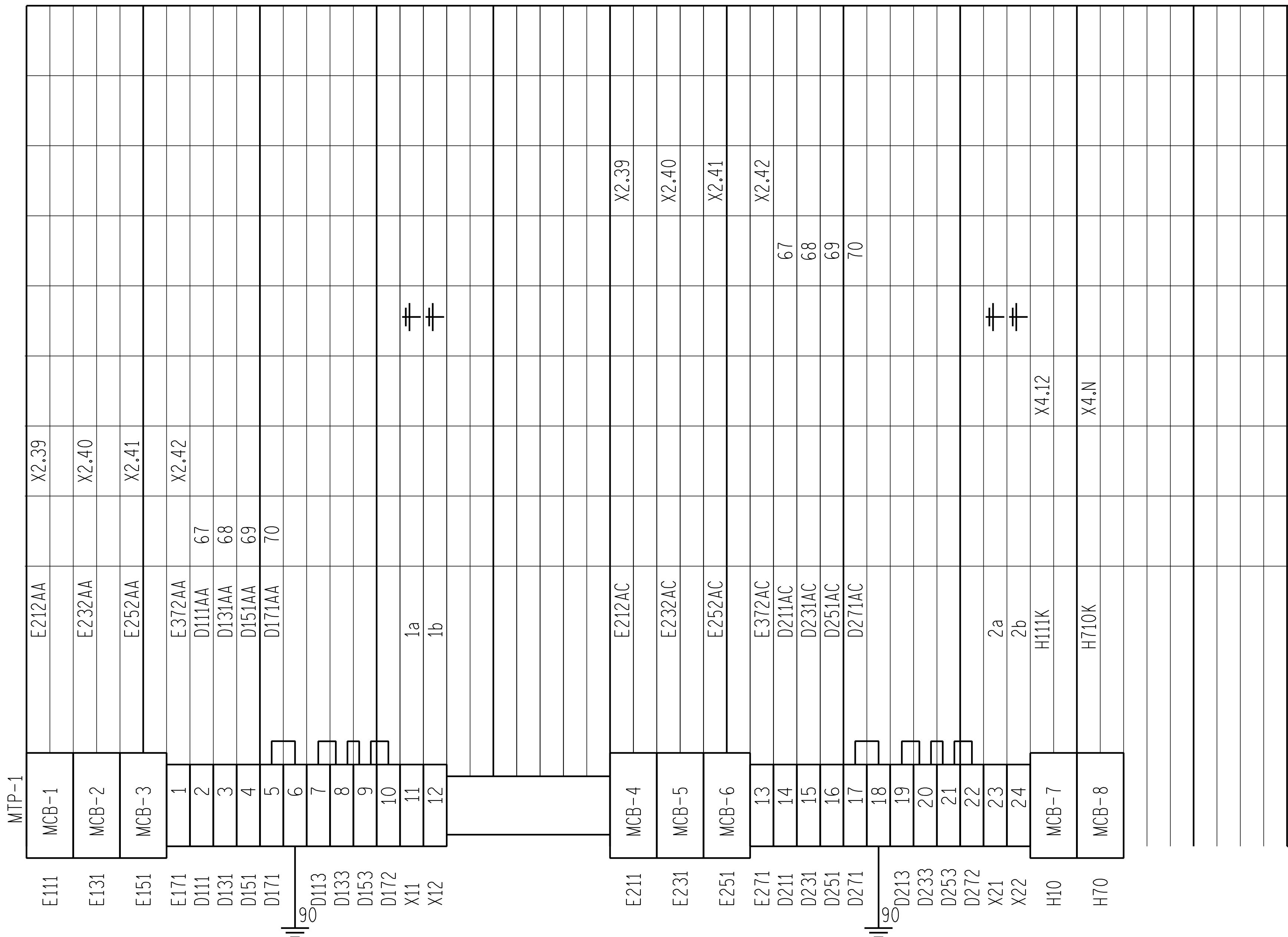
SET	SHEET	REVISION
21	02	00

PANEL TYPE DESIGNATION 3MM01C Rev 02

MASTER TRACING FILED UNDER D-WC-8118 SHEET 02 REVISION 02

A4L

TOP OF MODULE



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
AC107	4	-	66kV FEEDER 3 RP
AC118	4	-	66kV FEEDER 3 CTJB
53	10Pr	8Pr	IDF
43	4	2	AC/DC DISTRIBUTION PANEL
AA107	4	-	66kV FEEDER 1 RP
AA118	4	-	66kV FEEDER 1 CTJB

DRG NO.	REFERENCE DRAWINGS:
SHEET 03	CABLING DIAGRAM
SHEET 02	KEY DIAGRAM
SHEET 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2019
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
STATISTICAL METERING & QOS PANEL
66kV FEEDER 1 & 3
METER MODULE CABLING DIAGRAM

D-WC-8118	SET	SHEET	REVISION
	21	03	00

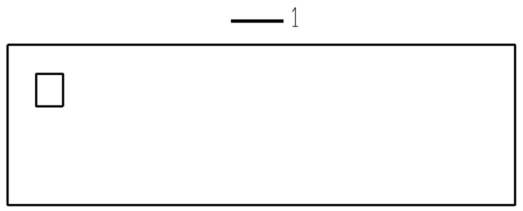
AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

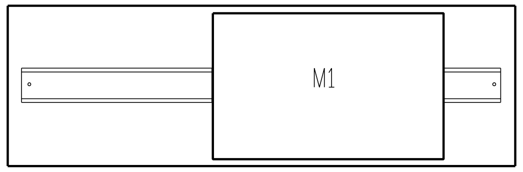
SCALE NTS

PANEL TYPE DESIGNATION 3MM01C Rev 02 A3L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 REVISION 02

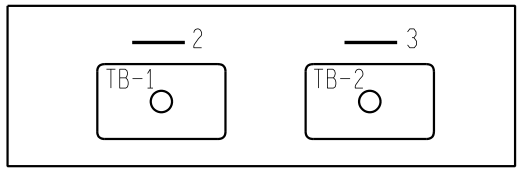


FRONT VIEW

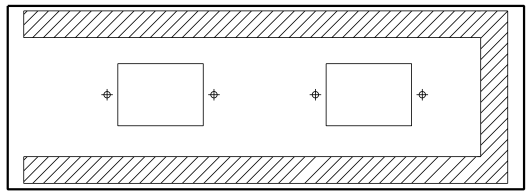


REAR VIEW

LABEL No.	LABEL INSCRIPTION
1	MAIN INTAKE FEEDER 2,4 & 6 QOS METER
2	AS SHOWN
3	AS SHOWN
4	AS SHOWN
5	AS SHOWN



EQUIPMENT PLATE
FRONT VIEW



EQUIPMENT PLATE
REAR VIEW

LABEL 4 100x20mm

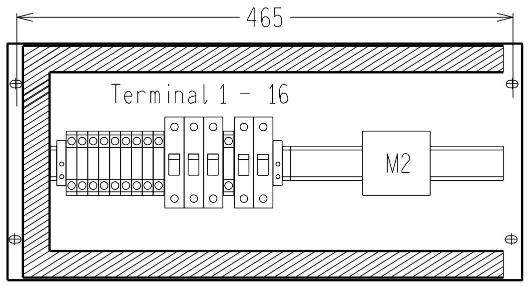
MAIN CT

R | W | B | N

LABEL 5 100x20mm

MAIN VT

R | W | B | N



TERMINAL PLATE

LEGEND	DESCRIPTION	APPROVED EQUIPMENT
	MINIATURE CIRCUIT BREAKER CURVE 2, > 5kA (MCB)	MERLIN GERIN MULTI 9, 2A or CBI: TYPE QF-1-D, 2A
	TERMINALS: SPRING LOADED	METER TERMINAL PLATE: WEIDMULLER WDU 10 SL or ENTRELEC TYPE M 10/10.RS or ALSTOM ELMEX TYPE KULT 1 METER MODULE: WEIDMULLER WDU 6 SL or ENTRELEC TYPE M 6/8.RS or ALSTOM ELMEX TYPE KST 6WS
	END STOP	WEIDMULLER EW35/2 or ENTRELEC BAM or ALSTOM ELMEX SCUN or SCUDD or SCKN or PHOENIX CONTACT E/UK or CLIPFIX 35 or KLEMSAN KD3 or LEGRAND VIKING 3 39403
	TRUNKING	25 x 60mm TRUNKING

EQUIPMENT SCHEDULE

SYMBOLS	DESCRIPTION	MANUFACTURE	TYPE
M1	POWER QUALITY DEVICE	CT LABS	VECTO III
TB 1 & 2	TEST BLOCK	GEC MEASUREMENTS	PK 2
CB	MINIATURE CIRCUIT BREAKER		
M2	MODEM	TELTONIKA	RUT 905

DRG NO.	REFERENCE DRAWINGS:
SHEET 05	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 04	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 03	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 02	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 01	QUALITY OF SUPPLY MODULE 1 LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

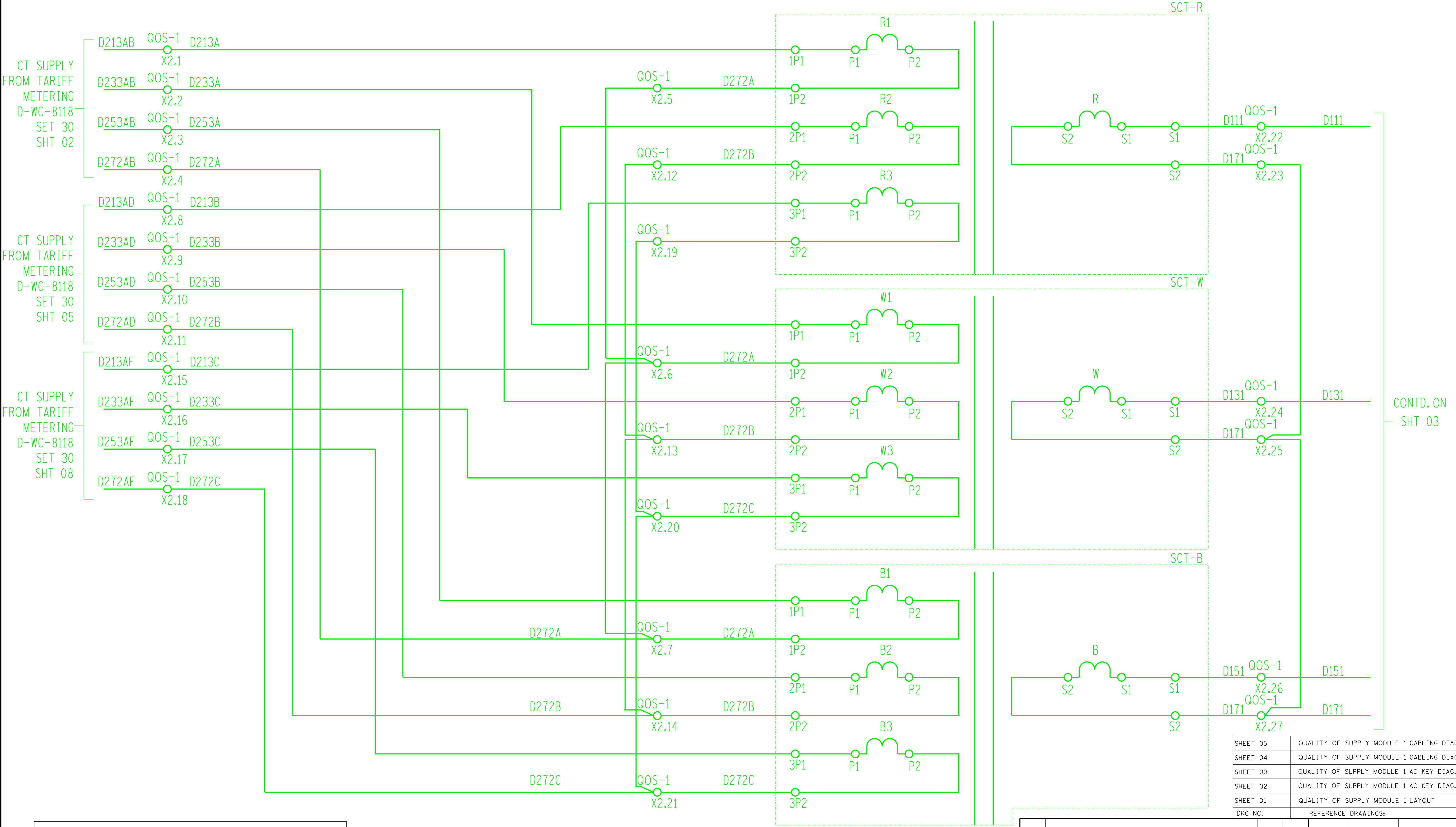
Eskom

AUTH:
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
66kV FEEDERS 2,4 & 6
QUALITY OF SUPPLY MODULE 1
LAYOUT

	SET	SHEET	REVISION
D-WC-8118	23	01	00

A3L



NOTE:
CONTRACTOR TO PROPOSE LAYOUT BASED ON AVAILABLE SUMMATION CTs.

LEGEND	
M1	METER MODULE 1
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
CB	CIRCUIT BREAKER
QOS-1	QUALITY OF SUPPLY - MODULE 1

DRG NO.	REFERENCE DRAWINGS:
SHEET 05	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 04	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 03	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 02	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 01	QUALITY OF SUPPLY MODULE 1 LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

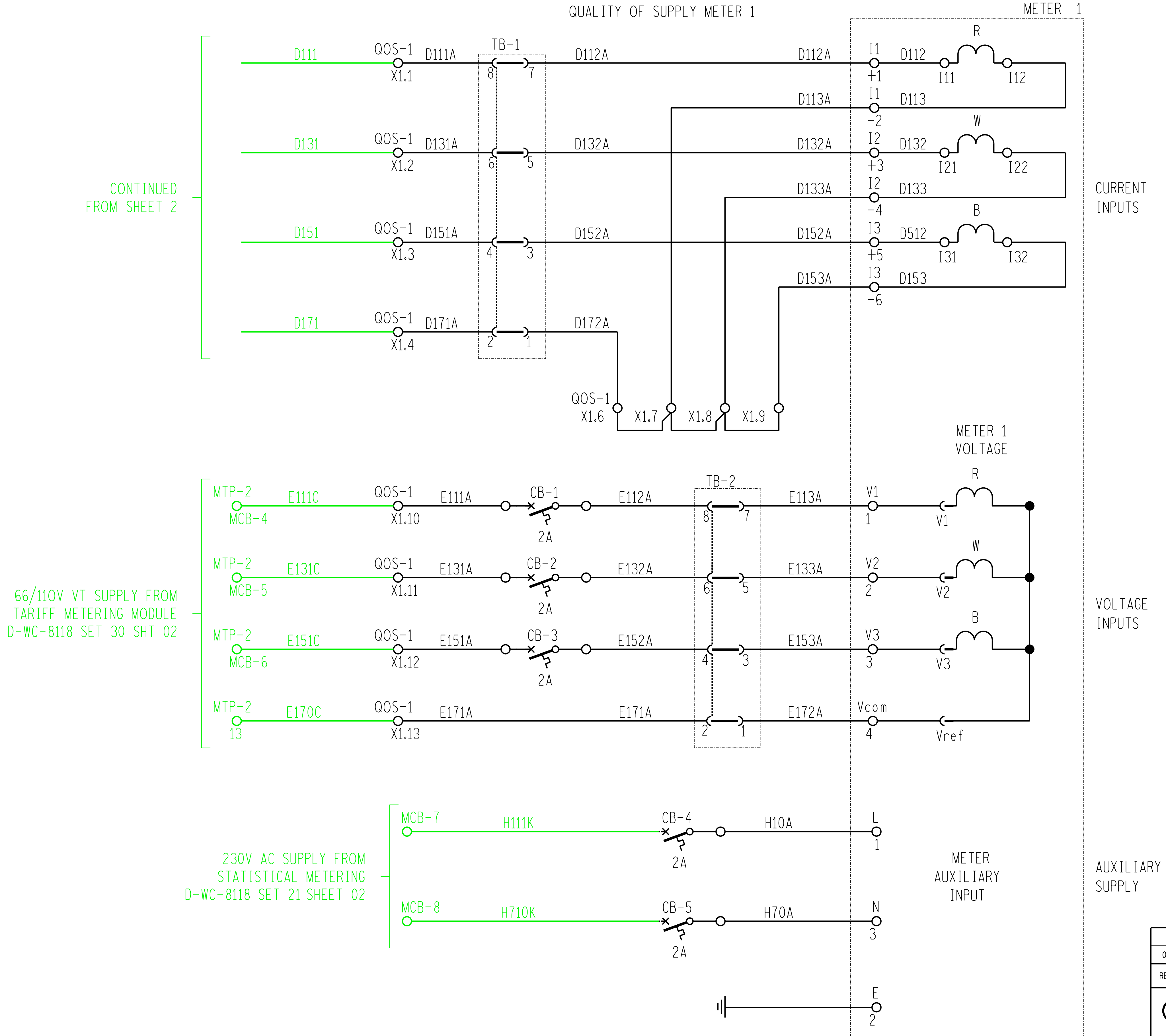
Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
66kV FEEDERS 2, 4 & 6
QUALITY OF SUPPLY MODULE 1
AC KEY DIAGRAM

DRG NO.	SET	SHEET	REVISION
D-WC-8118	23	02	00

A3L



NOTE:

1. EARTHED IN TARIFF METERING MODULE - SEE D-WC-8118 SET 30 SHT 02

LEGEND	
M1	METER MODULE 1
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
CB	CIRCUIT BREAKER
QOS-1	QUALITY OF SUPPLY - MODULE 1

DRG NO.	REFERENCE DRAWINGS:
SHEET 05	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 04	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 03	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 02	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 01	QUALITY OF SUPPLY MODULE 1 LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

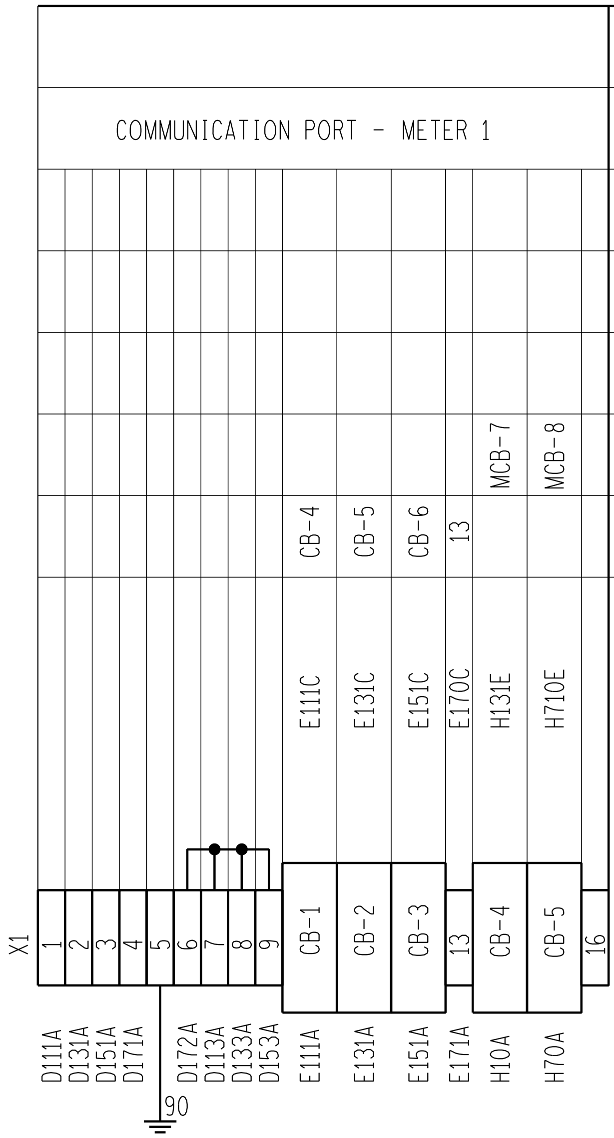
Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
66kV FEEDERS 2,4 & 6
QUALITY OF SUPPLY MODULE 1
AC KEY DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	23	03	00

A3L



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
SA04	-	-	66kV FEEDER 2
-	-	-	AC SUPPLY WIRING FROM FEEDER 2 STATISTICAL METERING MODULE
58	4	-	VT WIRING FROM 66kV FEEDER 2 TARIFF METERING MODULE

DRG NO.	REFERENCE DRAWINGS:
SHEET 05	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 04	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 03	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 02	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 01	QUALITY OF SUPPLY MODULE 1 LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH:
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
66kV FEEDERS 2,4 & 6
QUALITY OF SUPPLY MODULE 1
CABLING DIAGRAM

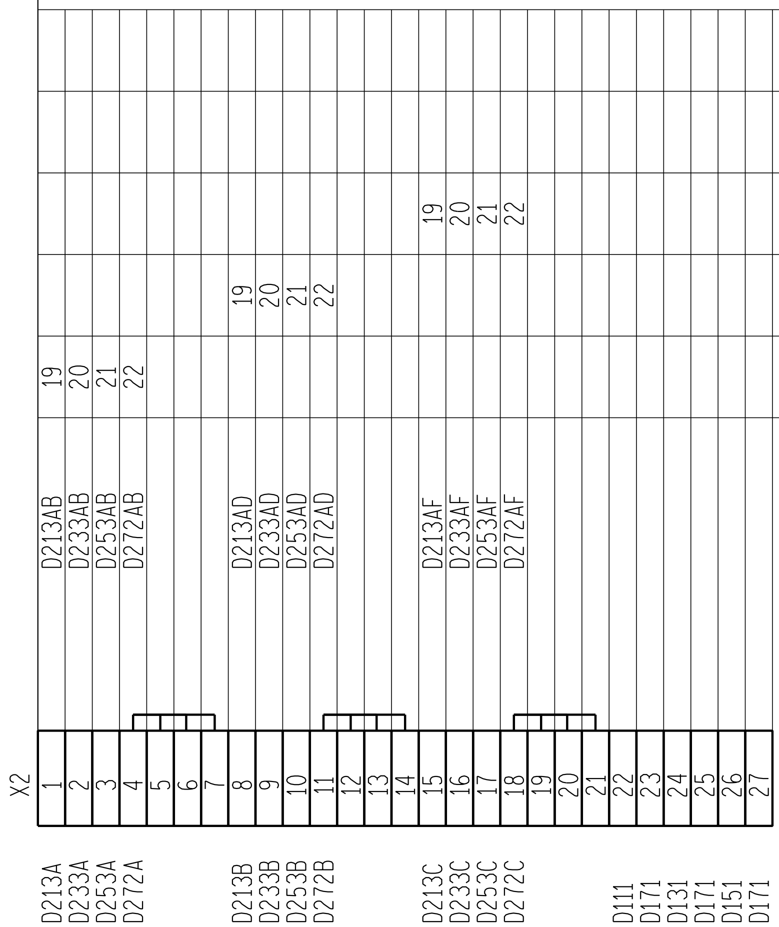
DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	23	04	00

SCALE NTS

THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

A3L



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
57	4	-	CT WIRING FROM 66kV FEEDER 6 TARIFF METERING MODULE
56	4	-	CT WIRING FROM 66kV FEEDER 4 TARIFF METERING MODULE
55	4	-	CT WIRING FROM 66kV FEEDER 2 TARIFF METERING MODULE

DRG NO.	REFERENCE DRAWINGS:
SHEET 05	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 04	QUALITY OF SUPPLY MODULE 1 CABLING DIAG.
SHEET 03	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 02	QUALITY OF SUPPLY MODULE 1 AC KEY DIAG.
SHEET 01	QUALITY OF SUPPLY MODULE 1 LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 13/08/2019

YSTERVARK SUBSTATION
66kV FEEDERS 2,4 & 6 QUALITY OF SUPPLY MODULE 1 CABLING DIAGRAM

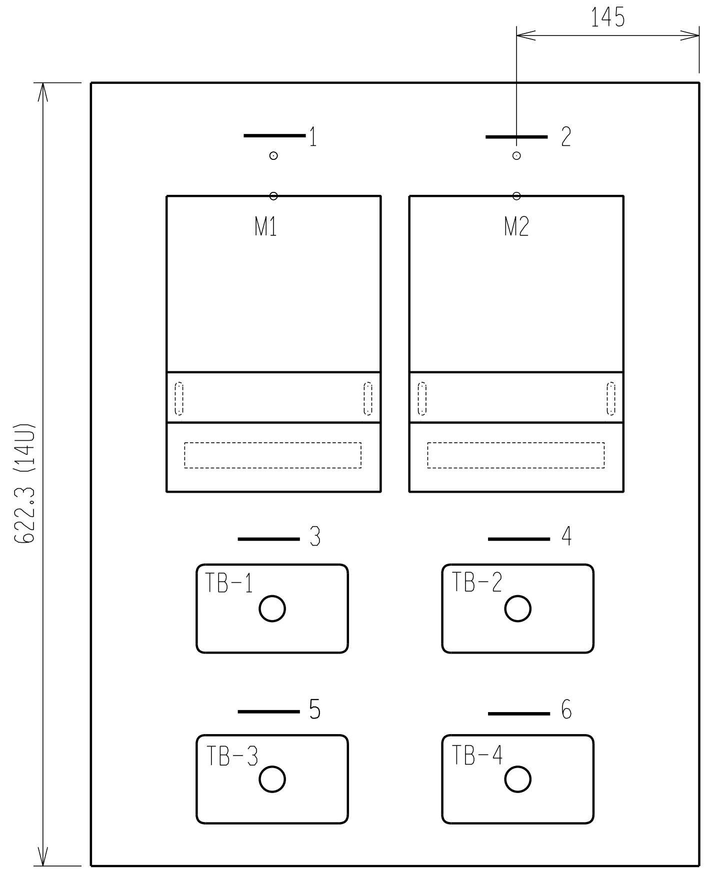
AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

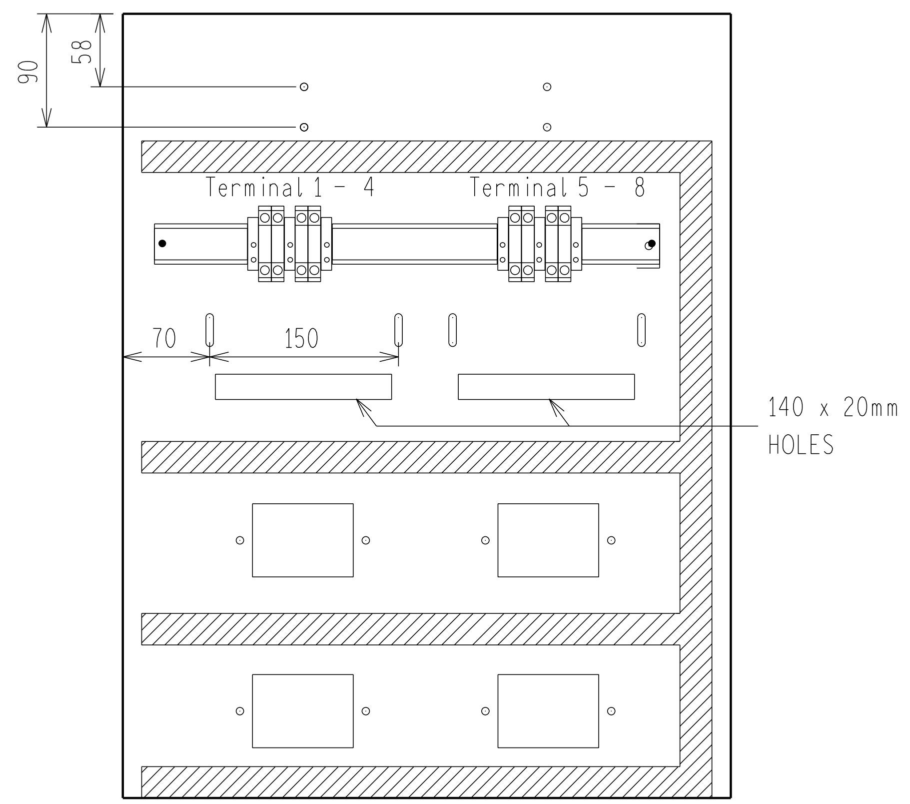
	SET	SHEET	REVISION
D-WC-8118	23	05	00

A3L

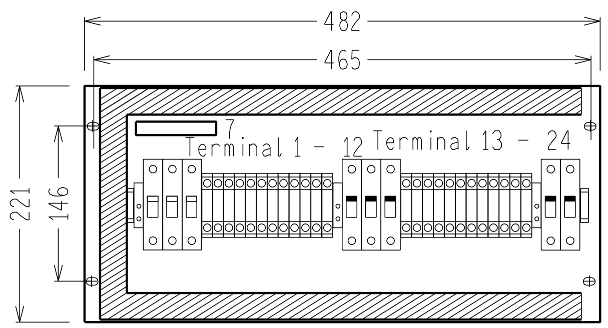
1 2 3 4 5 6 7 8 9 10 11 12



EQUIPMENT PLATE - FRONT VIEW



EQUIPMENT PLATE - REAR VIEW



METER TERMINAL PLATE

LABEL No.	LABEL INSCRIPTION
1	66kV FDR 2 METER (MAIN)
2	66kV FDR 2 METER (CHECK)
3	AS SHOWN
4	AS SHOWN
5	AS SHOWN
6	AS SHOWN
7	66kV FDR 2 TARIFF MEASUREMENTS

LABEL 3 100x20mm

66kV FDR 2 CT (MAIN)

R | W | B | N

LABEL 4 100x20mm

66kV FDR 2 CT (CHECK)

R | W | B | N

LABEL 5 100x20mm

66kV FDR 2 VT (MAIN)

R | W | B | N

LABEL 6 100x20mm

66kV FDR 2 VT (CHECK)

R | W | B | N

LEGEND	DESCRIPTION	APPROVED EQUIPMENT
	MINIATURE CIRCUIT BREAKER CURVE 2, > 5kA (MCB)	MERLIN GERIN MULTI 9,5A or CBI: TYPE QF-1-D,6A
	TERMINALS: SPRING LOADED	METER TERMINAL PLATE: WEIDMULLER WDU 10 SL or ENTRELEC TYPE M 10/10.RS or ALSTOM ELMEX TYPE KULT 1 METER MODULE: WEIDMULLER WDU 6 SL or ENTRELEC TYPE M 6/8.RS or ALSTOM ELMEX TYPE KST 6WS
	END STOP	WEIDMULLER EW35/2 or ENTRELEC BAM or ALSTOM ELMEX SCUN or SCUDD or SCKN or PHOENIX CONTACT E/UK or CLIPFIX 35 or KLEMSAN KD3 or LEGRAND VIKING 3 39403
	TRUNKING	25 x 60mm TRUNKING

EQUIPMENT SCHEDULE

SYMBOLS	DESCRIPTION	MANUFACTURE	TYPE
M1 & M2	DEMAND METER 3PH4W 1A		
TB	TEST BLOCK	GEC MEASUREMENTS	PK 4
MCB	MINIATURE CIRCUIT BREAKER		

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 19/08/2019

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 2 METER MODULE
EQUIPMENT LAYOUT

D-WC-8118

SET	SHEET	REVISION
30	01	00

AECOM

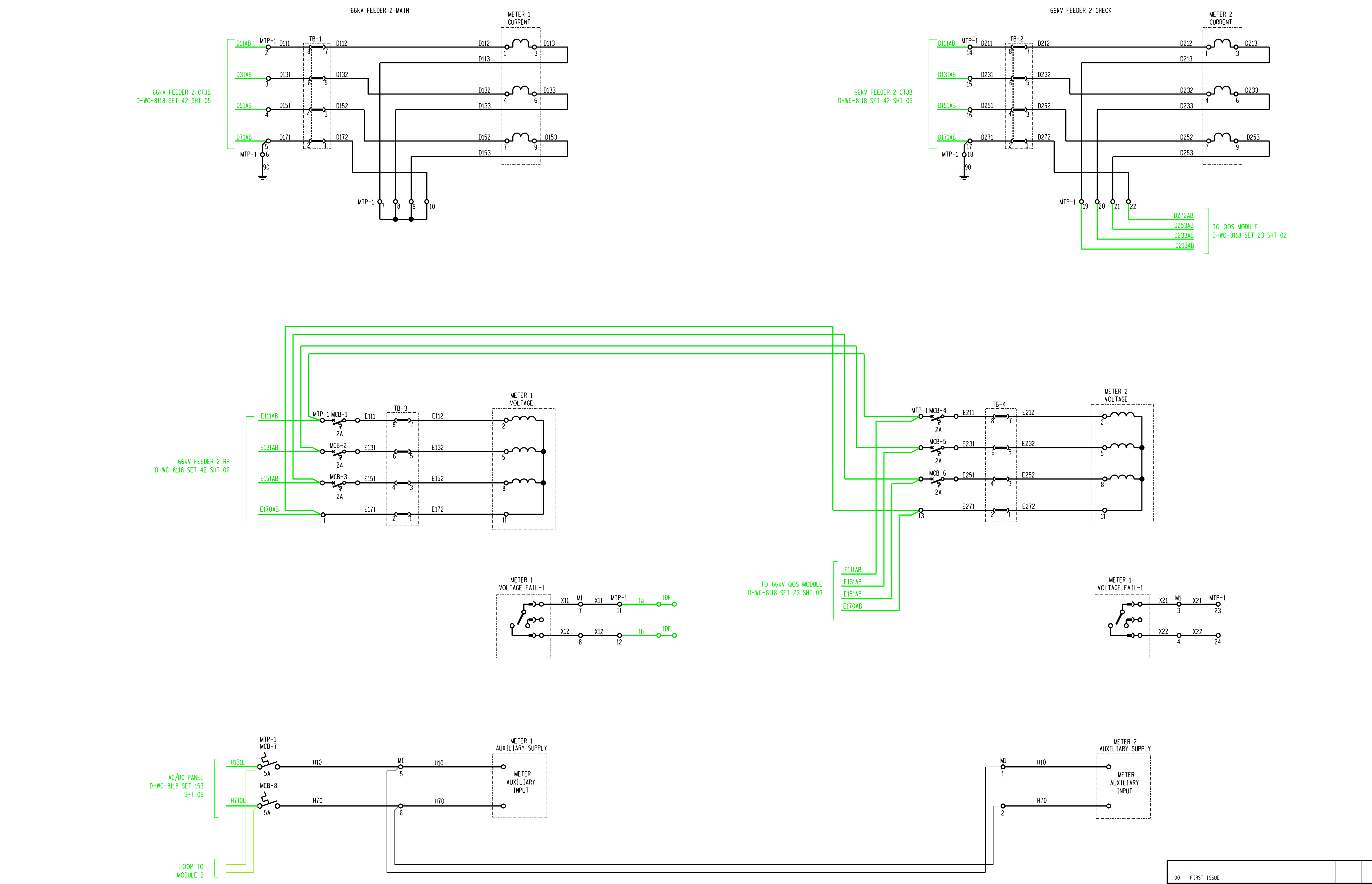
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

PANEL TYPE DESIGNATION 3MM01C Rev 02 A3L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 01 REVISION 02

A B C D E F G H



LEGEND	
M1	METER INTERMEDIATE TERMINALS
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
MCB	MINIATURE CIRCUIT BREAKER

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
					/ /	153272156-00003
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

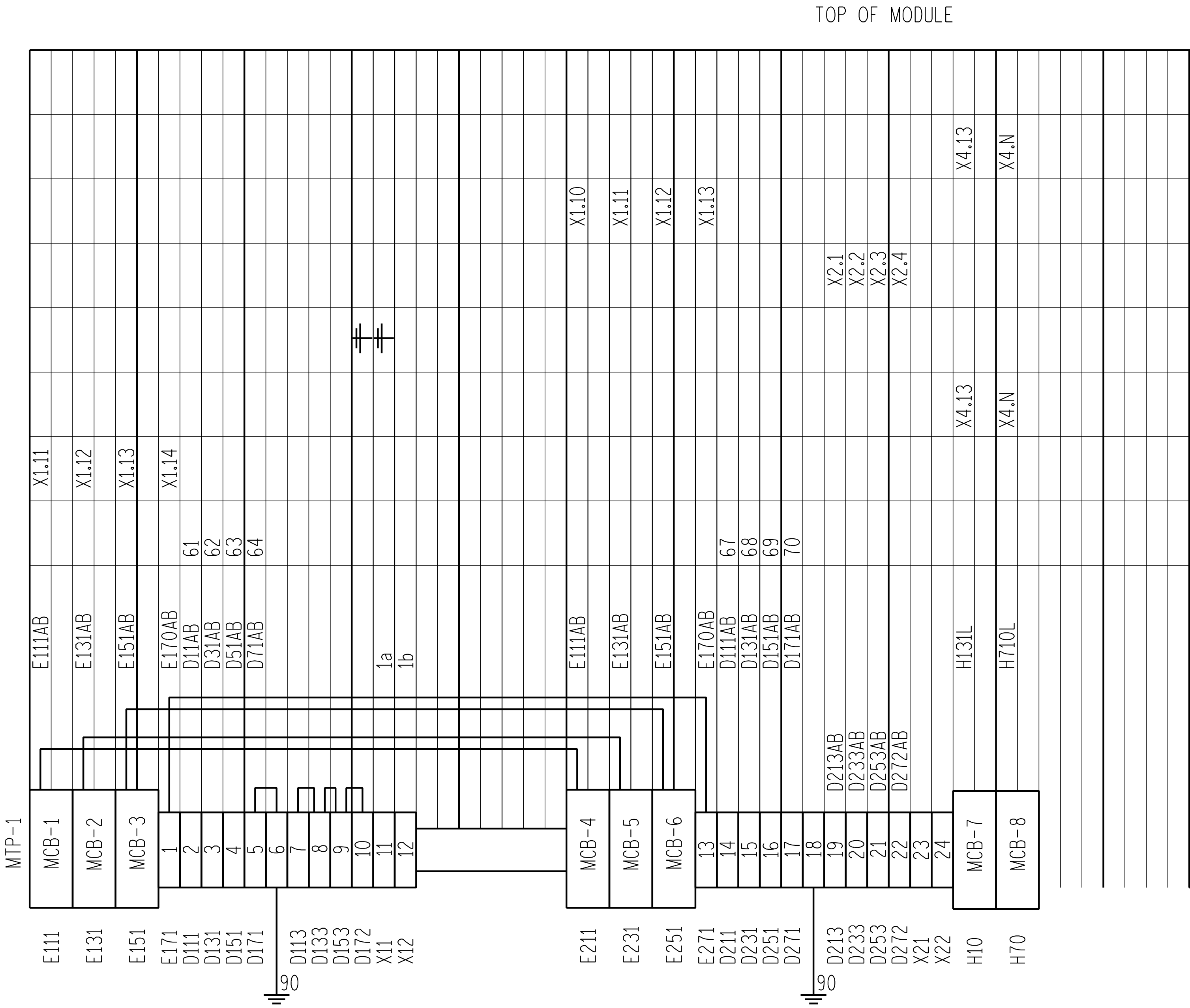
Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 11/10/2019

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 2
METER MODULE KEY DIAGRAM

D-WC-8118	SET	SHEET	REVISION
	30	02	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 02 REVISION 02



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
LOOP	LOOP	LOOP	TARIFF METERING MODULE 2
55	4	-	QUALITY OF SUPPLY
55	4	-	QUALITY OF SUPPLY
54	10Pr	7Pr	IDF
44	4	2	AC/DC DISTRIBUTION PANEL
AB114	4	-	66kV FEEDER 2 RP
AB118	12	4	66kV FEEDER 2 CTJB

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

TARIFF METERING PANEL
66kV FEEDER 2
METER MODULE CABLING DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 11/10/2019

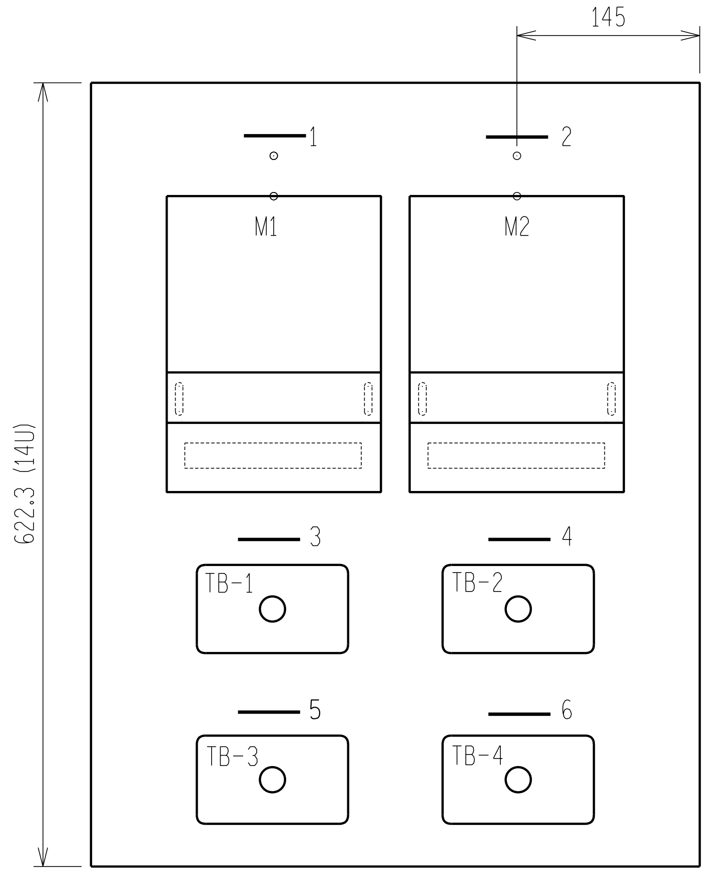
AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

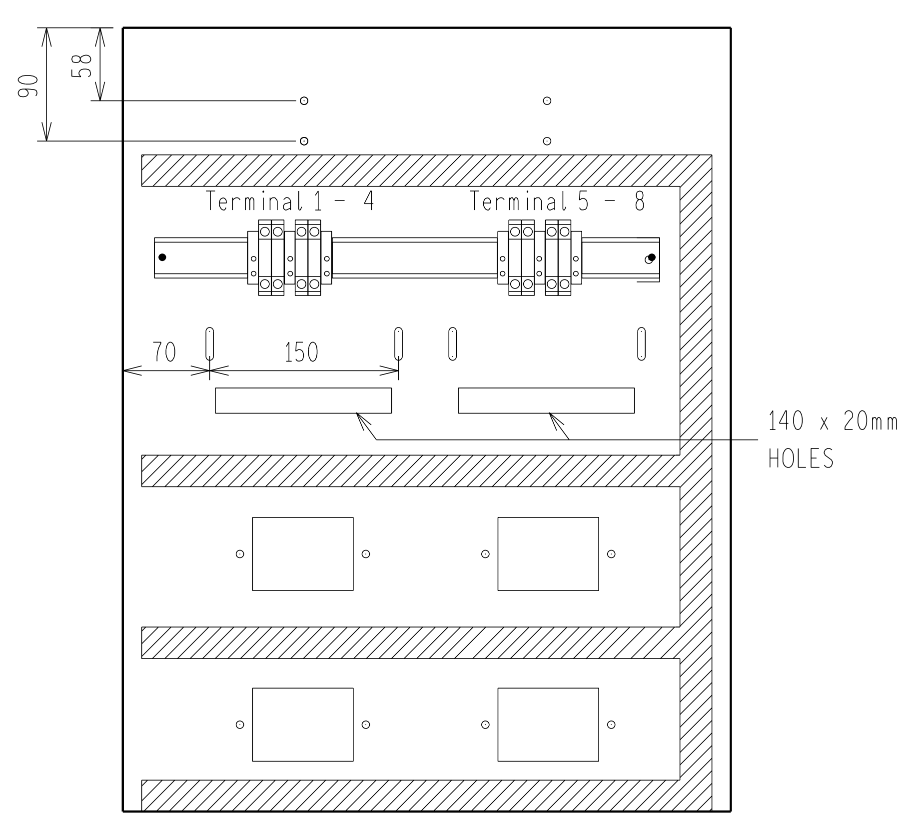
D-WC-8118	SET	SHEET	REVISION
	30	03	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 REVISION 02

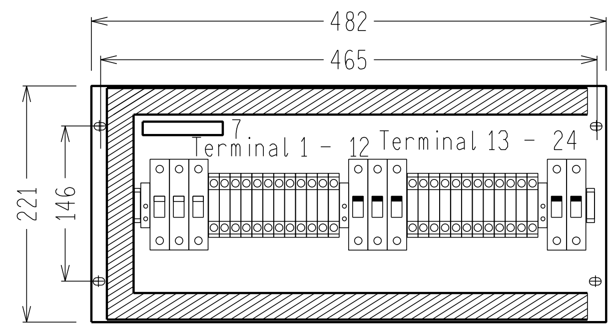
PANEL TYPE DESIGNATION 3MM01C Rev 02 A3L



EQUIPMENT PLATE - FRONT VIEW



EQUIPMENT PLATE - REAR VIEW



METER TERMINAL PLATE

LABEL No.	LABEL INSCRIPTION
1	66kV FDR 4 METER (MAIN)
2	66kV FDR 4 METER (CHECK)
3	AS SHOWN
4	AS SHOWN
5	AS SHOWN
6	AS SHOWN
7	66kV FDR 4 TARIFF MEASUREMENTS

LABEL 3 100x20mm

66kV FDR 4 CT (MAIN)

R | W | B | N

LABEL 4 100x20mm

66kV FDR 4 CT (CHECK)

R | W | B | N

LABEL 5 100x20mm

66kV FDR 4 VT (MAIN)

R | W | B | N

LABEL 6 100x20mm

66kV FDR 4 VT (CHECK)

R | W | B | N

LEGEND	DESCRIPTION	APPROVED EQUIPMENT
	MINIATURE CIRCUIT BREAKER CURVE 2, > 5kA (MCB)	MERLIN GERIN MULTI 9,5A or CBI: TYPE QF-1-D, 6A
	TERMINALS: SPRING LOADED	METER TERMINAL PLATE: WEIDMULLER WDU 10 SL or ENTRELEC TYPE M 10/10.RS or ALSTOM ELMEX TYPE KULT 1 METER MODULE: WEIDMULLER WDU 6 SL or ENTRELEC TYPE M 6/8.RS or ALSTOM ELMEX TYPE KST 6WS
	END STOP	WEIDMULLER EW35/2 or ENTRELEC BAM or ALSTOM ELMEX SCUN or SCUDD or SCKN or PHOENIX CONTACT E/UK or CLIPFIX 35 or KLEMSAN KD3 or LEGRAND VIKING 3 39403
	TRUNKING	25 x 60mm TRUNKING

EQUIPMENT SCHEDULE

SYMBOLS	DESCRIPTION	MANUFACTURE	TYPE
M1 & M2	DEMAND METER 3PH4W 1A		
TB	TEST BLOCK	GEC MEASUREMENTS	PK 4
MCB	MINIATURE CIRCUIT BREAKER		

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					

Eskom

YSTERVARK SUBSTATION

TARIFF METERING PANEL
66kV FEEDER 4 METER MODULE
EQUIPMENT LAYOUT

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 19/08/2019

D-WC-8118

SET	SHEET	REVISION
30	04	00

AECOM

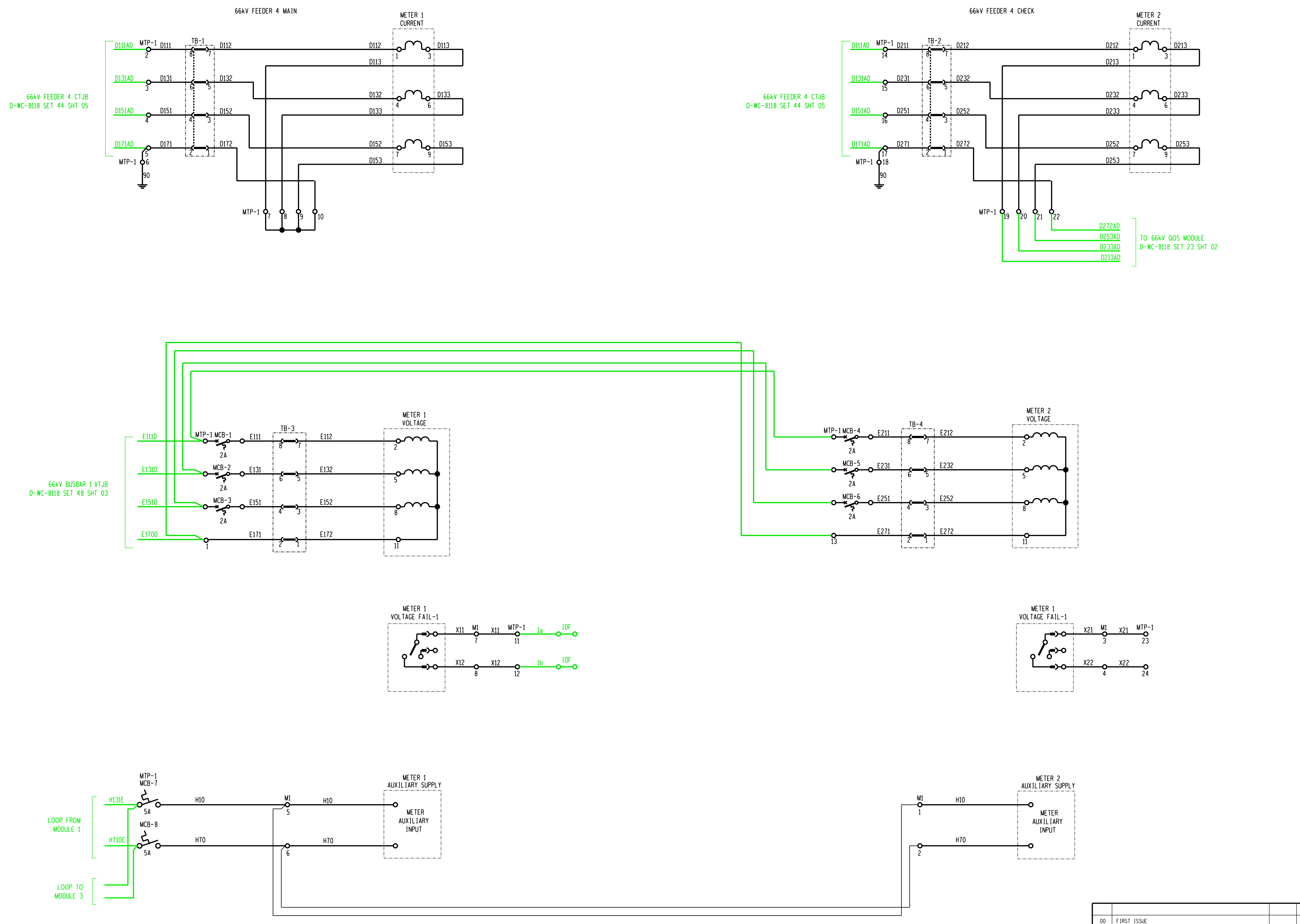
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

PANEL TYPE DESIGNATION 3MM01C Rev 02

A3L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 04 REVISION 02



LEGEND	
M1	METER INTERMEDIATE TERMINALS
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
MCB	MINIATURE CIRCUIT BREAKER

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 4
SHEET 02	KEY DIAGRAM - FEEDER 4
SHEET 01	EQUIPMENT LAYOUT - FEEDER 4

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
					/ /	
00	FIRST ISSUE				/ /	153272156-00003

Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 19/08/2019

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 4
METER MODULE KEY DIAGRAM

D-WC-8118	SET	SHEET	REVISION
	30	05	00

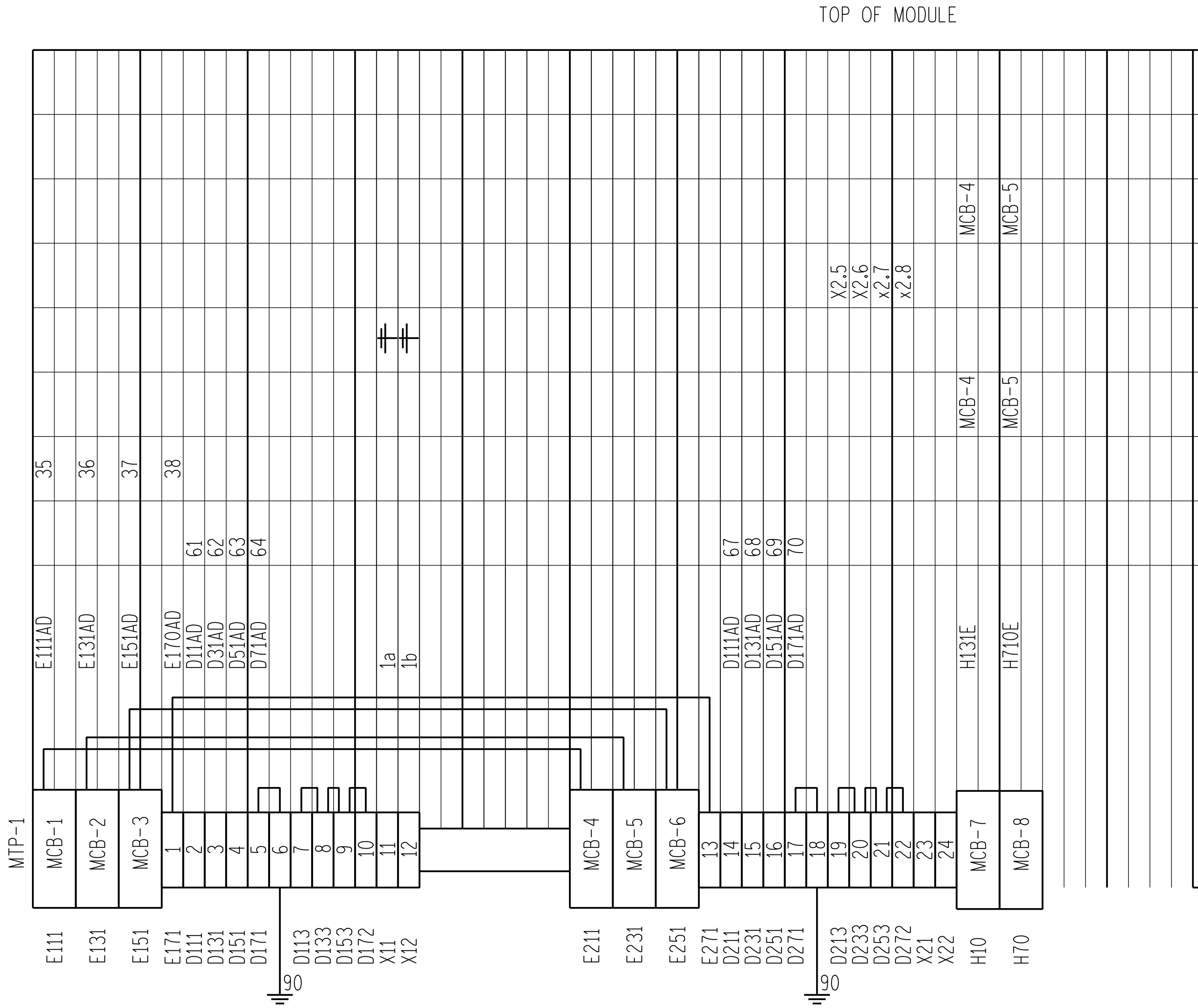
AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

PANEL TYPE DESIGNATION 3MM01C Rev 02

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 05 REVISION 02



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
LOOP	LOOP	LOOP	TARIFF MODULE 3
57	4	-	QUALITY OF SUPPLY
54	10Pr	7Pr	IDF
LOOP	LOOP	LOOP	TARIFF MODULE 1
AD114	4	-	66kV FEEDER 4 RP
AD118	12	4	66kV FEEDER 4 CTJB

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 4
METER MODULE CABLING DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: ../../2019

D-WC-8118

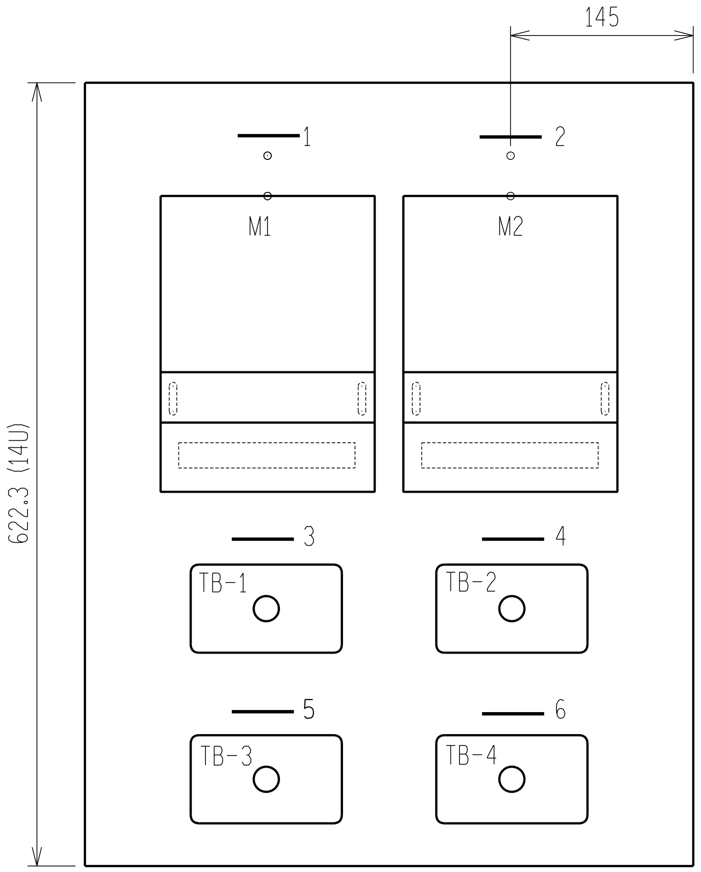
SET	SHEET	REVISION
30	06	00

SCALE NTS
THIS DRAWING IS THE PROPERTY OF ESKOM

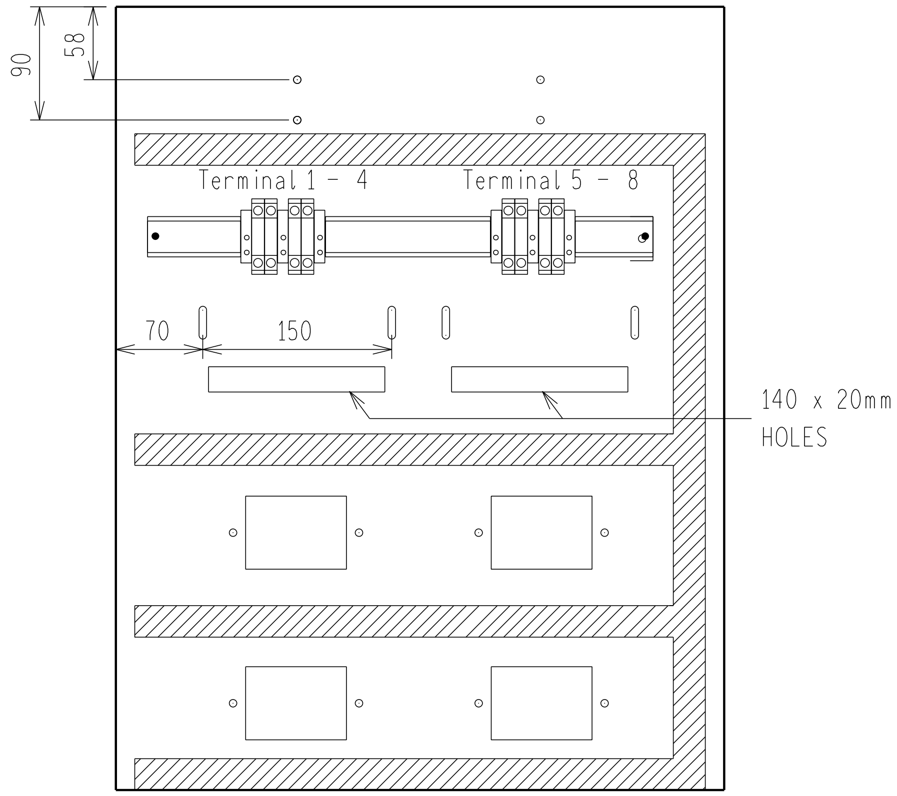
AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

MASTER TRACING FILED UNDER D-WC-8118 SHEET 06 REVISION 02

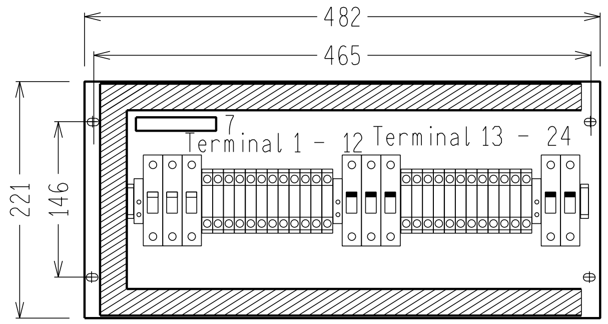
PANEL TYPE DESIGNATION 3MM01C Rev 02
A3L



EQUIPMENT PLATE - FRONT VIEW



EQUIPMENT PLATE - REAR VIEW



METER TERMINAL PLATE

LABEL No.	LABEL INSCRIPTION
1	66kV FDR 6 METER (MAIN)
2	66kV FDR 6 METER (CHECK)
3	AS SHOWN
4	AS SHOWN
5	AS SHOWN
6	AS SHOWN
7	66kV FDR 6 TARIFF MEASUREMENTS

LABEL 3 100x20mm

66kV FDR 6 CT (MAIN)

R | W | B | N

LABEL 4 100x20mm

66kV FDR 6 CT (CHECK)

R | W | B | N

LABEL 5 100x20mm

66kV FDR 6 VT (MAIN)

R | W | B | N

LABEL 6 100x20mm

66kV FDR 6 VT (CHECK)

R | W | B | N

LEGEND	DESCRIPTION	APPROVED EQUIPMENT
	MINIATURE CIRCUIT BREAKER CURVE 2, > 5kA (MCB)	MERLIN GERIN MULTI 9,5A or CBI: TYPE QF-1-D, 6A
	TERMINALS: SPRING LOADED	METER TERMINAL PLATE: WEIDMULLER WDU 10 SL or ENTRELEC TYPE M 10/10.RS or ALSTOM ELMEX TYPE KULT 1 METER MODULE: WEIDMULLER WDU 6 SL or ENTRELEC TYPE M 6/8.RS or ALSTOM ELMEX TYPE KST 6WS
	END STOP	WEIDMULLER EW35/2 or ENTRELEC BAM or ALSTOM ELMEX SCUN or SCUDD or SCKN or PHOENIX CONTACT E/UK or CLIPFIX 35 or KLEMSAN KD3 or LEGRAND VIKING 3 39403
	TRUNKING	25 x 60mm TRUNKING

EQUIPMENT SCHEDULE

SYMBOLS	DESCRIPTION	MANUFACTURE	TYPE
M1 & M2	DEMAND METER 3PH4W 1A		
TB	TEST BLOCK	GEC MEASUREMENTS	PK 4
MCB	MINIATURE CIRCUIT BREAKER		

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 19/08/2019

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 6 METER MODULE
EQUIPMENT LAYOUT

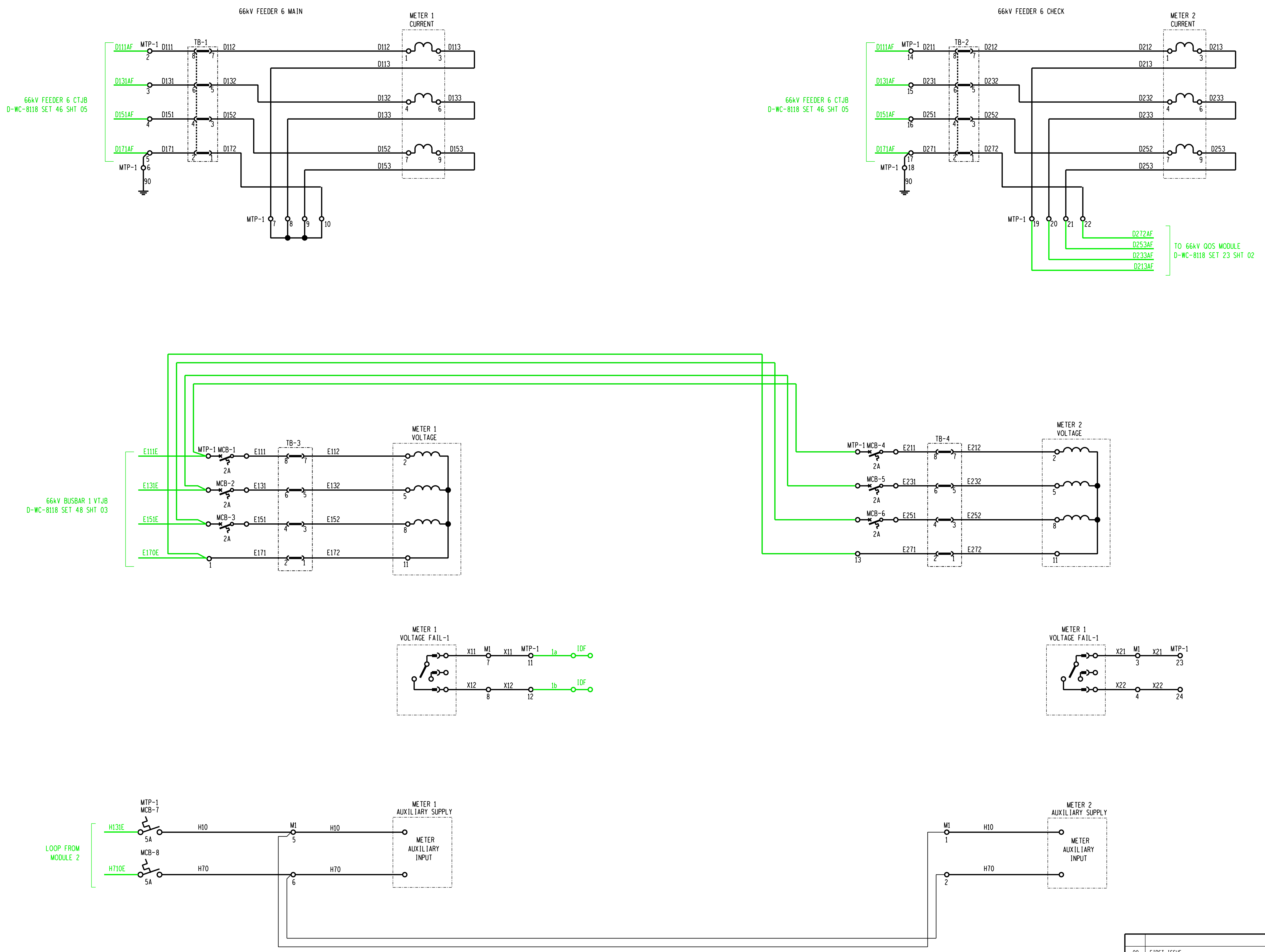
D-WC-8118

SET	SHEET	REVISION
30	07	00

PANEL TYPE DESIGNATION 3MM01C Rev 02

A3L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 07 REVISION 02



LEGEND	
M1	METER INTERMEDIATE TERMINALS
MTP	METER TERMINAL PLATE
TB	TEST BLOCK
MCB	MINIATURE CIRCUIT BREAKER

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 6
SHEET 05	KEY DIAGRAM - FEEDER 6
SHEET 04	EQUIPMENT LAYOUT - FEEDER 6
SHEET 03	DABLING DIAGRAM - FEEDER 6
SHEET 02	KEY DIAGRAM - FEEDER 6
SHEET 01	EQUIPMENT LAYOUT - FEEDER 6

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
					/ /	153272156-00003
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE NTS
THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 19/08/2019

YSTERVARK SUBSTATION
TARIFF METERING PANEL
66kV FEEDER 6
METER MODULE KEY DIAGRAM

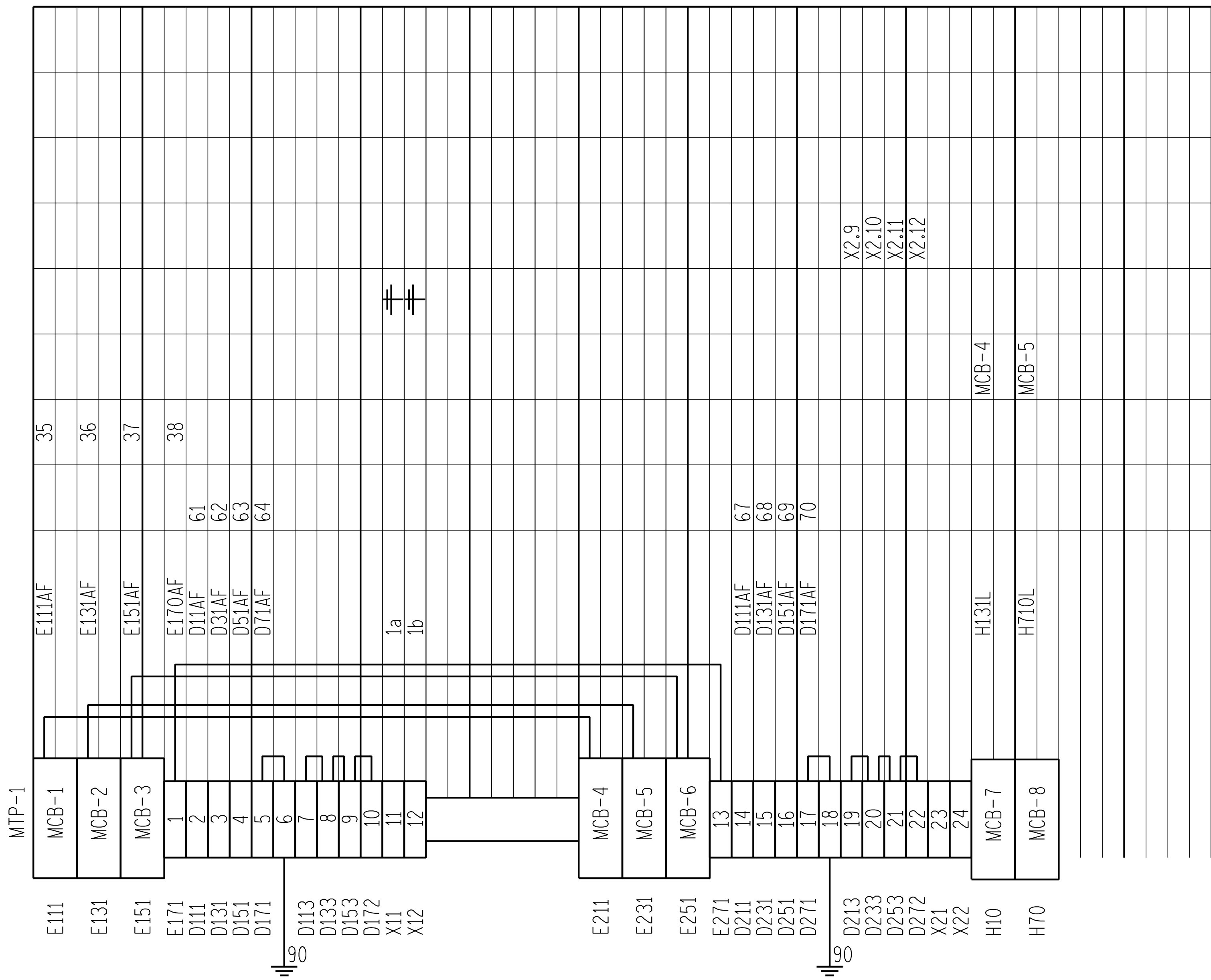
DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	30	08	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 08 REVISION 02

PANEL TYPE DESIGNATION 3MM01C Rev 02

A1L

TOP OF MODULE



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
57	4	-	QUALITY OF SUPPLY
54	10Pr	7Pr	IDF
LOOP	LOOP	LOOP	TARIFF MODULE 2
AF114	4	-	66kV FEEDER 6 RP
AF118	12	4	66kV FEEDER 6 CTJB

DRG NO.	REFERENCE DRAWINGS:
SHEET 09	DABLING DIAGRAM - FEEDER 6
SHEET 08	KEY DIAGRAM - FEEDER 6
SHEET 07	EQUIPMENT LAYOUT - FEEDER 6
SHEET 06	DABLING DIAGRAM - FEEDER 4
SHEET 05	KEY DIAGRAM - FEEDER 4
SHEET 04	EQUIPMENT LAYOUT - FEEDER 4
SHEET 03	DABLING DIAGRAM - FEEDER 2
SHEET 02	KEY DIAGRAM - FEEDER 2
SHEET 01	EQUIPMENT LAYOUT - FEEDER 2

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
						153272156-00003
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

TARIFF METERING PANEL
66kV FEEDER 6
METER MODULE CABLING DIAGRAM

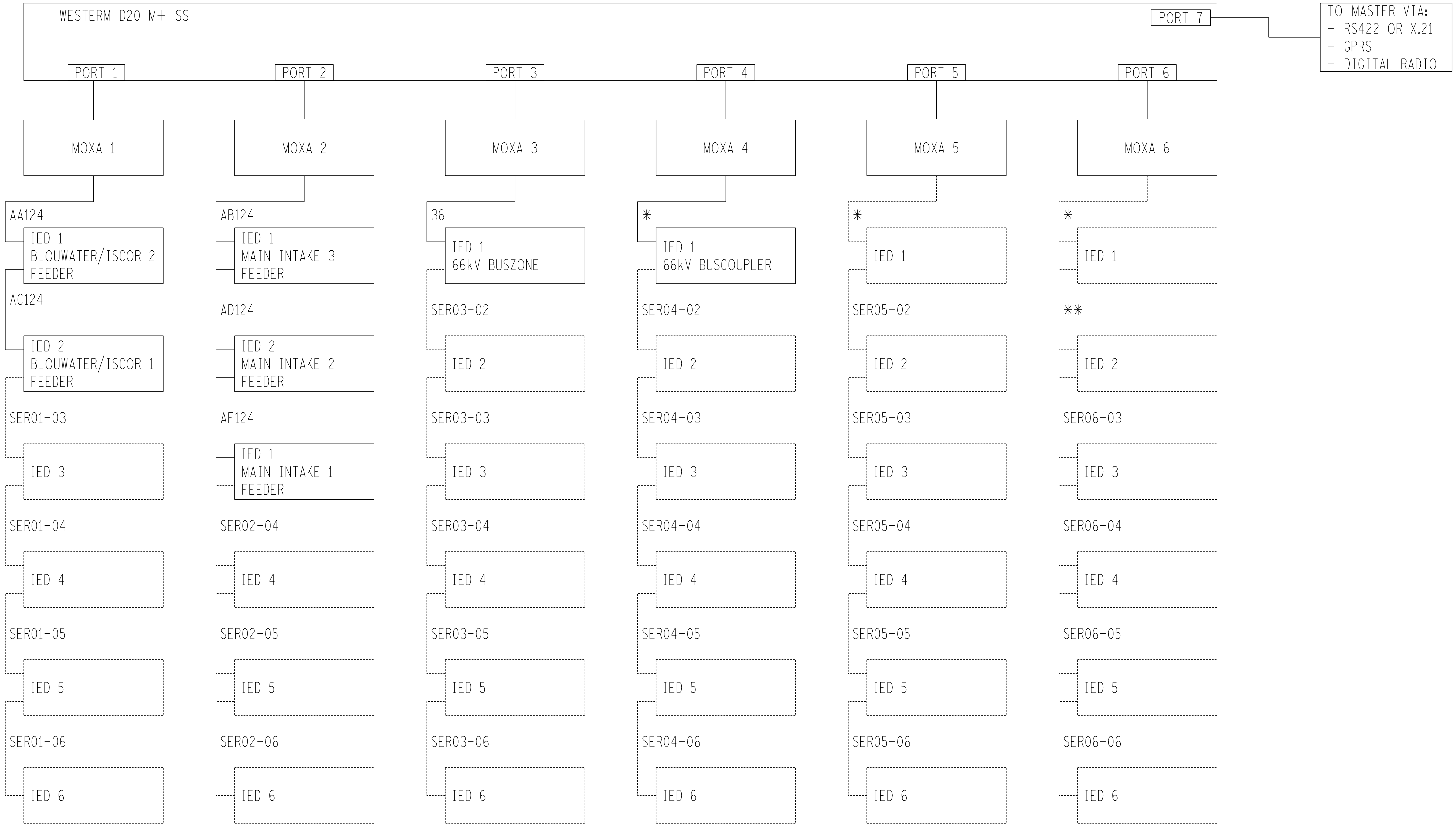
AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 19/08/2019

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	30	09	00

SCALE NTS

THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07



NOTE: DOTTED MOXA's & IED's FUTURE.

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				/ /

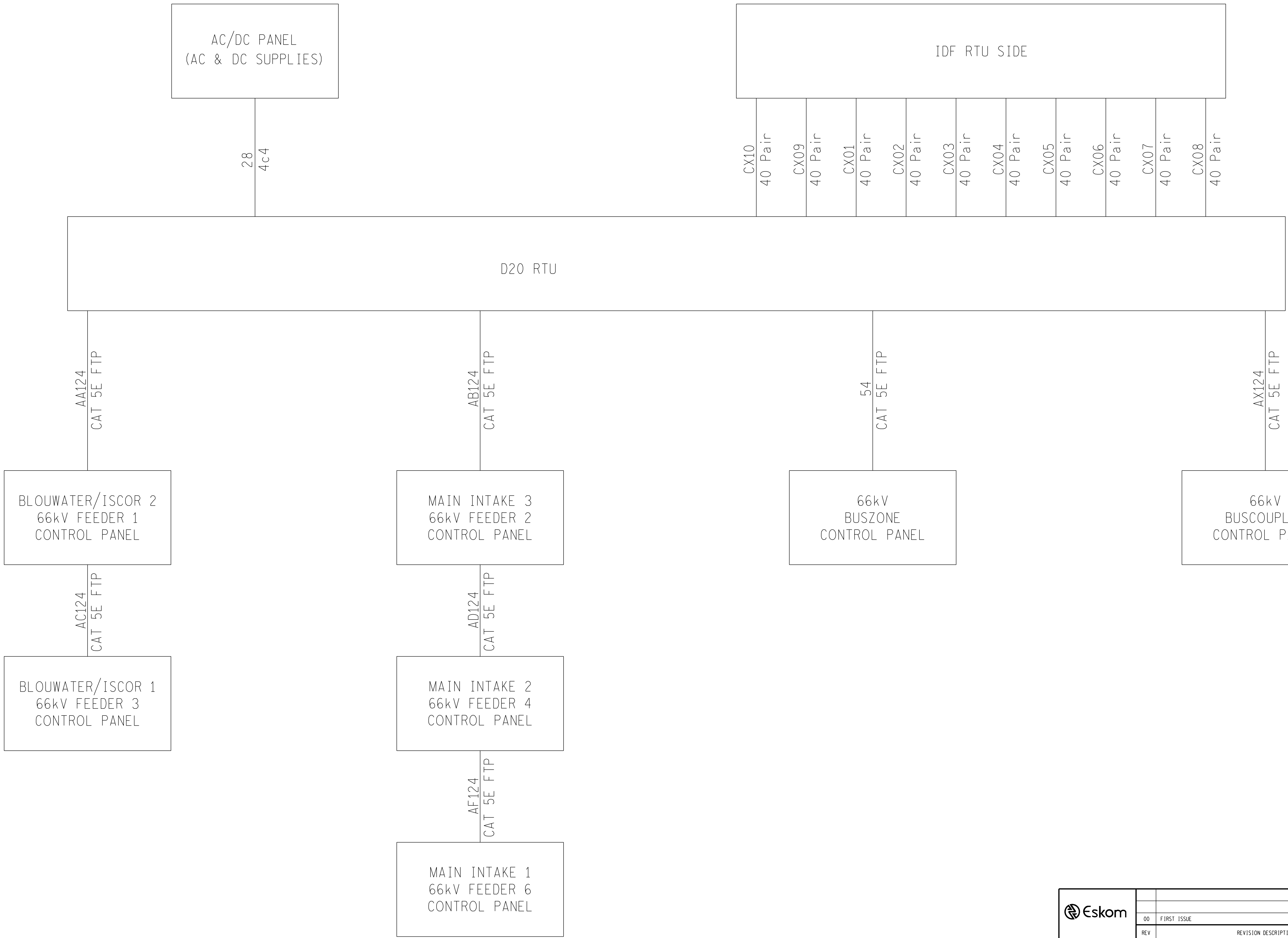
PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 08/10/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :
	THIS DRAWING IS THE PROPERTY OF ESKOM ©

YSTERVARK SUBSTATION
RTU PANEL (D20)
COMMS CABLE BLOCK DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	31	01	00

LEVELS 1 5 10

A1L



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				/ /

Eskom

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 08/10/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

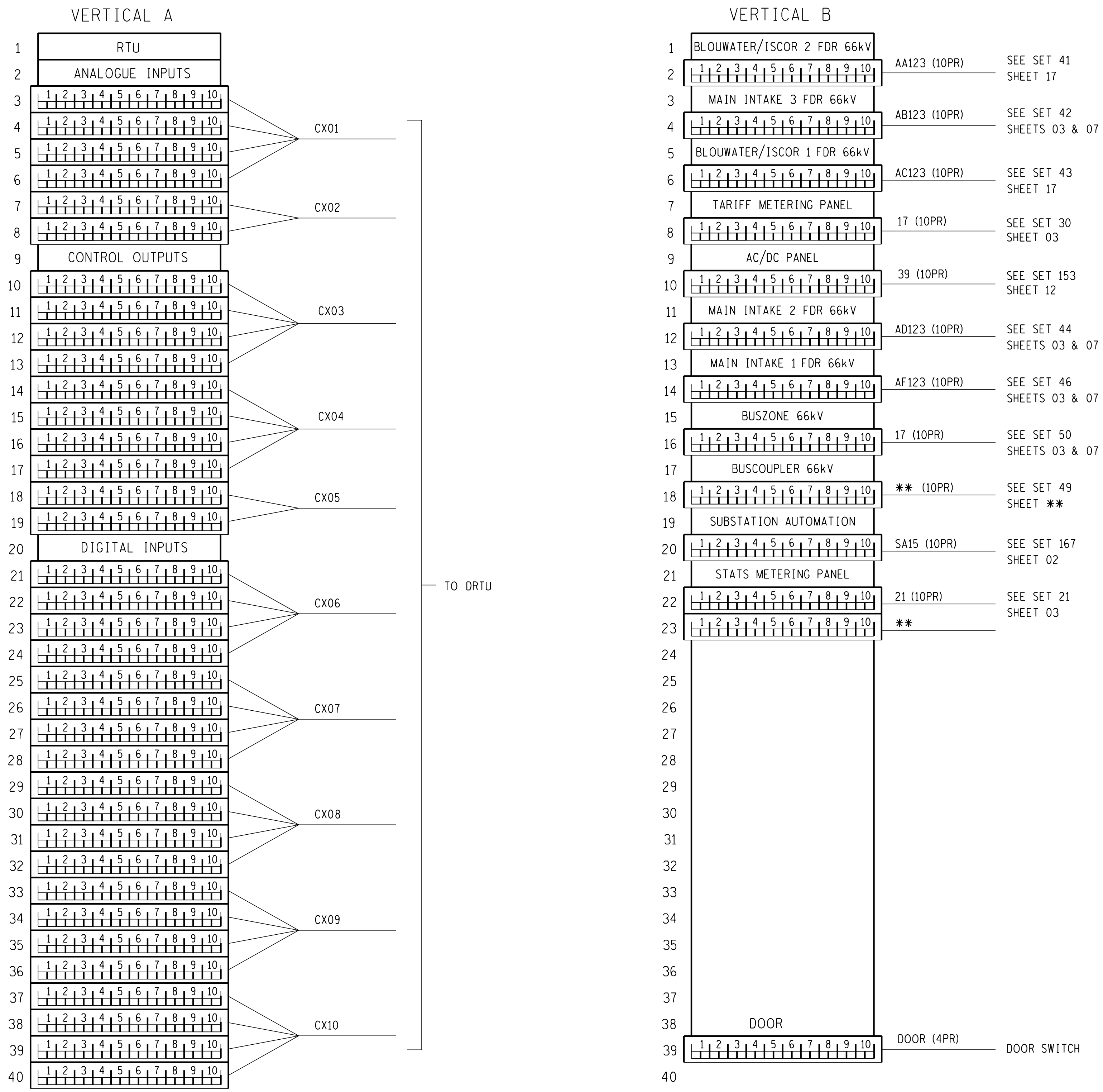
YSTERVARK SUBSTATION
RTU PANEL
COMMS CABLE BLOCK DIAGRAM

D-WC-8118	SET	SHEET	REVISION
	31	02	00

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

LEVELS 1 5 10

A1L



00	FIRST ISSUE			/ /
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE

Eskom

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 08/10/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
RTU PANEL (D20)
IDF LAYOUT & CABLES

D-WC-8118	SET	SHEET	REVISION
	32	01	00

LEVELS 1 5 10 15

A1L

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	2	29/05/2015	UPDATED DESIGN CHANGE DESCRIPTION
01	PANEL EQUIPMENT LAYOUT	2	29/05/2015	UPDATED BACKPLATE NUMBERS OF TERMINALS
02	LOGIC DIAGRAM	2	29/05/2015	LEVEL 2 & 3 NOTES ADDED
03	SINGLE LINE DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
04	AC KEY DIAGRAM	2	29/05/2015	CORRECTED ALL CT CORES NEUTRAL, R & B DESIGNATIONS
05	VT SUPPLY KEY DIAGRAM	2	29/05/2015	ADDED 4 TERMINALS TO METERING VT SUPPLY
06	MAIN DC KEY DIAGRAM	2	29/05/2015	TEST TERMINALS ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 1 ADDED
07	MAIN DC KEY DIAGRAM	2	29/05/2015	IED PSU WIRE NUMBER CORRECTED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
08	TELEPROTECTION DC KEY DIAGRAM	2	29/05/2015	ADDED EXPLANATORY NOTE AND SET THREE TERMINAL DIFFERENTIAL OPTION TO LEVEL 4
09	BACK-UP DC KEY DIAGRAM	2	29/05/2015	TEST TERMINALS ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
10	BACK-UP DC KEY DIAGRAM	2	29/05/2015	LEVEL 12 & 13 BREAKER DETAILS UPDATED
11	BACK-UP DC KEY DIAGRAM	2	29/05/2015	NOTE 2 DETAIL ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
12	CLOSE DC KEY DIAGRAM	2	29/05/2015	CBC-CR AND CBCS-X1 TERMINALS CORRECTED, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 3 ADDED
13	INDICATION DC KEY DIAGRAM	2	29/05/2015	LEVEL 12 & 13 BREAKER DETAILS UPDATED
14	SPRING REWIND AND AC KEY DIAGRAM	2	29/05/2015	UPDATED DISCHARGE POINT TERMINAL NUMBER, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 1 ADDED
15	REA AND MEASUREMENTS KEY DIAGRAM	2	29/05/2015	ALTERED RJ45 CONNECTIONS DISPLAY SYMBOL (LEVEL 28)
16	SUPERVISORY STATUS & CONTROL KEY DIAGRAM	2	29/05/2015	DROPPING RESISTORS REMOVED & NOTE 1 ALTERED
17	SUPERVISORY ALARMS KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
18	DISTURBANCE RECORDER KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
19	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	X71 P7 INPUT DESIGNATIONS UPDATED
20	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	FLIP FLOP STATE AND RELAYS RXMB1 & RXMA1 OHMIC VALUES UPDATED, MODULE RCPM.C/T & R2F.1 REFERENCE SHEET NUMBERS UPDATED
21	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
22	PANEL CABLING DIAGRAM	2	29/05/2015	ADDED 4 TERMINALS TO X2.39-42, LEVEL 12 & 13 BREAKER DETAILS UPDATED
23	PANEL CABLING DIAGRAM	2	29/05/2015	CORRECTED X6.39 TERMINAL TYPE & REMOVED X5 DROPPING RESISTORS; ADDED TEST SOCKET DETAILS, LVL 12 & 13 BREAKER DETAILS UPDATED
24	PANEL CABLING DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
25	CTJB CABLING DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
26	LINE VTJB LAYOUT & KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
27	CABLE BLOCK DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2	4FZD3920 DISTANCE/ DIFFERENTIAL SCHEME	17	
3	4FZ3920 DISTANCE SCHEME	18	FEEDER PRIMARY OUTBOARD BYPASS (ORDERING OPTION)
4	THREE TERMINAL DIFFERENTIAL OPTION	19	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - ACTOM AREVA i5MT FREE ISSUED)
5		20	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - CAMILLE BAUER SINEAX)
6		21	FRONT PLATE V AND I ANALOGUE METERS (ORDERING OPTION)
7		22	SINGLE PHASE V AND I TRANSDUCERS (ORDERING OPTION)
8		23	SUPERVISORY INDICATION AND CONTROL (HARDWIRED) (ORDERING OPTION)
9		24	IDF WIRING (HARDWIRED)
10	STANDARD DESIGN DRAWING	25	SUPERVISORY STATUS INDICATION (DNP3)
11	STANDARD CTJB AC CONNECTION	26	DISTURBANCE RECORDER (ORDERING OPTION)
12	STANDARD OUTDOOR HV ABB 3P CIRCUIT-BREAKER 132kV (AS PER ABB DRAWINGS 1HSB543200-AAF REV G)	27	STANDARD COMMS OPTIONS (FIBRE AND SPA REMOTE ENG. ACCESS)
13	STANDARD OUTDOOR HV ABB 3P CIRCUIT-BREAKER 36-72.5kV (AS PER ABB DRAWINGS 1HYB902173 REV 3)	28	IEC-61850/ETHERNET COMMS (ORDERING OPTION)
14	VOLTAGE SELECTOR RELAY (VSR) DOUBLE BUSBAR (ORDERING OPTION)	29	TIME SYNCHRONISATION EXTERNAL INPUTS RED670
15	LINE VT CONNECTION DIAGRAM	30	TIME SYNCHRONISATION INTERNAL INPUTS RED670 (ORDERING OPTION)

θ MUTUALLY EXCLUSIVE LEVELS/SHEETS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.
x MUTUALLY INCLUSIVE LEVELS/SHEETS.

66kV FEEDER 1: BLOUWATER/ISCOR 2

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
COVER SHEET

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	00	00

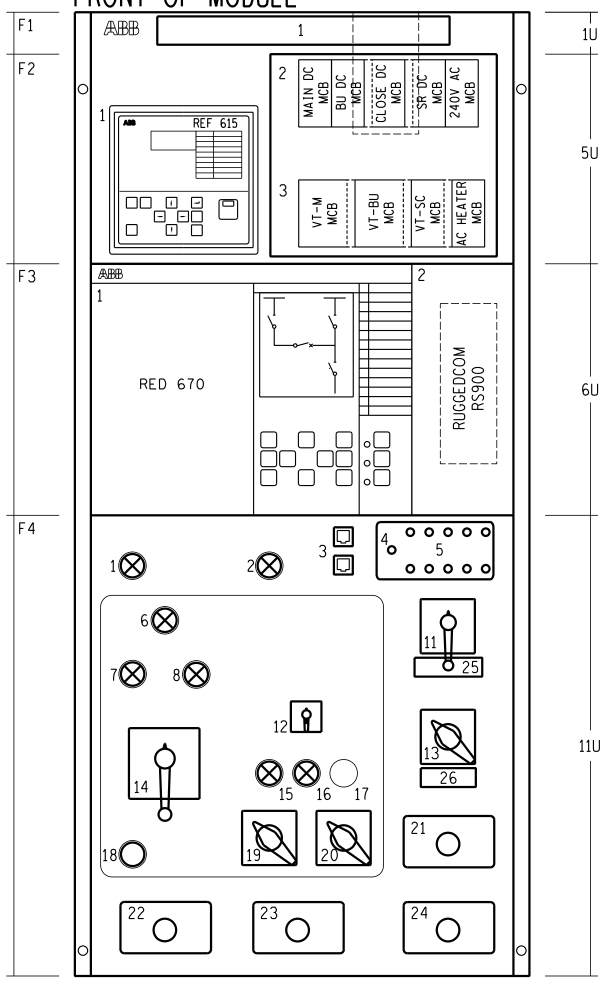
LEVELS 1 5 10

PANEL TYPE DESIGNATION 4FZD-3920

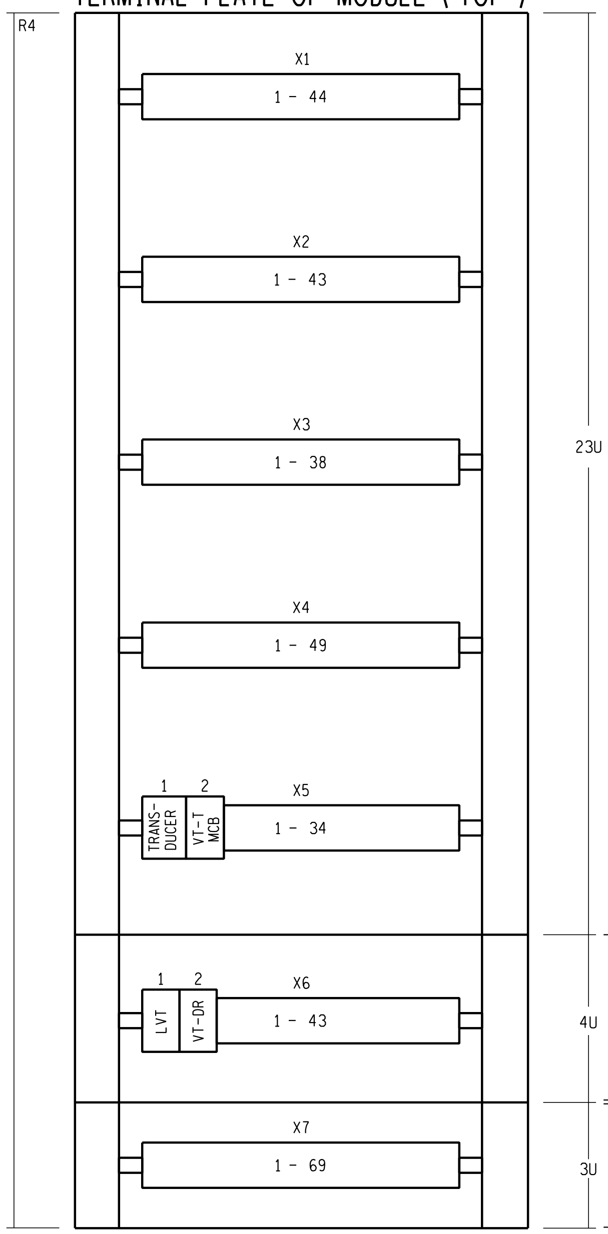
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 00 OF 27 REVISION 00

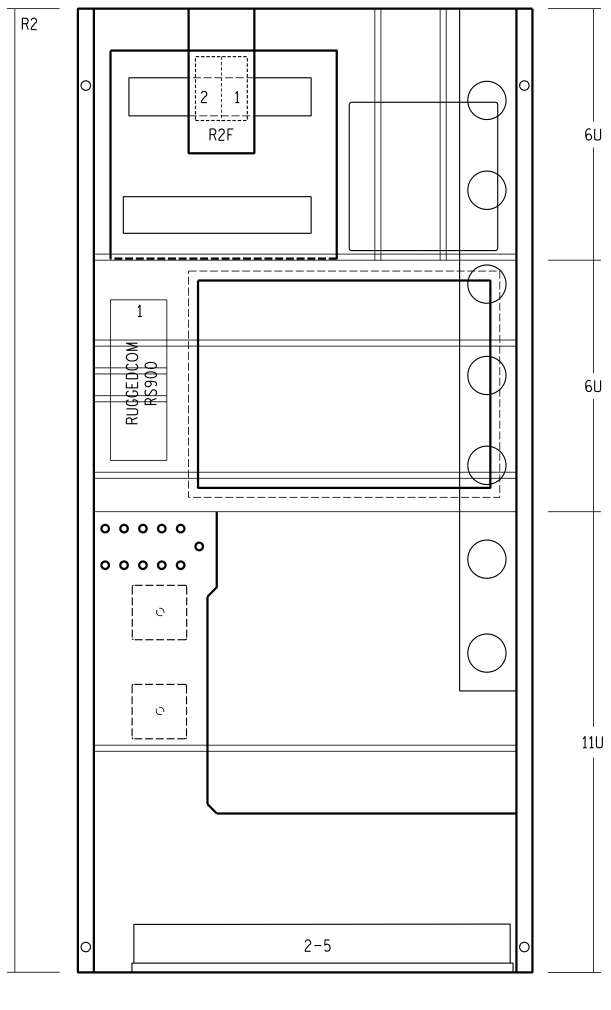
FRONT OF MODULE



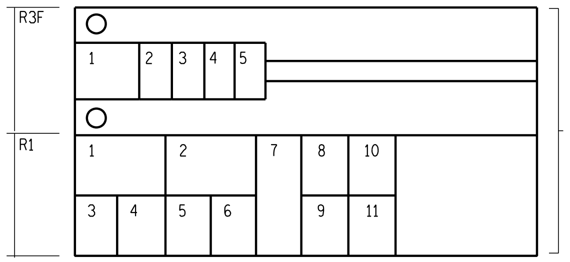
TERMINAL PLATE OF MODULE (TOP)



REAR OF MODULE

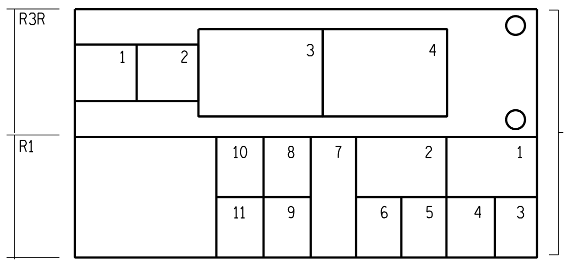


INTERNAL TO MODULE



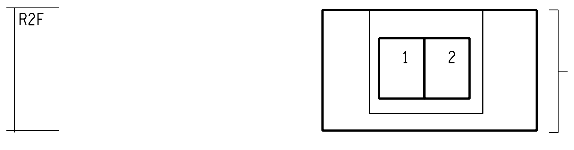
LAYOUT FOR 110V AND 220V DC SCHEME (FRONT VIEW)

INTERNAL TO MODULE



LAYOUT FOR 110V AND 220V DC SCHEME (REAR VIEW)

INTERNAL TO MODULE



LAYOUT FOR 110V AND 220V DC SCHEME (FRONT ACCESS VIA MCB (F2) DOOR)

LOCATION			DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT OF MODULE						
F1	1		LABEL			
F2	1		BACK-UP IED	DIRECTIONAL BACK-UP PROTECTION	REF615	ABB
	2	1	MCB(M)	MAIN DC SUPPLY MCB (110V, 220V SCHEME) (16 AMP)	S282-UC B16	ABB
		2	MCB(BU)	BACK-UP DC SUPPLY MCB (110V, 220V SCHEME) (16 AMP)	S282-UC B16	ABB
		3	MCBX(CL)	CLOSE DC SUPPLY MCB AUXILIARY CONTACT	S2-H11 I	ABB
		4	MCB(CL)	CLOSE DC SUPPLY MCB (110V, 220V SCHEME) (10 AMP)	S282-UC B10	ABB
		5	MCBX(SR)	SPRING REWIND DC SUPPLY MCB AUXILIARY CONTACT	S2-H11 I	ABB
		6	MCB(SR)	SPRING REWIND DC SUPPLY MCB (110V, 220V SCHEME) (20 AMP)	S282-UC B20	ABB
		7	MCB(AC)	MAIN AC SUPPLY MCB (10 AMP)	S282-UC B10	ABB
	3	1	MCB(VT-M)	VT SUPPLY MAIN PROTECTION MCB (3 POLE) (2 AMP)	S203-C 2	ABB
		2	MCBX(VT-M)	VT SUPPLY MAIN PROTECTION MCB AUXILIARY CONTACT	S2C-H6R	ABB
		3	MCB(VT-BU)	VT SUPPLY BACK-UP PROTECTION MCB (3 POLE) (2 AMP)	S203-C 2	ABB
		4	MCBX(VT-BU)	VT SUPPLY BACK-UP PROTECTION MCB AUXILIARY CONTACT	S2C-H6R	ABB
		5	MCB(VT-SC)	VT SUPPLY SYNCH CHECK MCB (2 AMP)	S202-C 2	ABB
		6	MCBX(VT-SC)	VT SUPPLY SYNCH CHECK MCB AUXILIARY CONTACT	S2C-H6R	ABB
		7	MCB(H)	HEATER SUPPLY MCB (6 AMP)	S282-UC B6	ABB
F3	1		MAIN IED	INTERGRATED DISTANCE/DIFFERENTIAL FEEDER PROTECTION RELAY	RED670	ABB
F4	1		PNH	PROTECTION NOT HEALTHY INDICATION (AMBER)	CL523Y	ABB
	2		ARC-OFF/LOCKED-OUT	AUTO RECLOSE OFF & CLOSE LOCK-OUT INDICATION (AMBER) (CL520 = 240V DC)	CL515Y	ABB
	3		IEC61850 RELAY COM PORTS	IEC61850 RELAY TEST ETHERNET COMMUNICATION PORTS		
	4		ESD	ELECTROSTATIC DISCHARGE POINT	SOCKET (BLUE)	COMMUNICA
	5	1	TP-1	TEST POINT 1 - MAIN PROTECTION TRIP (RED PHASE)	SOCKET (RED)	COMMUNICA
		2	TP-2	TEST POINT 2 - MAIN PROTECTION TRIP (WHITE PHASE)	SOCKET (RED)	COMMUNICA
		3	TP-3	TEST POINT 3 - MAIN PROTECTION TRIP (BLUE PHASE)	SOCKET (RED)	COMMUNICA
		4	TP-4	TEST POINT 4 - BREAKER FAIL BUS STRIP	SOCKET (RED)	COMMUNICA
		5	TP-5	TEST POINT 5 - MAIN DC NEGATIVE SUPPLY	SOCKET (BLACK)	COMMUNICA
		6	TP-6	TEST POINT 6 - BREAKER FAIL RETRIP CROSS TRIP	SOCKET (RED)	COMMUNICA
		7	TP-7	TEST POINT 7 - SUPERVISORY TRIP	SOCKET (RED)	COMMUNICA
		8	TP-8	TEST POINT 8 - BACK-UP PROTECTION TRIP	SOCKET (RED)	COMMUNICA
		9	TP-9	TEST POINT 9 - ARC OR EXTERNAL CLOSE	SOCKET (RED)	COMMUNICA
		10	TP-10	TEST POINT 10 - BACK-UP DC NEGATIVE SUPPLY	SOCKET (BLACK)	COMMUNICA
	6		CBNH	CIRCUIT BREAKER NOT HEALTHY INDICATION (AMBER)	CL515Y	ABB
	7		CBO	CIRCUIT BREAKER OPEN INDICATION (GREEN)	CL515G	ABB
	8		CBC	CIRCUIT BREAKER CLOSE INDICATION (RED)	CL515R	ABB
	11		TNS	TEST NORMAL SWITCH	CR0867	LOP SWITCH
	12		LCS	LAMP CHECK SWITCH	CA4 A321-621	KRAUSE & NAIMER
	13		TPIS	TELEPROTECTION ISOLATOR SWITCH	CR-0866	LOP SWITCH
	14		CBCS	CIRCUIT BREAKER CONTROL SWITCH	CR-0604	LOP SWITCH
	15		ARC OFF	AUTO RECLOSE SELECTION STATE PUSH BUTTON (AMBER) (110V OR 220V DC)	MP3-11Y, MBH-101	ABB
	16		ARC 3 POLE	AUTO RECLOSE SELECTION STATE PUSH BUTTON (AMBER) (110V OR 220V DC)	MP3-11Y, MBH-101	ABB
	17			(BLANK)		
	18		TTPB	TRIP TEST PUSH BUTTON/ PROTECTIVE COVER	CP10-10R-10/ YSF	ABB
	19		BFIS	BREAKER FAIL ISOLATOR SWITCH	CR-0866A	LOP SWITCH
	20		SIS	SUPERVISORY ISOLATOR SWITCH	CR-0316	LOP SWITCH
	21		CTTB-BU	CT TEST BLOCK (BACK-UP)	PK2 (4 WAY)	IST
	22		CTTB-M	CT TEST BLOCK (MAIN)	PK2 (4 WAY)	IST
	23		VTTB-M	VT TEST BLOCK (MAIN)	PK2 (4 WAY)	IST
	24		VTTB-BU	VT TEST BLOCK (BACK-UP)	PK2 (4 WAY)	IST
	25		M.O.T. - LINK A CLOSED = NO SYNCH CHECK	LABEL INDICATING EMERGENCY CLOSE CONTROL WITHOUT SYNCH CHECK WHEN LINK A IS CLOSED, AND TNS SELECTED TO MAIN ON TEST		
	26		REMOTE DIFF ISOLATION	LABEL INDICATING TPIS BLOCKS REMOTE DIFF UNIT (OPTIONAL)		
INTERNAL TO MODULE						
R1	1		VSR-1	ISOLATOR 1 REPEAT RELAY (✱ AN=110V DC, AS=220V DC) (OPTIONAL)	RXMVB 2 RK 251205-✱	ABB
	2		VSR-2	ISOLATOR 2 REPEAT RELAY (✱ AN=110V DC, AS=220V DC) (OPTIONAL)	RXMVB 2 RK 251205-✱	ABB
	3			(BLANK)		
	4			(BLANK)		
	5		RCPM_C/T	SNUBBER CIRCUIT	RCPM1 PR56512029-AA	ABB
	6		CT-X	BACK-UP TO MAIN CROSS TRIP AUXILIARY RELAY (✱ AN = 110V DC, AS = 220V DC)	RXMA 1 RK 211072-✱	ABB
	7		PSU	48 VOLT DC POWER SUPPLY UNIT (OPTIONAL)	RXTUG	ABB
	8		TCS-M	TRIP CIRCUIT SUPERVISION MAIN (MAIN)	BTCS110	ABB
	9			(BLANK)		
	10			(BLANK)		
	11		TCS-BU	TRIP CIRCUIT SUPERVISION BACK-UP (BACK-UP)	BTCS110	ABB
R3F	1		D1	LAMP CHECK DIODES	PR56592018	WEIDMULLER/ ABB
	2		D2	CROSS TRIP DIODES	PR56512033.BA	WEIDMULLER/ ABB
	3		D3	CROSS TRIP DIODES	PR56512033.BA	WEIDMULLER/ ABB
	4		D4	BLOCKING DIODE (MEASURING POINTS)	PR56592018/4.PNH	WEIDMULLER/ ABB
	5		D5	BLOCKING DIODE (TRIP CIRCUIT SUPERVISION 3 POLE)	PR56512033.BA	WEIDMULLER/ ABB
R3R	1		DCF-M	DC FAIL RELAY (MAIN) (✱ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	2		DCF-BU	DC FAIL RELAY (BACKUP) (✱ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	3		MCTS	MAIN CT SHORTING RELAY (✱ 110=110V DC, 220=220V DC) (OPTIONAL)	BJ8-110V DC	ARTECHE
	4		BCTS	BACK-UP CT SHORTING RELAY (✱ 110=110V DC, 220=220V DC) (OPTIONAL)	BJ8-110V DC	ARTECHE
R2F	1		CBC-CR	CIRCUIT BREAKER CLOSE AUXILIARY RELAY (✱ AN = 110V DC, AS = 220V DC)	RXMB1 1MRK 000 803-✱	ABB
	2			(BLANK)		
REAR OF MODULE						
R2	1		ROUTER	IEC61850 ROUTER (OPTIONAL)	RS900-HI-D-MTMTMT	RUGGEDCOM
	2		CBOS-X1	CIRCUIT BREAKER OPEN SUPERVISORY AUXILIARY 1 RELAY (48V DC) (OPTIONAL)	CR-U048DC3	ABB
	3		CBCS-X1	CIRCUIT BREAKER CLOSE SUPERVISORY AUXILIARY 1 RELAY (48V DC) (OPTIONAL)	CR-U048DC3	ABB
	4		PNH-X1	PROTECTION NOT HEALTHY AUXILIARY 1 RELAY (✱ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	5		PNH-X2	PROTECTION NOT HEALTHY AUXILIARY 2 RELAY (✱ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
				(OPTIONAL 3 PHASE)	SINEAX CAM/iSTATi5MT	CAMILLE/ AREVA
R4	X5.1		TRANSDUCER	MEASUREMENTS TRANSDUCER & INTERFACE (OPTIONAL 1 PHASE)	SINEAX U543, I543	CAMILLE BAUER
				(OPTIONAL 1 PHASE)	VA4-LDG6, CA4-LDG6	POWERCON
	X5.2		MCB (VT-T)	TRANSDUCER VT SUPPLY MCB (3 POLE) (2 AMP)	S203-C 2	ABB
	X6.1		MCB (LVT)	DISTURBANCE RECORDER LVT SUPPLY MCB (OPTIONAL) (1 AMP)	S202-C 1	ABB
	X6.2		MCB (VT-DR)	DISTURBANCE RECORDER VT SUPPLY MCB (3 POLE) (OPTIONAL) (1 AMP)	S203-C 1	ABB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 1
PANEL EQUIPMENT LAYOUT

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

SCALE

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
41	01	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 01 OF 27 REVISION 00

REF670 AND REF615 RELAYS USE PCM600 AS THEIR SOFTWARE TOOL. THE REQUIRED CONNECTIVITY PACKAGES FOR THESE RELAYS IS THE RELION SERIES SOFTWARE.

RED670: MAIN DISTANCE/DIFFERENTIAL RELAY
NOTE THAT THE INTERNAL TELEPROTECTION/DIFFERENTIAL COMMUNICATION LINK OF THIS RELAY IS ONLY COMPATABLE WITH A MIRRORED RELAY ON THE DISTRIBUTION CONTRACT OR SCHEMES 6FZD3500 AND 6FZD3600 ON THE TRANSMISSION CONTRACT.

EXPLANATION OF THE CONTROLLED SWITCHES USED IN THE RED670 MAIN RELAY
GT SWITCHES, WHICH ARE SETTABLE IN THE PCM600 ENGINEERING PARAMETER SETTING (PS) SOFTWARE, AND MAY BE FOUND WITHIN THE PARAMETER SETTINGS UNDER THE APPLICATION CONFIGURATION SECTIONS THEY ARE CONFIGURED WITHIN, ARE MASKED AS FOLLOWS:

GT-01) INTERNAL COMMUNICATION CARD LINK FAIL FUNCTION SELECTION
SET GT01 TO 'ON' (THE DEFAULT) IF THE SCHEME HAS A COMMUNICATION CARD IN SLOT X34 OR X35 AND IT IS USED.
SET GT01 TO 'OFF' IF THE CARD IS NOT USED OR IF THE SCHEME DOES NOT HAVE A COMMUNICATION CARD IN SLOT X34 OR X35.

TO TAKE ADVANTAGE OF THE TEF CARRIER GUARD FAIL MASKING: SET UNBLOCK = RESTART IN THE PST SOFTWARE AND SET SECURITY = 35ms.

GT-02) TEST OUTPUTS
SET GT02 TO 'ON' TO ENABLE PHASE AND EARTH FAULT IMPEDANCE STARTER TEST OUTPUTS.
SET GT02 TO 'OFF' (THE DEFAULT) TO ENABLE CARRIER RECEIVE AND CARRIER SEND TEST OUTPUTS.

GT-03) INSTANTANEOUS TRIP PARALLEL/SERIES LOGIC FUNCTION SELECTION
SET GT03 TO 'OFF' (THE DEFAULT) FOR PARALLEL OPTION WHICH ALLOWS EITHER FUNCTION, DIFFERENTIAL OR DISTANCE (Z1 OR Z2 AIDED), TO INITIATE THE TRIP (INCREASED DEPENDABILITY).
WITH GT03 SET 'ON', THE SERIES OPTION IS CHOSEN WHICH REQUIRES BOTH FUNCTIONS TO OPERATE TO INITIATE AN INSTANTANEOUS TRIP (INCREASED SECURITY).

GT-04) CARRIER GUARD ZONE ACCELERATION BLOCK
SET GT04 TO 'OFF' (THE DEFAULT) IN 'Application Configuration/Monitoring/Logic/LogicGate' WHEN THE CARRIER GUARD IS NOT USED.
SET GT04 TO 'ON' WHEN USING THE CARRIER GUARD AND USING THE ZONE ACCELERATION FUNCTIONALITY. NOTE THAT ZONE ACCELERATION CAN BE SET ON OR OFF (THE DEFAULT) WITHIN THE SETTINGS AND SHOULD ONLY BE USED FOR SINGLE RADIAL LINES.

GT-05) CARRIER GUARD SELECTION
SET GT05 TO 'ON' FOR CARRIER GUARD USEAGE. SET TO 'OFF' (THE DEFAULT) IF THERE IS NO 50V DC SUPPLY TO THE EXTERNAL TELEPROTECTION (PLC) SCHEME CIRCUIT.

GT-06) PARALLEL FEEDER DISTANCE-TO-FAULT COMPENSATION SELECTION
SET GT06 TO 'OFF' (THE DEFAULT) FOR NO PARALLEL FEEDER DISTANCE TO FAULT COMPENSATION (FAULT LOCATOR ACCURACY).
SET GT06 TO 'ON' FOR DTF FAULT LOCATOR COMPENSATION FOR PARALLEL FEEDERS (DOUBLE CIRCUIT FEEDERS).

GT-07) UNDERVOLTAGE OVERLOAD TRIP OR OVERVOLTAGE TRIP FUNCTION SELECTION
THE U/V OVERLOAD TRIP FUNCTION (THE DEFAULT) MAY BE REPLACED WITH THE 'OVLD' TRIP FUNCTION (SET GT07 TO 'ON' FOR OVLD TRIP) IF THE SOLE CRITERIA IS CURRENT.

A SETTABLE TIMER FUNCTION, TS14, IS USED FOR THE TIMING OF THE OVERLOAD (OVLD) TRIP FUNCTION. TS14 WILL DELAY THE OVERLOAD TRIP OUTPUT AND IS SETTABLE IN THE PST SOFTWARE. TS14 IS IN SERIES WITH THE OVLD FUNCTION TIMER T OUTPUT (i.e. THE TIMERS ARE ADATIVE). IF TS14 IS SET TO 'OFF', THE OVLD TRIP AND THE U/V OVLD ARE BLOCKED BUT THE OVLD ALARM WOULD REMAIN FUNCTIONAL (i.e. THE OVLD ALARM OUTPUT IS TAKEN OFF BEFORE TS14 AND THE OVLD ALARM WOULD OPERATE AFTER OVLD FUNCTION TIME TIMEOUT).
NOTE THAT THE U/V FUNCTION TIMER RUNS CONCURRENTLY WITH THE OVLD TRIP OUTPUT FOR THE U/V TRIP OUTPUT.

GT-08) BROKEN CONDUCTOR TRIP OR ALARM FUNCTION SELECTION
THE BROKEN CONDUCTOR ALARM FUNCTION (THE DEFAULT) MAY BE REPLACED WITH THE BROKEN CONDUCTOR TRIP FUNCTION (SET GT08 TO 'ON' FOR BC TRIP) IF THE CONNECTED POWER PARAMETERS ALLOW IT.

GT-09) FUSE FAIL BREAKER STATUS DUDI FUNCTION SELECTION
SET GT09 TO 'OFF' (THE DEFAULT) FOR EXCLUSION OF THE BREAKER STATUS WITHIN THE DUDI FUNCTION DECISION LOGIC (THEN RELIES SOLELY ON THE CONDITION 'phase Imag > IPh setting' TO BE FULFILLED FOR INITIATION OF DUDI). SET GT09 'ON' FOR INCLUSION OF THE BREAKER STATUS LOGIC (THEN RELIES ON EITHER OF THE CONDITIONS 'phase Imag > IPh setting' OR 'CIRCUIT BREAKER CLOSED' TO BE FULFILLED FOR INITIATION OF THE DUDI FUNCTION).

GT-11) POLE DISAGREEMENT FUNCTION SELECTION
THE POLE DISAGREEMENT FUNCTION (PD) INCLUDES BOTH BREAKER AUXILIARY CONTACT ANALYSIS (TRADITIONAL METHOD) AND A CURRENT BASED FUNCTIONALITY. THEY ARE INDEPENDANT OF EACH OTHER.

THE CURRENT BASED OPTION CAN BE SET FOR CONTINUOUS MONITORING OR FOR A PERIOD OF 200ms AFTER THE BREAKER CHANGES STATE (CurrSel='CB OPEN MONITOR' IS THE SETTING FOR THE 200ms OPTION - INITIATED VIA CLOSE OR 3 POLE TRIP COMMANDS).
IF THE CURRENT BASED OPTION IS USED, THEN IT IS RECOMMENDED TO CHOOSE THE 200ms OPTION, AS OPPOSED TO THE CONTINUOUS OPTION, AS IT IS MORE SECURE.
IF THE CURRENT BASED OPTION IS NOT REQUIRED (RECOMMENDED), SET THE 'Curr Sel' TO 'OFF' (THE DEFAULT).

FUNCTIONALITY HAS BEEN ADDED TO THE TRADITIONAL METHOD OF PD AND THUS THERE IS AN OPTION TO HAVE IT SUPERVISED BY USING THE BROKEN CONDUCTOR 'START' FUNCTIONALITY AND BROKEN CONDUCTOR FUNCTION CURRENT SETTINGS. THIS IS STILL INDEPENDANT OF THE SOLELY CURRENT BASED OPTION IN THE PREVIOUS PARAGRAPH.

SET GT11 TO 'ON' (THE DEFAULT) FOR TRADITIONAL POLE DISAGREEMENT FUNCTIONALITY (i.e. BREAKER AUXILIARY CONTACT ANALYSIS).
SET GT11 TO 'OFF' TO ENABLE A COMBINATION THAT USES BREAKER AUXILIARY CONTACTS AND THE BROKEN CONDUCTOR START FUNCTIONALITY.
THIS EXTRA FUNCTIONALITY HAS BEEN ADDED TO ENHANCE SECURITY OF THE SCHEME (i.e. PD WITH BCondStart WOULD NOT OPERATE FOR A FAULTY BREAKER AUXILIARY CONTACT ONLY) BUT WITH DECREASED DEPENDABILITY (i.e. THE LINE MUST BE ENERGISED, CONNECTED AND POSSIBLY LOADED BEFORE A PD COULD OPERATE).

GT-12) ZONE 2 AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF IMPEDANCE ZONE 2 AUTORECLOSE INITIATION (Z2 ARC INITIATE), SET GT12 TO 'ON'. SET GT12 TO 'OFF' (THE DEFAULT) FOR NO ZONE 2 ARC INITIATE.

GT-13) FAULT AND TRIP COUNTER RESET
GT13 DEFAULT = 'OFF'. SET GATE 'ON' THEN 'OFF' WHEN REPLACING THE HV BREAKER.

GT-14) TEF (EARTH-FAULT RED670) AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF TEF AUTORECLOSE INITIATION, SET GT14 TO 'ON' (THE DEFAULT) IN 'Application Configuration/Closing ARCend Sync/Logic/LogicGate'.
SET GT14 TO 'OFF' FOR NO TEF ARC INITIATE.

GT-15) O/C (RED670) AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF O/C AUTORECLOSE INITIATION, SET GT15 TO 'ON' IN 'Application Configuration/Closing ARCend Sync/Logic/LogicGate'.
SET GT15 TO 'OFF' FOR NO O/C ARC INITIATE (THE DEFAULT).

GT-16) SYNCH CHECK FUNCTION
SET GT16 TO 'OFF' (THE DEFAULT) FOR USAGE OF THE SYNCH CHECK AUTO FUNCTION. SET GT16 TO 'ON' IF THERE IS NO SYNCH CHECK LINE VT.

GT-18) TRIP CIRCUIT SUPERVISION CLOSE BLOCKING
SET GT18 TO 'ON' IN 'PARAMETER SETTING/MONOTORING' FOR ANY TCS FAIL (FROM MAIN OR BACK-UP TRIP COIL CIRCUITS) TO BLOCK A CLOSE.
TCS FAIL WILL NOT BLOCK A CLOSE IF GT18 IS SET 'OFF' UNLESS BOTH MAIN AND BACK-UP TRIP CIRCUITS HAVE FAILED. THE DEFAULT SETTING IS GT18='OFF'.
A PNH AND A CBNH ALARM WILL BE ISSUED FOR A TCS FAIL, IRRESPECTIVE OF THE GT18 STATE.

REF615: BACK-UP RELAY SETTINGS AND LOGIC

CB CLOSE CONTROL LOGIC
THE BACK-UP RELAY HAS BEEN MASKED AND THE SCHEME WIRED TO ENABLE BREAKER CONTROL WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST).
THE CLOSE PULSE CAN BE ISOLATED IF REQUIRED BY LINK A ON THE TERMINAL STRIP AS THE BACK-UP RELAY DOES NOT OFFER SYNCH-CHECK.
THE DEFAULT LINK A POSITION IS 'OPEN'.

SUPERVISORY BREAKER CONTROL:
THE BACK-UP RELAY IS ALSO MASKED FOR SUPERVISORY DNP3 AND HARDWIRED REMOTE BREAKER CONTROL (VIA MAIN ON TEST AND SIS SELECTION).

BREAKER FAIL LOGIC (51BF)
THE FUNCTION IS ONLY ENABLED WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST). THERE IS NO TELEPROTECTION LINKED TO THIS OUTPUT AND THE BREAKER FAIL OUTPUT IS ALSO ISOLATED VIA THE BFIS SWITCH. THE BF TRIP PULSE OUTPUT IS SET TO 200ms.

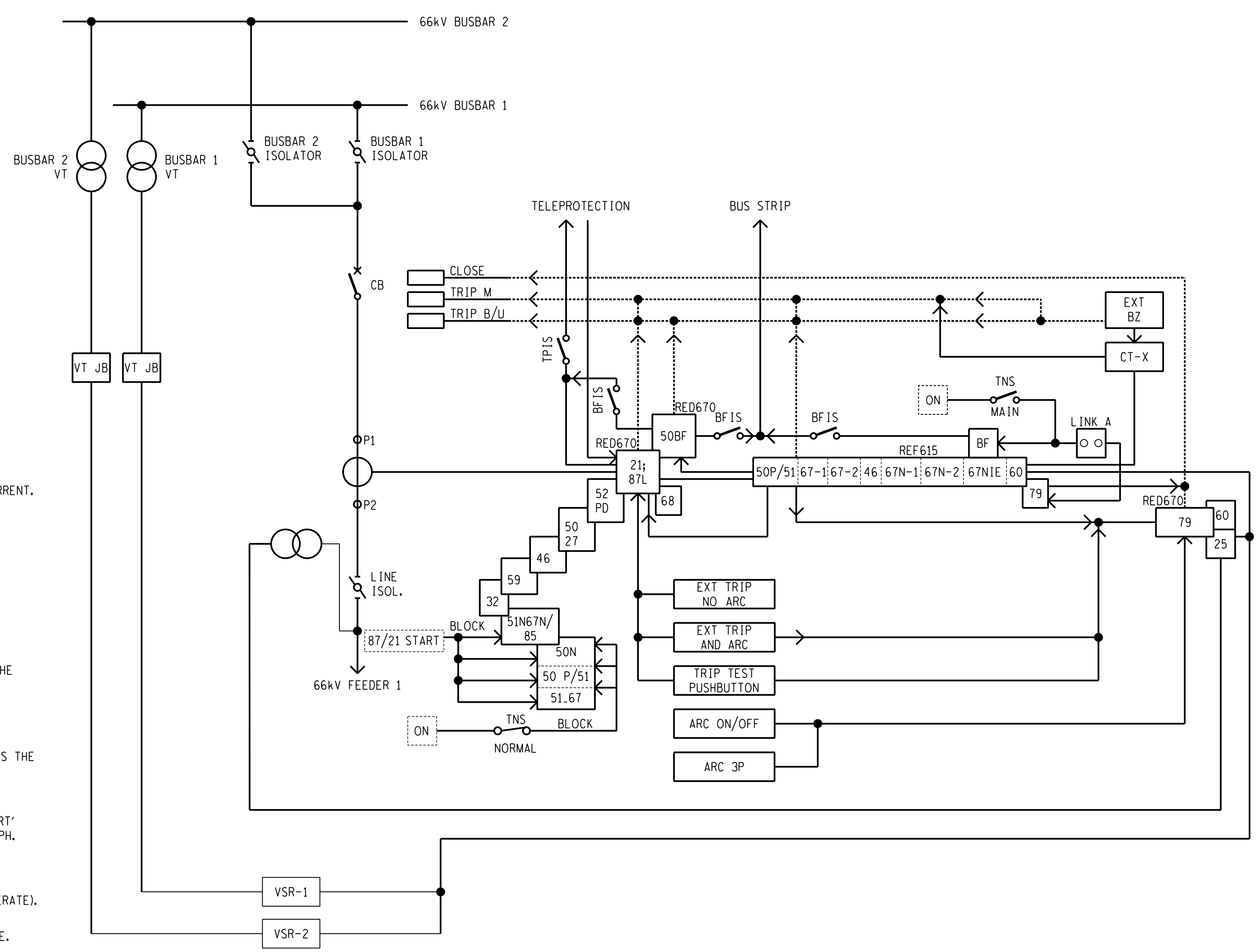
AUTORECLOSE (DARREC1(79))
THE RELAY INCLUDES ARC FUNCTIONALITY. THE FUNCTION IS MASKED SUCH THAT IT IS ENABLED WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST).
HOWEVER, DUE TO LIMITATIONS, BACK-UP RELAY INTERNAL ARC ON/OFF IS NOT SELECTABLE VIA SUPERVISORY OR FROM THE OPERATOR PANEL. THE FUNCTION CAN BE SET ON/OFF VIA EITHER ALTERNATIVE SETTING SELECTION OR MANUALLY AND SHOULD ONLY BE USED IN LONG TERM EMERGENCIES.
NOTE THAT THE FUNCTION IS AUTOMATICALLY INHIBITED FOR A MANUAL CLOSE.

2ND HARMONIC INRUSH DETECTION FUNCTIONALITY
THE INRUSH DETECTION FUNCTION, INRPHAR1, IS MASKED TO BLOCK THE FOLLOWING FUNCTIONS WHEN OPERATED:
DIR_OC1 (67-1(1)), DIR HighSetOC (67-2), HonDir InstOC (50P/51), AND IS MASKED TO ENABLE THE DIR_OC2 (67-1(2)) FUNCTION'S MULTIPLIER.

CB CLOSED MULTIPLIER (TPGAPC1 GENERIC TIMER, DEFAULT TIME = 500ms):
TP GAPC1 IS MASKED TO THE FOLLOWING FUNCTIONS TO ENABLE THE MULTIPLIER WHEN THE BREAKER CLOSES IF REQUIRED:
DIR HighSetOC (67-2), NonDIR InstOC (50P/51), SEF DIR EF2 (67N-1), DEF HighSet (67N-2), NonDIR_InstEF (51N-2), NegSeq_OC1/2 (46(1/2)).

THERMAL OVERLOAD (ThermOVLD (49F))
THE FUNCTION HAS BEEN MASKED FOR INDICATION AND NOT TRIP PURPOSES. HOWEVER, THE BLOCK BREAKER CLOSE FOR TEMPERATURE EXCEED HAS BEEN MASKED.
TO CIRCUMVENT THE BLOCK CLOSE FUNCTIONALITY, SET THE RECLOSE TEMPERATURE TO MAXIMUM OR SET THE FUNCTION OFF.

BROKEN CONDUCTOR ((46PD) OVERVOLTAGE 3PH O/V (59)), UNDERVOLTAGE 3PH U/V (27), PosSeq-U/V (47U), NegSeq-O/V (47O)
THESE FUNCTIONS HAVE BEEN MASKED FOR ALARMING PURPOSES ONLY. HOWEVER, THE OPERATION OF THE FUNCTIONS WOULD INHIBIT THE INTERNAL ARC FUNCTION (ENABLED VIA TNS OFF NORMAL).



LEGEND	
21	DISTANCE PROTECTION FUNCTION
25	SYNCHRONISM-CHECK FUNCTION
27	UNDERVOLTAGE FUNCTION
32	DIRECTIONAL OVERPOWER FUNCTION
46	NEGATIVE SEQUENCE OVERCURRENT/ BROKEN COND FUNCTIONS
50BF	BREAKER FAIL FUNCTION
50N	NON-DIR INSTANTANEOUS EARTHFAULT FUNCTION
50/51	INSTANTANEOUS OR TIME DELAY OVERCURRENT FUNCTION
50P/51	NON-DIR INSTANTANEOUS OVERCURRENT FUNCTION
51	AC INVERSE TIME O/C FUNCTION
52PD	POLE DISAGREEMENT PROTECTION FUNCTION
59	OVERVOLTAGE FUNCTION FUNCTION
60	FUSE FAILURE FUNCTION
67-1	DIR OVERCURRENT IDMT OR DT FUNCTION
67-2	DIR HIGHSET OVERCURRENT FUNCTION
67N-1	DIRECT EARTHFAULT IDMT OR DT FUNCTION
67N-2	DIR HIGHSET EARTHFAULT FUNCTION
67NIE	INTERMITANT EARTHFAULT FUNCTION
68	POWERSWING FUNCTION
79	AUTO RECLOSE FUNCTION
85	EARTH FAULT FUNCTION AIDED
87L	LINE DIFFERENTIAL PROTECTION FUNCTION
AUX	AUXILIARY
BCD	BINARY CODED DECIMAL
BZ	BUSZONE

LEGEND	
CT-X	CROSS TRIP AUXILIARY
DIR	DIRECTIONAL
DT	DEFINITE TIME
DTTR	DIRECT TRANSFER TRIP RECIEVE
DTTS	DIRECT TRANSFER TRIP SEND
GPS	GLOBAL POSITIONING SYSTEM
GSM	GPS TIME SYNCHRONISATION MODULE
LDCM	LINE DATA COMMUNICATION MODULE (TELEPROTECTION AND DIFFERENTIAL COMMUNICATION)
LSB/MSB	LEAST SIGNIFICANT BIT /MOST SIGNIFICANT BIT
LSB	LEAST SIGNIFICANT BIT
MSB	MOST SIGNIFICANT BIT
OEM	OPTICAL ETHERNET MODULE
PCM600	CONFIGURATION, PARAMETER SETTING & DISTURBANCE HANDLING ENGINEERING TOOL PACKAGE FOR ABB RELION SERIES
PS	PARAMETER SETTING TOOL WITHIN PCM600
REA	REMOTE ENGINEERING ACCESS
SLM	SERIAL COMMUNICATION MODULE LON AND SPA BUS
SYNCH	CHECK SYNCHRONISM OR SYNCHRONISM-CHECK
TCS	TRIP CIRCUIT SUPERVISION (MONITOR)
TP	TEST POINT
TRIP B/U	TRIP BACKUP CIRCUIT BREAKER COIL
TRIP M	TRIP MAIN CIRCUIT BREAKER COIL
VSR	VOLTAGE SELECTION RELAY

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
LOGIC DIAGRAM

D-WC-8118

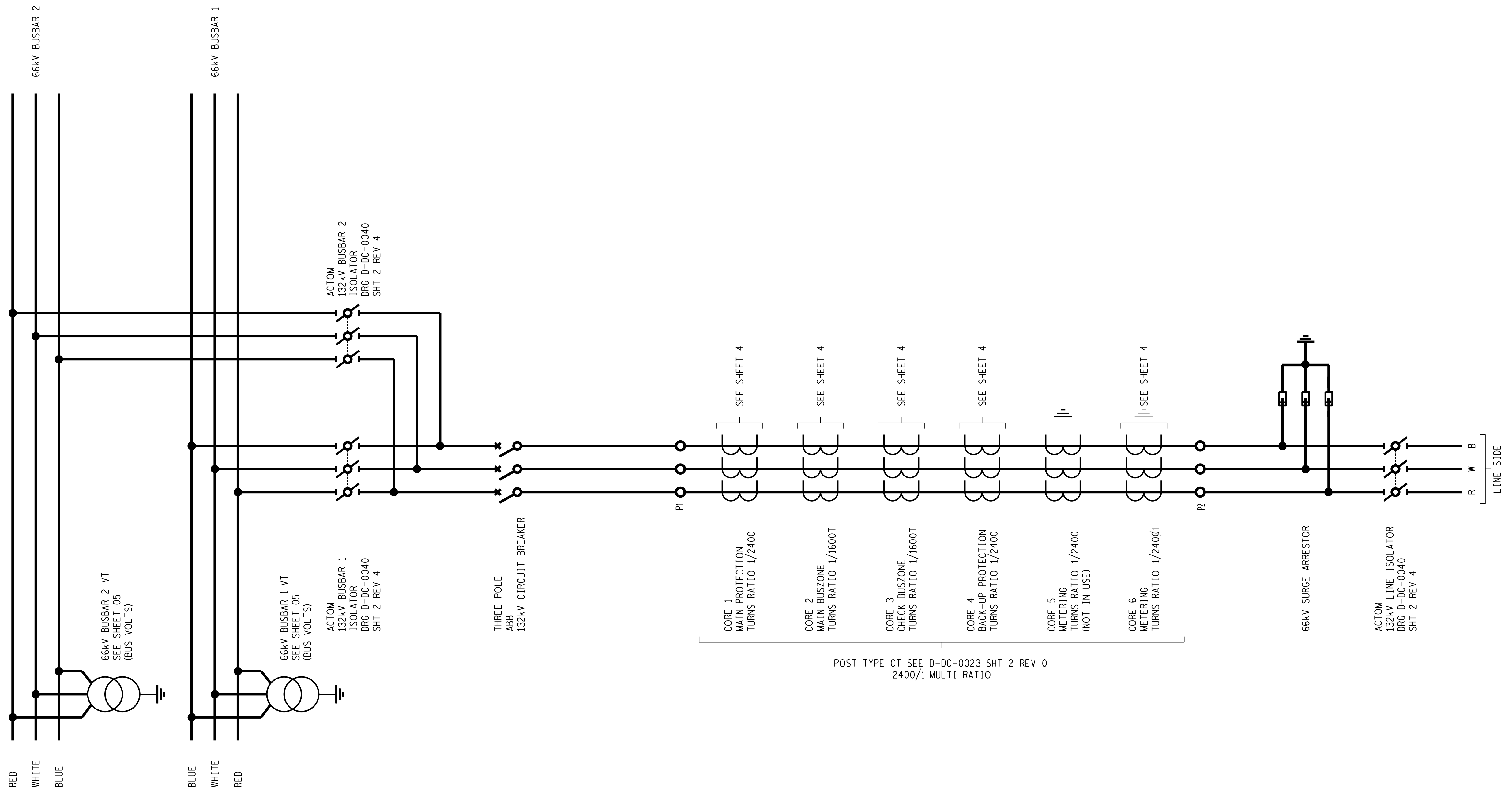
SET NUMBER	SHEET NUMBER	REVISION
41	02	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 02 OF 27 REVISION 00



DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
SINGLE LINE DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	03	00

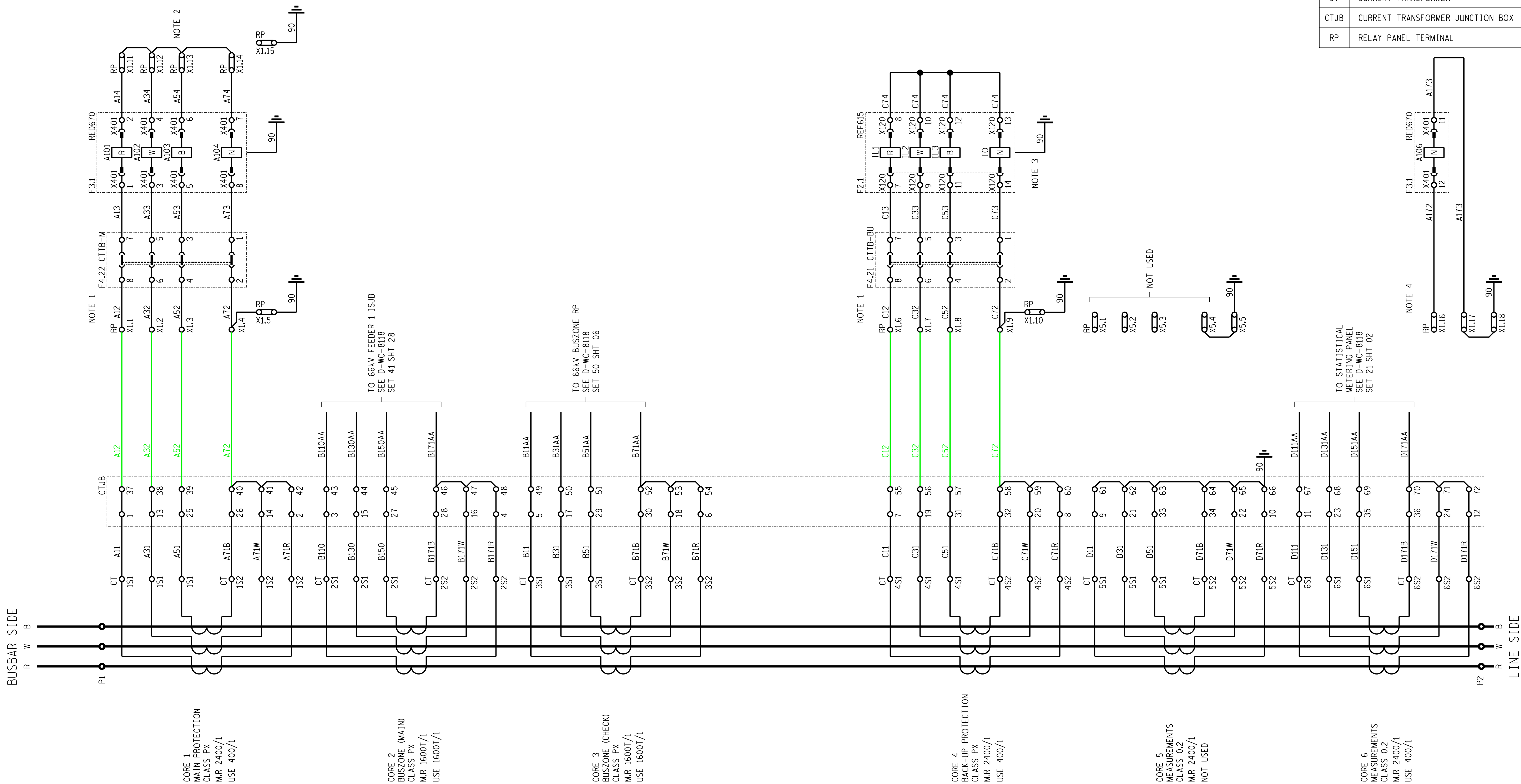
LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 OF 27 REVISION 00

	TERMINAL DESCRIPTION
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
RP	RELAY PANEL TERMINAL



NOTE:

1. IF THE FEEDER HAS OUTBOARD PRIMARY PLANT BYPASS CAPABILITY THEN SWITCH ON DRAWING LEVEL 18 (I.E. THE CT SHORTING OPTION IS TO THEN BE ORDERED AND USED).
2. AN EXTERNAL DISTURBANCE RECORDER MAY BE CONNECTED HERE IF NO DISTURBANCE RECORDER CT CORE IS AVAILABLE.
3. THE BACK-UP IED FEATURES AN AUTOMATIC CT SHORT-CIRCUIT CONNECTOR WHEN THE PLUG-IN UNIT IS WITHDRAWN.
4. FOR THE CASE OF DOUBLE CIRCUIT LINES WITH REGARD TO THE FAULT LOCATOR ACCURACY, THE INFLUENCE OF THE ZERO-SEQUENCE MUTUAL IMPEDANCE IS COMPENSATED FOR BY CONSIDERING THE RESIDUAL CURRENT ON THE PARALLEL LINE. FOR THIS CASE, USE THESE RELAY CT INPUTS.

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION

66kV FEEDER 1

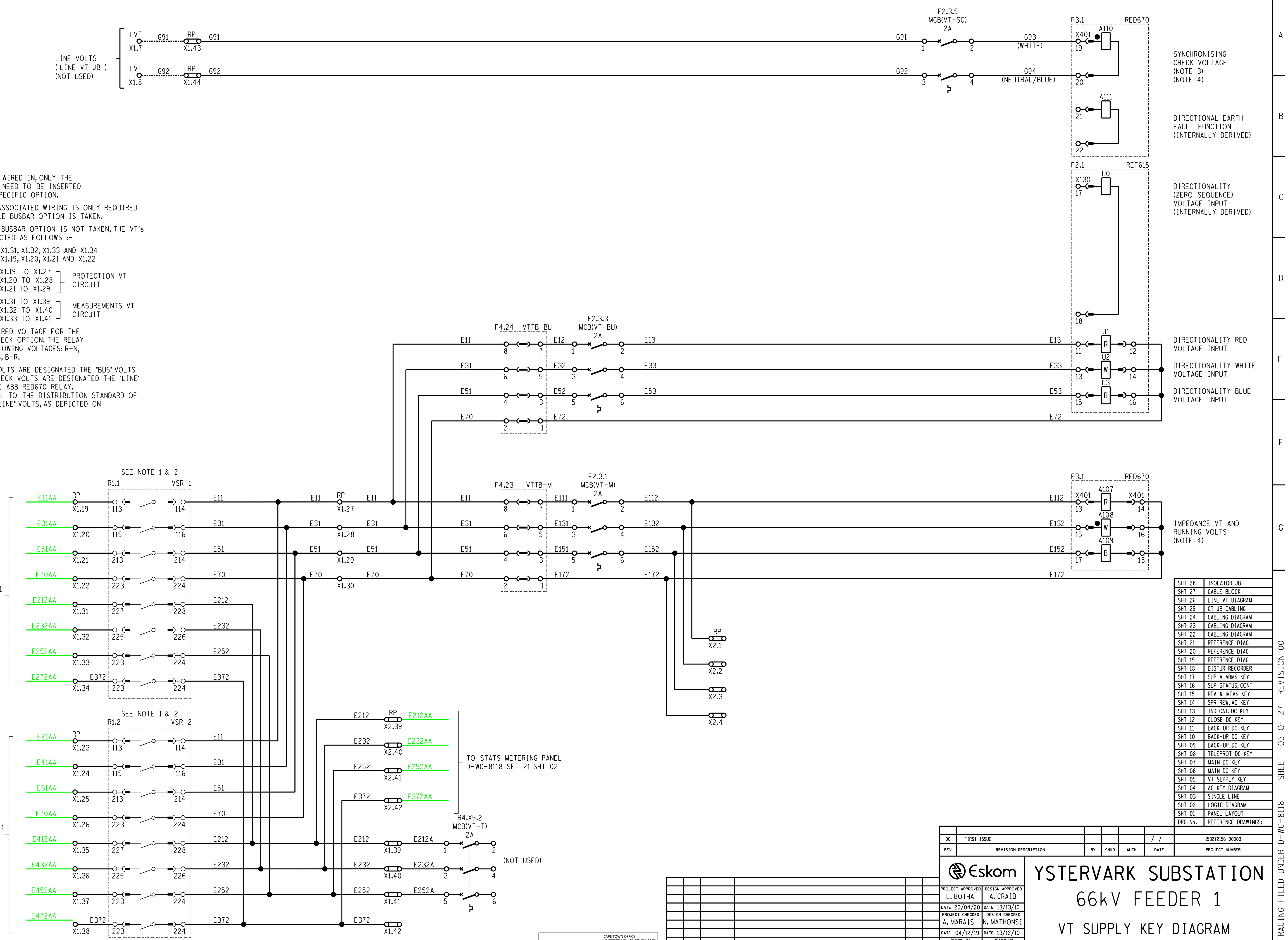
AC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	04	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L



NOTE:

1. ALL OPTIONS ARE WIRED IN, ONLY THE OPTIONAL RELAYS NEED TO BE INSERTED TO SELECT THE SPECIFIC OPTION.
2. RELAY VSR WITH ASSOCIATED WIRING IS ONLY REQUIRED WHEN THE MULTIPLE BUSBAR OPTION IS TAKEN.

   IF THE MULTIPLE BUSBAR OPTION IS NOT TAKEN, THE VT's ARE TO BE CONNECTED AS FOLLOWS :-

   MEASUREMENTS - X1.31, X1.32, X1.33 AND X1.34
   PROTECTION - X1.19, X1.20, X1.21 AND X1.22

   ADD LOOPS FROM X1.19 TO X1.27, X1.20 TO X1.28, X1.21 TO X1.29 — PROTECTION VT CIRCUIT

   AND X1.31 TO X1.39, X1.32 TO X1.40, X1.33 TO X1.41 — MEASUREMENTS VT CIRCUIT
3. SELECT THE PREFERED VOLTAGE FOR THE SYNCHRONISING CHECK OPTION. THE RELAY CAN USE THE FOLLOWING VOLTAGES: R-N, W-N, B-N, R-W, W-B, B-R.
4. THE IMPEDANCE VOLTS ARE DESIGNATED THE "BUS" VOLTS AND THE SYNCH CHECK VOLTS ARE DESIGNATED THE "LINE" VOLTS WITHIN THE ABB RED670 RELAY. THIS IS IDENTICAL TO THE DISTRIBUTION STANDARD OF "BUS" VOLTS AND "LINE" VOLTS, AS DEPICTED ON SHEETS 3 AND 5.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM

CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION

66kV FEEDER 1

VT SUPPLY KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	05	00

LEVELS 1 2 5 10 11 12 21 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 05 OF 27 REVISION 00

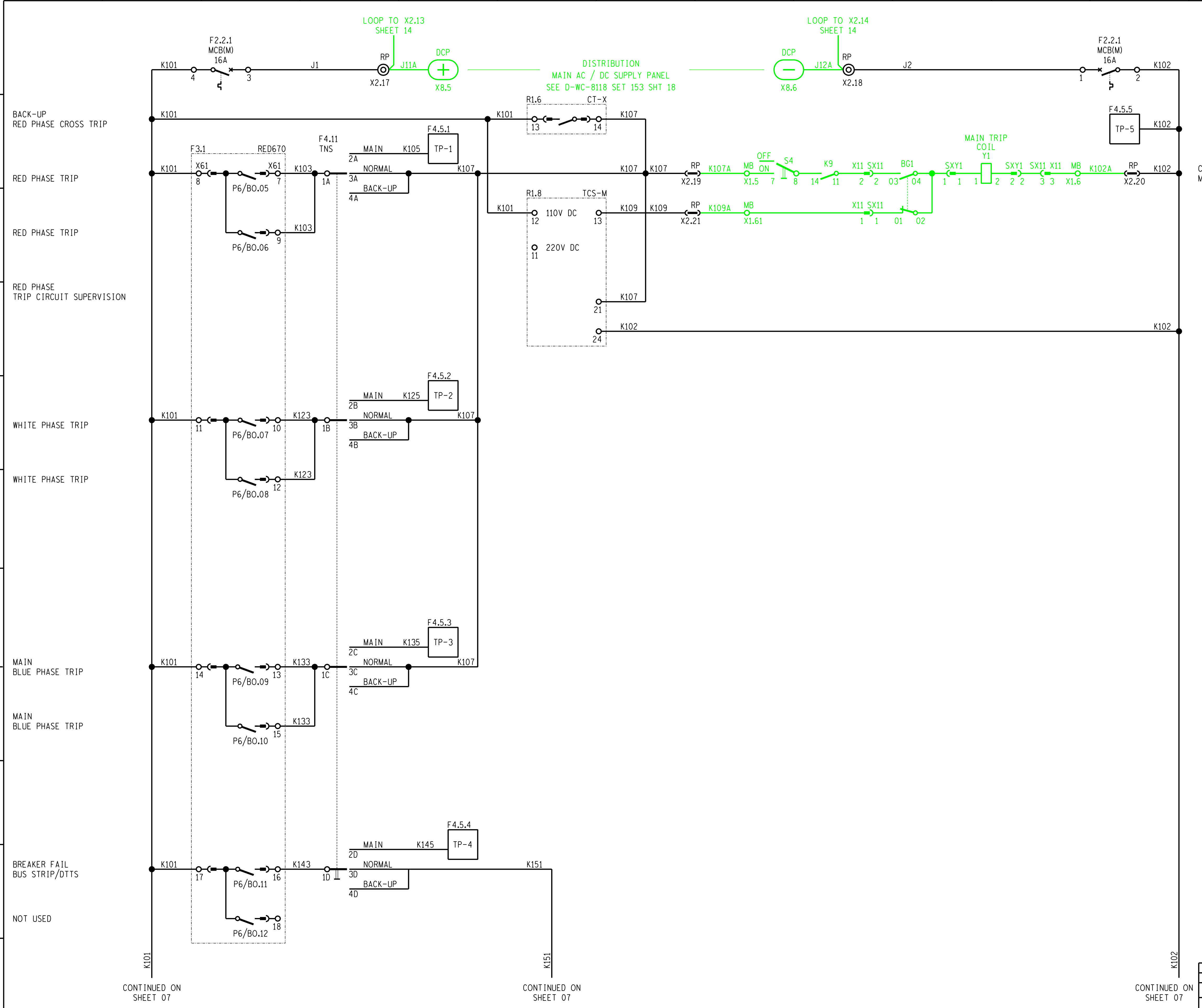


ABB 132kV THREE POLE BREAKER LEGEND	
ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
MAIN DC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	06	00

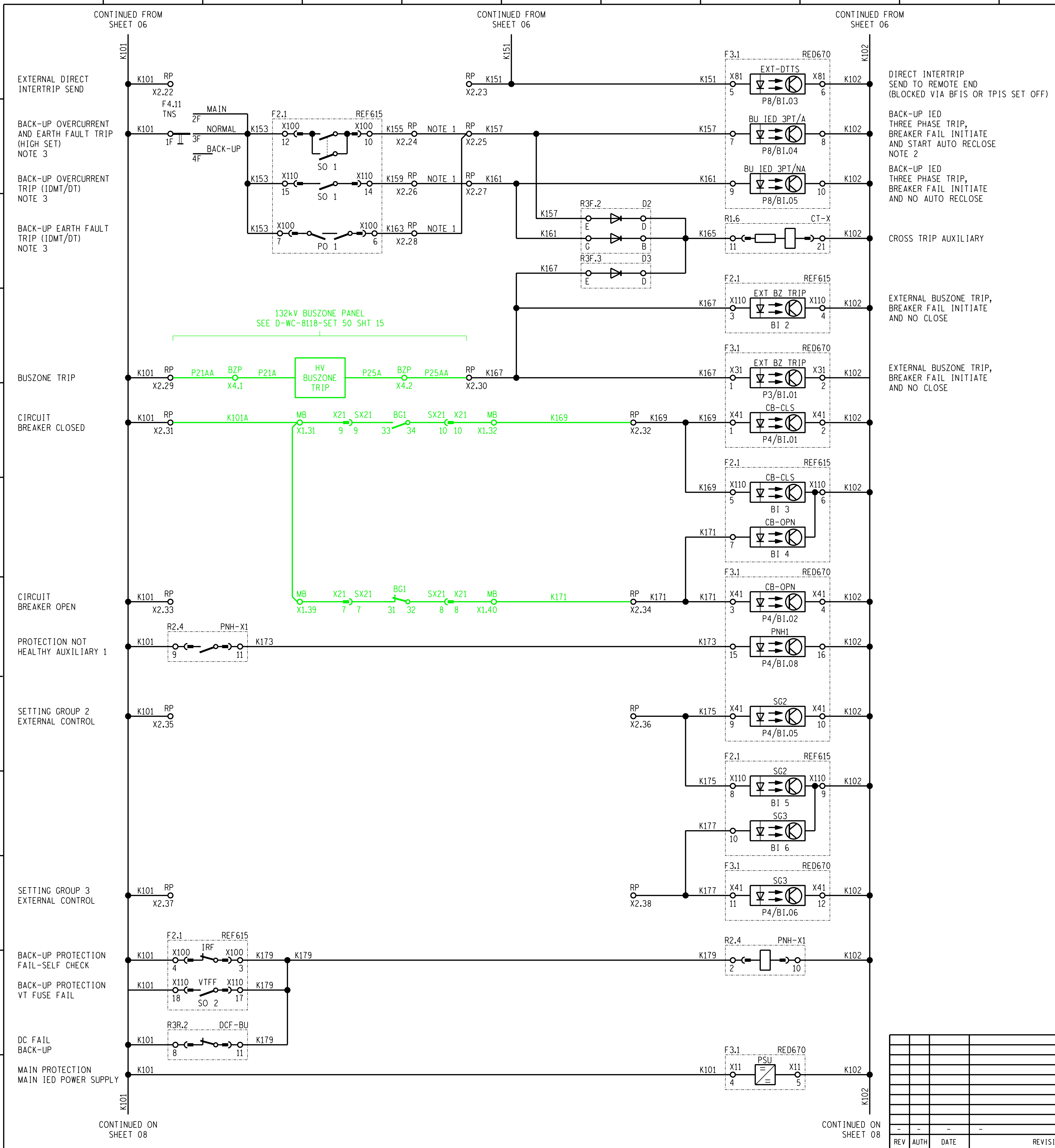
LEVELS 1 2 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

SHEET 06 OF 27 REVISION 00

MASTER TRACING FILED UNDER D-WC-8118



NOTE:

1. CONNECT RELAY PANEL TERMINALS AS REQUIRED FOR INITIATION OF AUTO RECLOSE.
2. FOR RED670 IMPEDANCE FUNCTION, ZONE 2 INITIATED AUTO-RECLOSE SET GATE 12 TO 'ON' (DEFAULT = 'OFF').
3. THESE OUTPUTS OF THE BACK-UP IED (REF615) ARE MASKED/ SET TO 'NON-LATCHED'.

ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 1
MAIN DC KEY DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	41	07	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

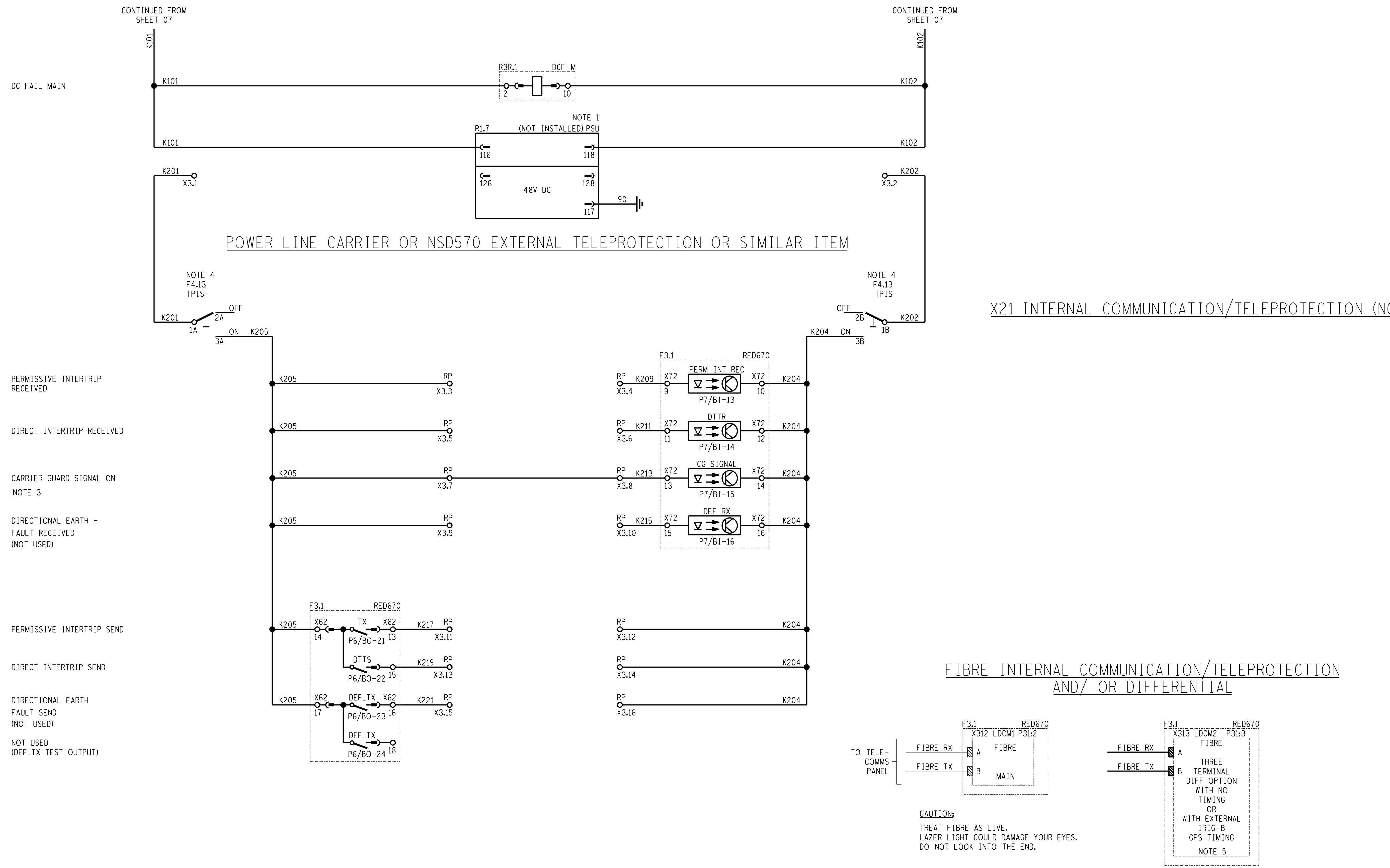
SCALE

LEVELS 1 2 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 07 OF 27 REVISION 00



NOTE:

1. THE 110/48 VOLT DC/DC CONVERTER IS OPTIONAL. THE SUBSTATION 48 VOLT DC SUPPLY CAN BE USED IF AVAILABLE.
2. NO GROUND - LEAVE CONNECTOR WITHOUT ANY CONNECTION
   DIRECT GROUND - CONNECT PIN 2 DIRECTLY TO EARTH
   SOFT GROUND - CONNECT PIN 1 TO PIN 2
3. SET GATE 1 IN SETTINGS TO 'ON' TO ENABLE INTERNAL COMMUNICATION/ TELEPROTECTION FAIL LOGIC ('ON' IS THE DEFAULT). SET GATE 1 TO 'OFF' IF THE EXTERNAL CARRIER GUARD IS USED OR IF THE INT. COMM/TELEPROTECTION CARD IS NOT USED.
4. REMOTE DIFF ISOLATION:
   SIMULTANEOUSLY SWITCH THE LOCAL & REMOTE TPIS SWITCHES TO 'OFF', ALTERNATIVELY, REMOVE THE TX & RX FIBRES FROM ONE IED.
5. THE INTERNAL GPS TIMING CARD (OPTIONAL) USES SLOT P31:3 X313.
   THE EXTERNAL GPS TIMING INPUT CARD (OPTIONAL) USES SLOT P30:2 X302.
   DEPENDANT ON IF ONE OF THE ABOVE CARDS ARE ORDERED, THE THREE TERMINAL DIFF COMMUNICATION CARD (OPTIONAL), WOULD BE PLACED IN THE UNUSED SLOT (i.e. SLOT P31:3 X313 OR P30:2 X302). IF NEITHER TIMING CARD IS ORDERED BUT THE THREE TERMINAL DIFF COMMUNICATION CARD IS ORDERED, IT WILL BE PLACED IN SLOT P31:3 X313.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. BRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CONNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
TELEPROTECTION DC KEY DIAGRAM

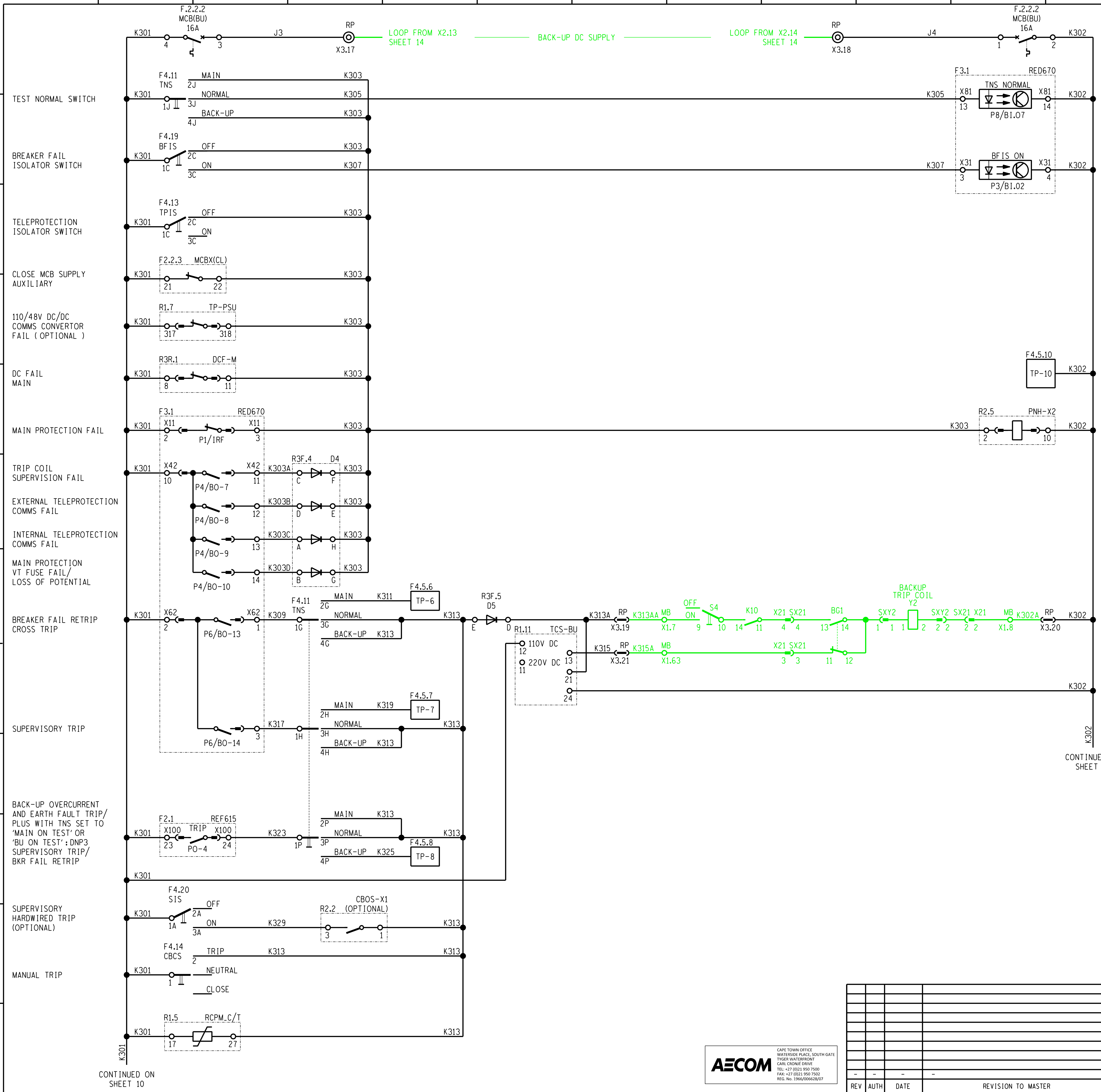
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	08	00

LEVELS 1 2 4 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920

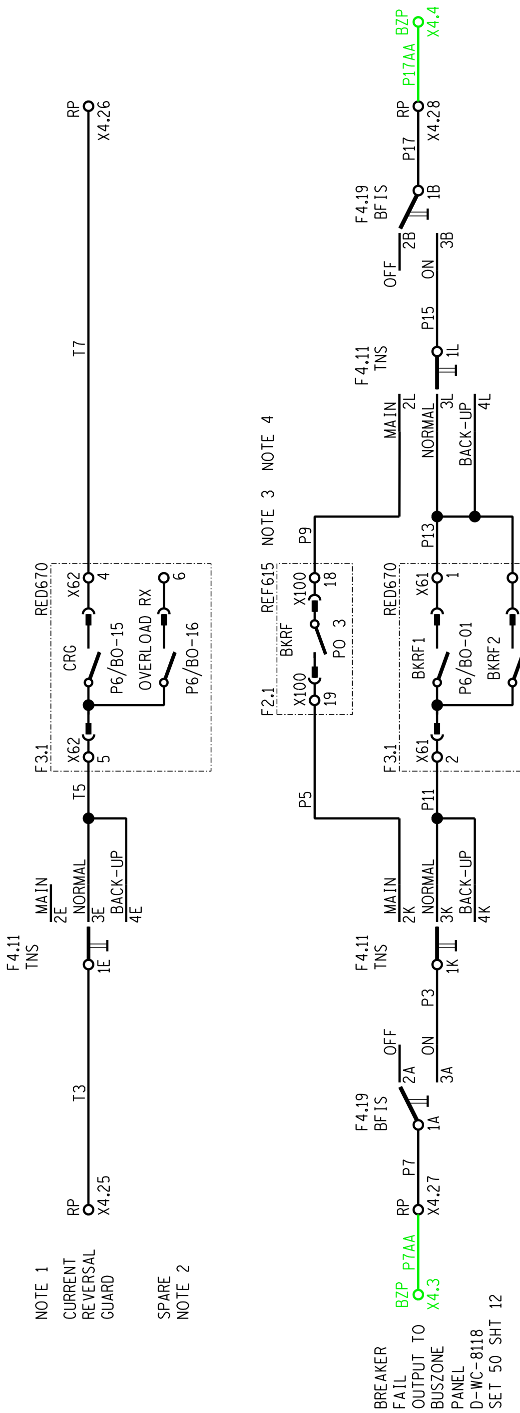
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 08 OF 27 REVISION 00



NOTE:

1. FOR PARALLEL FEEDERS WITH A SOURCE ON THE LOCAL & REMOTE BARS AND WHERE DISTANCE IMPEDANCE POR TELEPROTECTION SCHEMES ARE USED AND THE ADJACENT PARALLEL FEEDER IS A PHASE 1/ PHASE 2 ERA SCHEME
   i.e. THE OUTPUT IS ONLY RELEVANT IF THERE IS AN OLD SCHEME ON THE PARALLEL FEEDERS, USE THE CRG OUTPUT TO CONTROL (BLOCK) THE ADJACENT FEEDERS ZONE 2 AIDED TRIP RECIEVE. NOTE THAT THE CRG CONTACT IS OPERATED BY A FINAL ISSUED ZONE 2 AIDED OUTPUT TRIP PULSE AND HAS A DELAY ON DROP-OFF OF 50ms.
2. THE DIRECTIONAL OVERPOWER FUNCTION HAS A STAGE 1 TRIP SENT TO THE REMOTE DISTRIBUTION RELAY VIA THE INTERNAL COMMUNICATION TELEPROTECTION MODULE, AND IS OUTPUTTED ON THE SPARE CONTACT P6/BO-16 AT THE REMOTE RELAY. THE CONTACT MAY BE USED TO TRIP A REMOTE EXTERNAL LOAD. ESKOM PERSONNEL ARE TO WIRE OUT THE CONTACT IF REQUIRED (i.e. SHIFT WIRE T7 FROM TERMINAL X62.4 TO X62.6 AND UPDATE THE DRAWING ACCORDINGLY).
   THE STAGE 2 TRIP IS A LOCAL OVERPOWER (OVERLOAD) TRIP.
3. BACK-UP IED (REF615) BREAKER FAIL WILL ONLY BE ACTIVE FOR CONDITIONS 'MAIN ON TEST' AND 'BACK-UP ON TEST'.
4. ALL BREAKER FAIL OUTPUT CONTACTS ARE MASKED/SET TO 'NON-LATCHED'.



SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. BRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CONNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
BACK-UP DC KEY DIAGRAM

DRG No.	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	09	00

LEVELS 1 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 09 OF 27 REVISION 00

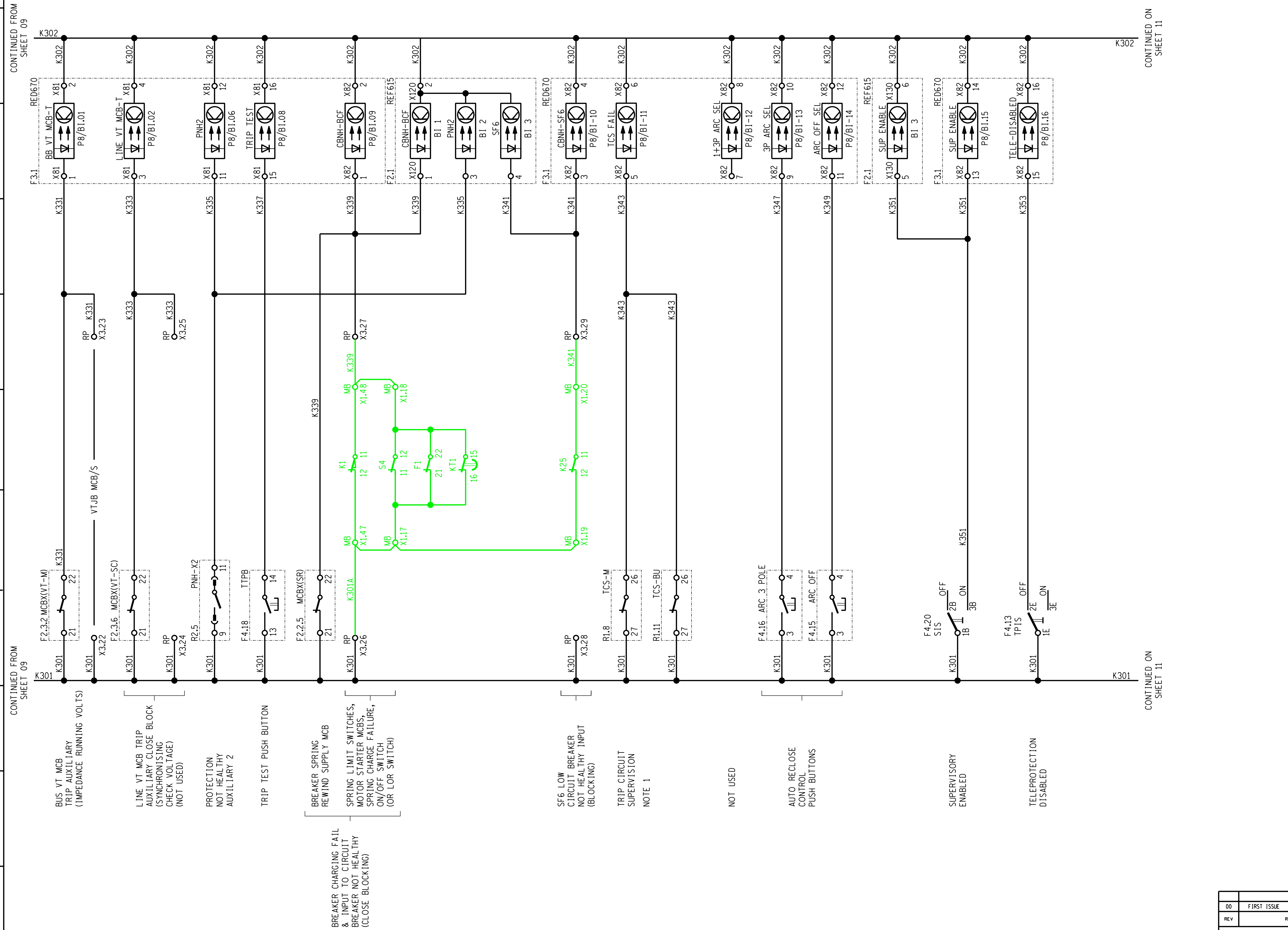


ABB 132kV THREE POLE BREAKER LEGEND	
ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

NOTE:

1. TCS FAIL BLOCKS A BREAKER CLOSE IF GATE 18 IS SET 'ON' IN 'PARAMETER SETTING/ MONOTORING'.
   TCS FAIL WILL NOT BLOCK A CLOSE IF GATE 18 IS SET 'OFF' (UNLESS BOTH MAIN AND BACK-UP TCS ARE FAILED)
   BUT IT WILL STILL ISSUE A CBNH ALARM.
   A PNH ALARM WILL ALSO BE ISSUED FOR A TCS FAIL, IRRESPECTIVE OF GATE 18'S STATE
   (GATE 18 DEFAULT = 'OFF').

AECOM

CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom

PROJECT APPROVED	DESIGN APPROVED
L.BOTHA	A.CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A.MARAIS	N.MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K.STEYNBERG	C.CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

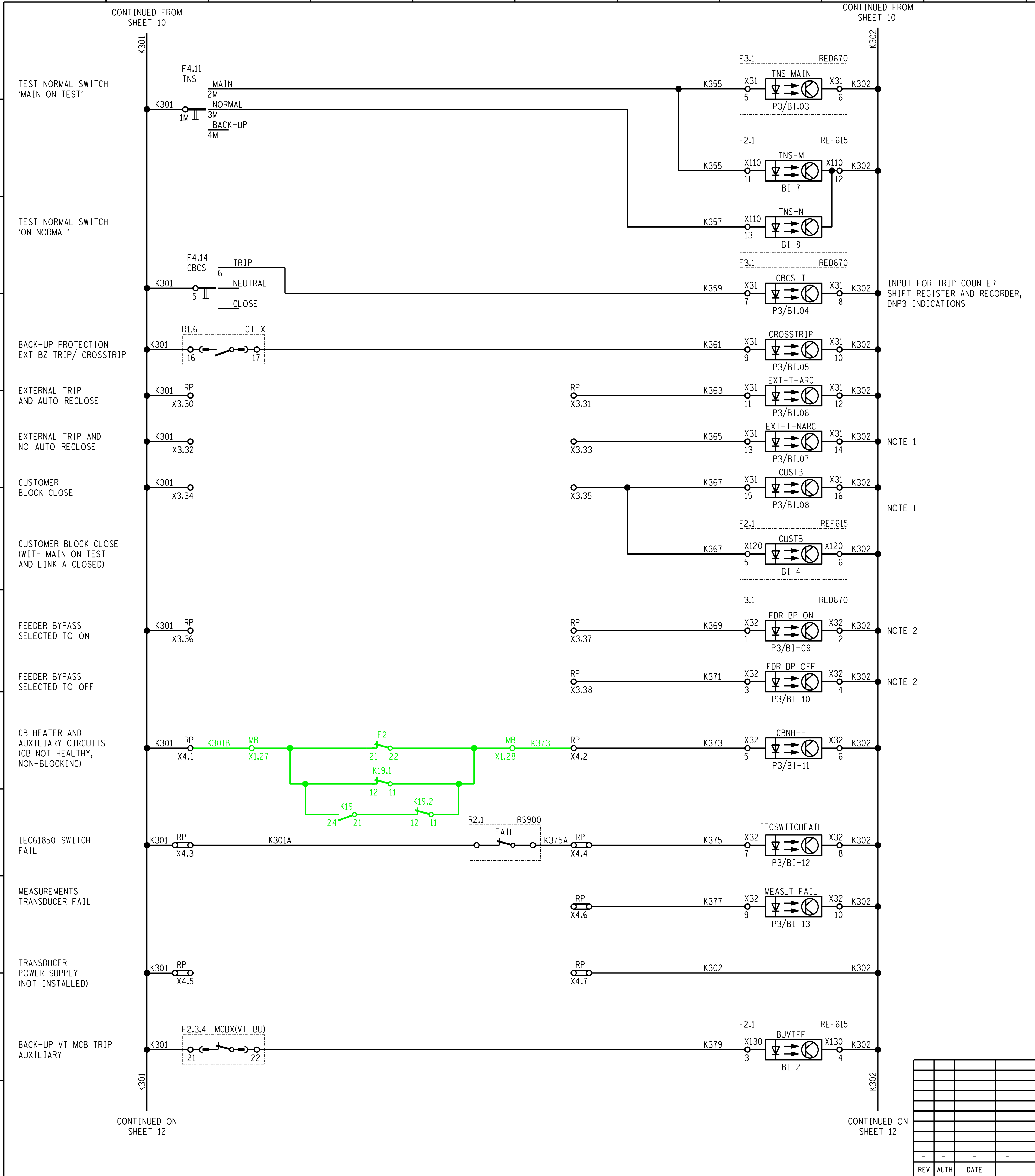
YSTERVARK SUBSTATION
66kV FEEDER 1
BACK-UP DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	10	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 27 REVISION 00



NOTE:

1. A PERMANENT INPUT IS REQUIRED TO BLOCK AN EXTERNAL CLOSE.
2. THIS BYPASS LOGIC IS USED FOR THE SUPERVISORY DNP3 STATUS, THE HMI DISPLAY AND THE AUTOMATED REMOTE ARC BYPASS AND DIFF OUT OF SERVICE SELECTION LOGIC. NOTE THAT A 'G' ISOLATOR CONTACT MUST BE USED FOR THE 'ON' SELECTION AND A 'N' ISOLATOR CONTACT MUST BE USED FOR THE 'OFF' SELECTION.

ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

REVISION TO MASTER	BY	CHKD
-	-	-

YSTERVARK SUBSTATION
66kV FEEDER 1
BACK-UP DC KEY DIAGRAM

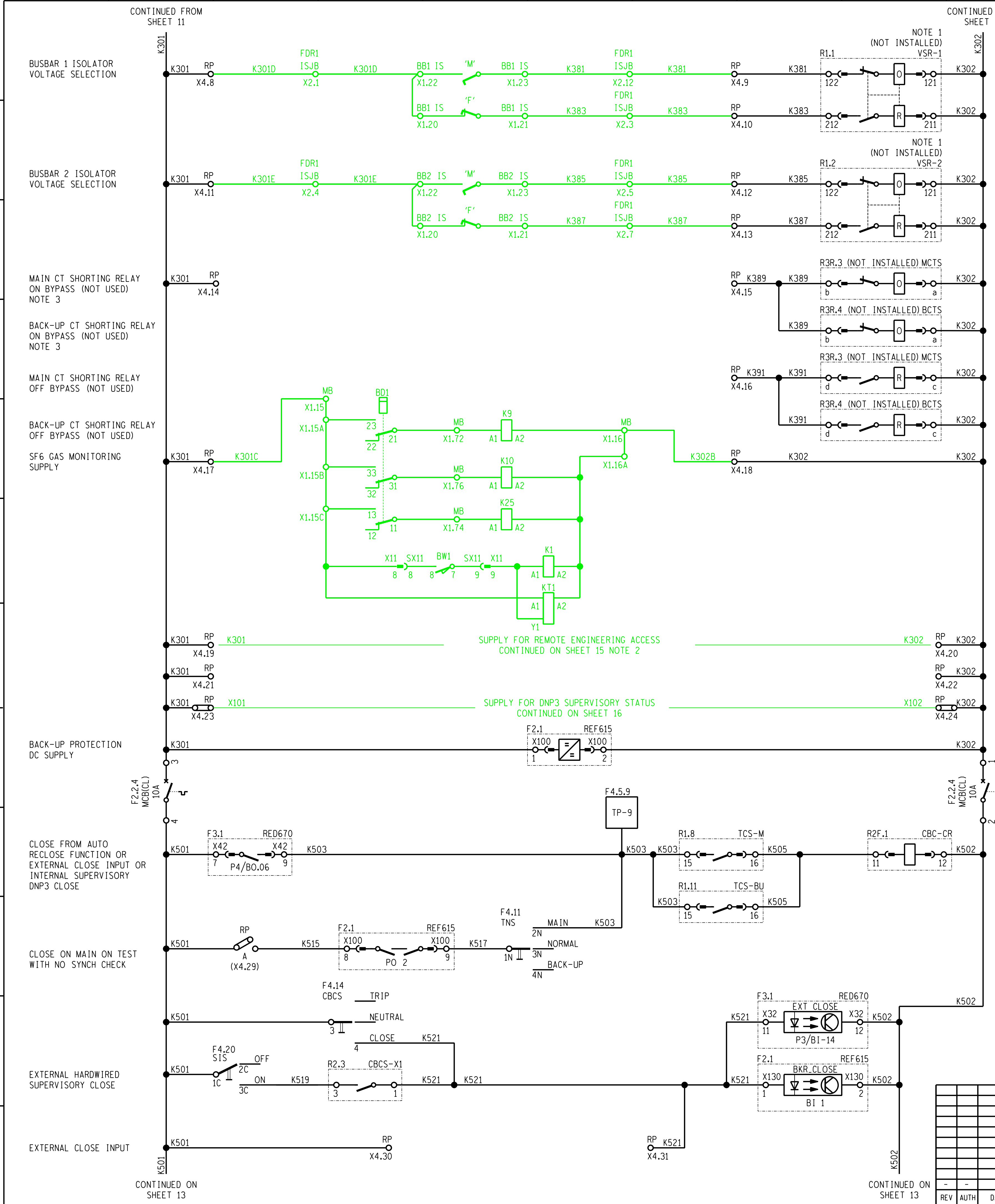
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	11	00

LEVELS 1 2 5 10 11 12 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 27 REVISION 00



NOTE:

1. ALL OPTIONS ARE WIRED IN, ONLY THE OPTIONAL RELAYS NEED TO BE INSERTED TO SELECT THE SPECIFIC OPTION.
2. ESKOM TO INSTALL JUMPERS TO BACKPLATE MODULES ON SITE IF THE OPTION IS ORDERED.
3. FOR CT SHORTING ON BYPASS, 'GS' CONTACTS AND 'N' CONTACTS OF THE ISOLATOR MUST BE USED.

ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 1
CLOSE DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	12	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
-	-	-	-	-	-	

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 27 REVISION 00

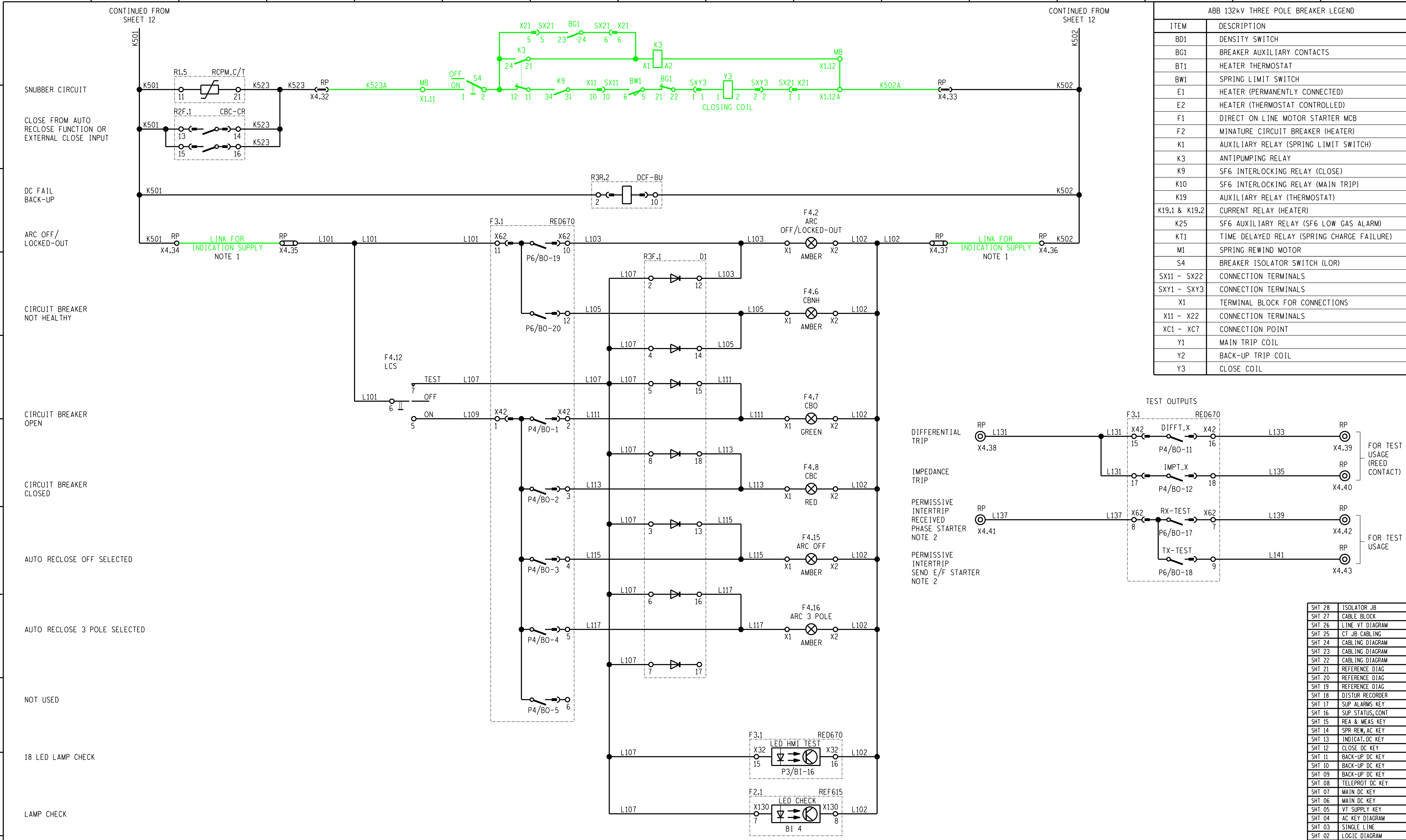


ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

NOTE:

1. JUMPERS TO BE INSTALLED BY ESKOM PERSONNEL OR AN ALTERNATIVE DC SUPPLY TO BE CONNECTED.
2. TO OBTAIN DISTANCE PHASE AND EARTH-FAULT STARTERS DURING TESTING, SET GATE 2 TO 'ON'. TO OBTAIN PERMISSIVE TEST POINTS, SET GATE 2 TO 'OFF' (THE DEFAULT).

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
-	-	-	-	-	-	

YSTERVARK SUBSTATION
66kV FEEDER 1
INDICATION DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	13	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 13 OF 27 REVISION 00

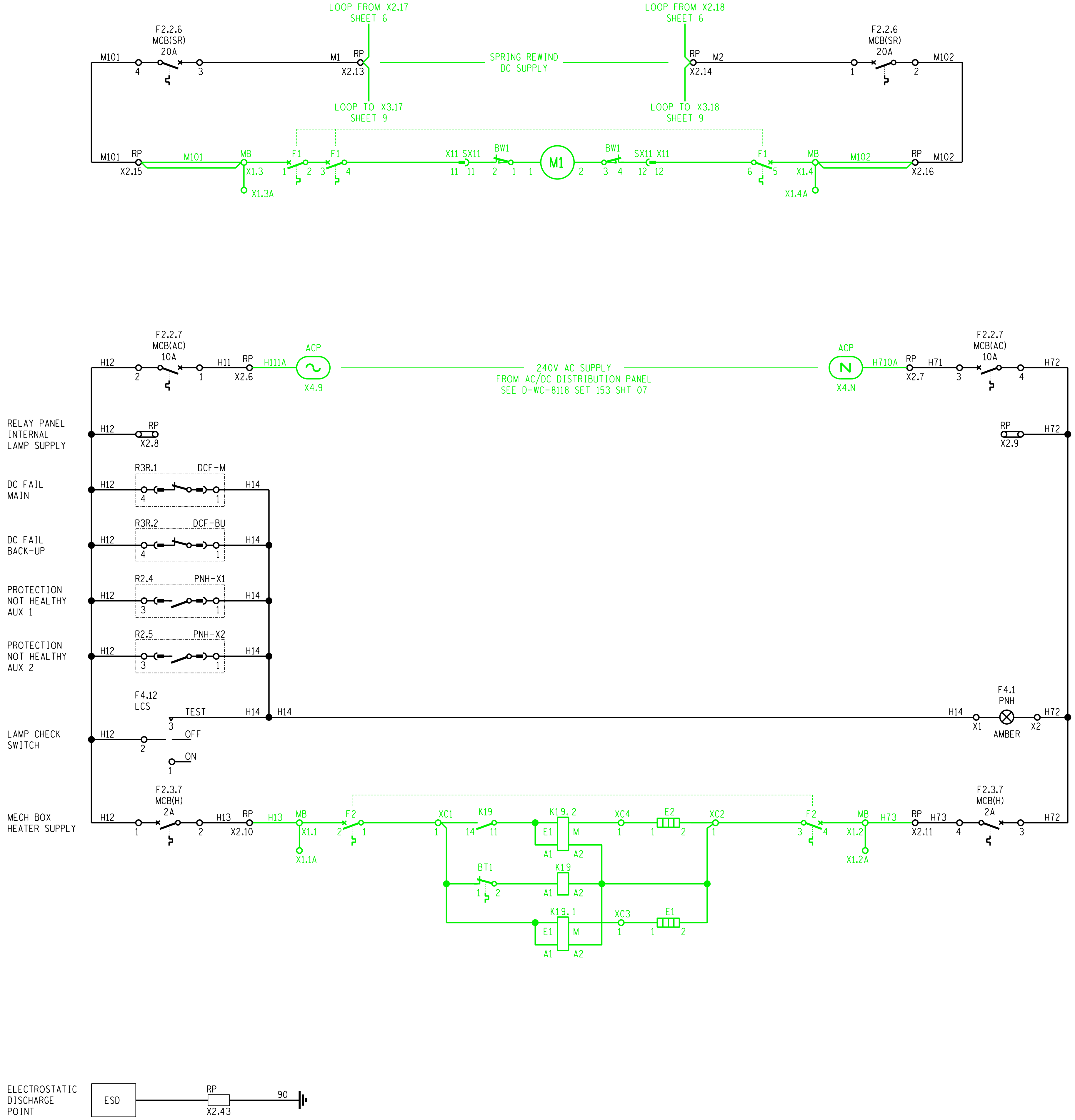


ABB 132kV THREE POLE BREAKER LEGEND	
ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-		-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
SPRING REWIND AND AC KEY DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
41	14	00

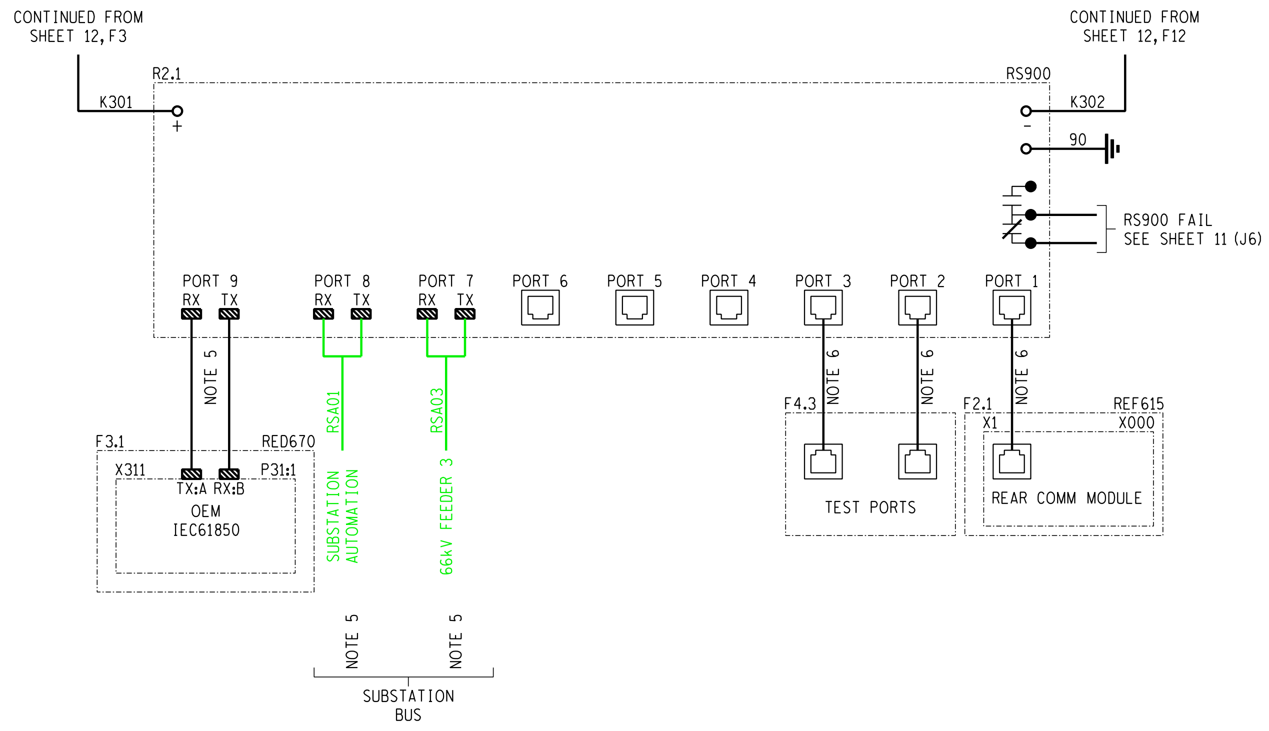
LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

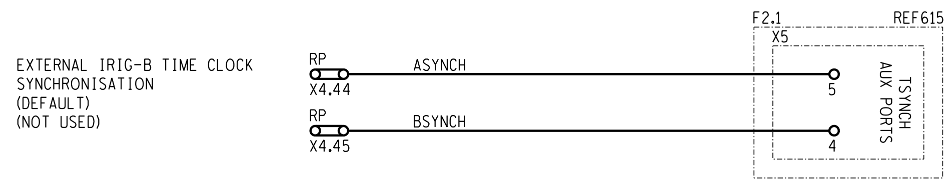
MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 27 REVISION 00

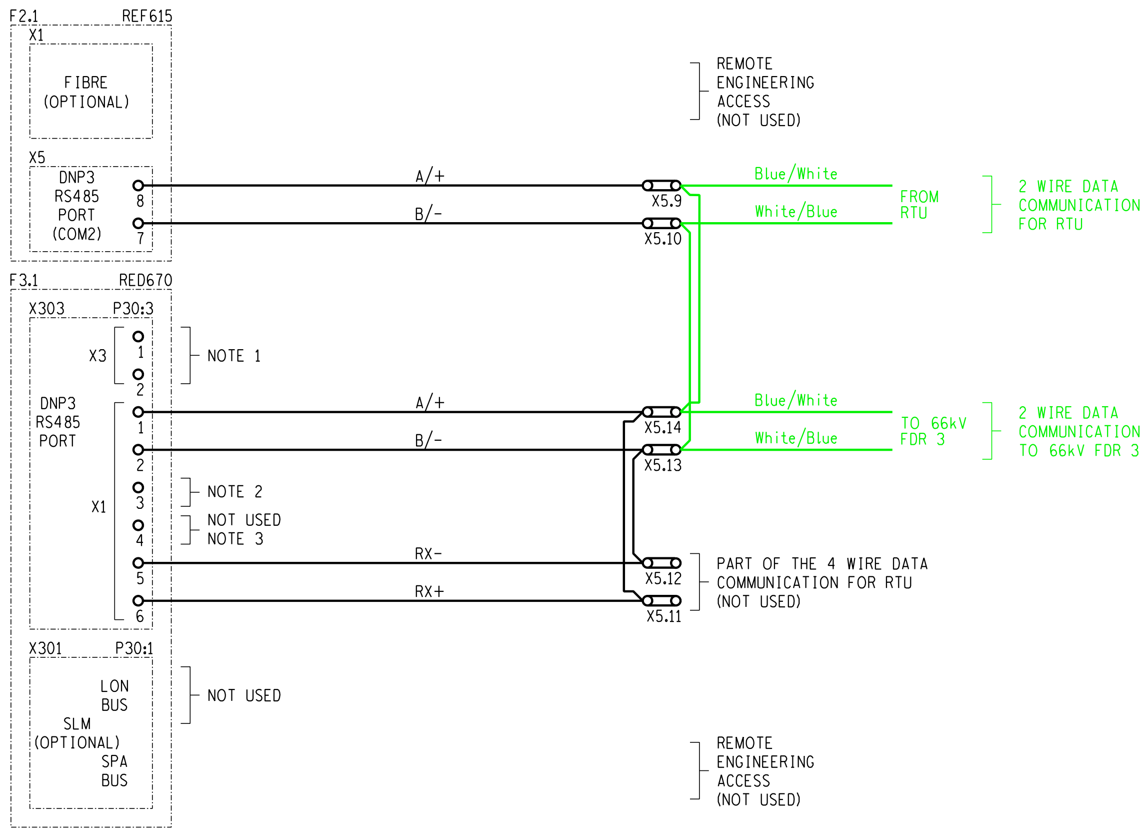
REMOTE ENGINEERING ACCESS IEC61850



TIME SYNCHRONISATION

NOTE 4





NOTE:

1. X3 OF THE RED670 IS THE SOFT GROUND CONNECTOR. IT MAY BE UNCONNECTED OR IT CAN BE CONNECTED TO THE GND WITH AN RC NET PARALLEL WITH A MOV.
2. TERMINATION RESISTOR FOR TRANSMITTER AND RECEIVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
3. TERMINATION RESISTOR FOR RECEIVER IN THE 4 WIRE CASE (CONNECT TO RX+).
4. IF ACCURATE TIMING IS STILL REQUIRED BUT NEITHER OF THE GPS TIMING OPTIONS ARE CHOSEN, THEN USE SNTP TIMING VIA THE IEC61850 OPTIONAL CONNECTION (NOT AS ACCURATE AS GPS TIMING).
5. 100 BASE FX MULTIMODE 1300nm (GLASS), ST CONNECTORS
6. STANDARD RJ45 PORT 100 BASE TX

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
REA AND MEASUREMENTS KEY DIAG

DRG No.	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	15	00

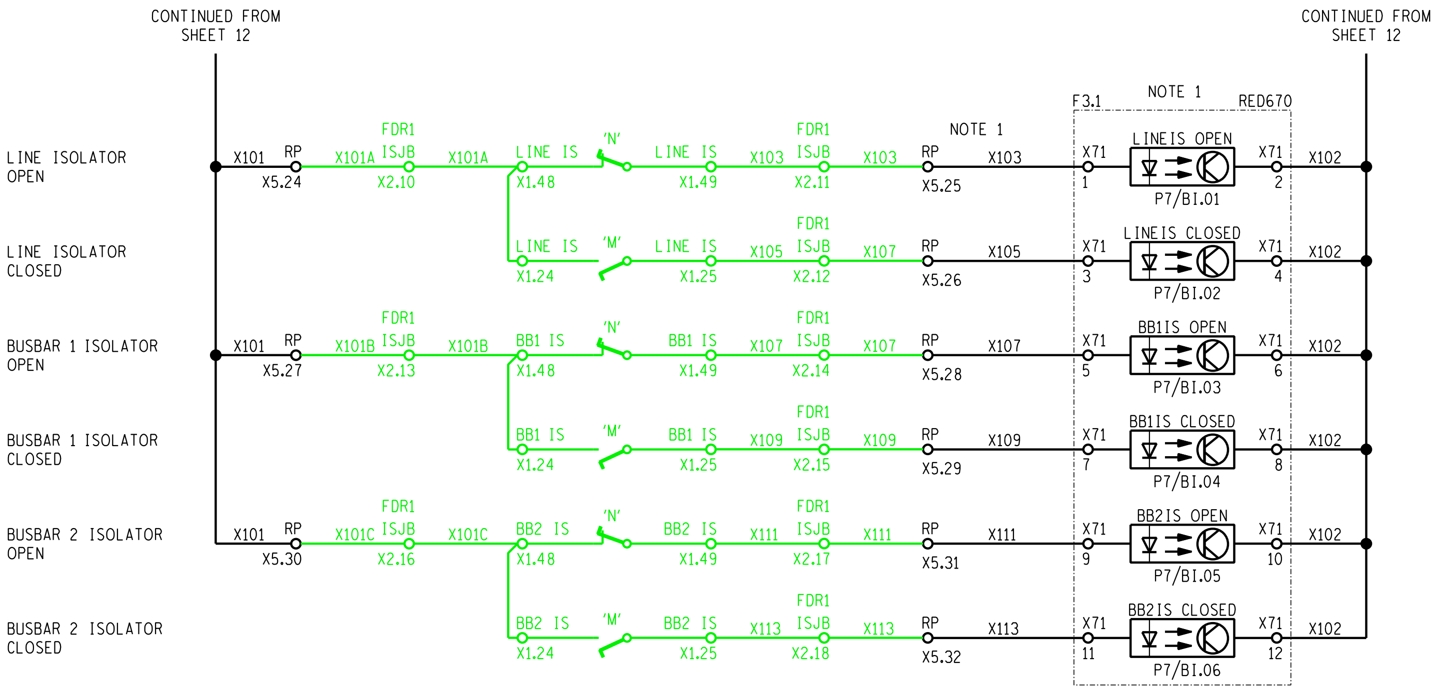
LEVELS 1 2 5 10 23 24 28

PANEL TYPE DESIGNATION 4FZD-3920

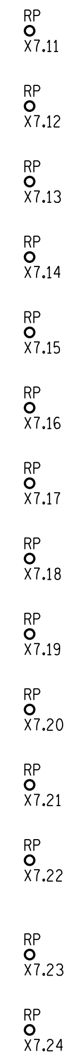
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 15 OF 27 REVISION 00

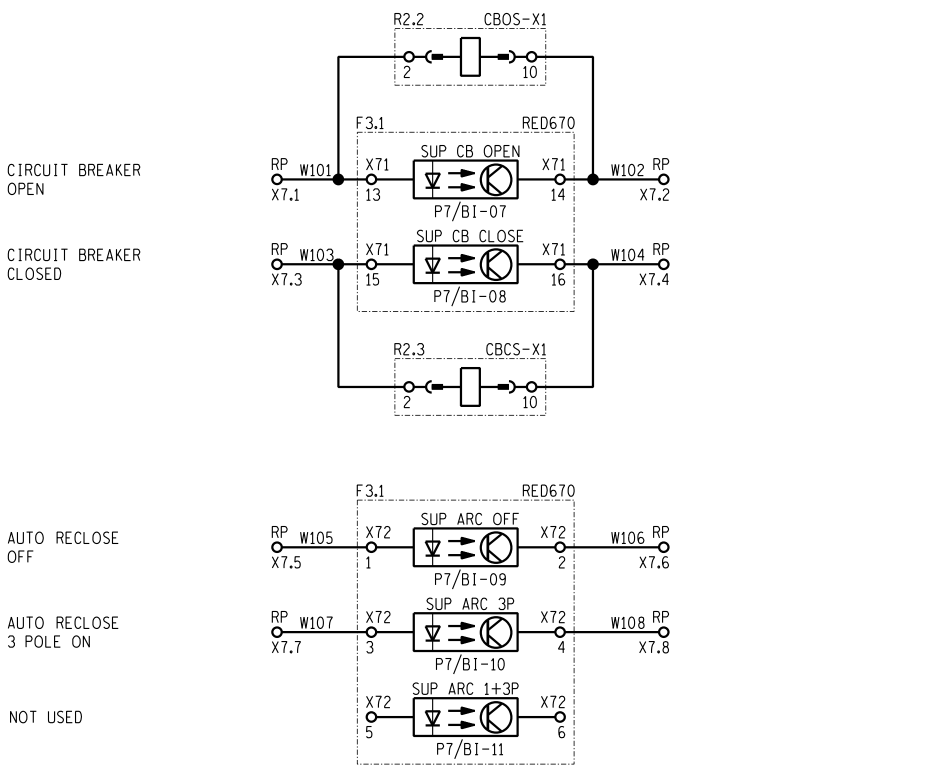
SUPERVISORY STATUS 48V DC (DNP3 OPTIONAL & HMI DISPLAY)



SUPERVISORY STATUS (HARDWIRED OPTIONAL)



SUPERVISORY CONTROLS 48V DC (HARDWIRED OPTIONAL)



NOTE:

1. THESE INDICATIONS MUST ALWAYS BE WIRED IN BY ESKOM.
   THE RED670 IED HMI GRAPHICAL DISPLAY EDITOR SINGLE LINE DIAGRAM (SLD) SHOULD BE ALTERED BY ESKOM COMMISSIONING STAFF TO REFLECT THE BUSBAR ARRANGEMENT ON SITE - IN PCM600, GO TO 'GRAPHIC DISPLAY EDITOR'.
   COMMISSIONING STAFF MUST ALSO DEFAULT THE HMI DISPLAY TO THE SLD BY SELECTING ON THE RED670 HMI MAIN MENU, SETTINGS, GENERAL SETTINGS, HMI, SCREEN, DEFAULT SCREEN = SINGLE LINE DIAGRAM.
   NOTE THAT THE BYPASS ISOLATOR STATUS MAY BE FOUND ON THE BACK-UP DC KEY DIAGRAM.

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20	DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19	DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19	DRAWN BY C. CANNON DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 1
SUPERVIS. STATUS & CONTROL KEY

SCALE

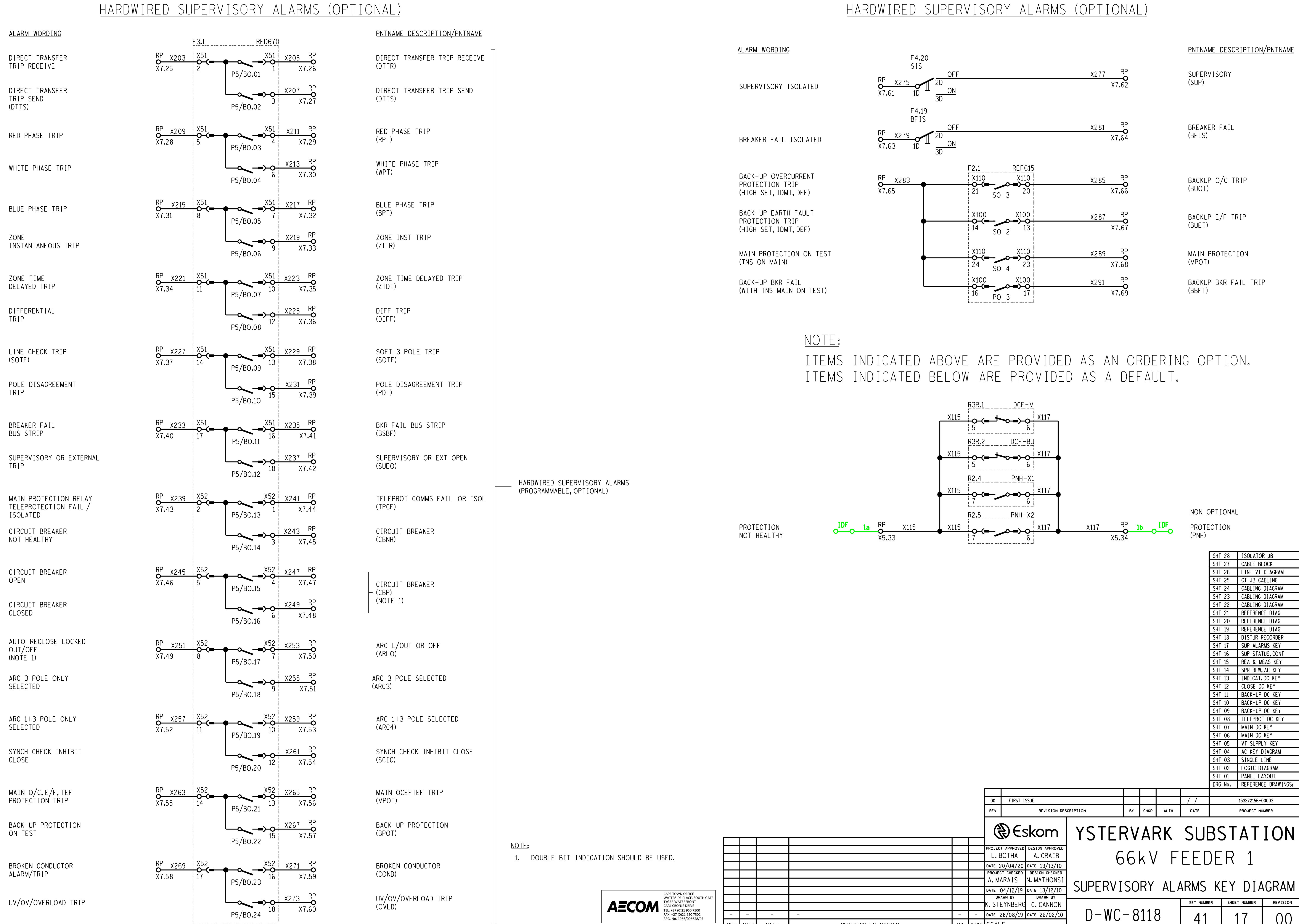
D-WC-8118 | SET NUMBER 41 | SHEET NUMBER 16 | REVISION 00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 16 OF 27 REVISION 00



NOTE:

1. DOUBLE BIT INDICATION SHOULD BE USED.

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY: K. STEYNBERG	DRAWN BY: C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
SUPERVISORY ALARMS KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	17	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 17 OF 27 REVISION 00

DISTURBANCE RECORDER/ ADDITIONAL SUPERVISORY ALARMS (OPTIONAL)

(NOT INSTALLED)

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

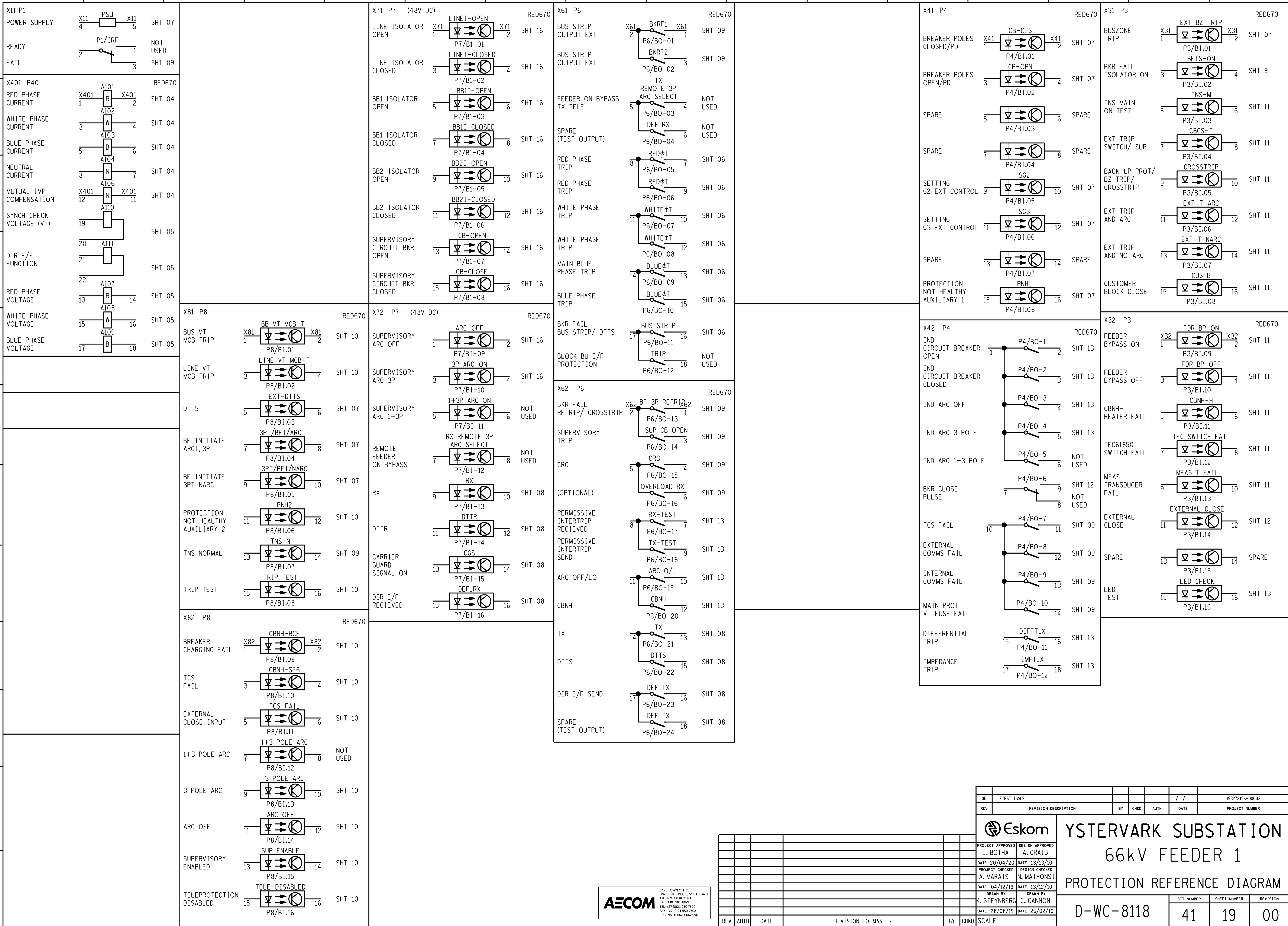
YSTERVARK SUBSTATION
66kV FEEDER 1
DISTURBANCE RECORDER KEY DIAG

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	18	00

LEVELS 1 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 27 REVISION 00



REV	DATE	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00		FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L.BOTHA	A.CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A.MARAIS	N.MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K.STEYNBERG	C.CANNON
DATE 28/08/19	DATE 26/02/10

REV | AUTH | DATE | REVISION TO MASTER | BY | CHKD | SCALE

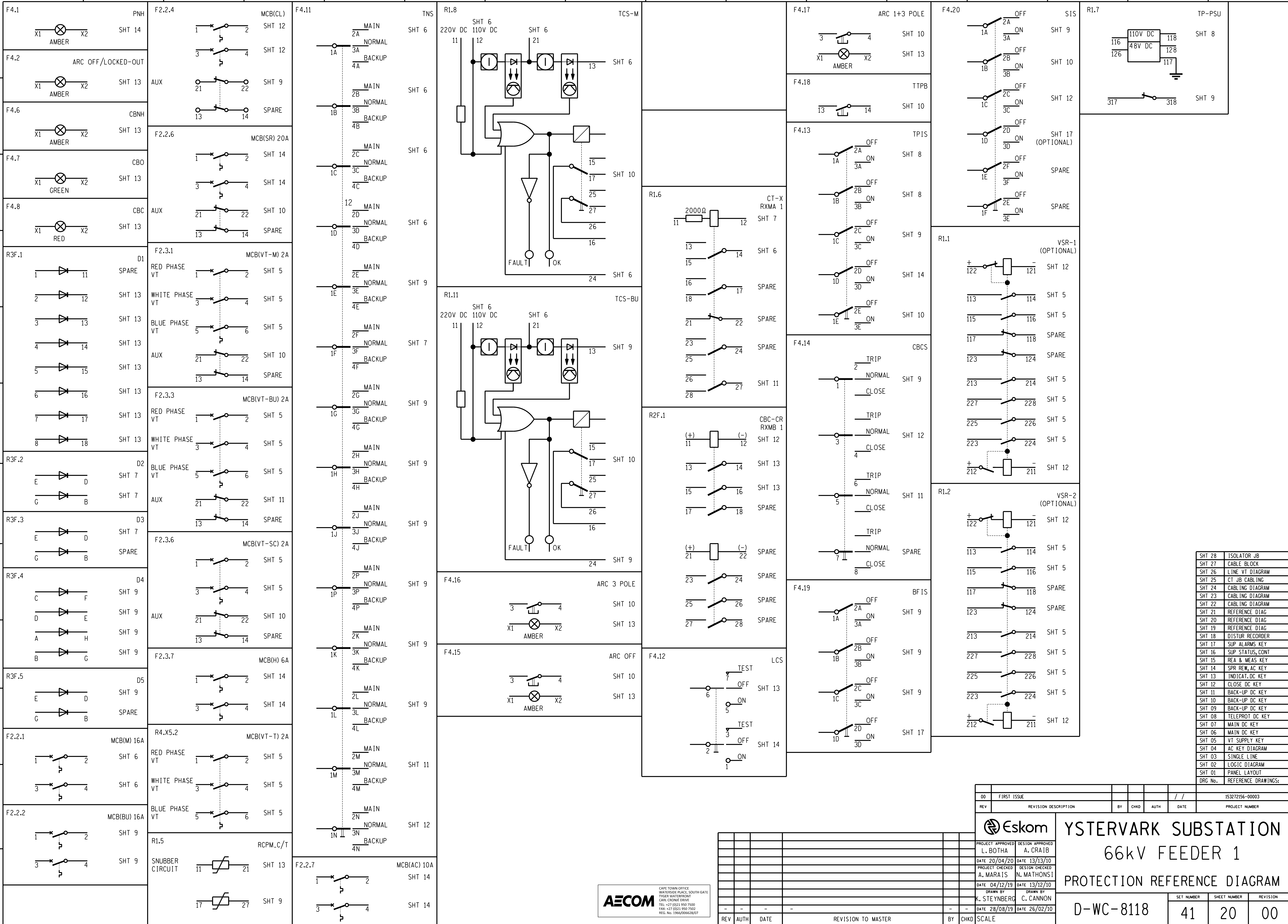
YSTERVARK SUBSTATION
66kV FEEDER 1
PROTECTION REFERENCE DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	19	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 19 OF 27 REVISION 00



SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19
DRAWN BY C. CANNON DATE 26/02/10
SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
PROTECTION REFERENCE DIAGRAM

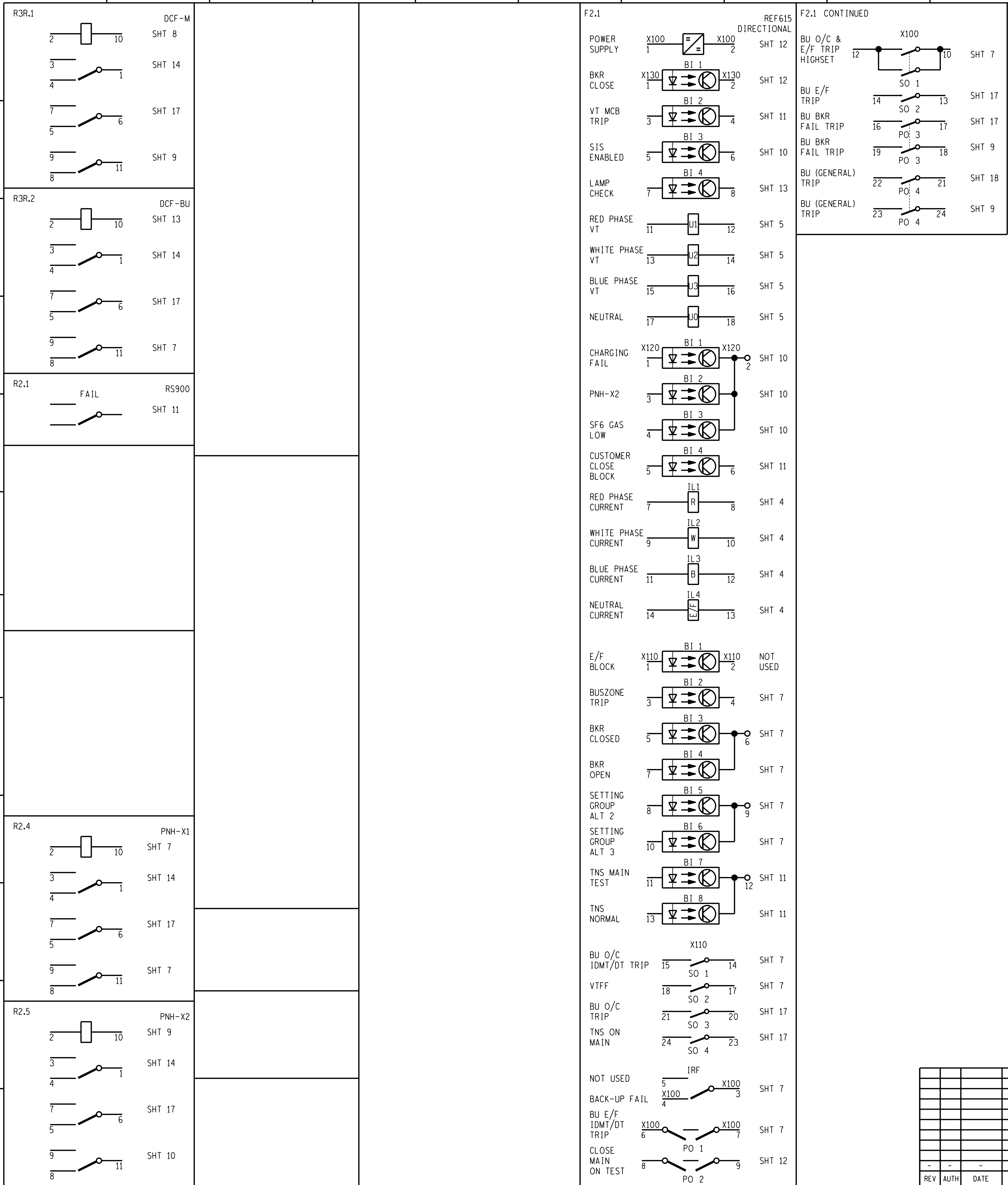
D-WC-8118 — SET NUMBER 41 — SHEET NUMBER 20 — REVISION 00

REV | AUTH | DATE | REVISION TO MASTER | BY | CHKD

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 20 OF 27 REVISION 00



SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19
DRAWN BY C. CANNON DATE 26/02/10
SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
PROTECTION REFERENCE DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
41	21	00

LEVELS 1 2 5 10 11 12 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 21 OF 27 REVISION 00

X1

Function	Wire	X1	Lead	AA104	AA112	AA113			
SYNCHRONISING CHECK VOLTAGE	G92	⊙44							
	G91	⊙43							
MEASUREMENTS VT SUPPLY	E372	⊙42							
	E252	⊙41							
	E232	⊙40							
	E212	⊙39							
BUSBAR 2 MEASUREMENTS VT INPUTS (VT SELECTION)	E372	38	E472AA			22			
	E252	37	E452AA			21			
	E232	36	E432AA			20			
	E212	35	E412AA			19			
BUSBAR 1 MEASUREMENTS VT INPUTS (VT SELECTION)	E372	34	E272AA		22				
	E252	33	E252AA		21				
	E232	32	E232AA		20				
	E212	31	E212AA		19				
MAIN PROTECTION VT INPUT	E70	30							
	E51	29							
	E31	28							
	E11	27							
BUSBAR 2 PROTECTION VT INPUTS (VT SELECTION)	E70	26	E70AA			18			
	E51	25	E61AA			17			
	E31	24	E41AA			16			
	E11	23	E21AA			15			
BUSBAR 1 PROTECTION VT INPUTS (VT SELECTION)	E70	22	E71AA		18				
	E51	21	E51AA		17				
	E31	20	E31AA		16				
	E11	19	E11AA		15				
		●18	90						
PARALLEL FDR FLD COMPENSATION (IF REQUIRED)	A173	⊙17							
	A172	⊙16							
		●15	90						
DISTURBANCE RECORDER CT CCT	A74	⊙14							
	A54	⊙13							
	A34	⊙12							
	A14	⊙11							
		●10	90						
BACK-UP PROTECTION CT INPUT	C72	9	C72	58*					
	C52	8	C52	57					
	C32	7	C32	56					
	C12	6	C12	55					
		●5	90						
MAIN PROTECTION CT INPUT	A72	4	A72	40*					
	A52	3	A52	39					
	A32	2	A32	38					
	A12	1	A12	37					
		D-RAIL							

CABLE NUMBER	AA104	AA112	AA113			
CABLE SIZE	12	12	12			
NUMBER OF SPARES	4	4	4			
DESTINATION	CT JUNCTION BOX	66kV BUSBAR 1 VTJB	66kV BUSBAR 2 VTJB 1			

X2

Function	Wire	X2	Lead	AA122	AA107	AA117	AA105	AA106	
DISCHARGE RESISTOR	ESD		90						
METERING PANEL VT OUTPUT	E372	⊙42	E372AA		1				
	E252	⊙41	E252AA		MCB-3				
	E232	⊙40	E232AA		MCB-2				
	E212	⊙39	E212AA		MCB-1				
SG3	K177	38							
	K101	37							
SG2	K175	36							
	K101	35							
CB OPEN IND	K171	34	K171				X1.40		
	K101	33							
CB CLOSED IND	K169	32	K169				X1.32		
	K101	31	K101A				X1.31		
EXT BUSZONE TRIP	K167	30	P25AA			X4.2			
	K101	29	P21AA			X4.1			
BKR FAIL INITIATE BACK-UP PROTECTION AND BZ CROSSTRIP	K163	28							
	K161	27							
	K159	26							
	K157	25							
	K155	24							
EXT DTTS	K151	23							
	K101	22							
MAIN TRIP	K109	⊙21	K109A				X1.61		
	K102	⊙20	K102A				X1.6		
	K107	⊙19	K107A				X1.5		
MAIN DC SUPPLY	J2	⊠18	J12A	X8.6					
	J1	⊠17	J11A	X8.5					
SPRING REWIND SUPPLY	M102	16	M102 (2)					X1.4	
	M101	15	M101 (2)					X1.3	
	M2	14	TO X3.18						
	M1	13	TO X3.17						
	SPARE	12							
HEATER SUPPLY	H73	11	H73					X1.2	
	H13	10	H13					X1.1	
LAMP SUPPLY	H72	●9							
	H12	●8							
220V AC SCHEME SUPPLY	H71	7	H710	X4.N					
	H11	6	H111A	X4.9					
	SPARE	5							
DISTURBANCE RECORDER VT OUTPUT	E172	⊙4							
	E152	⊙3							
	E132	⊙2							
	E112	⊙1							
		D-RAIL							

CABLE NUMBER	AA122	AA107	AA117	AA105	AA106	
CABLE SIZE	4	4	4	19	12	
NUMBER OF SPARES	0	0	0	1	6	
DESTINATION	AC/DC DISTRIBUTION BOARD	STATS METERING PANEL	BUSZONE PANEL	HV CIRCUIT-BREAKER	HV CIRCUIT-BREAKER	

X3

Function	Wire	X3	Lead	AA105				
FDR BYPASS	K371	38						
	K369	37						
	K301	36						
CUSTOMER BLOCK CLOSE	K367	35						
	K301	34						
EXT TRIP NO ARC	K365	33						
	K301	32						
EXT TRIP AND ARC	K363	31						
	K301	30						
SF6 LOW	K341	29	K341	X1.20				
	K301	28						
BREAKER CHARGING FAIL	K339	27	K339	X1.48*				
	K301	26	K301A	X1.47*				
LINE VT SUPPLY FAIL	K333	25						
	K301	24						
BUS VT SUPPLY FAIL	K331	23						
	K301	22						
BACK-UP TRIP	K315	⊙21	K315A	X1.63				
	K302	⊙20	K302A	X1.8				
	K313A	⊙19	K313AA	X1.7				
BACK-UP DC SUPPLY	J4	⊠18	- FROM X2.14					
	J3	⊠17	- FROM X2.13					
DIR E/F SEND	K204	Ø16						
	K221	Ø15						
DIRECT INTERTRIP SEND	K204	Ø14						
	K219	Ø13						
PERMISSIVE INTERTRIP SEND	K204	Ø12						
	K217	Ø11						
DIR E/F RECIEVE	K215	Ø10						
	K205	Ø9						
CARRIER GUARD SIGNAL ON	K213	Ø8						
	K205	Ø7						
DIRECT INTERTRIP RECIEVE	K211	Ø6						
	K205	Ø5						
PERMISSIVE INTERTRIP RECIEVE	K209	Ø4						
	K205	Ø3						
TELEPROTECTION POWER SUPPLY (48V DC)	K202	2						
	K201	1						
		D-RAIL						

CABLE NUMBER	AA105					
CABLE SIZE	19					
NUMBER OF SPARES	1					
DESTINATION	HV CIRCUIT-BREAKER					

TERMINAL LOOPS (*)

RP	X2.13 - X3.17; X2.14 - X3.18
CB MB	X1.18 - X1.48; X1.31 - X1.39;
	X1.17 - X1.19 - X1.47
CTJB	40 - 41 - 42; 46 - 47 - 48; 52 - 53 - 54;
	58 - 59 - 60; 61 - 62 - 63 - 64 - 65 - 66 - E; 70 - 71 - 72 - E

NOTE:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   K101 [ ] K101 INDICATES NO CHANGE IN LEAD NUMBER.
   K301 [ ] K305 INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.
   STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
   ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
   ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
   Ø M4/6 RS SPRING LOADED ENTRELEC
   * M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
   X D2.5/5 SN ADD ENTRELEC TERMINALS
   □ M4/8 SF ENTRELEC FUSE TERMINALS
   ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
   R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED
5. NOTE THAT D6/8 ST1 RS TERMINALS MAY BE USED IN PLACE OF D6/8-ST-RS TERMINALS. THE YELLOW INSULATED TEST POINTS MAY BE REMOVED FROM THE EARTH LINKS, AT THE COMMISSIONING TECHNICIANS DISCRETION.
6. FINE TOOTHED HORIZONTAL TRUNKING SHALL BE USED.

DRG No.	REFERENCE DRAWINGS:	DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB	SHT 15	REA & MEAS KEY
SHT 27	CABLE BLOCK	SHT 14	SPR REW, AC KEY
SHT 26	LINE VT DIAGRAM	SHT 13	INDICAT. DC KEY
SHT 25	CT JB CABLING	SHT 12	CLOSE DC KEY
SHT 24	CABLING DIAGRAM	SHT 11	BACK-UP DC KEY
SHT 23	CABLING DIAGRAM	SHT 10	BACK-UP DC KEY
SHT 22	CABLING DIAGRAM	SHT 09	BACK-UP DC KEY
SHT 21	REFERENCE DIAG	SHT 08	TELEPROT DC KEY
SHT 20	REFERENCE DIAG	SHT 07	MAIN DC KEY
SHT 19	REFERENCE DIAG	SHT 06	MAIN DC KEY
SHT 18	DISTUR RECORDER	SHT 05	VT SUPPLY KEY
SHT 17	SUP ALARMS KEY	SHT 04	AC KEY DIAGRAM
SHT 16	SUP STATUS, CONT	SHT 03	SINGLE LINE
		SHT 02	LOGIC DIAGRAM
		SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED: L. BOTHA, DATE 20/04/20 — DESIGN APPROVED: A. CRAIB, DATE 13/13/10
PROJECT CHECKED: A. MARAIS, DATE 04/12/19 — DESIGN CHECKED: N. MATHONSI, DATE 13/12/10
DRAWN BY: K. STEYNBERG, DATE 28/08/19 — DRAWN BY: C. CANNON, DATE 26/02/10
SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
PANEL CABLING DIAGRAM

D-WC-8118 — SET NUMBER 41 — SHEET NUMBER 22 — REVISION 00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 — SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 22 OF 27 REVISION 00

X4

Function	Wire	Terminal	Ferrule	AA115		AA117	AA105		
VARS	W4	⋇ 49							
	W3	⋇ 48							
WATTS	W2	⋇ 47							
	W1	⋇ 46							
EXTERNAL TIME SYNCH INPUT	BSYNCH	⋇ 45							
	ASYNCH	⋇ 44							
COMMISSIONING TEST POINTS	L141	⊠ 43							
	L139	⊠ 42							
	L137	⊠ 41							
	L135	⊠ 40							
	L133	⊠ 39							
	L131	⊠ 38							
LINKS FOR INDICATION 110V DC SUPPLY	L102	● 37							
	K502	36							
	L101	● 35							
	K501	34							
BKR CLOSE OUTPUT	K502	● 33	K502A				X1.12A		
	K523	● 32	K523A				X1.11		
EXT CLOSE INPUT	K521	31							
	K501	30							
BU CLOSE, NO SYNCH	K501	●A29							
BKR FAIL TRIP OUTPUT	P17	28	P17AA			X4.4			
	P7	27	P7AA			X4.3			
CURRENT REVERSAL GUARD OUTPUT	T7	26							
	T3	25							
DNP3 STATUS SUPPLY	K302	⊙ 24	X102						
	K301	⊙ 23	X101						
EXTERNAL RECORDER SUPPLY	K302	22							
	K301	21							
REA SUPPLY	K302	20							
	K301	19							
SF6 GAS SUPPLY	K302	18	K302B				X1.16		
	K301	17	K301C				X1.15		
BYPASS CT SHORTING INPUTS	K391	16							
	K389	15							
	K301	14							
BUSBAR VOLTAGE SELECTION INPUTS	K387	13	K387	X2.6					
	K385	12	K385	X2.5					
	K301	11	K301E	X2.4					
	K383	10	K383	X2.3					
	K381	9	K381	X2.2					
	K301	8	K301D	X2.1					
MEASUREMENTS TRANSDUCER	K302	● 7							
	K377	● 6							
	K301	● 5							
IEC61850 SWITCH FAIL	K375	● 4	K375A						
	K301	● 3	K301A						
CBNH HEATER FAIL	K373	2	K373				X1.28		
	K301	1	K301B				X1.27		

D-RAIL

CABLE NUMBER	AA115		AA117	AA105		
CABLE SIZE	19		4	19		
NUMBER OF SPARES	7		0	1		
DESTINATION	66kV FEEDER 1 ISOLATOR JB		BUSZONE PANEL	HV CIRCUIT-BREAKER		

X5

Function	Wire	Terminal	Ferrule		AA115			AA124	AA127	AA123
SUPERVISORY ALARM PNH HARDWIRED	X117	Ø 34	1b							
	X115	Ø 33	1a							
BUSBAR 2 ISOLATOR STATUS	X113	Ø 32	X113		X2.18					
	X111	Ø 31	X111		X2.17					
	X101	Ø 30	X101C		X2.16					
BUSBAR 1 ISOLATOR STATUS	X109	Ø 29	X109		X2.15					
	X107	Ø 28	X107		X2.14					
	X101	Ø 27	X101B		X2.13					
LINE ISOLATOR STATUS	X105	Ø 26	X105		X2.12					
	X103	Ø 25	X103		X2.11					
	X101	Ø 24	X101A		X2.10					
		⋇ 23								
		⋇ 22								
		⋇ 21								
		⋇ 20								
		⋇ 19								
		⋇ 18								
		⋇ 17								
		⋇ 16								
		⋇ 15								
MAIN IED DATA FOR RTU	A/+	⋇ 14								
	B/-	⋇ 13							X5.10	
	RX-	⋇ 12							X5.9	
	RX+	⋇ 11								
BACK-UP IED DATA FOR RTU	B/-	⋇ 10						✳		
	A/+	⋇ 9						✳		
MEASUREMENTS CT CIRCUITS	D72A	⊙ 8								
		⊙ 7								
		⊙ 6								
		● 5	90							
		⊙ 4								
		⊙ 3								
		⊙ 2								
		⊙ 1								

D-RAIL

DIN RAIL MOUNTED

X5.2 VT-T MCB

X5.1 TRANSDUCER (OPTIONAL)

CABLE NUMBER		AA115			AA124	AA127	AA123
CABLE SIZE		4			4Pr	4Pr	10Pr
NUMBER OF SPARES		1			3Pr	3Pr	9Pr
DESTINATION		66kV FEEDER 1 ISOLATOR JB			RTU	66kV FEEDER 3 RP	IDF

TERMINAL LOOPS (✳)	
LINE IS MB	X1.24 - X1.48
BB1 IS MB	X1.24 - X1.48
BB2 IS MB	X1.24 - X1.48

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
- ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
- Ø M4/6 RS SPRING LOADED ENTRELEC
- ⋇ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
- X D2.5/5 SN ADD ENTRELEC TERMINALS
- □ M4/8 SF ENTRELEC FUSE TERMINALS
- ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
- [R] M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

2. NOTE THAT D6/8 ST1 RS TERMINALS MAY BE USED IN PLACE OF D6/8-ST-RS TERMINALS. THE YELLOW INSULATED TEST POINTS MAY BE REMOVED FROM THE EARTH LINKS, AT THE COMMISSIONING TECHNICIANS DISCRECTION.
3. THE DROPPING RESISTORS HAVE BEEN REMOVED FROM THE X5 RACK AT THE REQUEST OF ABB.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
PANEL CABLING DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	23	00

LEVELS 1 2 5 10 11 12 25 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

A B C D E F G H J K L M

Function	Wire	X7
SUPERVISORY ALARMS	X241	Ø 44
	X239	Ø 43
	X237	Ø 42
	X235	Ø 41
	X233	Ø 40
	X231	Ø 39
	X229	Ø 38
	X227	Ø 37
	X225	Ø 36
	X223	Ø 35
	X221	Ø 34
	X219	Ø 33
	X217	Ø 32
	X215	Ø 31
	X213	Ø 30
	X211	Ø 29
	X209	Ø 28
	X207	Ø 27
	X205	Ø 26
	X203	Ø 25
SF6 BREAKER ALARM STATUS	X145	Ø 24
	X143	Ø 23
BYPASS ISOLATOR STATUS	X141	Ø 22
	X139	Ø 21
	X137	Ø 20
BUSBAR 2 ISOLATOR STATUS	X135	Ø 19
	X133	Ø 18
	X131	Ø 17
BUSBAR 1 ISOLATOR STATUS	X129	Ø 16
	X127	Ø 15
	X125	Ø 14
LINE ISOLATOR STATUS	X123	Ø 13
	X121	Ø 12
	X119	Ø 11
	SPARE	Ø 10
	SPARE	Ø 9
SUPERVISORY CONTROL	W108	Ø 8
	W107	Ø 7
	W106	Ø 6
	W105	Ø 5
	W104	Ø 4
	W103	Ø 3
	W102	Ø 2
	W101	Ø 1
		D-RAIL

CABLE NUMBER						
CABLE SIZE						
NUMBER OF SPARES						
DESTINATION						

Function	Wire	X7
BACK-UP B/F TRIP	X291	Ø 69
TNS ON MAIN	X289	Ø 68
BACK-UP E/F TRIP	X287	Ø 67
BACK-UP O/C TRIP	X285	Ø 66
	X283	Ø 65
BREAKER FAILURE ISOLATED	X281	Ø 64
	X279	Ø 63
SUPERVISORY ISOLATED	X277	Ø 62
	X275	Ø 61
SUPERVISORY ALARMS	X273	Ø 60
	X271	Ø 59
	X269	Ø 58
	X267	Ø 57
	X265	Ø 56
	X263	Ø 55
	X261	Ø 54
	X259	Ø 53
	X257	Ø 52
	X255	Ø 51
	X253	Ø 50
	X251	Ø 49
	X249	Ø 48
	X247	Ø 47
	X245	Ø 46
	X243	Ø 45
		D-RAIL

CABLE NUMBER						
CABLE SIZE						
NUMBER OF SPARES						
DESTINATION						

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
- ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
- Ø M4/6 RS SPRING LOADED ENTRELEC
- ⁎ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
- X D2.5/5 SN ADD ENTRELEC TERMINALS
- □ M4/8 SF ENTRELEC FUSE TERMINALS
- ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
- R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
PANEL CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	24	00

LEVELS 1 2 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

TOP OF TERMINAL STRIP

To CURRENT TRANSFORMERs

AA101	AA102	AA103	Wire	X1	Link
		6S2	D171B	36	36
		6S1	D151	35	35
		5S2	D71B	34	34
		5S1	D51	33	33
		4S2	C71B	32	32
		4S1	C51	31	31
		3S2	B71B	30	30
		3S1	B51	29	29
		2S2	B171B	28	28
		2S1	B150	27	27
		1S2	A71B	26	26
		1S1	A51	25	25
	6S2		D171W	24	24
	6S1		D131	23	23
	5S2		D71W	22	22
	5S1		D31	21	21
	4S2		C71W	20	20
	4S1		C31	19	19
	3S2		B71W	18	18
	3S1		B31	17	17
	2S2		B171W	16	16
	2S1		B130	15	15
	1S2		A71W	14	14
	1S1		A31	13	13
6S2			D171R	12	12
6S1			D111	11	11
5S2			D71R	10	10
5S1			D11	9	9
4S2			C71R	8	8
4S1			C11	7	7
3S2			B71R	6	6
3S1			B11	5	5
2S2			B171R	4	4
2S1			B110	3	3
1S2			A71R	2	2
1S1			A11	1	1

AA101	AA102	AA103	CABLE NUMBER
12	12	12	CABLE SIZE
0	0	0	NUMBER OF SPARES
66kV FEEDER 1 66kV RED PHASE CT	66kV FEEDER 1 66kV WHITE PHASE CT	66kV FEEDER 1 66kV BLUE PHASE CT	DESTINATION

To CONTROL ROOM

Link	X2			AA104	AA119	AA118	AA126	
12	72	R						CORE 6
24	71	W						
36	70	B	D171AA			5		
35	69	B	D151AA			4		
23	68	W	D131AA			3		
11	67	R	D111AA			2		
10	66	R						CORE 5
22	65	W						
34	64	B						
33	63	B						
21	62	W						
9	61	R						
8	60	R						CORE 4
20	59	W						
32	58	B	C72	X1.9				
31	57	B	C52	X1.8				
19	56	W	C32	X1.7				
7	55	R	C12	X1.6				
6	54	R						CORE 3
18	53	W						
30	52	B	B71AA		X2.4			
29	51	B	B51AA		X2.3			
17	50	W	B31AA		X2.2			
5	49	R	B11AA		X2.1			
4	48	R						CORE 2
16	47	W						
28	46	B	B171AA				X1.7	
27	45	B	B150AA				X1.5	
15	44	W	B130AA				X1.3	
3	43	R	B110AA				X1.1	
2	42	R						CORE 1
14	41	W						
26	40	B	A72	X1.4				
25	39	B	A52	X1.3				
13	38	W	A32	X1.2				
1	37	R	A12	X1.1				

CABLE NUMBER	AA104	AA119	AA118	AA126
CABLE SIZE	12	4	4	4
NUMBER OF SPARES	4	0	0	0
DESTINATION	66kV FEEDER 1 RELAY PANEL	66kV BUSZONE RELAY PANEL	STATISTICAL METERING PANEL	66kV FEEDER 1 ISOLATOR JB

TERMINAL LOOPS (*)	
CT JB	40-41-42, 46-47-48, 52-53-54, 58-59-60, 61-62-63-64-65-66-E; 70-71-72-E.

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM CAPE TOWN OFFICE WATERSIDE PLACE, SOUTH GATE TYGER WATERFRONT CARL CRONJÉ DRIVE TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20	DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19	DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19	DRAWN BY C. CANNON DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
CTJB CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	25	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 25 OF 27 REVISION 00

(NOT USED)

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 1
LINE VTJB LAYOUT & KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	26	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 26 OF 27 REVISION 00

(NOT USED)

SEE D-WC-8118 SET 159

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 1
CABLE BLOCK DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	41	27	00

LEVELS 1 5 10 14 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 27 OF 27 REVISION 00

X2

		AA110	AA125	AA109		X2		AA115				
			X1.22		K301D	1	K301D	X4.8				
			X1.23		K381	2	K381	X4.9				
			X1.21		K383	3	K383	X4.10				
		X1.22			K301E	4	K301E	X4.11				
		X1.23			K385	5	K385	X4.12				
		X1.21			K387	6	K387	X4.13				
						7						
						8						
						9						
		X1.48			K101A	10	K101A	X5.24				
		X1.49			X103	11	X103	X5.25				
		X1.25			X105	12	X105	X5.26				
				X1.48	X101B	13	X101B	X5.27				
				X1.49	X107	14	X107	X5.28				
				X1.25	X109	15	X109	X5.29				
			X1.48		X101C	16	X101C	X5.30				
			X1.49		X111	17	X111	X5.31				
			X1.25		X113	18	X113	X5.32				
						19						
						20						
						21						
						22						
						23						
						24						
						25						
						26						
						27						
						28						
						29						
						30						
						31						
						32						
						33						
		AA110	AA125	AA109		CABLE NUMBER		AA115				
		12	19	19		CABLE SIZE		19				
		6	5	5		NUMBER OF SPARES		4				
		66kV LINE ISMB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB		DESTINATION		66kV FEEDER 1 RP				

X1

			AA126	AA125	AA109		X1		AA126	AA121	AA116		
					X1.32	B110AA	1	B110AA	43				
					X1.33	B111AA	2	B111AA		X1.1			
					X1.36	B130AA	3	B130AA	44				
					X1.37	B131AA	4	B131AA		X1.2			
					X1.40	B150AA	5	B150AA	45				
					X1.41	B151AA	6	B151AA		X1.3			
			48			B171AA	7	B171AA		X1.4			
				X1.32			8	B210AA					
				X1.33		B211AA	9	B211AA		X2.1			
				X1.36			10	B230AA					
				X1.37		B231AA	11	B231AA		X2.2			
				X1.40			12	B250AA					
				X1.41		B251AA	13	B251AA		X2.3			
							14	B271AA		X2.4			
						P3AA	15	P3AA			X4.5		
						P117AA	16	P117AA			X4.6		
						P5AA	17	P5AA			X4.7		
						P217AA	18	P217AA			X4.8		
							19						
							20						
							21						
							22						
							23						
							24						
							25						
							26						
							27						
							28						
							29						
							30						
			AA126	AA125	AA109		CABLE NUMBER		AA126	AA121	AA116		
			4	19	19		CABLE SIZE		4	12	4		
			-	5	6		NUMBER OF SPARES		-	4	-		
			66kV FEEDER 1 CTJB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB		DESTINATION		66kV FEEDR 1 CTJB	66kV BUSZONE RP	66kV BUSZONE RP		

LOOPED TERMINALS

BP ISMB	
BB1 ISMB	X1.20-X1.22; X1.24-X1.48; X1.32-X1.34; X1.33-X1.35; X1.37-X1.39; X1.41-X1.43; X1.44-X1.46; X1.45-X1.47
BB2 ISMB	X1.20-X1.22; X1.24-X1.48; X1.32-X1.34; X1.33-X1.35; X1.37-X1.39; X1.41-X1.43; X1.44-X1.46; X1.45-X1.47
LINE ISMB	X1.20-X1.22; X1.24-X1.48
ISJB	X1.1-X1.8; X1.3-X1.10; X1.5-X1.12; X1.7-X1.14

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 1

ISJB CABLING DIAGRAM

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 28/08/19	DATE 11/12/15

LEVELS:

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
41	28	00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

LEVELS 1 10

PANEL TYPE DESIGNATION 4FZD-3920

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 28 OF 28 REVISION 1

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	1	06/05/2016	NEW REVISION.
01	PANEL EQUIPMENT LAYOUT	1	06/05/2016	ADDED RELAY SIR-CCB-O.
02	SCHEME LOGIC DIAGRAM	1	06/05/2016	RELAY LABELS CHANGED.
03	SINGLE LINE DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
04	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
05	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
06	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
07	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPERVISORY CB CONTROL.
08	DC KEY DIAGRAM	1	06/05/2016	CB CLOSE FUNCTION NOT USED.
09	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPV. BREAKER OPEN.
10	INDICATIONS KEY DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL.
11	AC SUPPLY KEY & SPRING REWIND DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS. ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUST. TRIP & LOCK-OUT CONTACT ON SHEET 12.
12	SUPERVISORY KEY DIAGRAM	1	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM.
13	PROTECTION REFERENCE DIAGRAM	1	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.
14	PANEL CABLING DIAGRAM	1	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM.
15	PANEL CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
16	CTJB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
17	CUSTOMER INTERFACE JB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
18	CABLE BLOCK DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2		17	INDOOR SWITCHGEAR AS PER D-DT-5408r0 SHTs 1 - 6 (X1-X3 TERMINALS) WITH REMOTE PROTECTION SCHEME
3	SCHEME WITH HARDWIRED & SERIAL SCADA INTERFACE	18	OUTDOOR CONVENTIONAL CB & CTs
4	OPTIONAL SECOND REAR COMMS PORT & IRIG-B INPUT FOR P145 (USE WITH LEVEL 3)	19	STANDARD KIOSK TYPE CB & CTs AS PER D-DT-5407
5	SCHEME WITH SERIAL SCADA INTERFACE ONLY	20	
6	OPTIONAL SECOND REAR COMMS PORT & IRIG- B INPUT FOR P145 (USE WITH LEVEL 5)	21	
7		22	
8		23	
9		24	
10	STANDARD DESIGN DRAWING	25	
11		26	
12		27	
13		28	
14		29	
15		30	

θ

θ θ CIRCUIT-BREAKER OPTIONS

NOTE

AMP TRANSDUCER OPTION INCORPORATED INTO LEVELS 3, 5, 17, 18 & 19. DELETE IF NOT REQUIRED.
θ MUTUALLY EXCLUSIVE LEVELS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.

66kV FEEDER 2: MAIN INTAKE 3

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	NEW REVISION	AB	RB

LEVELS 1 10

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

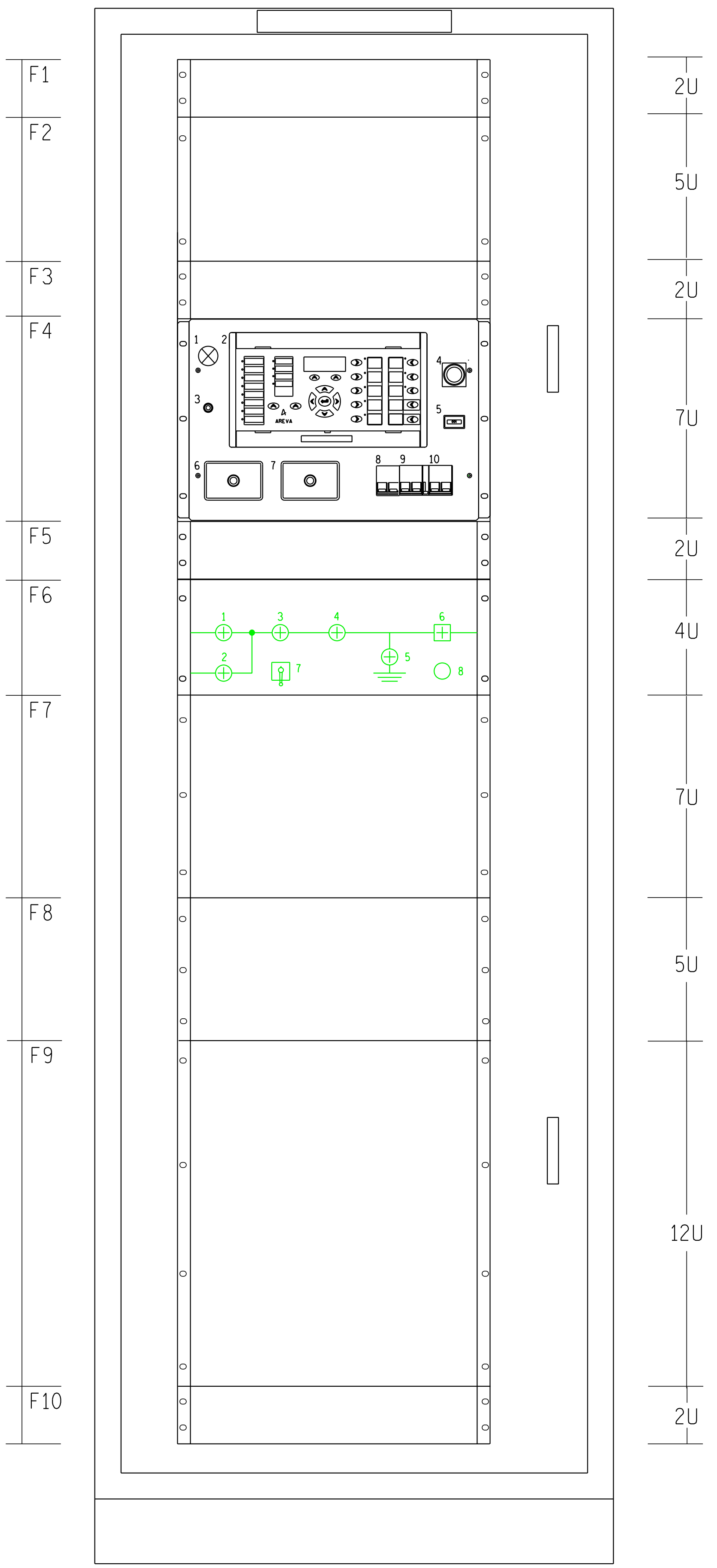
YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
COVER SHEET

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	00	00

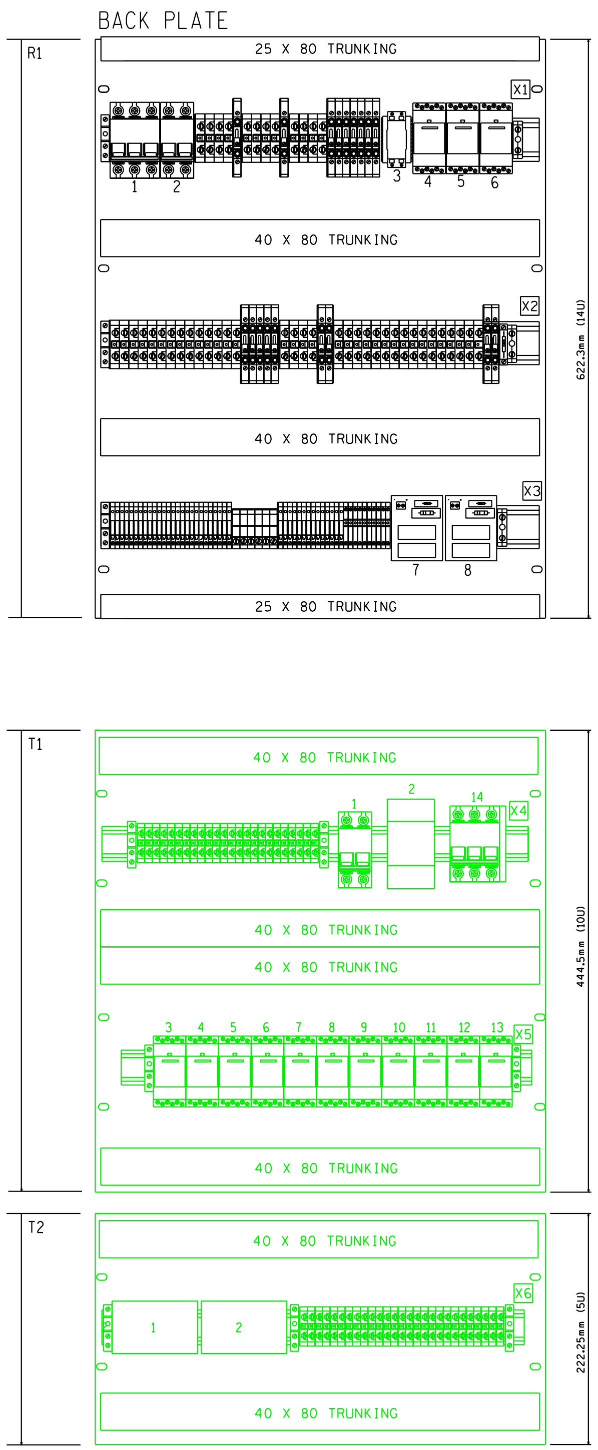
PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 0 OF 19 REVISION 1

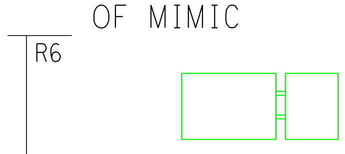
FRONT VIEW



BACK PLATE



MOUNTED ON RADIO RACK
OF MIMIC



LOCATION		DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW					
F1			2U BLANKING PLATE		
F2			5U BLANKING PLATE		
F3			2U BLANKING PLATE		
F4	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	ND-16-22B/2	CHNT
	2	P145	FEEDER MANAGEMENT RELAY	MiCOM P145	SCHNEIDER ELECTRIC
	3	ESD	ELECTROSTATIC DISCHARGE POINT	TEST POINT	HIRSCHMAN
	4	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	YSF & COVER	ADDA INDICATORS
	5	FC	FAULT COUNTER (6 DIGIT)	ZR6-2600-20✱0	FOX
				✱ = 6 (110Vdc), 7 (220Vdc)	
	6	CTTB	CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	7	VTTB	VOLTAGE TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	8	DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER (16A)	EP102UC(C16)	GE
	9	DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER (20A)	EP102UC(C20) & CA H	GE
	10	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G61NC(C10)	GE
F5			2U BLANKING PLATE		
F6	1	BB1-S	66kV FEEDER 2 BUSBAR 1 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	2	BB2-S	66kV FEEDER 2 BUSBAR 2 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	3	MIS-S	66kV FEEDER 2 MOTORISED ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	4	IS-S	TRANSFORMER 3 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	5	ES-S	TRANSFORMER 3 EARTHSWITCH SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	6	CB-S	TRANSFORMER 3 CIRCUIT BREAKER SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	7	CS	66kV FEEDER 3 MOTORISED ISOLATOR CONTROL SWITCH	A714-600	KRAUS & NAIMER
	8	RPBI	RESET PUSH BUTTON INDICATION (AMBER)		ADDA INDICATORS
F7			7U BLANKING PLATE		
F8			5U BLANKING PLATE		
F9			12U BLANKING PLATE		
F10			2U BLANKING PLATE		
BACK PLATE					
R1	1	MCB (VT)	VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02)	GE
	2	MCB (H)	MECHANISM BOX AC HEATER MINIATURE CIRCUIT-BREAKER (5A)	G61NC(C05)	GE
	3	DM	DIODE MODULE	KCH	ELMEX
		D1, D2	DIODES WITHIN DIODE MODULE (2)	DDSA9-16F	ACTOM
	4	CL-X	CLOSE AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	5	APT-X	ANTI-PUMP TIMER AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	6	PNH-X	PROTECTION NOT HEALTHY AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	7	AS-1	TRIPPING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
	8	AS-2	CLOSING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
T1	1	DCI MCB (I)	INDICATIONS DC ISOLATE MINIATURE CIRCUIT-BREAKER (6A)	EP102UC(C6)	GE
	2	TR-X	TRIP REPEAT AUXILIARY RELAY (110V DC)	BFT3	ARTECHE
	3	BF-X	BREAKER FAIL AUXILIARY RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	4	LC-X	LAMP CHECK AUXILIARY RELAY (230V AC)	MK3P5-S 230Vac	OMRON
	5	CB-X	CIRCUIT-BREAKER INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	6	BB1-X	BUSBAR 1 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	7	BB2-X	BUSBAR 2 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	8	MIS-X	MOTORISED ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	9	IS-X	TRANSFORMER 3 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	10	ES-X	TRANSFORMER 3 EARTHSWITCH INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	11	SIR-O	SUPERVISORY OPEN CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	12	SIR-C	SUPERVISORY CLOSE CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	13	SIR-CCB-O	CIRCUIT BREAKER SUPERVISORY CONTROL OPEN (48V DC)	MK3P5-S 48Vdc	OMRON
	14	MCB (VT2)	BUSBAR VOLTAGE SUPPLY MINIATURE CIRCUIT-BREAKER + AUX (2A)	G63(C02) + AUX	GE
T2	1	VSR-1	ISOLATOR 1 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
	2	VSR-2	ISOLATOR 2 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
REAR SIDE OF FRONT VIEW					
R6	1	DB-1	DIODE MODULE - 10 COMMONLY CONNECTED DIODES		MIMIC CRAFT
	2	DB-2	DIODE MODULE - 5 COMMONLY CONNECTED DIODES		MIMIC CRAFT

REFER TO SHEET 13 FOR DETAILS OF TERMINAL BLOCK MAKES AND TYPES.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED RELAY SIR-CCB-O	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
PANEL EQUIPMENT LAYOUT

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	01	00

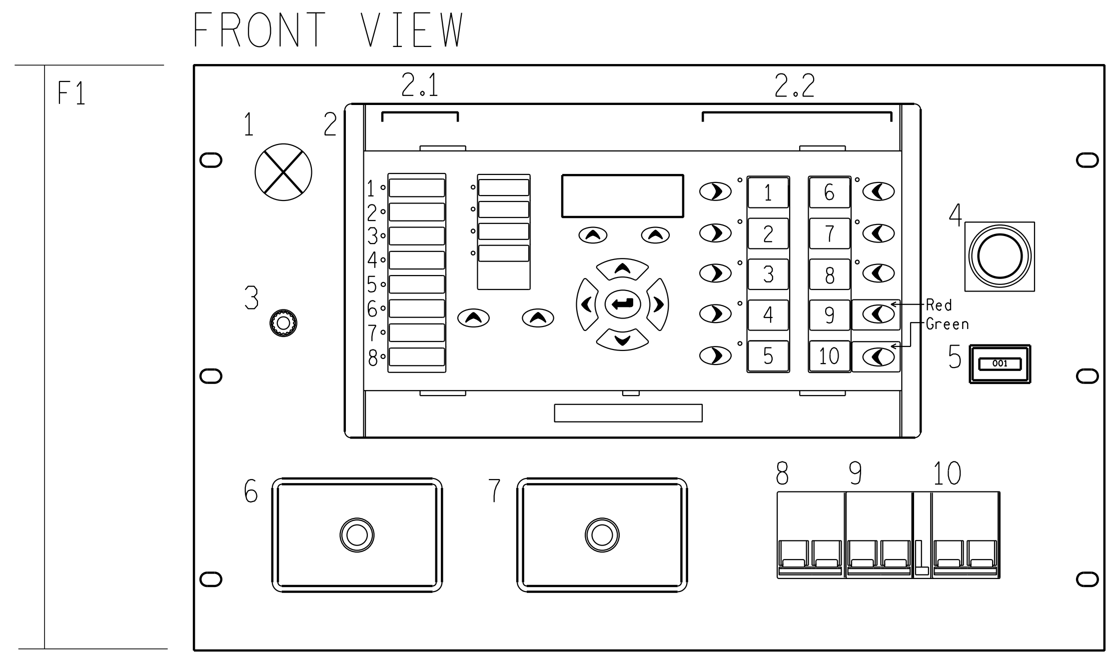
MASTER TRACING FILED UNDER D-WC-8118 SHEET 1 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

LEVELS 1 3 4 10

FRONT VIEW



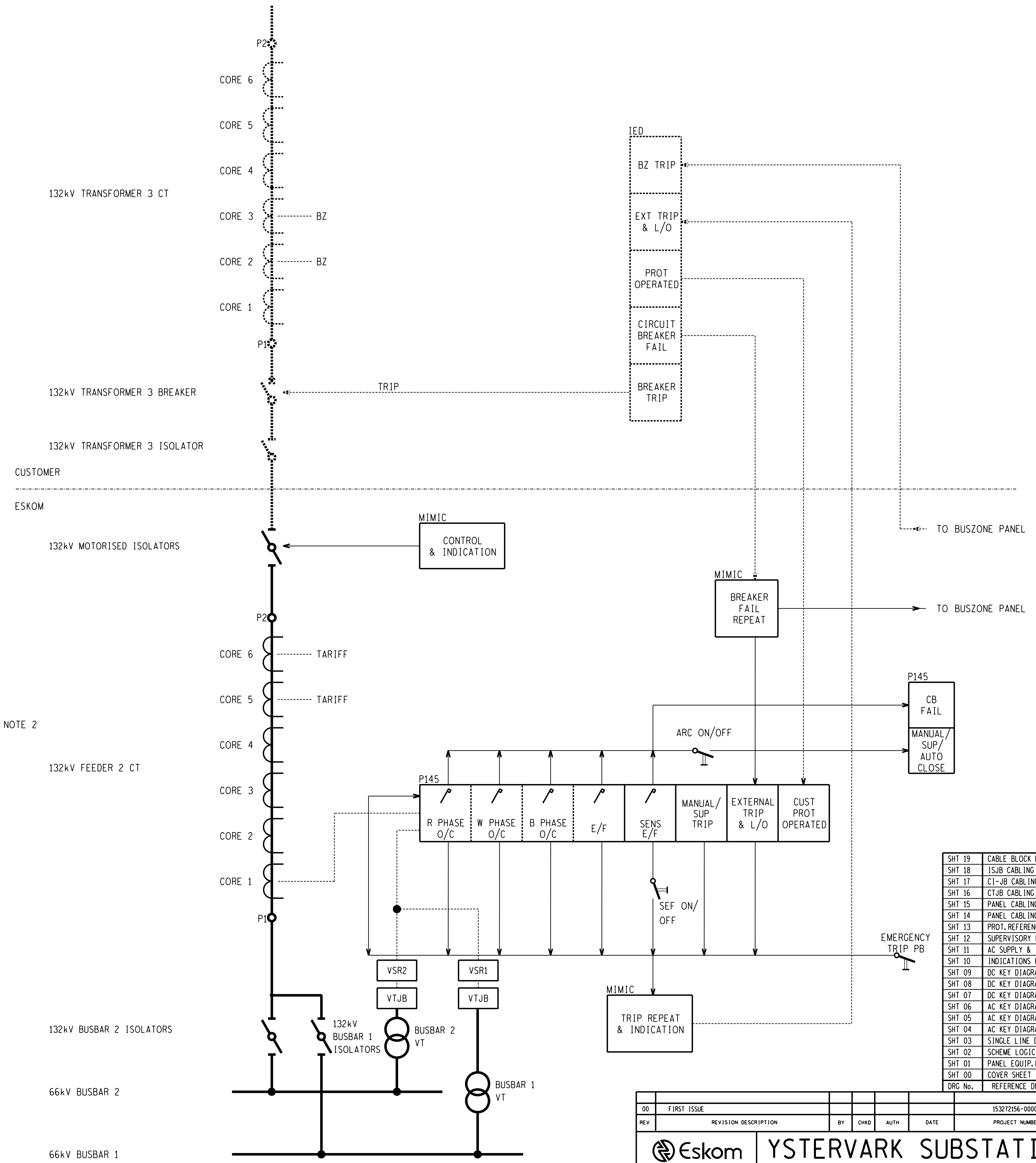
LOCATION		DESIGNATION	DESCRIPTION	LABEL
FRONT VIEW				
F1				
1		PNH-I	PROTECTION NOT HEALTHY INDICATION	PROTECTION NOT HEALTHY
2		P145	FEEDER MANAGEMENT RELAY	
2.1			PROGRAMMABLE LEDs	
	1		CIRCUIT-BREAKER CLOSED INDICATION (RED)	CB CLOSED
	2		CIRCUIT-BREAKER OPEN INDICATION (GREEN)	CB OPEN
	3		CIRCUIT-BREAKER NOT HEALTHY INDICATION	MOTORISED ISOL ALARM
	4		OVERCURRENT TRIP INDICATION	O/C TRIP (NOT USED)
	5		EARTH FAULT TRIP INDICATION	E/F TRIP (NOT USED)
	6		SENSITIVE EARTH FAULT TRIP INDICATION	SEF TRIP (NOT USED)
	7		OTHER TRIP	OTHER TRIP* (NOT USED)
	8		CIRCUIT-BREAKER FAIL ISOLATED ALARM	CB FAIL ISOL (NOT USED)
2.2			PROGRAMMABLE FUNCTION KEYs WITH LEDs	
	1		AUTO RECLOSE ON PUSH BUTTON & INDICATION	ARC ON (NOT USED)
	2		AUTO RECLOSE OFF PUSH BUTTON & INDICATION	ARC OFF (NOT USED)
	3		ARC LOCKED OUT INDICATION (PUSH BUTTON NOT USED)	ARC LOCKOUT (NOT USED)
	4		SENSITIVE EARTH FAULT ON PUSH BUTTON & INDICATION	SEF ON (NOT USED)
	5		SENSITIVE EARTH FAULT OFF PUSH BUTTON & INDICATION	SEF OFF (NOT USED)
	6		SUPERVISORY ISOLATE SWITCH ON PUSH BUTTON & INDICATION	SIS ON (NOT USED)
	7		SUPERVISORY ISOLATE SWITCH OFF PUSH BUTTON & INDICATION	SIS OFF (NOT USED)
	8		LAMP CHECK / TARGET RESET PUSH BUTTON & INDICATION	RESET / LAMP CH
	9		CIRCUIT-BREAKER CLOSE CONTROL (RED)	CLOSE** (NOT USED)
	10		CIRCUIT-BREAKER TRIP CONTROL (GREEN)	TRIP** (NOT USED)
3		ESD	ELECTROSTATIC DISCHARGE POINT	ESD
4		ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER	CUST BREAKER EMERGENCY TRIP
5		FC	FAULT COUNTER	FAULT COUNTER
6		CTTB	CURRENT TRANSFORMER TEST BLOCK	CURRENT TRANSFORMER TEST BLOCK
7		VTTB	VOLTAGE TRANSFORMER TEST BLOCK	VOLTAGE TRANSFORMER TEST BLOCK
8		DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER	MAIN DC SUPPLY MCB (16A)
9		DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER	SPRING REWIND DC MCB (20A)
10		MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER	AC SUPPLY MCB (10A)

* CB FAIL, FREQUENCY, VOLTAGE, POWER PROTECTION TRIP - SEE LCD DISPLAY FOR DETAILED ALARM DESCRIPTION.
** PRESS TWICE IN 3s TO OPERATE

NOTE 2

NOTE:

1. DOWNLOAD THE *.PSL FILE FROM THE P145 RELAY FOR FULL SCHEME LOGIC.
2. LED SHOWS RED FOR "ARC LOCK-OUT" AND GREEN FOR "ARC IN PROGRESS"



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

SHEET 2 OF 19 REVISION 1

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	RELAY LABELS CHANGED	AB	RB

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME SCHEME LOGIC DIAGRAM

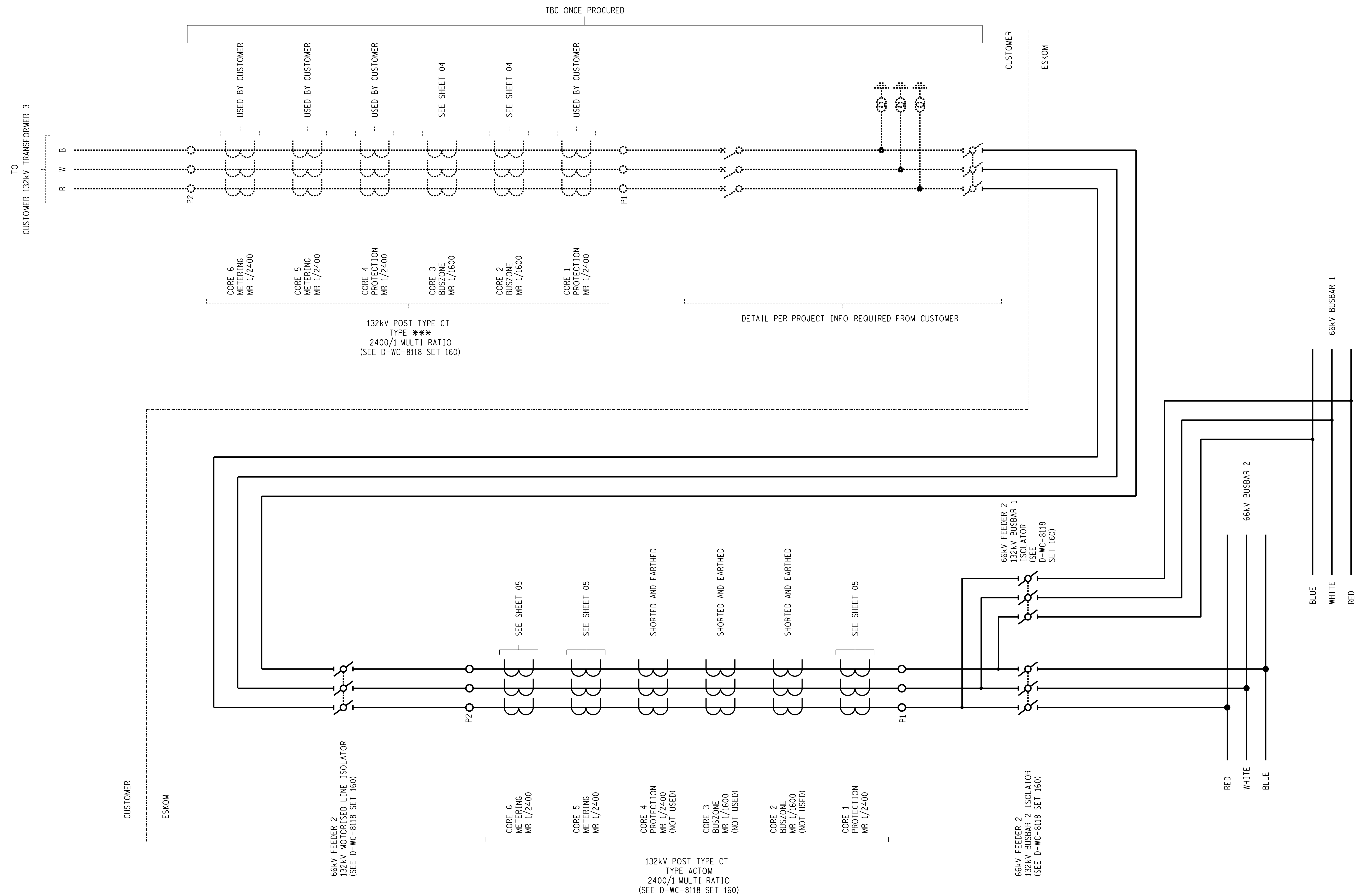
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	02	00

LEVELS:

LEVELS 1 10

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

LEVELS 1 10

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME SINGLE LINE DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	42	03	00

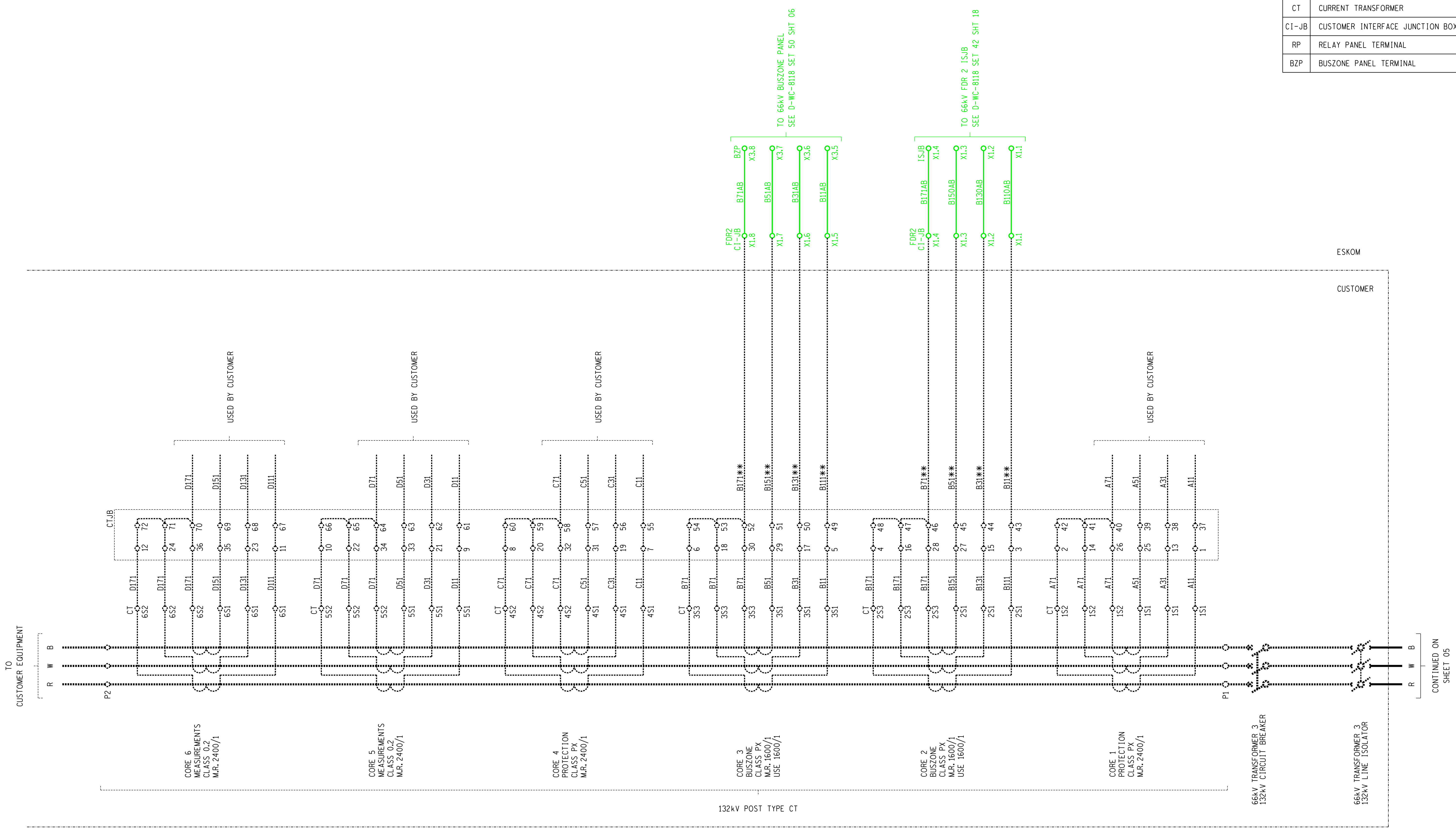
SHEET 3 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CI-JB	CUSTOMER INTERFACE JUNCTION BOX
RP	RELAY PANEL TERMINAL
BZP	BUSZONE PANEL TERMINAL



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE		REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION		AB	RB

LEVELS: 1 10

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

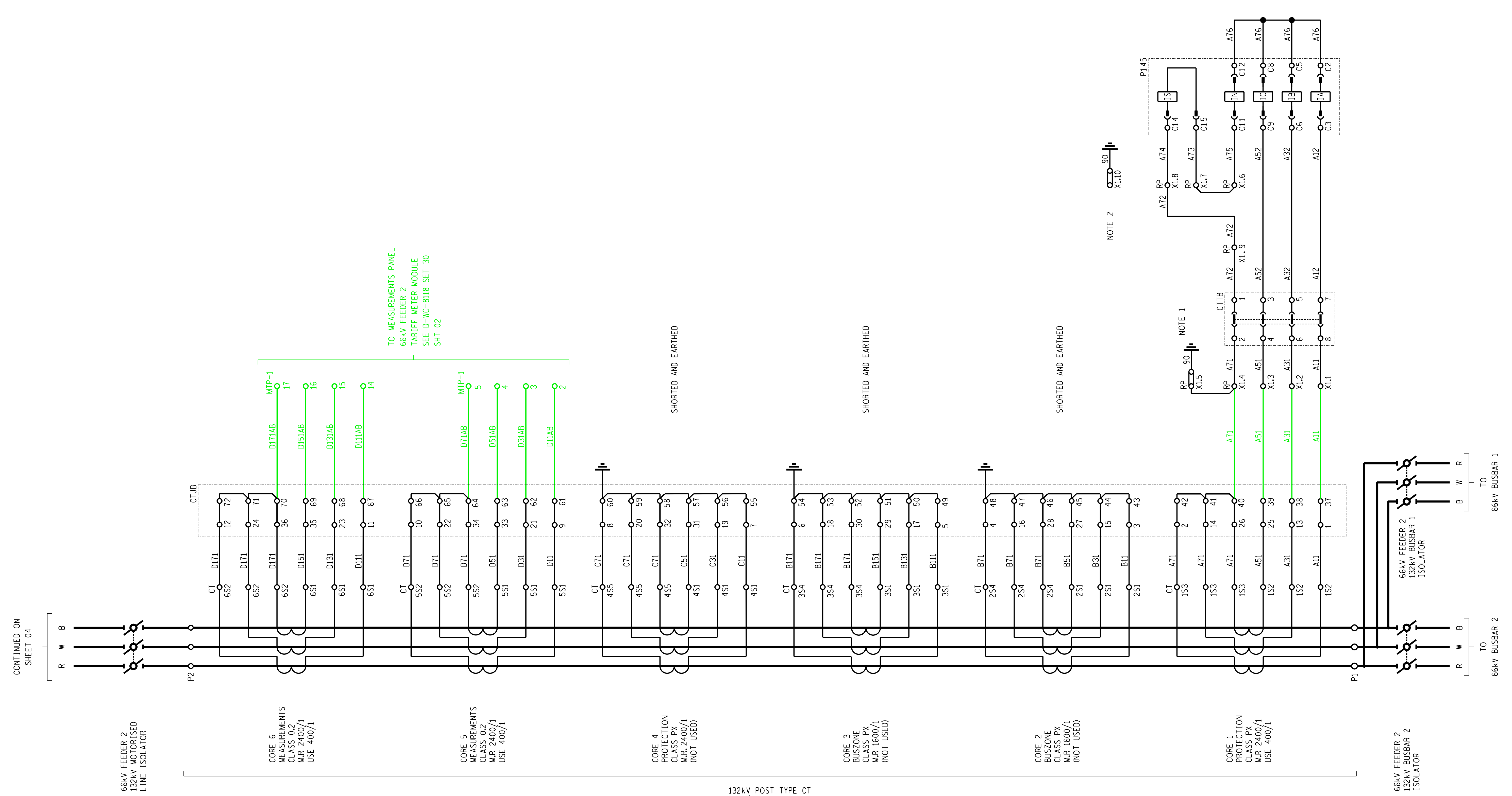
YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	04	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 4 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
BZJB	BUSZONE JUNCTION BOX
RP	RELAY PANEL TERMINAL



132kV POST TYPE CT
240/1 MULTI RATIO
(SEE D-WC-8118 SET 160)
(SEE NOTE 3)

NOTES:

1. FOR CONNECTION TO CORE BALANCE CT, LOOP:
   X1.6 - X1.9
   X1.7 - CT
   X1.8 - CT

   REMOVE LOOPS
   X1.6 - X1.7
   X1.8 - X1.9

2. THE LINK BETWEEN X1.8 AND X1.10 SHOULD BE INSTALLED IF A SEPARATE CORE BALANCE CT IS USED.

   THERE SHOULD ONLY BE ONE EARTH POINT ON EACH CT CIRCUIT.

3. REFER TO SETTING SHEET FOR CORRECT RATIO.

4. THE P145 RELAY IS SUITABLE FOR 1A OR 5A RATED CTs (VIA DIFFERENT TERMINAL INPUTS). THE STANDARD DRAWING INDICATES THE RELAY WIRED FOR 1A RATED CTs. USE THE TABLE BELOW TO DETERMINE THE CORRECT WIRING FOR 5A RATED CTs. SCHEMES ORDERED FOR 5A RATED CTs WILL BE WIRED AS SUCH IN THE FACTORY.

WIRE FERRULE NUMBER	P145 TERMINAL NUMBER 1A RATED	5A RATED
A12	C3	C1
A32	C6	C4
A52	C9	C7
A76	C12	C10
A73	C15	C13

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME AC KEY DIAGRAM

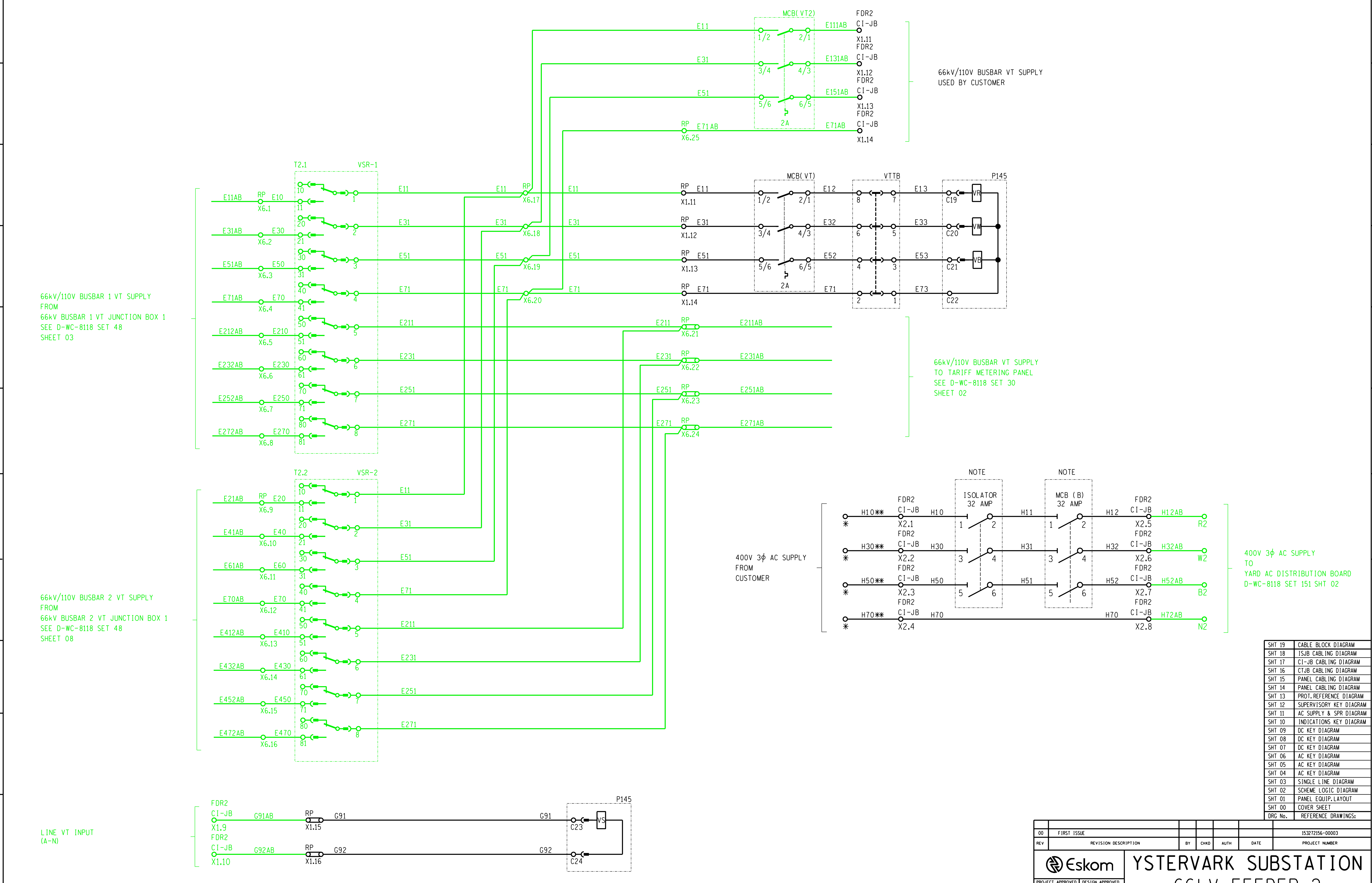
D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
42	05	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 5 OF 19 REVISION 1



NOTE
INSTALLED IN CUSTOMER INTERFACE JUNCTION BOX

SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

D-WC-8118 | SET NUMBER 42 | SHEET NUMBER 06 | REVISION 00

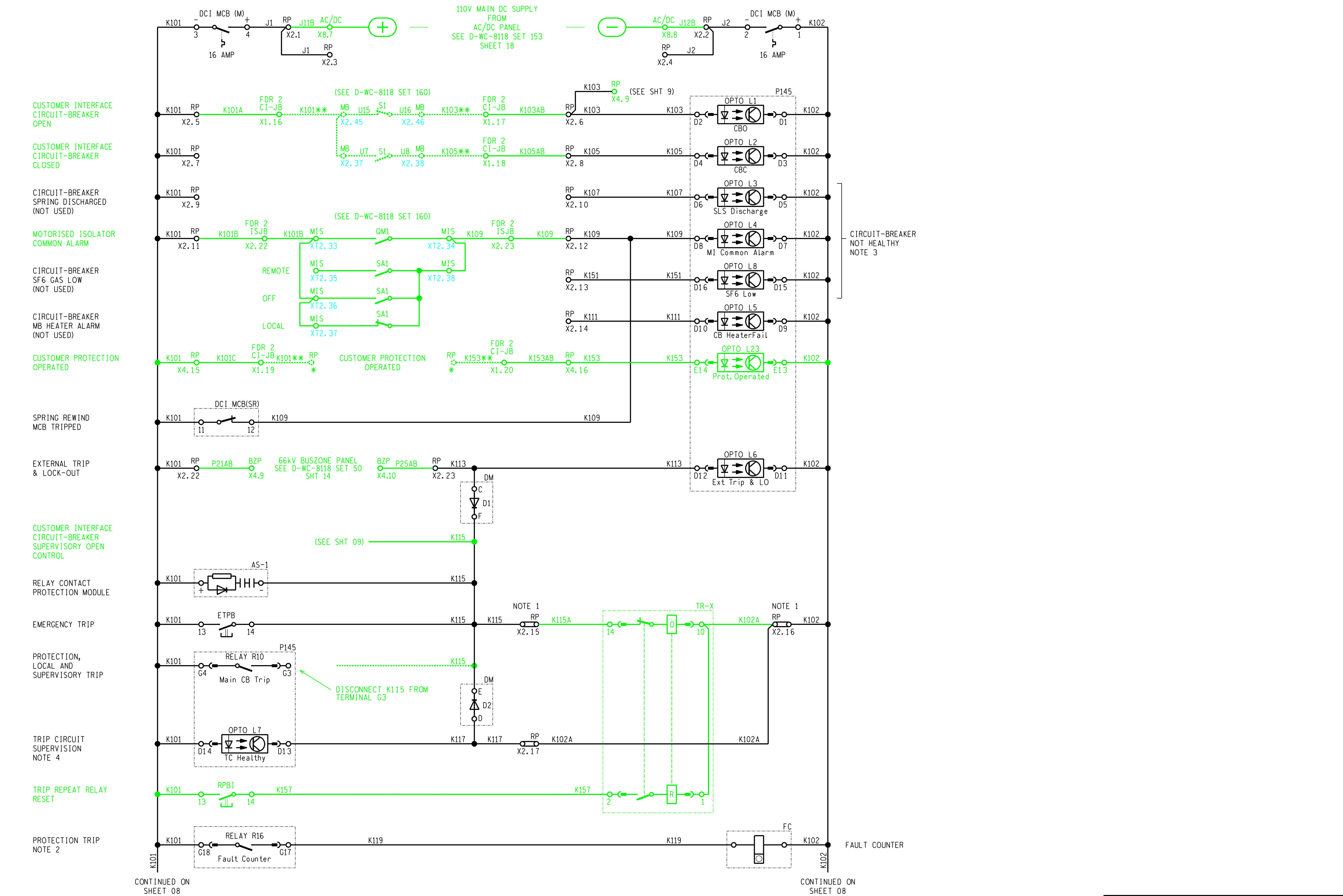
AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

LEVELS: 1 2 3 4 5 6 7 8 9 10

SHEET 6 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.
2. OPERATION OF P145 RELAY 3 RAISES THE LATCHED 'TRIP' LED ON THE RELAY AND INITIATES THE CIRCUIT-BREAKER FAIL FUNCTION. RELAY 3 MUST ALSO BE ASSERTED FOR ARC TO INITATE SUCCESSFULLY. RELAY 3 IS THUS CRITICAL TO THE CORRECT OPERATION OF THE SCHEME, EVEN THOUGH IT IS NOT WIRED. THE MASKING FOR RELAY 16 IS SIMILAR TO THAT FOR RELAY 3, BUT THE FORMER MAY BE BLOCKED BY A CONTROL INPUT DURING TESTING.
3. THE P145 WILL NOT ISSUE A CLOSE COMMAND TO THE CIRCUIT-BREAKER IF OPTO L3 IS ASSERTED (SLS DISCHARGED) OR OPTO L7 IS DE-ASSERTED (TRIP COIL FAILED). THE AUTO-RECLOSE LOGIC WAITS UNTIL THE END OF THE DEAD TIME BEFORE CHECKING THE SLS STATUS. IF THE SPRING IS DISCHARGED THE DEAD TIME IS EXTENDED UNTIL THE SPRING CHARGES, OR UNTIL A SETTABLE TIMER EXPIRES. EXPIRY OF THE TIMER CANCELS ARC.
4. ALL CLOSE COMMANDS TO THE CIRCUIT-BREAKER ARE BLOCKED IN THE EVENT THAT THE TRIP CIRCUIT IS UNHEALTHY (OPTO L7 DE-ASSERTED). IT IS THUS IMPERATIVE THAT PROVISION IS MADE FOR TRIP CIRCUIT SUPERVISION WHILST THE CIRCUIT-BREAKER IS IN THE OPEN POSITION. IF THE CIRCUIT-BREAKER DESIGN DOES NOT CATER FOR THIS, WIRE A N/C (52b) STATUS CONTACT BETWEEN X2.16 AND X2.17.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST.SUPERVISORY CB CONTROL	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED: L.BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A.MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K.STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

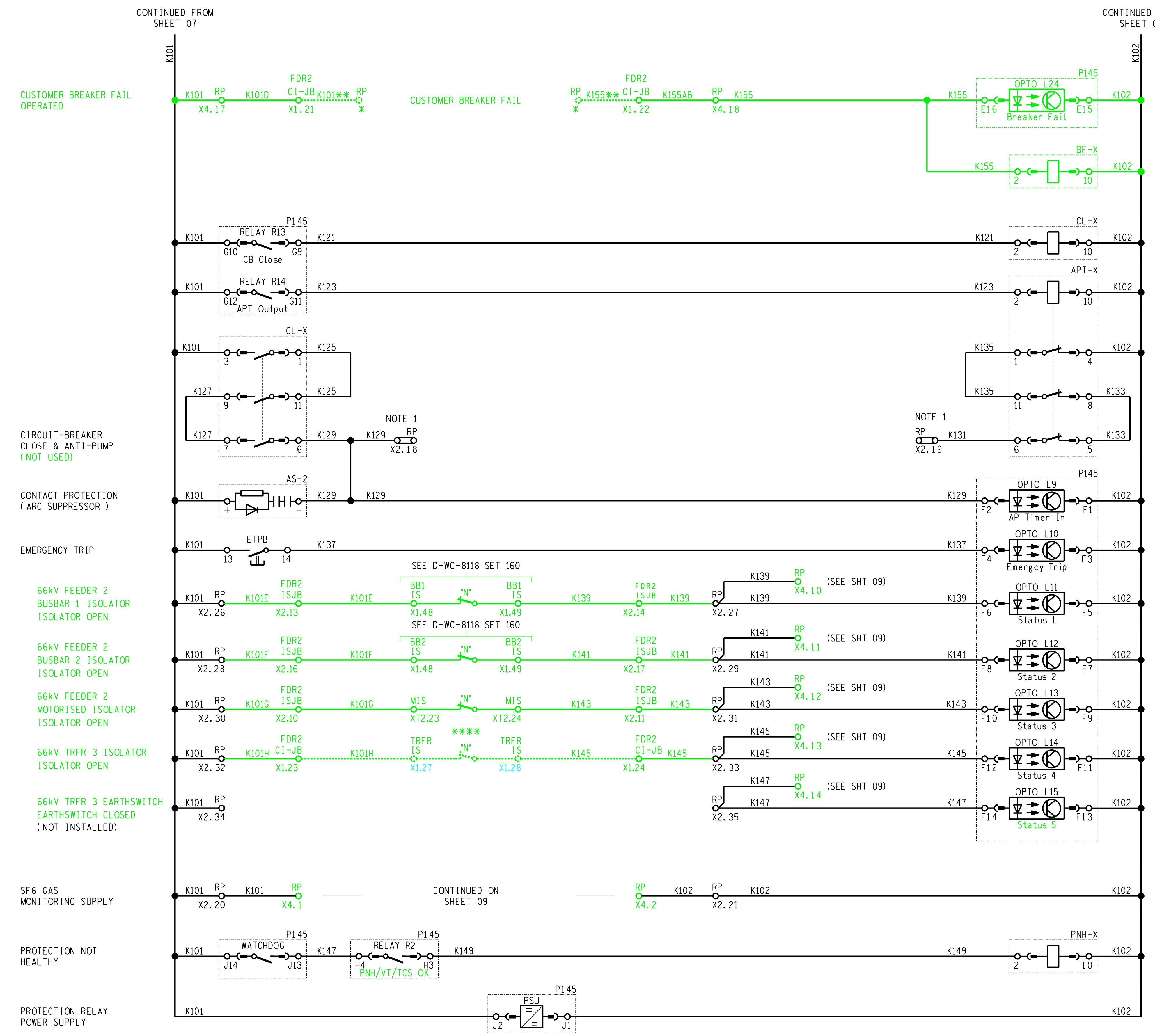
LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	07	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 7 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

SHEET 8 OF 19 REVISION 1

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME AC KEY DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
42	08	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CB CLOSE FUNCTION NOT USED	AB	RB

LEVELS:

AECOM

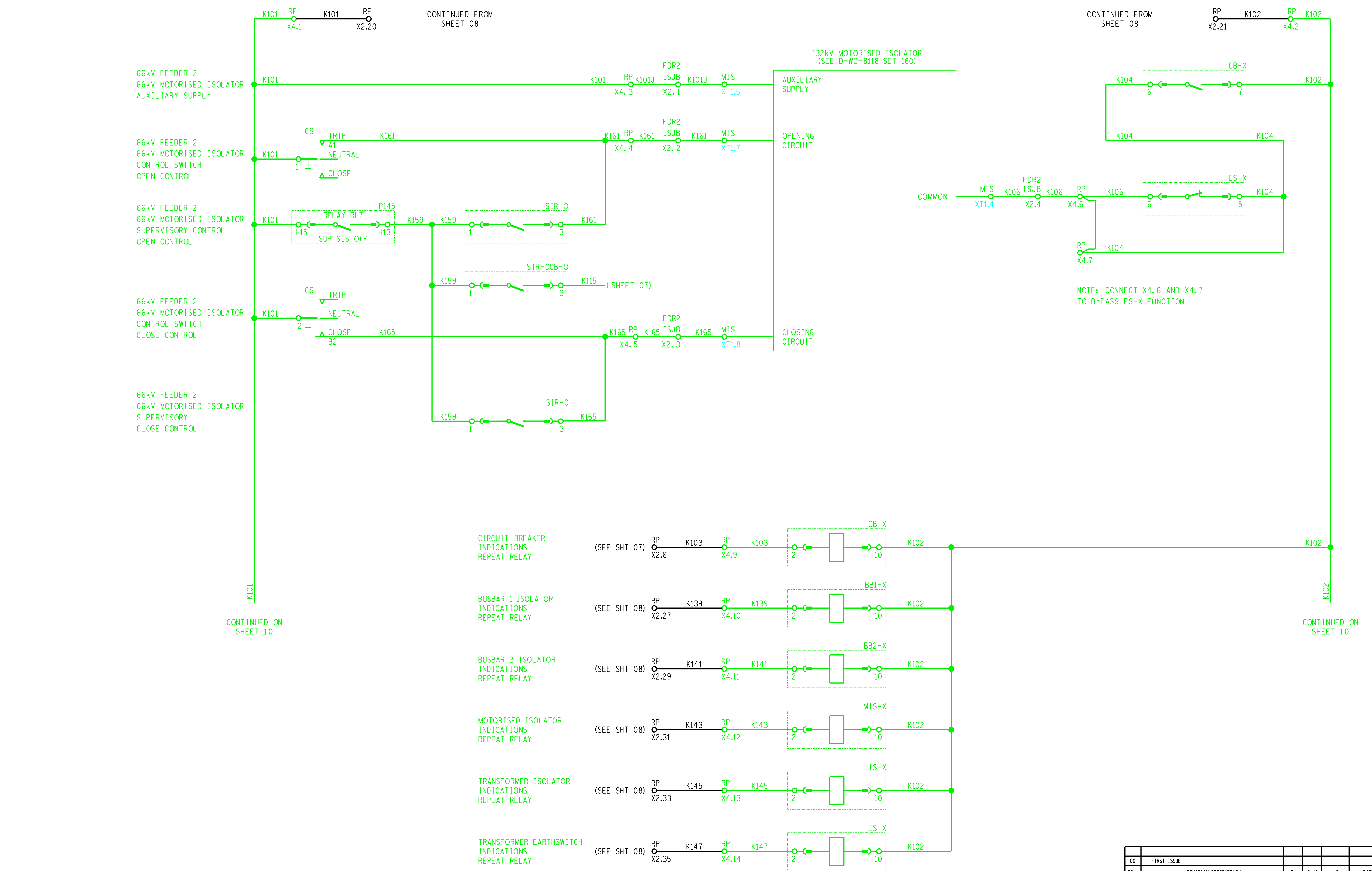
CAPE TOWN OFFICE WATERSIDE PLACE, SOUTH GATE TYGER WATERFRONT CARL CRONJE DRIVE TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST.SUPV.BREAKER OPEN	AB	RB

Eskom

PROJECT APPROVED L.BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A.MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K.STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15
LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

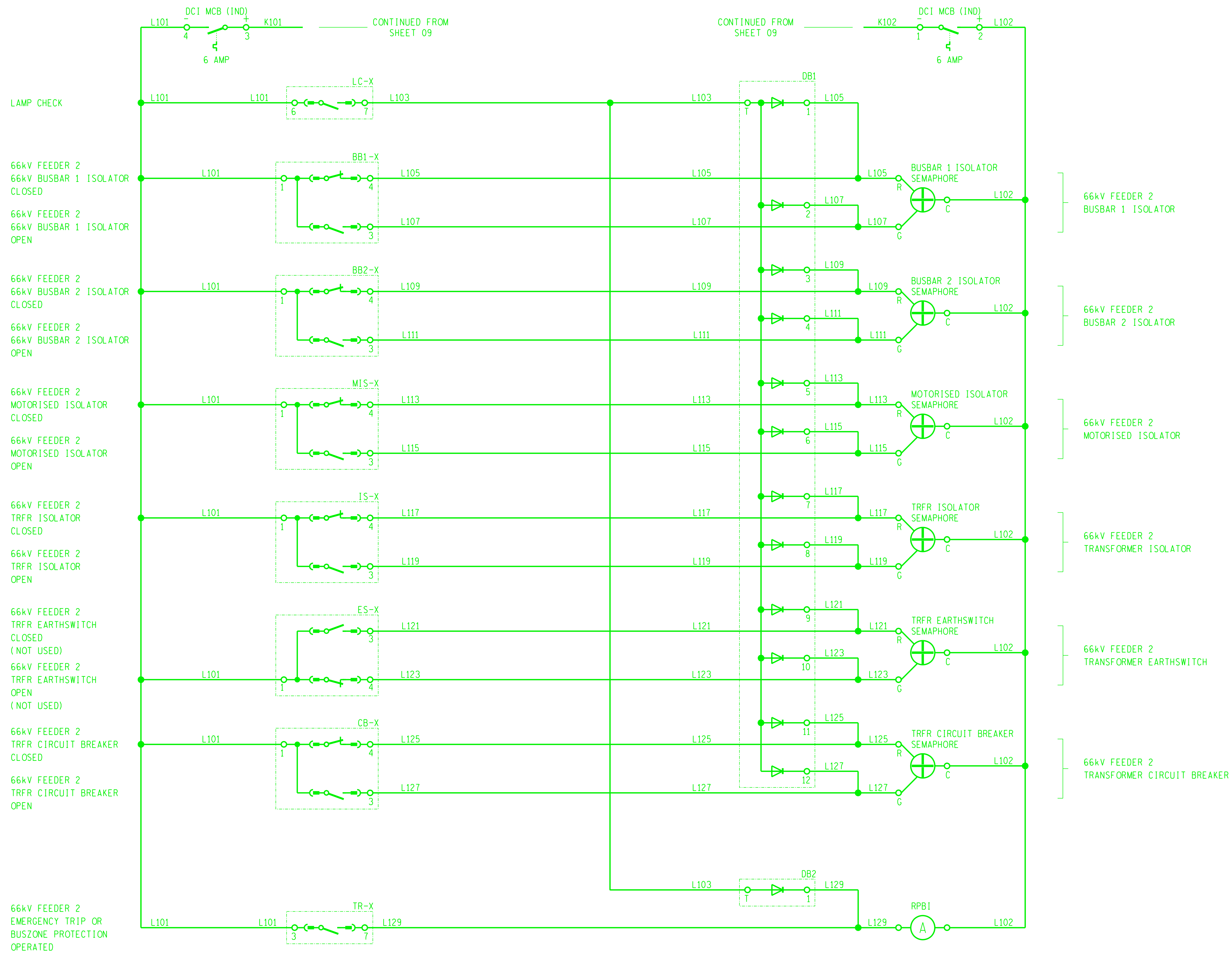
SET NUMBER	SHEET NUMBER	REVISION
42	09	00

D-WC-8118

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 9 OF 19 REVISION 1



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	42	10	00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

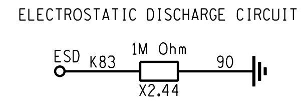
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL	AB	RB

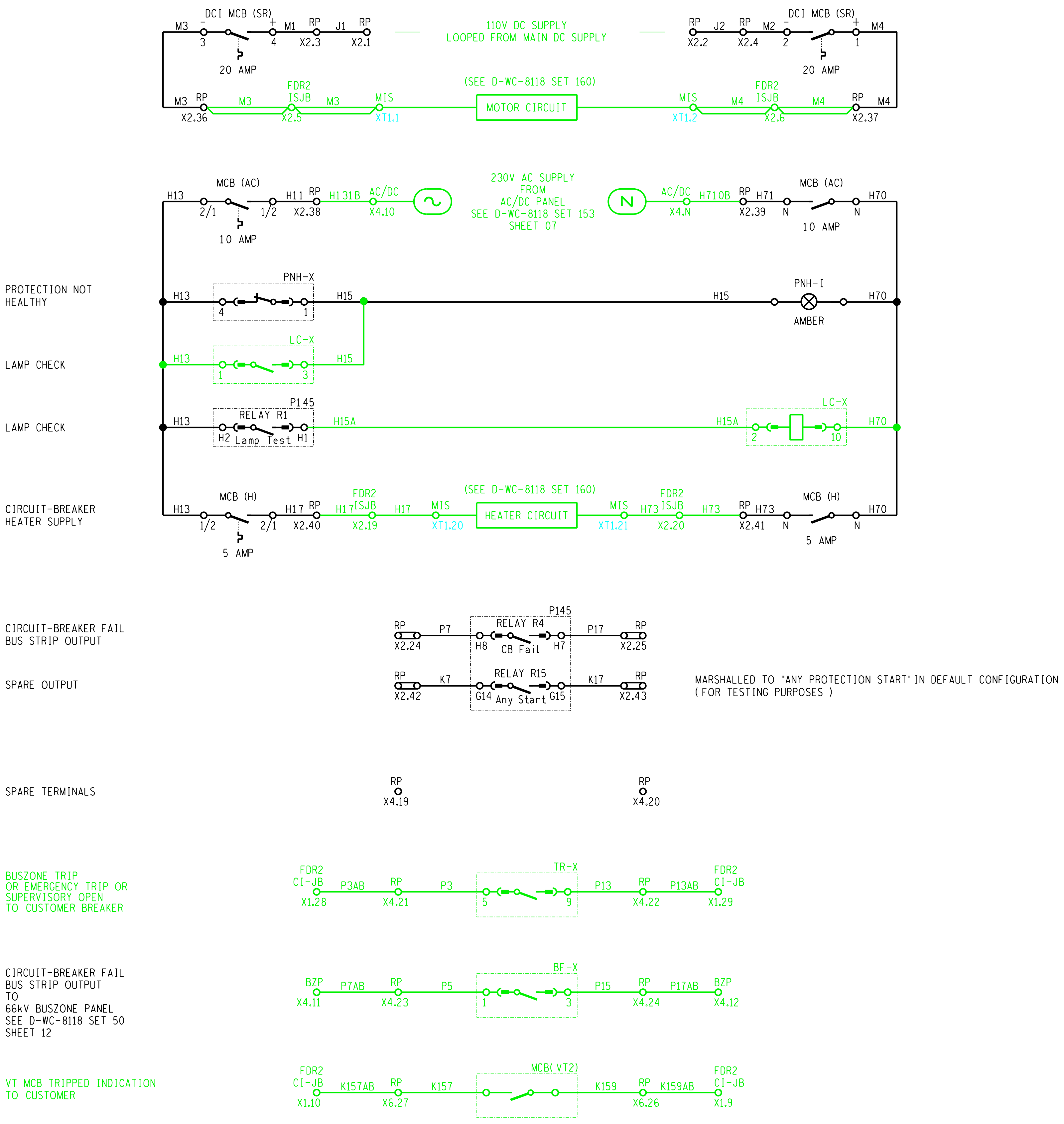
LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 19 REVISION 1

A1L





DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUSTOMER TRIP & L/OUT CONTACT ON SHT 12	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

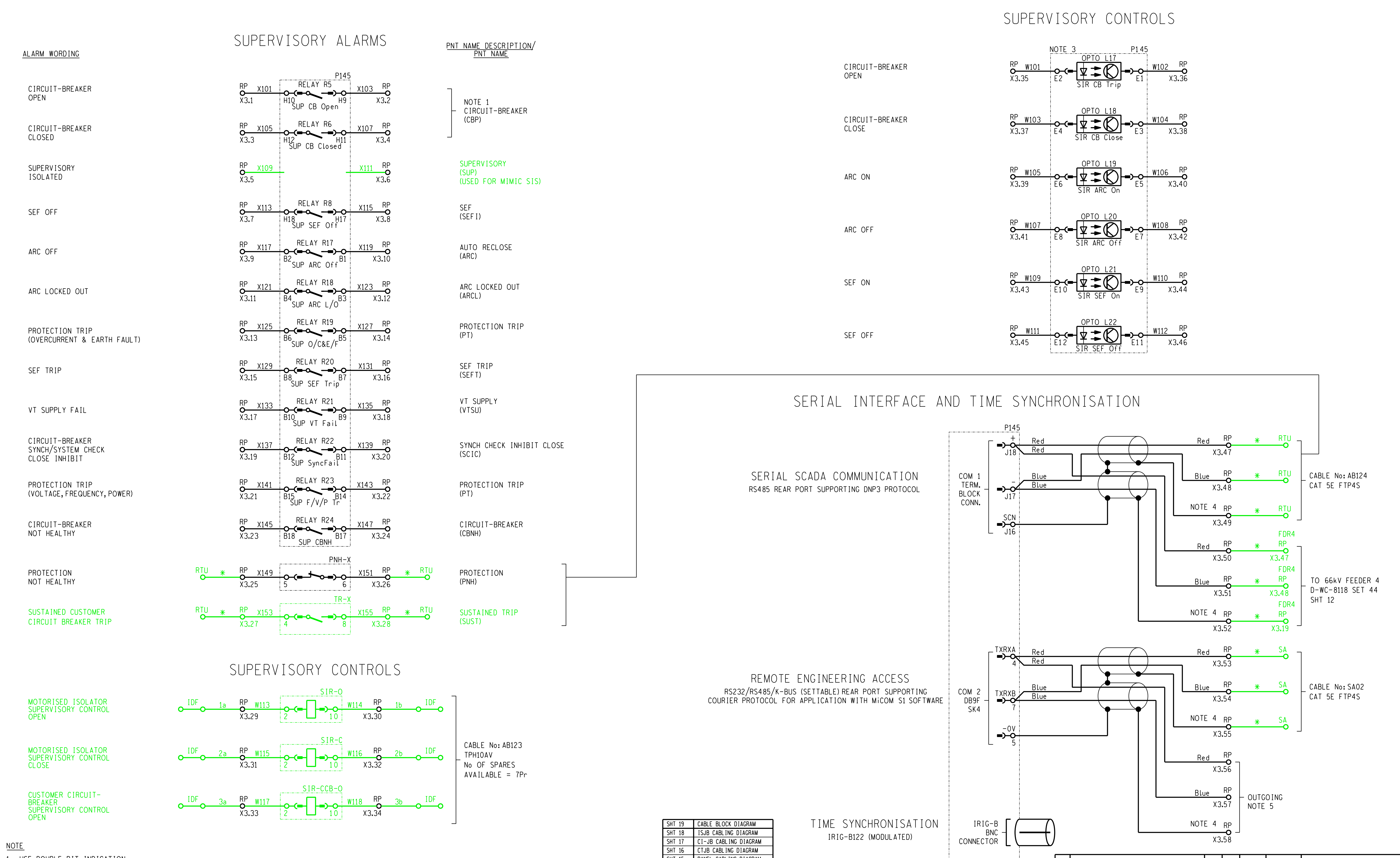
YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
AC SUPPLY KEY & SPRING REWIND DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	11	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 19 REVISION 1



NOTE

1. USE DOUBLE BIT INDICATION.
2. IN THE EVENT THAT HARDWIRED SUPERVISORY INDICATION OF AN UNDER FREQUENCY TRIP OR A CIRCUIT-BREAKER FAIL BUS STRIP IS REQUIRED, THE ALARMS "ARC OFF" AND "ARC LOCKED-OUT" MAY BE COMBINED INTO A SINGLE ALARM OF DESCRIPTION (POINT NAME):

   ARC L/OUT OR OFF (ARCLO)

   THE SPARE CONTACT CAN THEN BE MARSHALLED AS:

   BKR FAIL BUS STRIP (BFBS); OR

   FREQUENCY TRIP (FRT)
3. THE P145's OPTO INPUTS ARE RATED FROM 19Vdc TO 265Vdc, WITH THE PICK-UP RANGE OF EACH OPTO INDIVIDUALLY SELECTABLE BY SETTINGS.
4. RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
5. INSERT 120 OHM TERMINATING RESISTOR BETWEEN + AND - IF DAISY CHAIN TERMINATES AT THIS RELAY PANEL.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F. KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME SUPERVISORY ALARMS AND CONTROLS

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	12	00

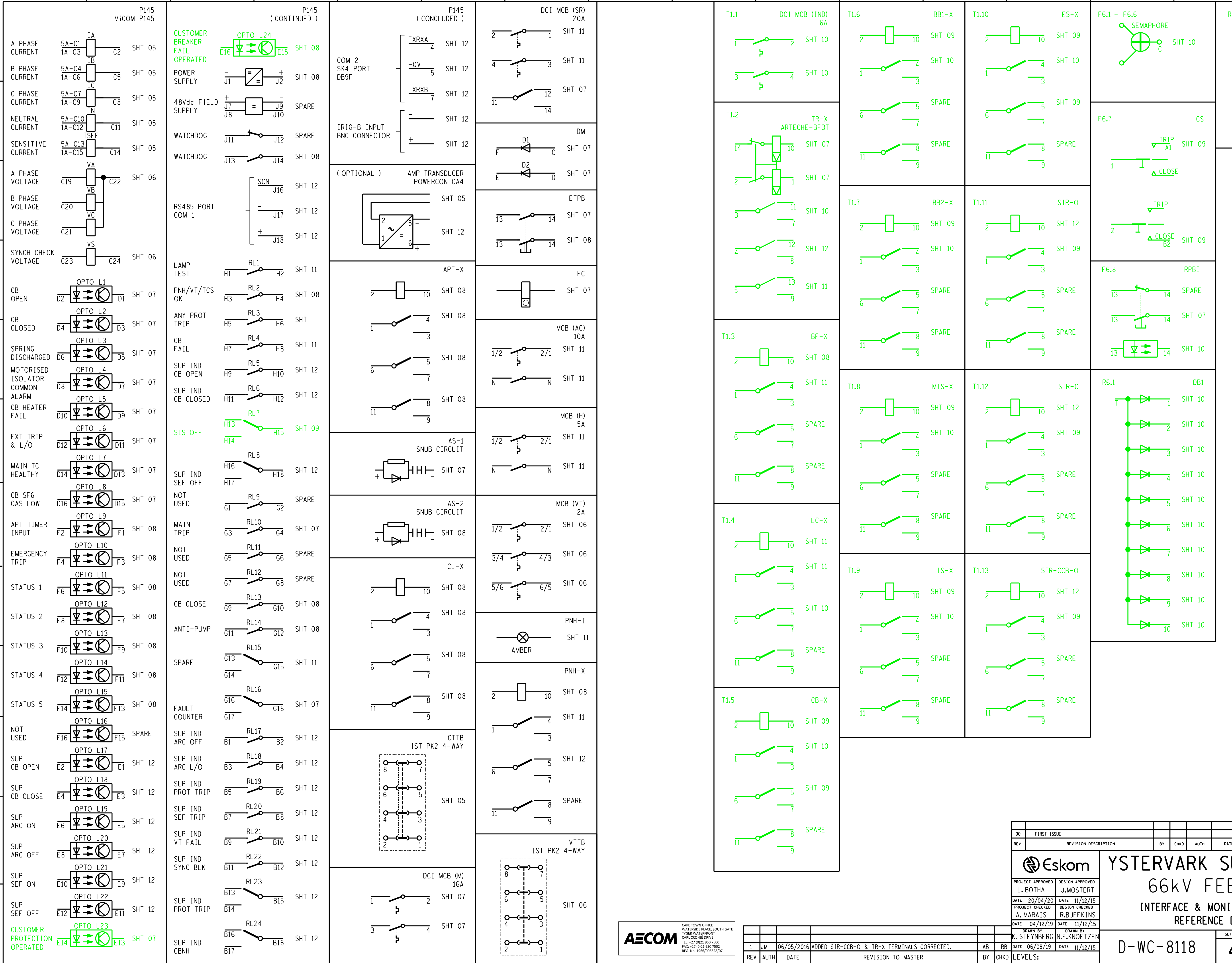
LEVELS: LEVELS 1 3 4 10

A1L

SHEET 12 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME REFERENCE DIAGRAM

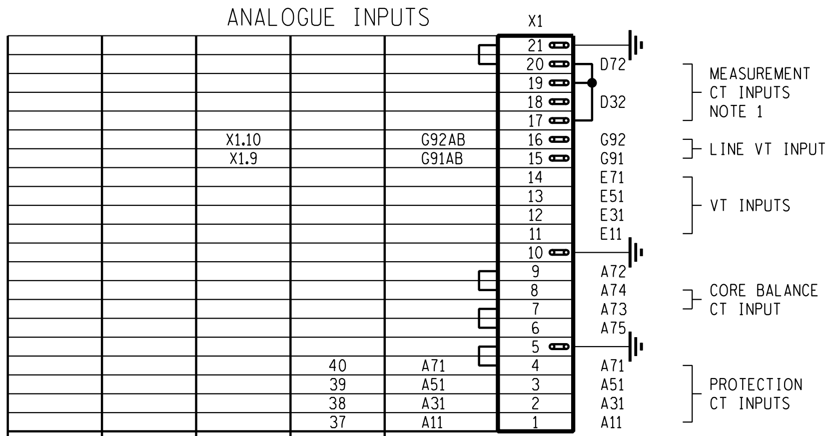
D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
42	13	00

LEVELS: 1 3 4 10

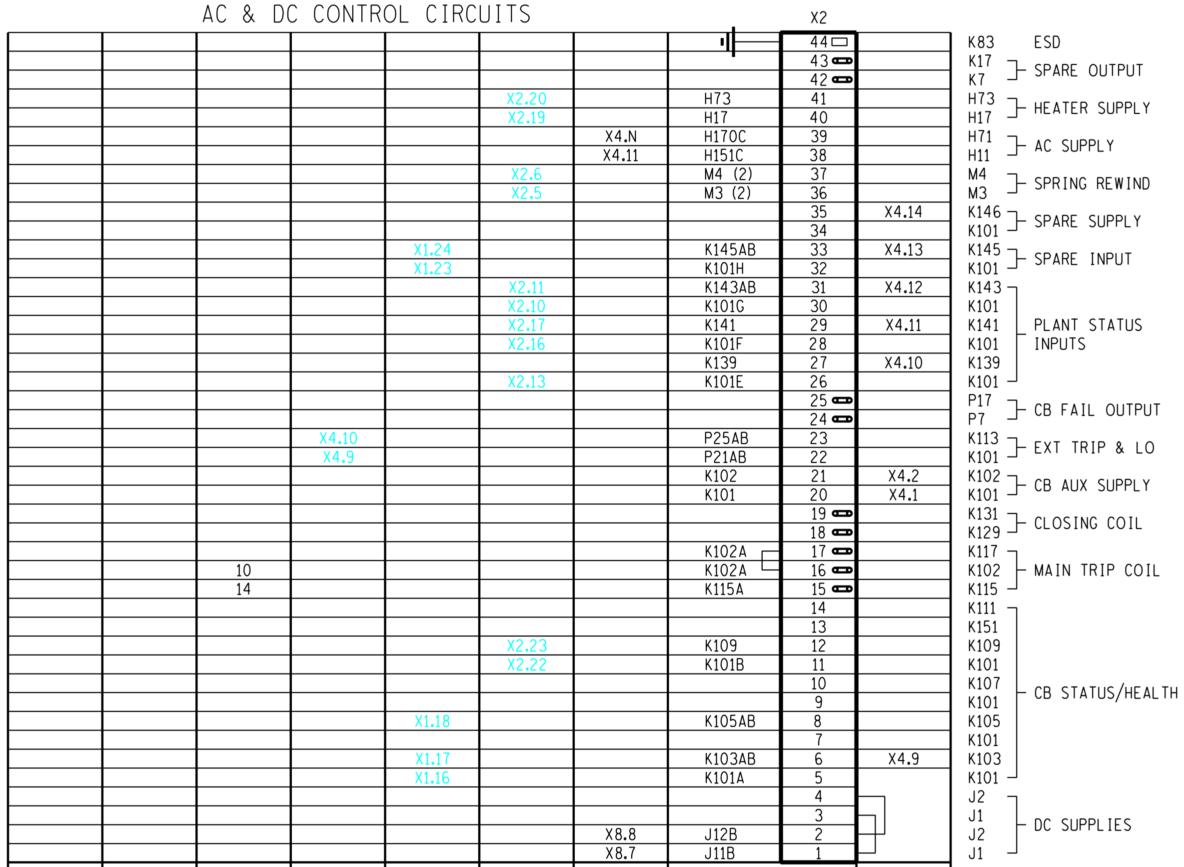
SHEET 13 OF 19 REVISION 1
MASTER TRACING FILED UNDER D-WC-8118
PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)
A1L

ANALOGUE INPUTS



		AB130	AB104	CABLE NUMBER
		4	12	CABLE SIZE
		2	8	NUMBER OF SPARES
		66kV FEEDER 2 CUSTOMER INTERFACE JB	66kV FEEDER 2 CTJB	DESTINATION

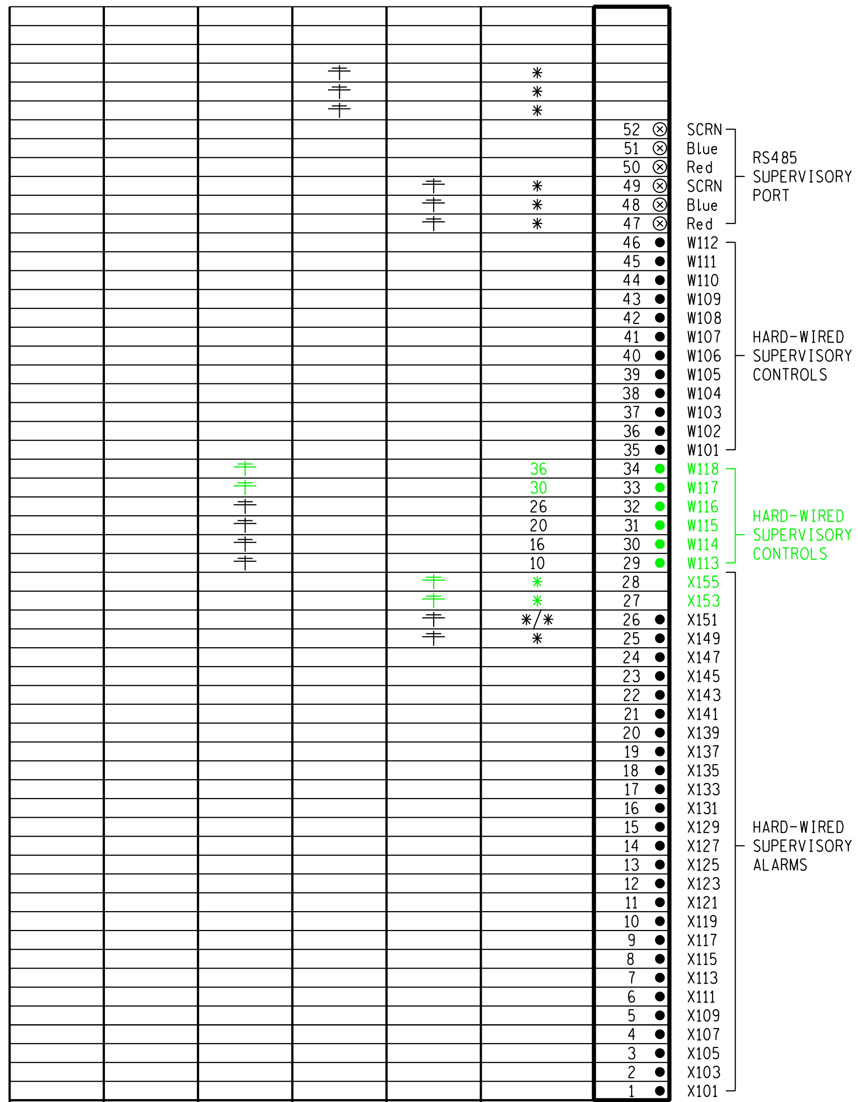
AC & DC CONTROL CIRCUITS



		–	AB117	AB108	AB115	AB122	CABLE NUMBER	–
		–	4	19	19	4	CABLE SIZE	–
		–	2	–	–	–	NUMBER OF SPARES	–
		WIRING TO TRIP REPEAT RELAY (TR-X)	66kV BUSZONE PANEL	66kV FEEDER 2 CUSTOMER INTERFACE JB	66kV FEEDER 2 ISOLATOR JUNCTION BOX	AC/DC PANEL	DESTINATION	WIRING TO STRIP X4

LOOPED TERMINALS	
66kV MIS MB	XT2.33-XT2.36-XT2.37; XT2.34-XT2.38;

SUPERVISORY ALARMS, CONTROLS & SERIAL COMMUNICATION.



		AB123	SA04	AB124	CABLE NUMBER
		10Pr	4	4	CABLE SIZE
		7Pr	1	1	NUMBER OF SPARES
		IDF	TELECOMMS & SUBSTATION AUTOMATION PANEL	RTU (SERIAL COMMUNICATION)	DESTINATION

NOTES:

1. TERMINALS X1.15 - X1.19 ONLY PROVIDED IF AMP TRANSDUCER OPTION IS TAKEN.
2. (2) INDICATES TWO LEADS IN PARALLEL.
3. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
4. LEAD NUMBERS SHOWN THUS
   P7 INDICATES NO CHANGE IN LEAD NUMBER.
   P7 P7A INDICATES CHANGE IN LEAD NUMBER.
5. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
6. THE SYMBOL '✳' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).

STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
● ENTRELEC D2,5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM	AB	RB

LEVELS 1 3 10

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
PANEL CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	14	00

A1L

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 19 REVISION 1

MIMIC INDICATIONS & CONTROL CIRCUITS

FEEDER 3 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV BUSZONE PANEL	66kV FEEDER 2 ISOLATOR JB	66kV FEEDER 2 CUSTOMER INTERFACE JB	DESTINATION	X4		INTERNAL WIRING		
		X4.12			P17AB	24			P15	CUSTOMER BREAKER FAIL (BF-X)
		X4.11			P7AB	23			P5	
				X1.29	P13AB	22			P13	BUS ZONE TRIP (TR-X) & EMERGENCY TRIP TEST PUSH BUTTON
				X1.28	P3AB	21			P3	
						20				SPARE
						19				
				X1.22	K155AB	18			K155	CUSTOMER BREAKER FAIL OPERATED
				X1.21	K101D	17			K101	
				X1.20	K153AB	16			K153	CUSTOMER PROTECTION OPERATED
				X1.19	K101C	15			K101	
	X2.35				K147	14				
	X2.33				K145	13			K145	INDICATION CIRCUITS
	X2.31				K143	12			K143	
	X2.29				K141	11			K141	
	X2.27				K139	10			K139	
	X2.6				K103	9			K103	
						8				
						7			K104	CONTROL CIRCUITS
			X2.4		K106	6			K106	
			X2.3		K165	5			K165	
			X2.2		K161	4			K161	
			X2.1		K101J	3			K101	
	X2.21				K102	2			K102	DC SUPPLIES
	X2.20				K101	1			K101	
X1.11					E111AB	MCB VT2	E11	X6.17	E11	CUSTOMER VT SUPPLY
X1.12					E131AB		E31	X6.18	E31	
X1.13					E151AB		E51	X6.19	E51	
AB136	-	AB117	AB115	AB108	CABLE NUMBER			-		
4	-	4	19	19	CABLE SIZE			-		
-	-	-	4	8	NUMBER OF SPARES			-		

VOLTAGE SELECTION AND DISTRIBUTION

FEEDER 2 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV TARIFF METERING PANEL	66kV BUSBAR 2 VTJB 1	66kV BUSBAR 1 VTJB 1	DESTINATION	X6		INTERNAL WIRING	INTERNAL WIRING
X1.32					X157AB	27	K157		
X131					X159AB	26	K159		
	X1.14				E171AB	25	E71		
		1			E271AB	24	E271		
		MCB-3			E251AB	23	E251		
		MCB-2			E231AB	22	E231		
		MCB-1			E211AB	21	E211		
					E71	20	E71	X1.14	
					E51	19	E51	X1.13	MCB(VT2).5
					E31	18	E31	X1.12	MCB(VT2).3
					E11	17	E11	X1.11	MCB(VT2).1
			38		E472AB	16	E470		
			37		E452AB	15	E450		
			36		E432AB	14	E430		
			35		E412AB	13	E410		
			34		E70AB	12	E70		
			33		E61AB	11	E60		
			32		E41AB	10	E40		
			31		E21AB	9	E20		
				38	E272AB	8	E270		
				37	E252AB	7	E250		
				36	E232AB	6	E230		
				35	E212AB	5	E210		
				34	E71AB	4	E70		
				33	E51AB	3	E50		
				32	E31AB	2	E30		
				31	E11AB	1	E10		
AB108	AB136	AB114	AB111	AB112	CABLE NUMBER			-	-
19	4	4	12	12	CABLE SIZE			-	-
5	-	-	4	4	NUMBER OF SPARES			-	-

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 ▭ INDICATES NO CHANGE IN LEAD NUMBER.
   P7 ▭ P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
5. THE SYMBOL '*' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).
6. STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
   - ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
   - ⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
   - ● ENTRELEC D2.5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
   - ○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
   - ▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
   - TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
   - TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	X4.19 & X4.20 NOT USED.	AB	RB

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
PANEL CABLING DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	15	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 15 OF 19 REVISION 1

To CURRENT TRANSFORMERs

TOP OF TERMINAL STRIP

AB101	AB102	AB103		X1	Wire
		6S2	D171	36	36
		6S1	D151	35	35
		5S2	D71	34	34
		5S1	D51	33	33
		4S5	C71	32	32
		4S1	C51	31	31
		3S4	B171	30	30
		3S1	B151	29	29
		2S4	B71	28	28
		2S1	B51	27	27
		1S3	A71	26	26
		1S2	A51	25	25
	6S2		D171	24	24
	6S1		D131	23	23
	5S2		D71	22	22
	5S1		D31	21	21
	4S5		C71	20	20
	4S1		C31	19	19
	3S4		B171	18	18
	3S1		B131	17	17
	2S4		B71	16	16
	2S1		B31	15	15
	1S3		A71	14	14
	1S2		A31	13	13
6S2			D171	12	12
6S1			D111	11	11
5S2			D71	10	10
5S1			D11	9	9
4S5			C71	8	8
4S1			C11	7	7
3S4			B171	6	6
3S1			B111	5	5
2S4			B71	4	4
2S1			B11	3	3
1S3			A71	2	2
1S2			A11	1	1
AB101	AB102	AB103	CABLE NUMBER		
12	12	12	CABLE SIZE		
-	-	-	NUMBER OF SPARES		
66kV FEEDER 2 RED PHASE CT	66kV FEEDER 2 WHITE PHASE CT	66kV FEEDER 2 BLUE PHASE CT	DESTINATION		

To CONTROL ROOM & BZJB

Wire	X2		AB104	AB133	Core
12	72 R				CORE 6
24	71 W				CORE 6
36	70 B	D171AB		17	CORE 6
35	69 B	D151AB		16	CORE 6
23	68 W	D131AB		15	CORE 6
11	67 R	D111AB		14	CORE 6
10	66 R				CORE 5
22	65 W				CORE 5
34	64 B	D71AB		5	CORE 5
33	63 B	D51AB		4	CORE 5
21	62 W	D31AB		3	CORE 5
9	61 R	D11AB		2	CORE 5
8	60 R				CORE 4
20	59 W				CORE 4
32	58 B				CORE 4
31	57 B				CORE 4
19	56 W				CORE 4
7	55 R				CORE 4
6	54 R				CORE 3
18	53 W				CORE 3
30	52 B				CORE 3
29	51 B				CORE 3
17	50 W				CORE 3
5	49 R				CORE 3
4	48 R				CORE 2
16	47 W				CORE 2
28	46 B				CORE 2
27	45 B				CORE 2
15	44 W				CORE 2
3	43 R				CORE 2
2	42 R				CORE 1
14	41 W				CORE 1
26	40 B	A71	X1.4		CORE 1
25	39 B	A51	X1.3		CORE 1
13	38 W	A31	X1.2		CORE 1
1	37 R	A11	X1.1		CORE 1
		CABLE NUMBER	AB104	AB133	
		CABLE SIZE	12	12	
		NUMBER OF SPARES	8	4	
		DESTINATION	66kV FEEDER 2 RELAY PANEL	TARIFF METERING PANEL 1 66kV FEEDER 2 TARIFF METER MODULE	

TERMINAL LOOPS	
CT JB	40-41-42-43-44-45-46-47-48-EARTH, 49-50-51-52-53-54-EARTH, 55-56-57-58-59-60-EARTH, 61-62-63-64-65-66-67-68-69-70-71-72

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L.BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A.MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K.STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
CTJB CABLING

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
42	16	00

LEVELS: 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 16 OF 19 REVISION 1

X1

					X1.1	B110AB	1	*	*		
					X1.3	B130AB	2	*	*		
					X1.5	B150AB	3	*	*		
					X1.7	B171AB	4	*	*		
				X3.5		B11AB	5	*	*		
				X3.6		B31AB	6	*	*		
				X3.7		B51AB	7	*	*		
				X3.8		B71AB	8	*	*		
		X1.15				G91AB	9	*			*
		X1.16				G92AB	10	*			*
	2/1					E111AB	11	*		*	
	3/4					E131AB	12	*		*	
	5/6					E151AB	13	*		*	
X1.28						E171AB	14	*		*	
							15				
			X2.5			K101A	16	*		*	
			X2.6			K103AB	17	*		*	
			X2.8			K105AB	18	*		*	
			X4.15			K101C	19	*		*	
			X4.16			K153AB	20	*		*	
			X4.17			K101D	21	*		*	
			X4.18			K155AB	22	*		*	
			X2.32			K101H	23	*		*	
			X2.33			K145AB	24	*		*	
							25				
							26				
							27				
			X4.21			P3AB	28	*		*	
			X4.22			P13AB	29	*		*	
							30				
			X6.26			K159AB	31	*		*	
			X6.27			K157AB	32	*		*	
AB113	AB113	AB130	AB108	AB117	*	CABLE NUMBER			*	*	*
4	4	4	19	12	4	CABLE SIZE			*	*	*
-	-	-	7	4	-	NUMBER OF SPARES			*	*	*
66kV FEEDER 2 RELAY PANEL	66kV FEEDER 2 RELAY PANEL TERMINAL STRIP 4 MCB(VT2)	66kV FEEDER 2 RELAY PANEL	66kV FEEDER 2 RELAY PANEL	66kV BUSZONE PANEL	66kV FEEDER 2 ISOLATOR JUNCTION BOX	DESTINATION			66kV TRANSFORMER 3 CTJB (CUSTOMER CT)	66kV TRANSFORMER 3 RELAY PANEL (CUSTOMER PROTECTION PANEL)	66kV TRANSFORMER 3 VTJB

X2

H10	1	H10**		*
H30	2	H30**		*
H50	3	H50**		*
H70	4	H70**		*
H12	5	H12AB	R2	
H32	6	H32AB	W2	
H52	7	H52AB	B2	
H70	8	H72AB	N2	
CABLE NUMBER			18	*
CABLE SIZE			4	*
NUMBER OF SPARES			-	*
DESTINATION			YARD AC/DC DISTRIBUTION BOARD	CUSTOMER AC/DC PANEL

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	**DESIGN CHECKED**
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	**DRAWN BY**
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
CUSTOMER INTERFACE JB

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	17	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 17 OF 19 REVISION 1

X2

		XT1.5			K101J	1	K101J	X4.3				
		XT1.7			K161	2	K161	X4.4				
		XT1.8			K165	3	K165	X4.5				
		XT1.4			K106	4	K106	X4.6				
		XT1.1			M3 (2)	5	M3 (2)	X2.36				
		XT1.2			M4 (2)	6	M4 (2)	X2.37				
						7						
						8						
						9						
		XT2.23			K101G	10	K101G	X2.30				
		XT2.24			K143	11	K143	X2.31				
						12						
				X1.48	K101E	13	K101E	X2.26				
				X1.49	K139	14	K139	X2.27				
						15						
			X1.48		K101F	16	K101F	X2.29				
			X1.49		K141	17	K141	X2.30				
						18						
		XT2.20			H17	19	H17	X2.40				
		XT2.21			H73	20	H73	X2.41				
						21						
		XT2.33			K101B	22	K101B	X2.11				
		XT2.34			K109	23	K109	X2.12				
						24						
						25						
						26						
						27						
						28						
						29						
						30						
						31						
						32						
						33						
		AB110	AB125	AB109	CABLE NUMBER			AB115				
		19	12	12	CABLE SIZE			19				
		7	4	4	NUMBER OF SPARES			3				
		66kV MOT.LINE ISMB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 2 RP				

X1

					X1.32	B110AB	1	B110AB	X1.1				
					X1.33	B111AB	2	B111AB		X1.5			
					X1.36	B130AB	3	B130AB	X1.2				
					X1.37	B131AB	4	B131AB		X1.6			
					X1.40	B150AB	5	B150AB	X1.3				
					X1.41	B151AB	6	B151AB		X1.7			
			48			B171AB	7	B171AB		X1.8			
				X1.32			8	B210AB					
				X1.33		B211AB	9	B211AB		X2.5			
				X1.36			10	B230AB					
				X1.37		B231AB	11	B231AB		X2.6			
				X1.40			12	B250AB					
				X1.41		B251AB	13	B251AB		X2.7			
							14	B271AB		X2.8			
							15						
							16						
							17						
							18						
							19						
							20						
							21						
							22						
							23						
							24						
							25						
							26						
							27						
							28						
							29						
							30						
			AB132	AB125	AB109	CABLE NUMBER			AB132	AB126			
			4	12	12	CABLE SIZE			4	12			
			-	4	4	NUMBER OF SPARES			-	4			
			66kV FDR 2 CIJB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 2 CIJB	66kV BUSZONE RP			

LOOPED TERMINALS	
BB1 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
BB2 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
MOT. ISMB	XT2.33-XT2.36; XT2.34-XT2.38
ISJB	X1.1-X1.8; X1.3-X1.10; X1.5-X1.12; X1.7-X1.14

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15
LEVELS:	

YSTERVARK SUBSTATION
66kV FEEDER 2
INTERFACE & MONITORING SCHEME
ISJB CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	18	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 19 REVISION 1

SEE D-WC-8118 SET 159

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 2

INTERFACE & MONITORING SCHEME
CABLE BLOCK DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	19	00

LEVELS 1 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 19 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	2	29/05/2015	UPDATED DESIGN CHANGE DESCRIPTION
01	PANEL EQUIPMENT LAYOUT	2	29/05/2015	UPDATED BACKPLATE NUMBERS OF TERMINALS
02	LOGIC DIAGRAM	2	29/05/2015	LEVEL 2 & 3 NOTES ADDED
03	SINGLE LINE DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
04	AC KEY DIAGRAM	2	29/05/2015	CORRECTED ALL CT CORES NEUTRAL, R & B DESIGNATIONS
05	VT SUPPLY KEY DIAGRAM	2	29/05/2015	ADDED 4 TERMINALS TO METERING VT SUPPLY
06	MAIN DC KEY DIAGRAM	2	29/05/2015	TEST TERMINALS ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 1 ADDED
07	MAIN DC KEY DIAGRAM	2	29/05/2015	IED PSU WIRE NUMBER CORRECTED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
08	TELEPROTECTION DC KEY DIAGRAM	2	29/05/2015	ADDED EXPLANATORY NOTE AND SET THREE TERMINAL DIFFERENTIAL OPTION TO LEVEL 4
09	BACK-UP DC KEY DIAGRAM	2	29/05/2015	TEST TERMINALS ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
10	BACK-UP DC KEY DIAGRAM	2	29/05/2015	LEVEL 12 & 13 BREAKER DETAILS UPDATED
11	BACK-UP DC KEY DIAGRAM	2	29/05/2015	NOTE 2 DETAIL ADDED, LEVEL 12 & 13 BREAKER DETAILS UPDATED
12	CLOSE DC KEY DIAGRAM	2	29/05/2015	CBC-CR AND CBCS-X1 TERMINALS CORRECTED, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 3 ADDED
13	INDICATION DC KEY DIAGRAM	2	29/05/2015	LEVEL 12 & 13 BREAKER DETAILS UPDATED
14	SPRING REWIND AND AC KEY DIAGRAM	2	29/05/2015	UPDATED DISCHARGE POINT TERMINAL NUMBER, LEVEL 12 & 13 BREAKER DETAILS UPDATED, NOTE 1 ADDED
15	REA AND MEASUREMENTS KEY DIAGRAM	2	29/05/2015	ALTERED RJ45 CONNECTIONS DISPLAY SYMBOL (LEVEL 28)
16	SUPERVISORY STATUS & CONTROL KEY DIAGRAM	2	29/05/2015	DROPPING RESISTORS REMOVED & NOTE 1 ALTERED
17	SUPERVISORY ALARMS KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
18	DISTURBANCE RECORDER KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
19	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	X71 P7 INPUT DESIGNATIONS UPDATED
20	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	FLIP FLOP STATE AND RELAYS RXMB1 & RXMA1 OHMIC VALUES UPDATED, MODULE RCPM.C/T & R2F.1 REFERENCE SHEET NUMBERS UPDATED
21	PROTECTION REFERENCE DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
22	PANEL CABLING DIAGRAM	2	29/05/2015	ADDED 4 TERMINALS TO X2.39-42, LEVEL 12 & 13 BREAKER DETAILS UPDATED
23	PANEL CABLING DIAGRAM	2	29/05/2015	CORRECTED X6.39 TERMINAL TYPE & REMOVED X5 DROPPING RESISTORS; ADDED TEST SOCKET DETAILS, LVL 12 & 13 BREAKER DETAILS UPDATED
24	PANEL CABLING DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
25	CTJB CABLING DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
26	LINE VTJB LAYOUT & KEY DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION
27	CABLE BLOCK DIAGRAM	2	29/05/2015	AS PER PREVIOUS REVISION

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2	4FZD3920 DISTANCE/ DIFFERENTIAL SCHEME	17	
3	4FZ3920 DISTANCE SCHEME	18	FEEDER PRIMARY OUTBOARD BYPASS (ORDERING OPTION)
4	THREE TERMINAL DIFFERENTIAL OPTION	19	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - ACTOM AREVA i5MT FREE ISSUED)
5		20	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - CAMILLE BAUER SINEAX)
6		21	FRONT PLATE V AND I ANALOGUE METERS (ORDERING OPTION)
7		22	SINGLE PHASE V AND I TRANSDUCERS (ORDERING OPTION)
8		23	SUPERVISORY INDICATION AND CONTROL (HARDWIRED) (ORDERING OPTION)
9		24	IDF WIRING (HARDWIRED)
10	STANDARD DESIGN DRAWING	25	SUPERVISORY STATUS INDICATION (DNP3)
11	STANDARD CTJB AC CONNECTION	26	DISTURBANCE RECORDER (ORDERING OPTION)
12	STANDARD OUTDOOR HV ABB 3P CIRCUIT-BREAKER 132kV (AS PER ABB DRAWINGS 1HSB543200-AAF REV G)	27	STANDARD COMMS OPTIONS (FIBRE AND SPA REMOTE ENG. ACCESS)
13	STANDARD OUTDOOR HV ABB 3P CIRCUIT-BREAKER 36-72.5kV (AS PER ABB DRAWINGS 1HYB902173 REV 3)	28	IEC-61850/ETHERNET COMMS (ORDERING OPTION)
14	VOLTAGE SELECTOR RELAY (VSR) DOUBLE BUSBAR (ORDERING OPTION)	29	TIME SYNCHRONISATION EXTERNAL INPUTS RED670
15	LINE VT CONNECTION DIAGRAM	30	TIME SYNCHRONISATION INTERNAL INPUTS RED670 (ORDERING OPTION)

θ MUTUALLY EXCLUSIVE LEVELS/SHEETS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.
x MUTUALLY INCLUSIVE LEVELS/SHEETS.

66kV FEEDER 3: BLOUWATER/ISCOR 1

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
COVER SHEET

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	43	00	00

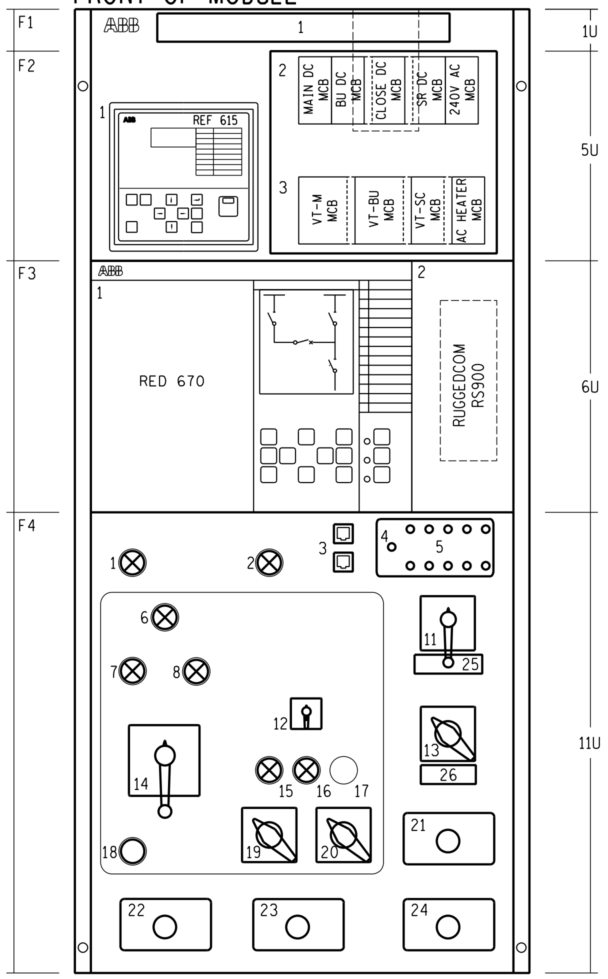
LEVELS 1 5 10

PANEL TYPE DESIGNATION 4FZD-3920

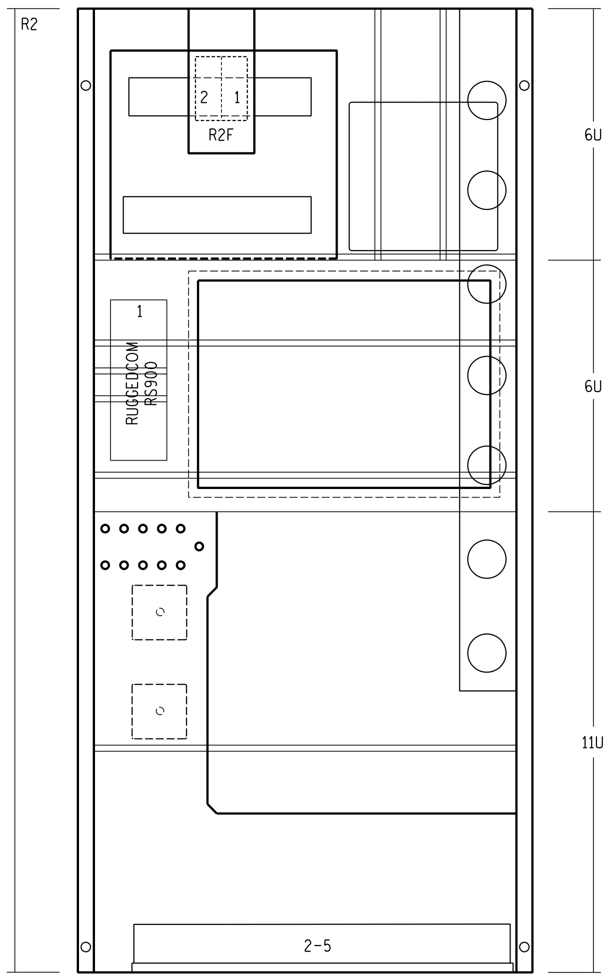
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 00 OF 27 REVISION 00

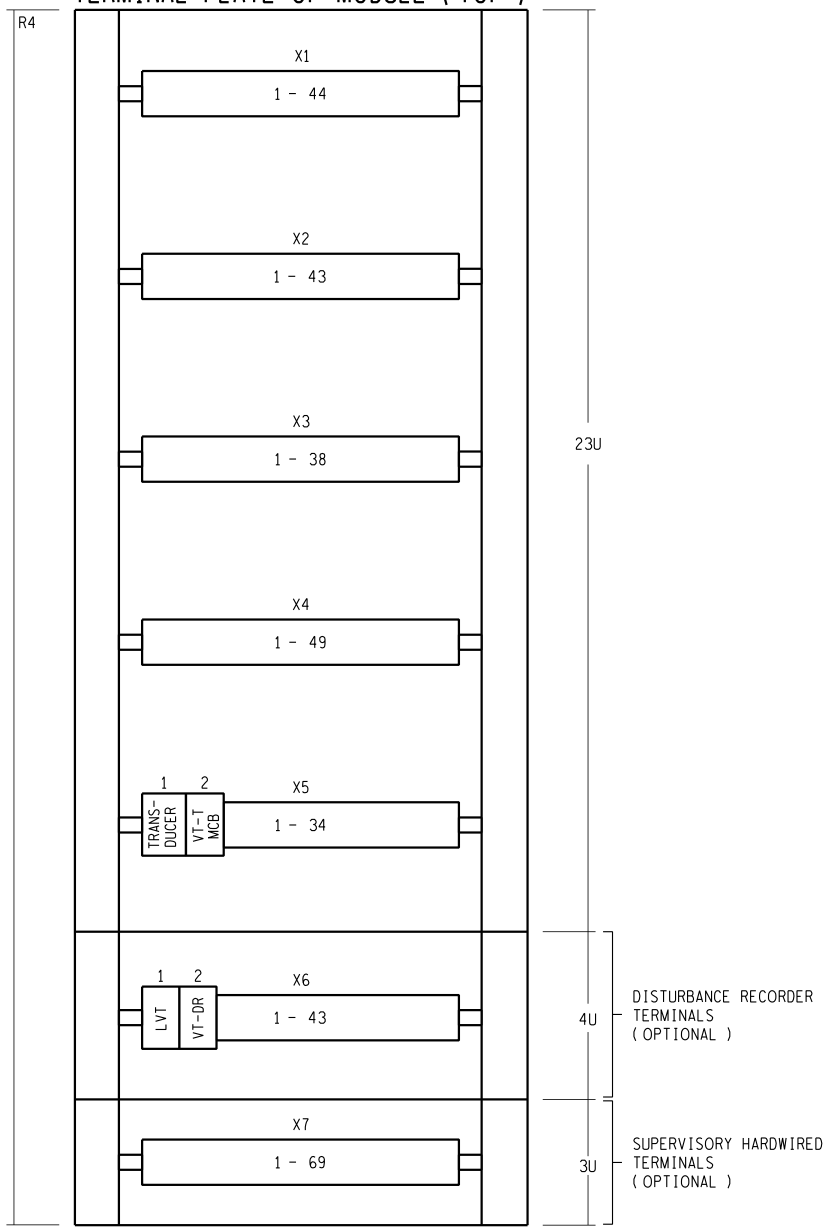
FRONT OF MODULE



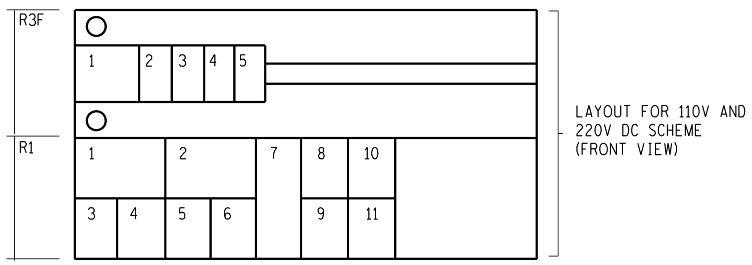
REAR OF MODULE



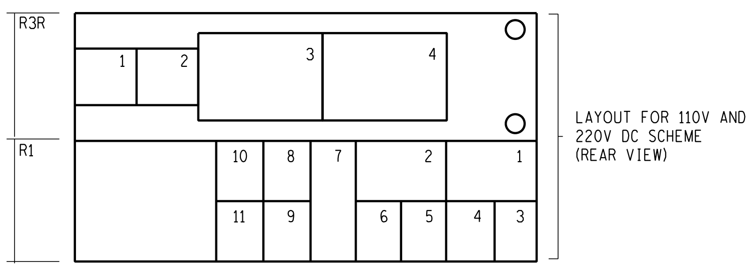
TERMINAL PLATE OF MODULE (TOP)



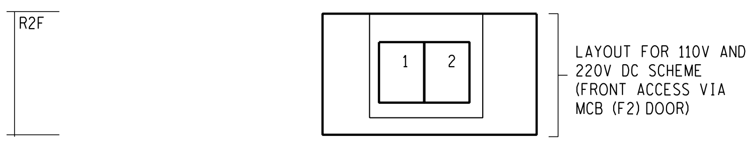
INTERNAL TO MODULE



INTERNAL TO MODULE



INTERNAL TO MODULE



LOCATION			DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT OF MODULE						
F1	1		LABEL			
F2	1		BACK-UP IED	DIRECTIONAL BACK-UP PROTECTION	REF615	ABB
	2	1	MCB(M)	MAIN DC SUPPLY MCB (110V, 220V SCHEME) (16 AMP)	S282-UC B16	ABB
		2	MCB(BU)	BACK-UP DC SUPPLY MCB (110V, 220V SCHEME) (16 AMP)	S282-UC B16	ABB
		3	MCBX(CL)	CLOSE DC SUPPLY MCB AUXILIARY CONTACT	S2-H11 I	ABB
		4	MCB(CL)	CLOSE DC SUPPLY MCB (110V, 220V SCHEME) (10 AMP)	S282-UC B10	ABB
		5	MCBX(SR)	SPRING REWIND DC SUPPLY MCB AUXILIARY CONTACT	S2-H11 I	ABB
		6	MCB(SR)	SPRING REWIND DC SUPPLY MCB (110V, 220V SCHEME) (20 AMP)	S282-UC B20	ABB
		7	MCB(AC)	MAIN AC SUPPLY MCB (10 AMP)	S282-UC B10	ABB
	3	1	MCB(VT-M)	VT SUPPLY MAIN PROTECTION MCB (3 POLE) (2 AMP)	S203-C 2	ABB
		2	MCBX(VT-M)	VT SUPPLY MAIN PROTECTION MCB AUXILIARY CONTACT	S2C-H6R	ABB
		3	MCB(VT-BU)	VT SUPPLY BACK-UP PROTECTION MCB (3 POLE) (2 AMP)	S203-C 2	ABB
		4	MCBX(VT-BU)	VT SUPPLY BACK-UP PROTECTION MCB AUXILIARY CONTACT	S2C-H6R	ABB
		5	MCB(VT-SC)	VT SUPPLY SYNCH CHECK MCB (2 AMP)	S202-C 2	ABB
		6	MCBX(VT-SC)	VT SUPPLY SYNCH CHECK MCB AUXILIARY CONTACT	S2C-H6R	ABB
		7	MCB(H)	HEATER SUPPLY MCB (6 AMP)	S282-UC B6	ABB
F3	1		MAIN IED	INTERGRATED DISTANCE/DIFFERENTIAL FEEDER PROTECTION RELAY	RED670	ABB
F4	1		PNH	PROTECTION NOT HEALTHY INDICATION (AMBER)	CL523Y	ABB
	2		ARC-OFF/LOCKED-OUT	AUTO RECLOSE OFF & CLOSE LOCK-OUT INDICATION (AMBER) (CL520 = 240V DC)	CL515Y	ABB
	3		IEC61850 RELAY COM PORTS	IEC61850 RELAY TEST ETHERNET COMMUNICATION PORTS		
	4		ESD	ELECTROSTATIC DISCHARGE POINT	SOCKET (BLUE)	COMMUNICA
	5	1	TP-1	TEST POINT 1 - MAIN PROTECTION TRIP (RED PHASE)	SOCKET (RED)	COMMUNICA
		2	TP-2	TEST POINT 2 - MAIN PROTECTION TRIP (WHITE PHASE)	SOCKET (RED)	COMMUNICA
		3	TP-3	TEST POINT 3 - MAIN PROTECTION TRIP (BLUE PHASE)	SOCKET (RED)	COMMUNICA
		4	TP-4	TEST POINT 4 - BREAKER FAIL BUS STRIP	SOCKET (RED)	COMMUNICA
		5	TP-5	TEST POINT 5 - MAIN DC NEGATIVE SUPPLY	SOCKET (BLACK)	COMMUNICA
		6	TP-6	TEST POINT 6 - BREAKER FAIL RETRIP CROSS TRIP	SOCKET (RED)	COMMUNICA
		7	TP-7	TEST POINT 7 - SUPERVISORY TRIP	SOCKET (RED)	COMMUNICA
		8	TP-8	TEST POINT 8 - BACK-UP PROTECTION TRIP	SOCKET (RED)	COMMUNICA
		9	TP-9	TEST POINT 9 - ARC OR EXTERNAL CLOSE	SOCKET (RED)	COMMUNICA
		10	TP-10	TEST POINT 10 - BACK-UP DC NEGATIVE SUPPLY	SOCKET (BLACK)	COMMUNICA
	6		CBNH	CIRCUIT BREAKER NOT HEALTHY INDICATION (AMBER)	CL515Y	ABB
	7		CBO	CIRCUIT BREAKER OPEN INDICATION (GREEN)	CL515G	ABB
	8		CBC	CIRCUIT BREAKER CLOSE INDICATION (RED)	CL515R	ABB
	11		TNS	TEST NORMAL SWITCH	CR0867	LOP SWITCH
	12		LCS	LAMP CHECK SWITCH	CA4 A321-621	KRAUSE & NAIMER
	13		TPIS	TELEPROTECTION ISOLATOR SWITCH	CR-0866	LOP SWITCH
	14		CBCS	CIRCUIT BREAKER CONTROL SWITCH	CR-0604	LOP SWITCH
	15		ARC OFF	AUTO RECLOSE SELECTION STATE PUSH BUTTON (AMBER) (110V OR 220V DC)	MP3-11Y, MBH-101	ABB
	16		ARC 3 POLE	AUTO RECLOSE SELECTION STATE PUSH BUTTON (AMBER) (110V OR 220V DC)	MP3-11Y, MBH-101	ABB
	17			(BLANK)		
	18		TTPB	TRIP TEST PUSH BUTTON/ PROTECTIVE COVER	CP10-10R-10/ YSF	ABB
	19		BFIS	BREAKER FAIL ISOLATOR SWITCH	CR-0866A	LOP SWITCH
	20		SIS	SUPERVISORY ISOLATOR SWITCH	CR-0316	LOP SWITCH
	21		CTTB-BU	CT TEST BLOCK (BACK-UP)	PK2 (4 WAY)	IST
	22		CTTB-M	CT TEST BLOCK (MAIN)	PK2 (4 WAY)	IST
	23		VTTB-M	VT TEST BLOCK (MAIN)	PK2 (4 WAY)	IST
	24		VTTB-BU	VT TEST BLOCK (BACK-UP)	PK2 (4 WAY)	IST
	25		M.O.T. - LINK A CLOSED =	LABEL INDICATING EMERGENCY CLOSE CONTROL WITHOUT SYNCH CHECK WHEN		
			NO SYNCH CHECK	LINK A IS CLOSED, AND TNS SELECTED TO MAIN ON TEST		
	26		REMOTE DIFF ISOLATION	LABEL INDICATING TPIS BLOCKS REMOTE DIFF UNIT (OPTIONAL)		
INTERNAL TO MODULE						
R1	1		VSR-1	ISOLATOR 1 REPEAT RELAY (✳ AN=110V DC, AS=220V DC) (OPTIONAL)	RXMVB 2 RK 251205-✳	ABB
	2		VSR-2	ISOLATOR 2 REPEAT RELAY (✳ AN=110V DC, AS=220V DC) (OPTIONAL)	RXMVB 2 RK 251205-✳	ABB
	3			(BLANK)		
	4			(BLANK)		
	5		RCPM_C/T	SNUBBER CIRCUIT	RCPM1 PR56512029-AA	ABB
	6		CT-X	BACK-UP TO MAIN CROSS TRIP AUXILIARY RELAY (✳ AN = 110V DC, AS = 220V DC)	RXMA 1 RK 211072-✳	ABB
	7		PSU	48 VOLT DC POWER SUPPLY UNIT (OPTIONAL)	RXTUG	ABB
	8		TCS-M	TRIP CIRCUIT SUPERVISION MAIN (MAIN)	BTCS110	ABB
	9			(BLANK)		
	10			(BLANK)		
	11		TCS-BU	TRIP CIRCUIT SUPERVISION BACK-UP (BACK-UP)	BTCS110	ABB
R3F	1		D1	LAMP CHECK DIODES	PR56592018	WEIDMULLER/ ABB
	2		D2	CROSS TRIP DIODES	PR56512033.BA	WEIDMULLER/ ABB
	3		D3	CROSS TRIP DIODES	PR56512033.BA	WEIDMULLER/ ABB
	4		D4	BLOCKING DIODE (MEASURING POINTS)	PR56592018/4.PNH	WEIDMULLER/ ABB
	5		D5	BLOCKING DIODE (TRIP CIRCUIT SUPERVISION 3 POLE)	PR56512033.BA	WEIDMULLER/ ABB
R3R	1		DCF-M	DC FAIL RELAY (MAIN) (✳ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	2		DCF-BU	DC FAIL RELAY (BACKUP) (✳ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	3		MCTS	MAIN CT SHORTING RELAY (✳ 110=110V DC, 220=220V DC) (OPTIONAL)	BJ8-110V DC	ARTECHE
	4		BCTS	BACK-UP CT SHORTING RELAY (✳ 110=110V DC, 220=220V DC) (OPTIONAL)	BJ8-110V DC	ARTECHE
R2F	1		CBC-CR	CIRCUIT BREAKER CLOSE AUXILIARY RELAY (✳ AN = 110V DC, AS = 220V DC)	RXMB1 1MRK 000 803-✳	ABB
	2			(BLANK)		
REAR OF MODULE						
R2	1		ROUTER	IEC61850 ROUTER (OPTIONAL)	RS900-HI-D-MTMTMT	RUGGEDCOM
	2		CBOS-X1	CIRCUIT BREAKER OPEN SUPERVISORY AUXILIARY 1 RELAY (48V DC) (OPTIONAL)	CR-U048DC3	ABB
	3		CBCS-X1	CIRCUIT BREAKER CLOSE SUPERVISORY AUXILIARY 1 RELAY (48V DC) (OPTIONAL)	CR-U048DC3	ABB
	4		PNH-X1	PROTECTION NOT HEALTHY AUXILIARY 1 RELAY (✳ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
	5		PNH-X2	PROTECTION NOT HEALTHY AUXILIARY 2 RELAY (✳ 110=110V DC, 220=220V DC)	CR-U110DC3L	ABB
				(OPTIONAL 3 PHASE)	SINEAX CAM/iSTATi5MT	CAMILLE/ AREVA
R4	X5.1		TRANSDUCER	MEASUREMENTS TRANSDUCER & INTERFACE (OPTIONAL 1 PHASE)	SINEAX U543,I543	CAMILLE BAUER
				(OPTIONAL 1 PHASE)	VA4-LDG6, CA4-LDG6	POWERCON
	X5.2		MCB (VT-T)	TRANSDUCER VT SUPPLY MCB (3 POLE) (2 AMP)	S203-C 2	ABB
	X6.1		MCB (LVT)	DISTURBANCE RECORDER LVT SUPPLY MCB (OPTIONAL) (1 AMP)	S202-C 1	ABB
	X6.2		MCB (VT-DR)	DISTURBANCE RECORDER VT SUPPLY MCB (3 POLE) (OPTIONAL) (1 AMP)	S203-C 1	ABB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
PANEL EQUIPMENT LAYOUT

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	01	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 01 OF 27 REVISION 00

REF670 AND REF615 RELAYS USE PCM600 AS THEIR SOFTWARE TOOL. THE REQUIRED CONNECTIVITY PACKAGES FOR THESE RELAYS IS THE RELION SERIES SOFTWARE.

RED670: MAIN DISTANCE/DIFFERENTIAL RELAY
NOTE THAT THE INTERNAL TELEPROTECTION/DIFFERENTIAL COMMUNICATION LINK OF THIS RELAY IS ONLY COMPATABLE WITH A MIRRORED RELAY ON THE DISTRIBUTION CONTRACT OR SCHEMES 6FZD3500 AND 6FZD3600 ON THE TRANSMISSION CONTRACT.

EXPLANATION OF THE CONTROLLED SWITCHES USED IN THE RED670 MAIN RELAY
GT SWITCHES, WHICH ARE SETTABLE IN THE PCM600 ENGINEERING PARAMETER SETTING (PS) SOFTWARE, AND MAY BE FOUND WITHIN THE PARAMETER SETTINGS UNDER THE APPLICATION CONFIGURATION SECTIONS THEY ARE CONFIGURED WITHIN, ARE MASKED AS FOLLOWS:

GT-01) INTERNAL COMMUNICATION CARD LINK FAIL FUNCTION SELECTION
SET GT01 TO 'ON' (THE DEFAULT) IF THE SCHEME HAS A COMMUNICATION CARD IN SLOT X34 OR X35 AND IT IS USED.
SET GT01 TO 'OFF' IF THE CARD IS NOT USED OR IF THE SCHEME DOES NOT HAVE A COMMUNICATION CARD IN SLOT X34 OR X35.

TO TAKE ADVANTAGE OF THE TEF CARRIER GUARD FAIL MASKING: SET UNBLOCK = RESTART IN THE PST SOFTWARE AND SET SECURITY = 35ms.

GT-02) TEST OUTPUTS
SET GT02 TO 'ON' TO ENABLE PHASE AND EARTH FAULT IMPEDANCE STARTER TEST OUTPUTS.
SET GT02 TO 'OFF' (THE DEFAULT) TO ENABLE CARRIER RECEIVE AND CARRIER SEND TEST OUTPUTS.

GT-03) INSTANTANEOUS TRIP PARALLEL/SERIES LOGIC FUNCTION SELECTION
SET GT03 TO 'OFF' (THE DEFAULT) FOR PARALLEL OPTION WHICH ALLOWS EITHER FUNCTION, DIFFERENTIAL OR DISTANCE (Z1 OR Z2 AIDED), TO INITIATE THE TRIP (INCREASED DEPENDABILITY).
WITH GT03 SET 'ON', THE SERIES OPTION IS CHOSEN WHICH REQUIRES BOTH FUNCTIONS TO OPERATE TO INITIATE AN INSTANTANEOUS TRIP (INCREASED SECURITY).

GT-04) CARRIER GUARD ZONE ACCELERATION BLOCK
SET GT04 TO 'OFF' (THE DEFAULT) IN 'Application Configuration/Monitoring/Logic/LogicGate' WHEN THE CARRIER GUARD IS NOT USED.
SET GT04 TO 'ON' WHEN USING THE CARRIER GUARD AND USING THE ZONE ACCELERATION FUNCTIONALITY. NOTE THAT ZONE ACCELERATION CAN BE SET ON OR OFF (THE DEFAULT) WITHIN THE SETTINGS AND SHOULD ONLY BE USED FOR SINGLE RADIAL LINES.

GT-05) CARRIER GUARD SELECTION
SET GT05 TO 'ON' FOR CARRIER GUARD USEAGE. SET TO 'OFF' (THE DEFAULT) IF THERE IS NO 50V DC SUPPLY TO THE EXTERNAL TELEPROTECTION (PLC) SCHEME CIRCUIT.

GT-06) PARALLEL FEEDER DISTANCE-TO-FAULT COMPENSATION SELECTION
SET GT06 TO 'OFF' (THE DEFAULT) FOR NO PARALLEL FEEDER DISTANCE TO FAULT COMPENSATION (FAULT LOCATOR ACCURACY).
SET GT06 TO 'ON' FOR DTF FAULT LOCATOR COMPENSATION FOR PARALLEL FEEDERS (DOUBLE CIRCUIT FEEDERS).

GT-07) UNDERVOLTAGE OVERLOAD TRIP OR OVERVOLTAGE TRIP FUNCTION SELECTION
THE U/V OVERLOAD TRIP FUNCTION (THE DEFAULT) MAY BE REPLACED WITH THE 'OVLD' TRIP FUNCTION (SET GT07 TO 'ON' FOR OVLD TRIP) IF THE SOLE CRITERIA IS CURRENT.

A SETTABLE TIMER FUNCTION, TS14, IS USED FOR THE TIMING OF THE OVERLOAD (OVLD) TRIP FUNCTION. TS14 WILL DELAY THE OVERLOAD TRIP OUTPUT AND IS SETTABLE IN THE PST SOFTWARE. TS14 IS IN SERIES WITH THE OVLD FUNCTION TIMER T OUTPUT (i.e. THE TIMERS ARE ADATIVE). IF TS14 IS SET TO 'OFF', THE OVLD TRIP AND THE U/V OVLD ARE BLOCKED BUT THE OVLD ALARM WOULD REMAIN FUNCTIONAL (i.e. THE OVLD ALARM OUTPUT IS TAKEN OFF BEFORE TS14 AND THE OVLD ALARM WOULD OPERATE AFTER OVLD FUNCTION TIME TIMEOUT).
NOTE THAT THE U/V FUNCTION TIMER RUNS CONCURRENTLY WITH THE OVLD TRIP OUTPUT FOR THE U/V TRIP OUTPUT.

GT-08) BROKEN CONDUCTOR TRIP OR ALARM FUNCTION SELECTION
THE BROKEN CONDUCTOR ALARM FUNCTION (THE DEFAULT) MAY BE REPLACED WITH THE BROKEN CONDUCTOR TRIP FUNCTION (SET GT08 TO 'ON' FOR BC TRIP) IF THE CONNECTED POWER PARAMETERS ALLOW IT.

GT-09) FUSE FAIL BREAKER STATUS DUDI FUNCTION SELECTION
SET GT09 TO 'OFF' (THE DEFAULT) FOR EXCLUSION OF THE BREAKER STATUS WITHIN THE DUDI FUNCTION DECISION LOGIC (THEN RELIES SOLELY ON THE CONDITION 'phase Imag > IPh setting' TO BE FULFILLED FOR INITIATION OF DUDI). SET GT09 'ON' FOR INCLUSION OF THE BREAKER STATUS LOGIC (THEN RELIES ON EITHER OF THE CONDITIONS 'phase Imag > IPh setting' OR 'CIRCUIT BREAKER CLOSED' TO BE FULFILLED FOR INITIATION OF THE DUDI FUNCTION).

GT-11) POLE DISAGREEMENT FUNCTION SELECTION
THE POLE DISAGREEMENT FUNCTION (PD) INCLUDES BOTH BREAKER AUXILIARY CONTACT ANALYSIS (TRADITIONAL METHOD) AND A CURRENT BASED FUNCTIONALITY. THEY ARE INDEPENDANT OF EACH OTHER.

THE CURRENT BASED OPTION CAN BE SET FOR CONTINUOUS MONITORING OR FOR A PERIOD OF 200ms AFTER THE BREAKER CHANGES STATE (CurrSel='CB OPEN MONITOR' IS THE SETTING FOR THE 200ms OPTION - INITIATED VIA CLOSE OR 3 POLE TRIP COMMANDS).
IF THE CURRENT BASED OPTION IS USED, THEN IT IS RECOMMENDED TO CHOOSE THE 200ms OPTION, AS OPPOSED TO THE CONTINUOUS OPTION, AS IT IS MORE SECURE.
IF THE CURRENT BASED OPTION IS NOT REQUIRED (RECOMMENDED), SET THE 'Curr Sel' TO 'OFF' (THE DEFAULT).

FUNCTIONALITY HAS BEEN ADDED TO THE TRADITIONAL METHOD OF PD AND THUS THERE IS AN OPTION TO HAVE IT SUPERVISED BY USING THE BROKEN CONDUCTOR 'START' FUNCTIONALITY AND BROKEN CONDUCTOR FUNCTION CURRENT SETTINGS. THIS IS STILL INDEPENDANT OF THE SOLELY CURRENT BASED OPTION IN THE PREVIOUS PARAGRAPH.

SET GT11 TO 'ON' (THE DEFAULT) FOR TRADITIONAL POLE DISAGREEMENT FUNCTIONALITY (i.e. BREAKER AUXILIARY CONTACT ANALYSIS).
SET GT11 TO 'OFF' TO ENABLE A COMBINATION THAT USES BREAKER AUXILIARY CONTACTS AND THE BROKEN CONDUCTOR START FUNCTIONALITY.
THIS EXTRA FUNCTIONALITY HAS BEEN ADDED TO ENHANCE SECURITY OF THE SCHEME (i.e. PD WITH BCondStart WOULD NOT OPERATE FOR A FAULTY BREAKER AUXILIARY CONTACT ONLY) BUT WITH DECREASED DEPENDABILITY (i.e. THE LINE MUST BE ENERGISED, CONNECTED AND POSSIBLY LOADED BEFORE A PD COULD OPERATE).

GT-12) ZONE 2 AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF IMPEDANCE ZONE 2 AUTORECLOSE INITIATION (Z2 ARC INITIATE), SET GT12 TO 'ON'. SET GT12 TO 'OFF' (THE DEFAULT) FOR NO ZONE 2 ARC INITIATE.

GT-13) FAULT AND TRIP COUNTER RESET
GT13 DEFAULT = 'OFF'. SET GATE 'ON' THEN 'OFF' WHEN REPLACING THE HV BREAKER.

GT-14) TEF (EARTH-FAULT RED670) AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF TEF AUTORECLOSE INITIATION, SET GT14 TO 'ON' (THE DEFAULT) IN 'Application Configuration/Closing ARCend Sync/Logic/LogicGate'.
SET GT14 TO 'OFF' FOR NO TEF ARC INITIATE.

GT-15) O/C (RED670) AUTORECLOSE INITIATE FUNCTION SELECTION
FOR SELECTION OF O/C AUTORECLOSE INITIATION, SET GT15 TO 'ON' IN 'Application Configuration/Closing ARCend Sync/Logic/LogicGate'.
SET GT15 TO 'OFF' FOR NO O/C ARC INITIATE (THE DEFAULT).

GT-16) SYNCH CHECK FUNCTION
SET GT16 TO 'OFF' (THE DEFAULT) FOR USAGE OF THE SYNCH CHECK AUTO FUNCTION. SET GT16 TO 'ON' IF THERE IS NO SYNCH CHECK LINE VT.

GT-18) TRIP CIRCUIT SUPERVISION CLOSE BLOCKING
SET GT18 TO 'ON' IN 'PARAMETER SETTING/MONOTORING' FOR ANY TCS FAIL (FROM MAIN OR BACK-UP TRIP COIL CIRCUITS) TO BLOCK A CLOSE.
TCS FAIL WILL NOT BLOCK A CLOSE IF GT18 IS SET 'OFF' UNLESS BOTH MAIN AND BACK-UP TRIP CIRCUITS HAVE FAILED. THE DEFAULT SETTING IS GT18='OFF'.
A PNH AND A CBNH ALARM WILL BE ISSUED FOR A TCS FAIL, IRRESPECTIVE OF THE GT18 STATE.

REF615: BACK-UP RELAY SETTINGS AND LOGIC

CB CLOSE CONTROL LOGIC
THE BACK-UP RELAY HAS BEEN MASKED AND THE SCHEME WIRED TO ENABLE BREAKER CONTROL WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST).
THE CLOSE PULSE CAN BE ISOLATED IF REQUIRED BY LINK A ON THE TERMINAL STRIP AS THE BACK-UP RELAY DOES NOT OFFER SYNCH-CHECK.
THE DEFAULT LINK A POSITION IS 'OPEN'.

SUPERVISORY BREAKER CONTROL:
THE BACK-UP RELAY IS ALSO MASKED FOR SUPERVISORY DNP3 AND HARDWIRED REMOTE BREAKER CONTROL (VIA MAIN ON TEST AND SIS SELECTION).

BREAKER FAIL LOGIC (51BF)
THE FUNCTION IS ONLY ENABLED WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST). THERE IS NO TELEPROTECTION LINKED TO THIS OUTPUT AND THE BREAKER FAIL OUTPUT IS ALSO ISOLATED VIA THE BFIS SWITCH. THE BF TRIP PULSE OUTPUT IS SET TO 200ms.

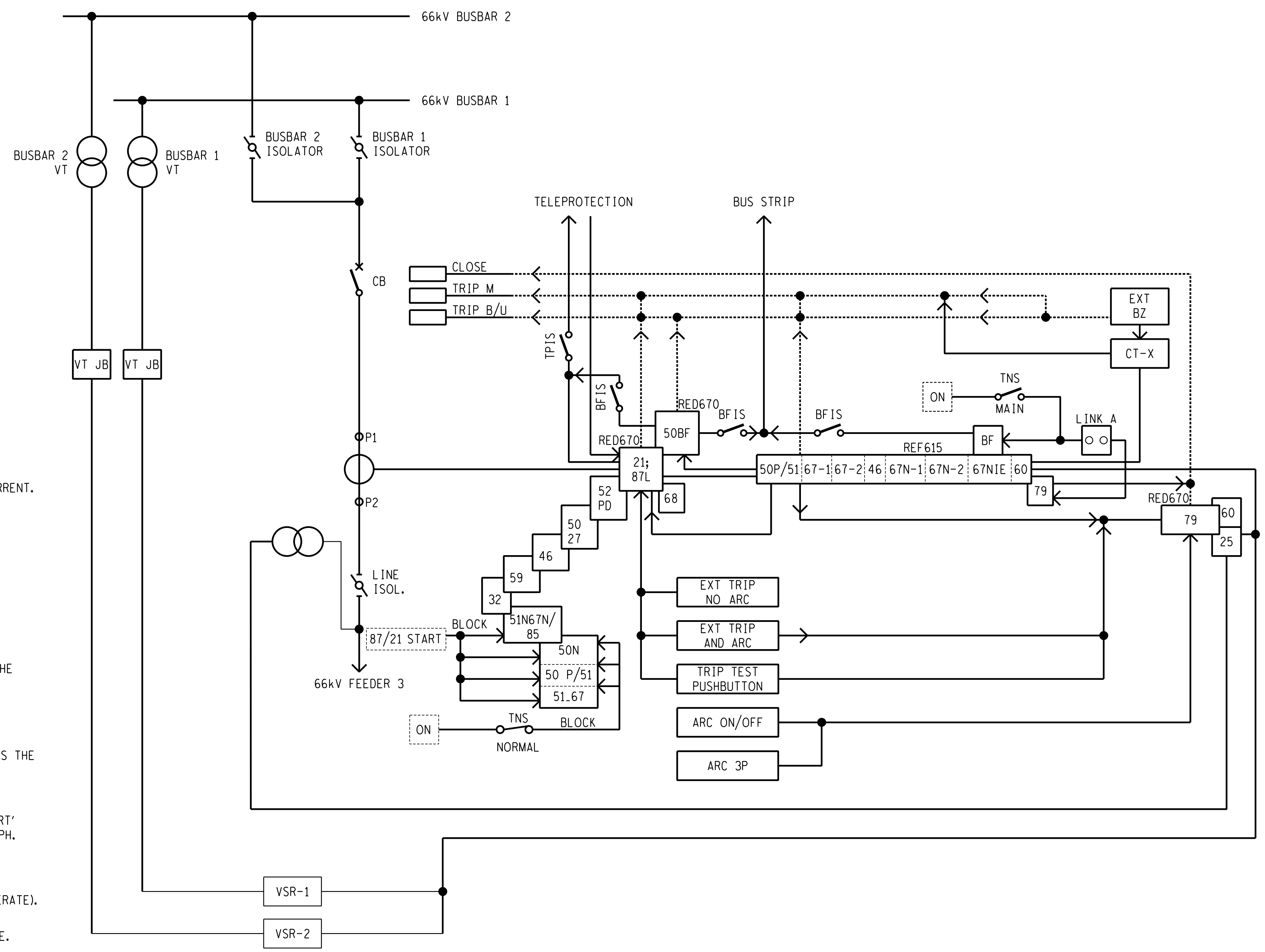
AUTORECLOSE (DARREC1(79))
THE RELAY INCLUDES ARC FUNCTIONALITY. THE FUNCTION IS MASKED SUCH THAT IT IS ENABLED WHEN THE TNS SWITCH IS SET TO 'MAIN ON TEST' (AND BACK-UP ON TEST).
HOWEVER, DUE TO LIMITATIONS, BACK-UP RELAY INTERNAL ARC ON/OFF IS NOT SELECTABLE VIA SUPERVISORY OR FROM THE OPERATOR PANEL. THE FUNCTION CAN BE SET ON/OFF VIA EITHER ALTERNATIVE SETTING SELECTION OR MANUALLY AND SHOULD ONLY BE USED IN LONG TERM EMERGENCIES.
NOTE THAT THE FUNCTION IS AUTOMATICALLY INHIBITED FOR A MANUAL CLOSE.

2ND HARMONIC INRUSH DETECTION FUNCTIONALITY
THE INRUSH DETECTION FUNCTION, INRPHAR1, IS MASKED TO BLOCK THE FOLLOWING FUNCTIONS WHEN OPERATED:
DIR_OC1 (67-1(1)), DIR HighSetOC (67-2), HonDir InstOC (50P/51), AND IS MASKED TO ENABLE THE DIR_OC2 (67-1(2)) FUNCTION'S MULTIPLIER.

CB CLOSED MULTIPLIER (TPGAPC1 GENERIC TIMER, DEFAULT TIME = 500ms):
TP GAPC1 IS MASKED TO THE FOLLOWING FUNCTIONS TO ENABLE THE MULTIPLIER WHEN THE BREAKER CLOSES IF REQUIRED:
DIR HighSetOC (67-2), NonDIR InstOC (50P/51), SEF DIR EF2 (67N-1), DEF HighSet (67N-2), NonDIR_InstEF (51N-2), NegSeq_OC1/2 (46(1/2)).

THERMAL OVERLOAD (ThermOVLD (49F))
THE FUNCTION HAS BEEN MASKED FOR INDICATION AND NOT TRIP PURPOSES. HOWEVER, THE BLOCK BREAKER CLOSE FOR TEMPERATURE EXCEED HAS BEEN MASKED.
TO CIRCUMVENT THE BLOCK CLOSE FUNCTIONALITY, SET THE RECLOSE TEMPERATURE TO MAXIMUM OR SET THE FUNCTION OFF.

BROKEN CONDUCTOR ((46PD) OVERVOLTAGE 3PH O/V (59)), UNDERVOLTAGE 3PH U/V (27), PosSeq-U/V (47U), NegSeq-O/V (47O)
THESE FUNCTIONS HAVE BEEN MASKED FOR ALARMING PURPOSES ONLY. HOWEVER, THE OPERATION OF THE FUNCTIONS WOULD INHIBIT THE INTERNAL ARC FUNCTION (ENABLED VIA TNS OFF NORMAL).



LEGEND	
21	DISTANCE PROTECTION FUNCTION
25	SYNCHRONISM-CHECK FUNCTION
27	UNDERVOLTAGE FUNCTION
32	DIRECTIONAL OVERPOWER FUNCTION
46	NEGATIVE SEQUENCE OVERCURRENT/ BROKEN COND FUNCTIONS
50BF	BREAKER FAIL FUNCTION
50N	NON-DIR INSTANTANEOUS EARTHFAULT FUNCTION
50/51	INSTANTANEOUS OR TIME DELAY OVERCURRENT FUNCTION
50P/51	NON-DIR INSTANTANEOUS OVERCURRENT FUNCTION
51	AC INVERSE TIME O/C FUNCTION
52PD	POLE DISAGREEMENT PROTECTION FUNCTION
59	OVERVOLTAGE FUNCTION FUNCTION
60	FUSE FAILURE FUNCTION
67-1	DIR OVERCURRENT IDMT OR DT FUNCTION
67-2	DIR HIGHSET OVERCURRENT FUNCTION
67N-1	DIRECT EARTHFAULT IDMT OR DT FUNCTION
67N-2	DIR HIGHSET EARTHFAULT FUNCTION
67NIE	INTERMITANT EARTHFAULT FUNCTION
68	POWERSWING FUNCTION
79	AUTO RECLOSE FUNCTION
85	EARTH FAULT FUNCTION AIDED
87L	LINE DIFFERENTIAL PROTECTION FUNCTION
AUX	AUXILIARY
BCD	BINARY CODED DECIMAL
BZ	BUSZONE

LEGEND	
CT-X	CROSS TRIP AUXILIARY
DIR	DIRECTIONAL
DT	DEFINITE TIME
DTTR	DIRECT TRANSFER TRIP RECIEVE
DTTS	DIRECT TRANSFER TRIP SEND
GPS	GLOBAL POSITIONING SYSTEM
GSM	GPS TIME SYNCHRONISATION MODULE
LDCM	LINE DATA COMMUNICATION MODULE (TELEPROTECTION AND DIFFERENTIAL COMMUNICATION)
LSB/MSB	LEAST SIGNIFICANT BIT /MOST SIGNIFICANT BIT
LSB	LEAST SIGNIFICANT BIT
MSB	MOST SIGNIFICANT BIT
OEM	OPTICAL ETHERNET MODULE
PCM600	CONFIGURATION, PARAMETER SETTING & DISTURBANCE HANDLING ENGINEERING TOOL PACKAGE FOR ABB RELION SERIES
PS	PARAMETER SETTING TOOL WITHIN PCM600
REA	REMOTE ENGINEERING ACCESS
SLM	SERIAL COMMUNICATION MODULE LON AND SPA BUS
SYNCH	CHECK SYNCHRONISM OR SYNCHRONISM-CHECK
TCS	TRIP CIRCUIT SUPERVISION (MONITOR)
TP	TEST POINT
TRIP B/U	TRIP BACKUP CIRCUIT BREAKER COIL
TRIP M	TRIP MAIN CIRCUIT BREAKER COIL
VSR	VOLTAGE SELECTION RELAY

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

YSTERVARK SUBSTATION
66kV FEEDER 3
LOGIC DIAGRAM

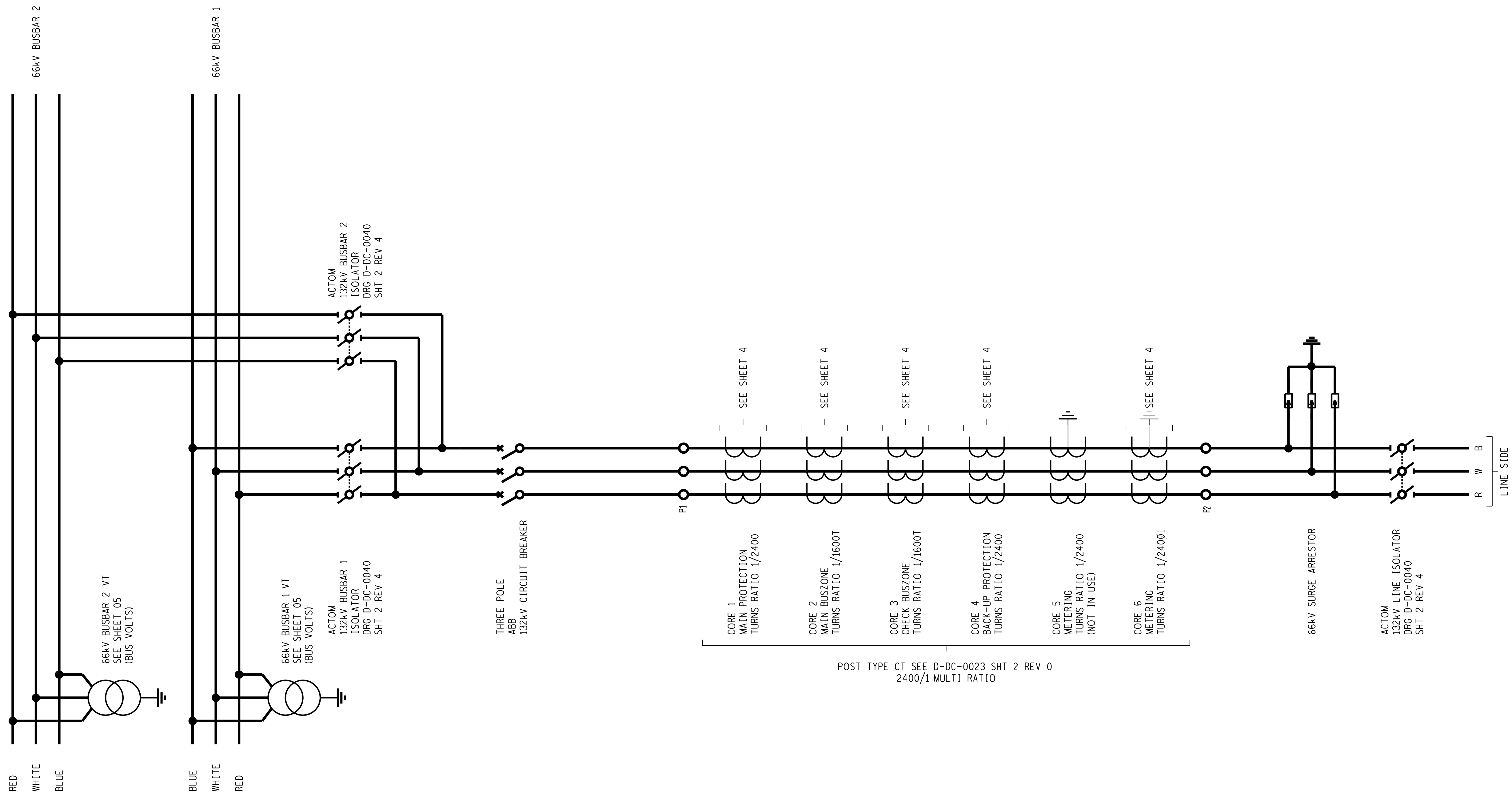
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	02	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 02 OF 27 REVISION 00



DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
SINGLE LINE DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	03	00

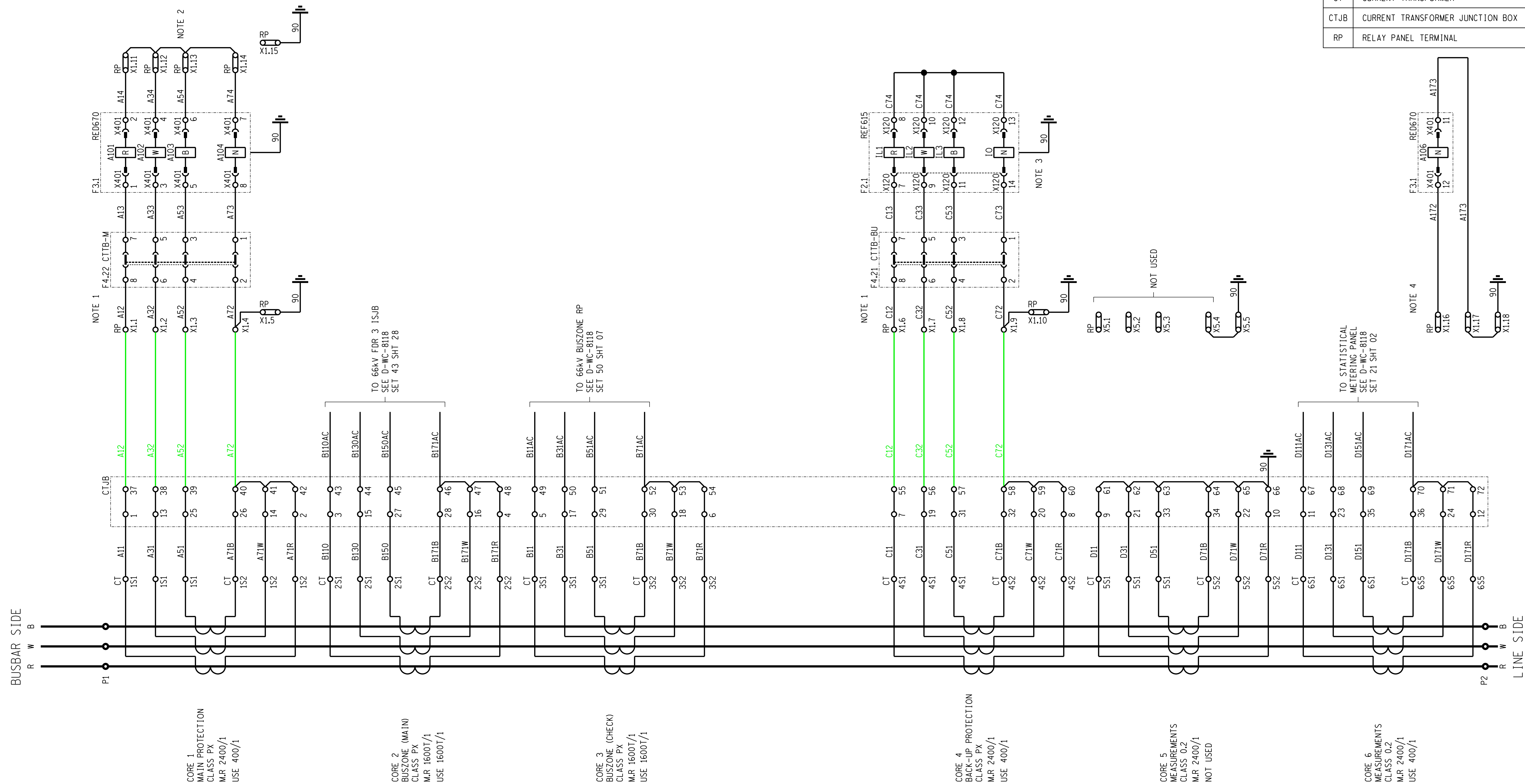
LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 OF 27 REVISION 00

	TERMINAL DESCRIPTION
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
RP	RELAY PANEL TERMINAL



NOTE:

1. IF THE FEEDER HAS OUTBOARD PRIMARY PLANT BYPASS CAPABILITY THEN SWITCH ON DRAWING LEVEL 18 (I.E. THE CT SHORTING OPTION IS TO THEN BE ORDERED AND USED).
2. AN EXTERNAL DISTURBANCE RECORDER MAY BE CONNECTED HERE IF NO DISTURBANCE RECORDER CT CORE IS AVAILABLE.
3. THE BACK-UP IED FEATURES AN AUTOMATIC CT SHORT-CIRCUIT CONNECTOR WHEN THE PLUG-IN UNIT IS WITHDRAWN.
4. FOR THE CASE OF DOUBLE CIRCUIT LINES WITH REGARD TO THE FAULT LOCATOR ACCURACY, THE INFLUENCE OF THE ZERO-SEQUENCE MUTUAL IMPEDANCE IS COMPENSATED FOR BY CONSIDERING THE RESIDUAL CURRENT ON THE PARALLEL LINE. FOR THIS CASE, USE THESE RELAY CT INPUTS.

AECOM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
AC KEY DIAGRAM

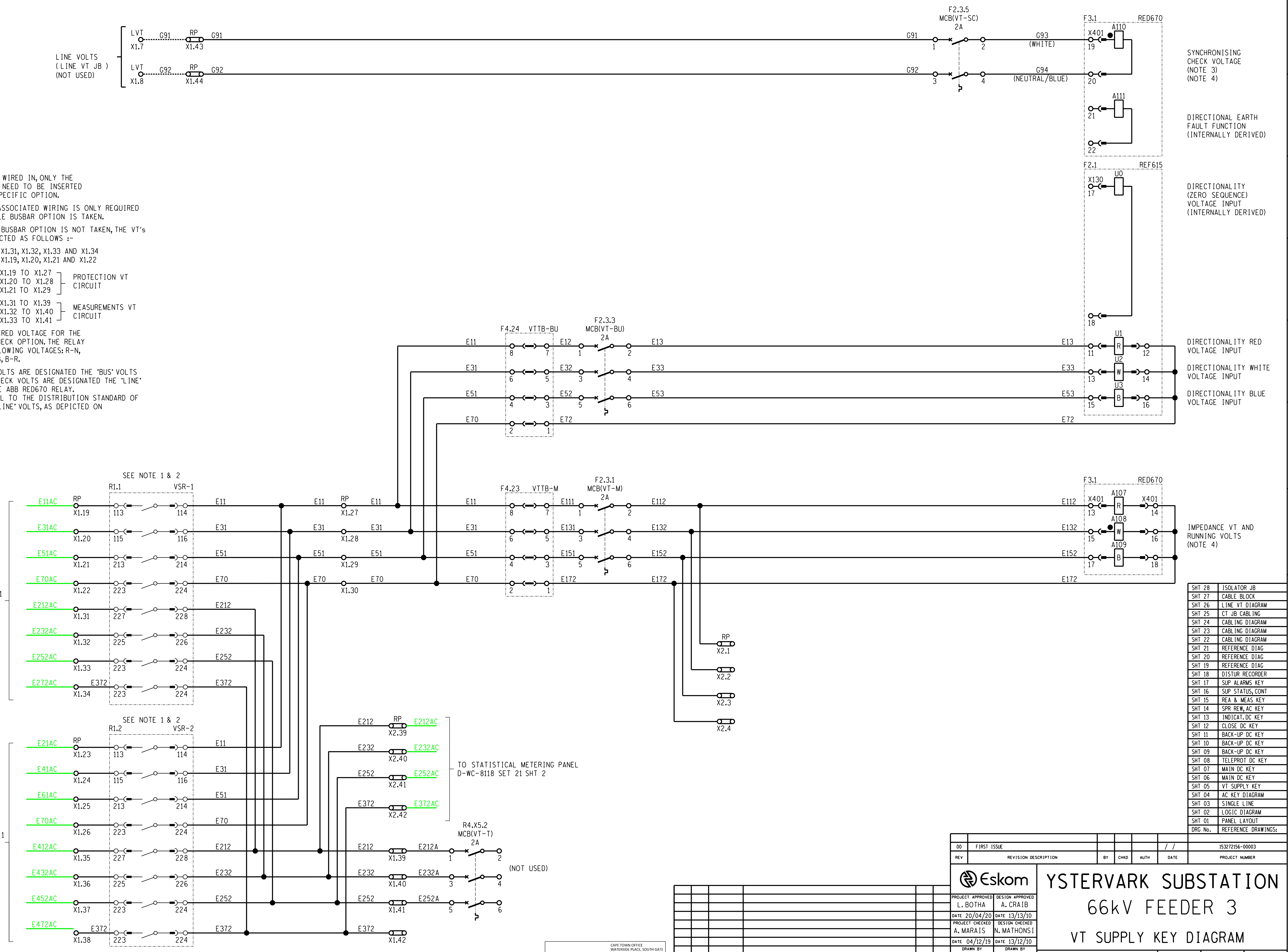
D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	43	04	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 04 OF 27 REVISION 00



NOTE:

1. ALL OPTIONS ARE WIRED IN, ONLY THE OPTIONAL RELAYS NEED TO BE INSERTED TO SELECT THE SPECIFIC OPTION.
2. RELAY VSR WITH ASSOCIATED WIRING IS ONLY REQUIRED WHEN THE MULTIPLE BUSBAR OPTION IS TAKEN.

   IF THE MULTIPLE BUSBAR OPTION IS NOT TAKEN, THE VT's ARE TO BE CONNECTED AS FOLLOWS :-

   MEASUREMENTS - X1.31, X1.32, X1.33 AND X1.34
   PROTECTION - X1.19, X1.20, X1.21 AND X1.22

   ADD LOOPS FROM X1.19 TO X1.27, X1.20 TO X1.28, X1.21 TO X1.29 — PROTECTION VT CIRCUIT

   AND X1.31 TO X1.39, X1.32 TO X1.40, X1.33 TO X1.41 — MEASUREMENTS VT CIRCUIT
3. SELECT THE PREFERED VOLTAGE FOR THE SYNCHRONISING CHECK OPTION. THE RELAY CAN USE THE FOLLOWING VOLTAGES: R-N, W-N, B-N, R-W, W-B, B-R.
4. THE IMPEDANCE VOLTS ARE DESIGNATED THE "BUS" VOLTS AND THE SYNCH CHECK VOLTS ARE DESIGNATED THE "LINE" VOLTS WITHIN THE ABB RED670 RELAY. THIS IS IDENTICAL TO THE DISTRIBUTION STANDARD OF "BUS" VOLTS AND "LINE" VOLTS, AS DEPICTED ON SHEETS 3 AND 5.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 3
VT SUPPLY KEY DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
43	05	00

REV | AUTH | DATE | REVISION TO MASTER | BY | CHKD | SCALE

LEVELS 1 2 5 10 11 12 21 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

SHEET 05 OF 27 REVISION 00

MASTER TRACING FILED UNDER D-WC-8118

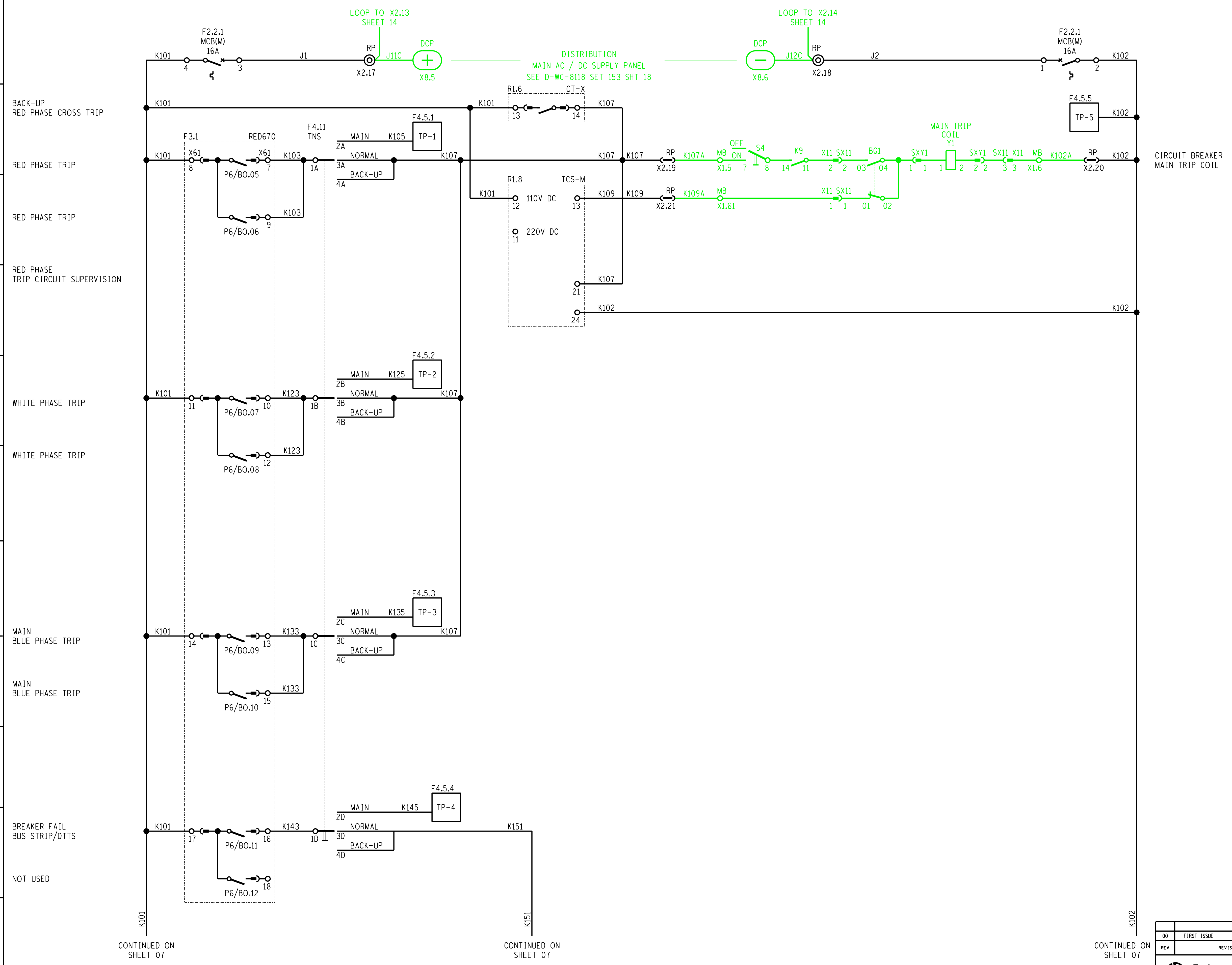


ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION

66kV FEEDER 3

MAIN DC KEY DIAGRAM

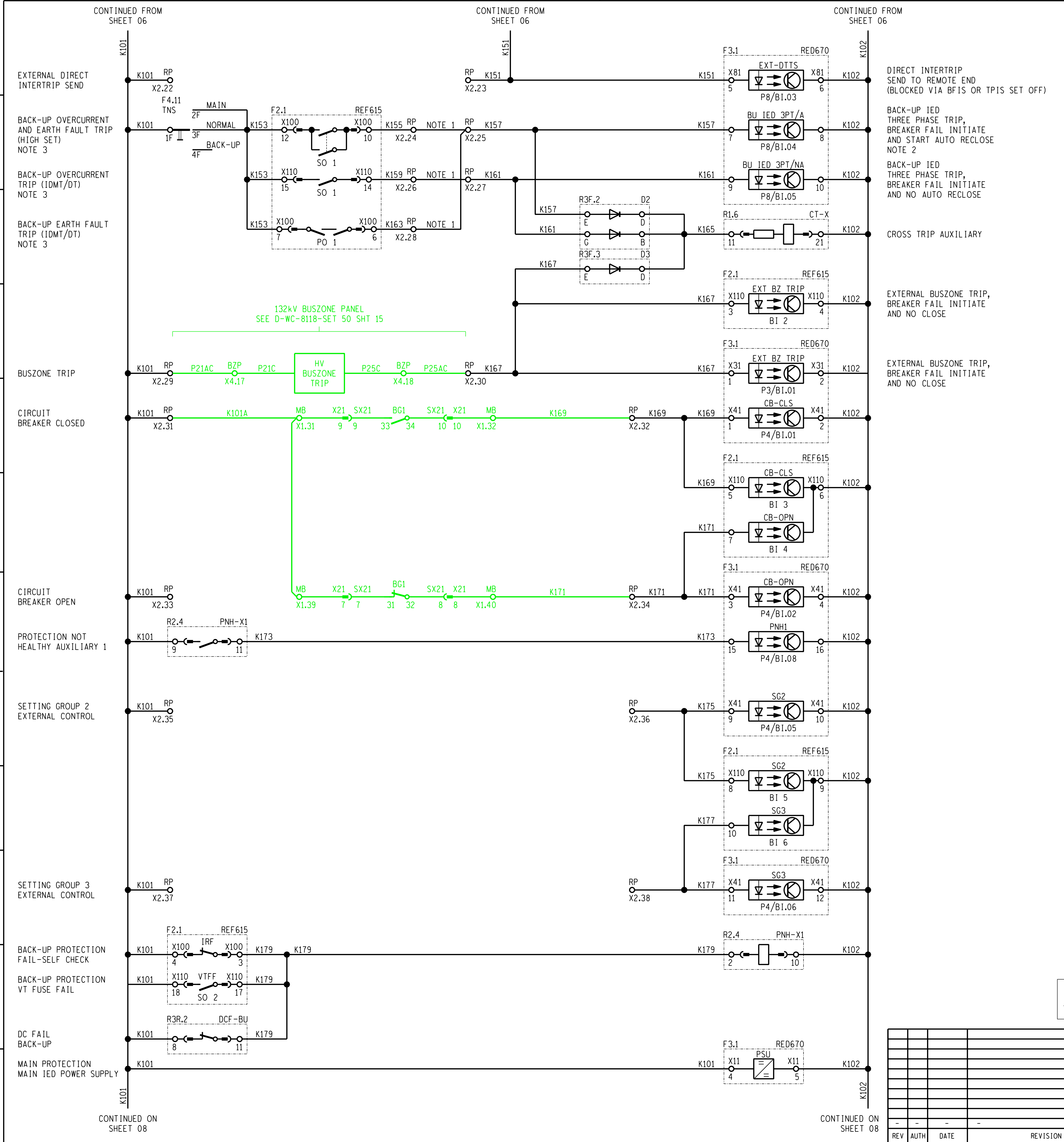
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	06	00

LEVELS 1 2 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 06 OF 27 REVISION 00



NOTE:

1. CONNECT RELAY PANEL TERMINALS AS REQUIRED FOR INITIATION OF AUTO RECLOSE.
2. FOR RED670 IMPEDANCE FUNCTION, ZONE 2 INITIATED AUTO-RECLOSE SET GATE 12 TO 'ON' (DEFAULT = 'OFF').
3. THESE OUTPUTS OF THE BACK-UP IED (REF615) ARE MASKED/SET TO 'NON-LATCHED'.

ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 3
MAIN DC KEY DIAGRAM

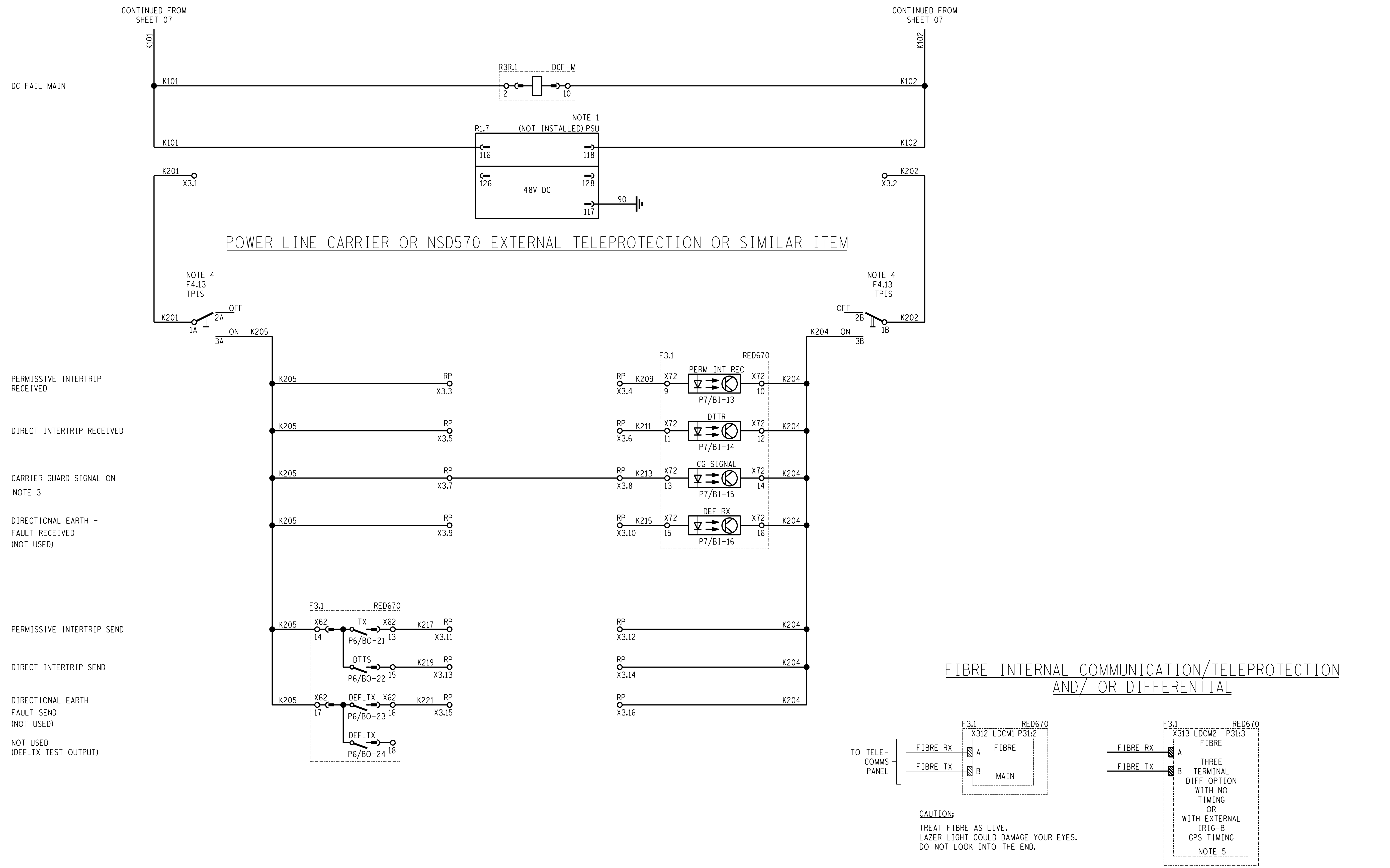
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	07	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
-	-	-	-	-	-	

LEVELS 1 2 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 07 OF 27 REVISION 00



NOTE:

1. THE 110/48 VOLT DC/DC CONVERTER IS OPTIONAL. THE SUBSTATION 48 VOLT DC SUPPLY CAN BE USED IF AVAILABLE.
2. NO GROUND - LEAVE CONNECTOR WITHOUT ANY CONNECTION
   DIRECT GROUND - CONNECT PIN 2 DIRECTLY TO EARTH
   SOFT GROUND - CONNECT PIN 1 TO PIN 2
3. SET GATE 1 IN SETTINGS TO 'ON' TO ENABLE INTERNAL COMMUNICATION/ TELEPROTECTION FAIL LOGIC ('ON' IS THE DEFAULT). SET GATE 1 TO 'OFF' IF THE EXTERNAL CARRIER GUARD IS USED OR IF THE INT.COMM/TELEPROTECTION CARD IS NOT USED.
4. REMOTE DIFF ISOLATION:
   SIMULTANEOUSLY SWITCH THE LOCAL & REMOTE TPIS SWITCHES TO 'OFF', ALTERNATIVELY, REMOVE THE TX & RX FIBRES FROM ONE IED.
5. THE INTERNAL GPS TIMING CARD (OPTIONAL) USES SLOT P31:3 X313.
   THE EXTERNAL GPS TIMING INPUT CARD (OPTIONAL) USES SLOT P30:2 X302.
   DEPENDANT ON IF ONE OF THE ABOVE CARDS ARE ORDERED, THE THREE TERMINAL DIFF COMMUNICATION CARD (OPTIONAL), WOULD BE PLACED IN THE UNUSED SLOT (i.e. SLOT P31:3 X313 OR P30:2 X302). IF NEITHER TIMING CARD IS ORDERED BUT THE THREE TERMINAL DIFF COMMUNICATION CARD IS ORDERED, IT WILL BE PLACED IN SLOT P31:3 X313.

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: A. BRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY: K. STEYNBERG	DRAWN BY: C. CONNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
TELEPROTECTION DC KEY DIAGRAM

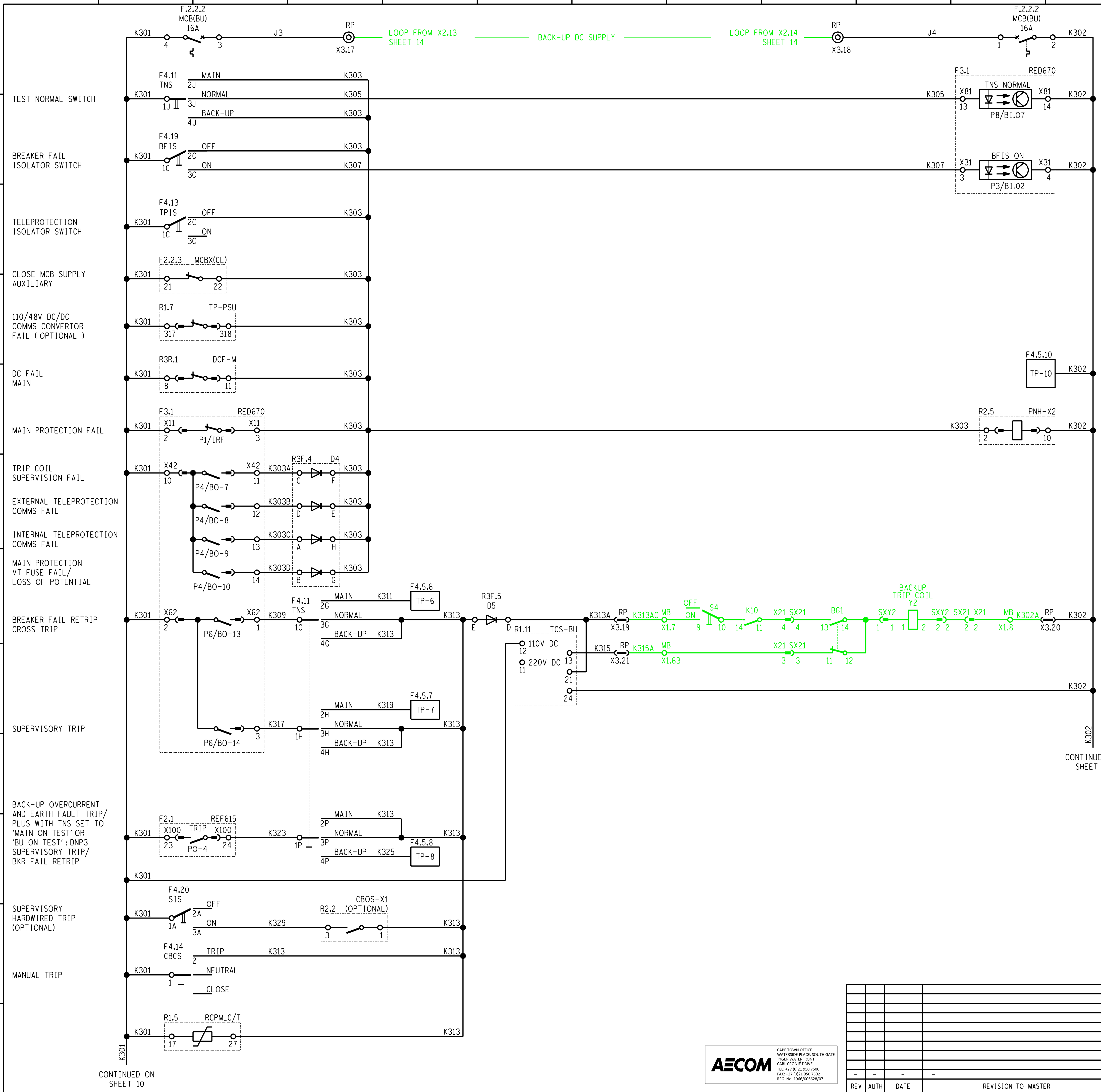
DRG No.	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	08	00

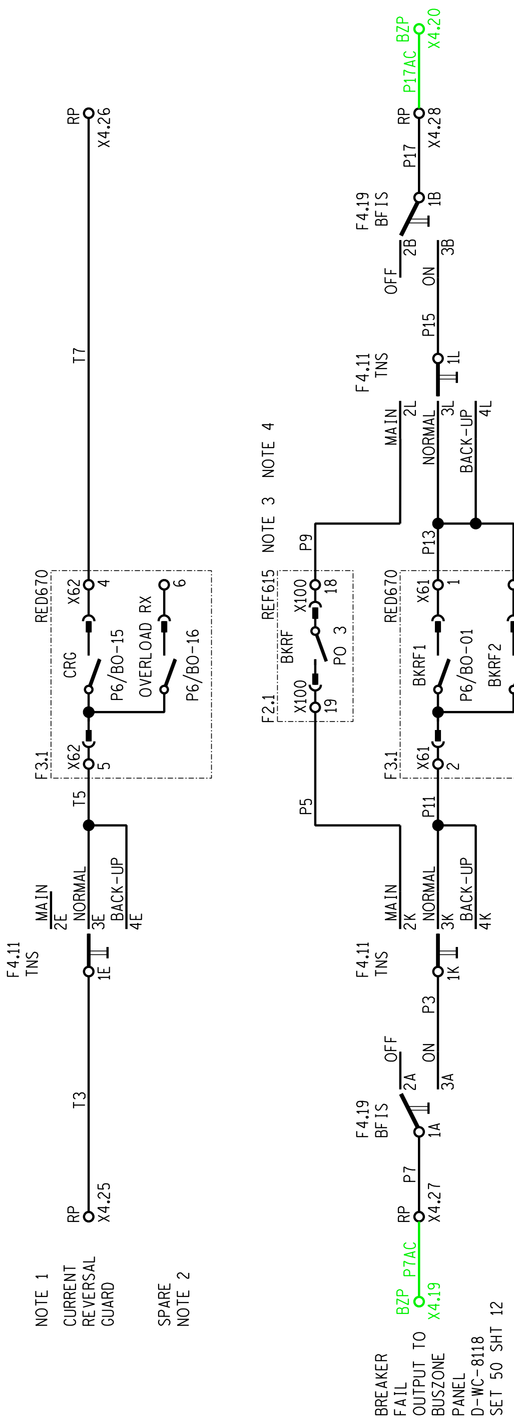
LEVELS 1 2 4 5 10 11 12 20 21 22 25 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

SHEET 08 OF 27 REVISION 00

MASTER TRACING FILED UNDER D-WC-8118





NOTE:

1. FOR PARALLEL FEEDERS WITH A SOURCE ON THE LOCAL & REMOTE BARS AND WHERE DISTANCE IMPEDANCE POR TELEPROTECTION SCHEMES ARE USED AND THE ADJACENT PARALLEL FEEDER IS A PHASE 1/ PHASE 2 ERA SCHEME
   i.e. THE OUTPUT IS ONLY RELEVANT IF THERE IS AN OLD SCHEME ON THE PARALLEL FEEDERS, USE THE CRG OUTPUT TO CONTROL (BLOCK) THE ADJACENT FEEDERS ZONE 2 AIDED TRIP RECIEVE.
   NOTE THAT THE CRG CONTACT IS OPERATED BY A FINAL ISSUED ZONE 2 AIDED OUTPUT TRIP PULSE AND HAS A DELAY ON DROP-OFF OF 50ms.
2. THE DIRECTIONAL OVERPOWER FUNCTION HAS A STAGE 1 TRIP SENT TO THE REMOTE DISTRIBUTION RELAY VIA THE INTERNAL COMMUNICATION TELEPROTECTION MODULE, AND IS OUTPUTTED ON THE SPARE CONTACT P6/BO-16 AT THE REMOTE RELAY. THE CONTACT MAY BE USED TO TRIP A REMOTE EXTERNAL LOAD. ESKOM PERSONNEL ARE TO WIRE OUT THE CONTACT IF REQUIRED (i.e. SHIFT WIRE T7 FROM TERMINAL X62.4 TO X62.6 AND UPDATE THE DRAWING ACCORDINGLY).
   THE STAGE 2 TRIP IS A LOCAL OVERPOWER (OVERLOAD) TRIP.
3. BACK-UP IED (REF615) BREAKER FAIL WILL ONLY BE ACTIVE FOR CONDITIONS 'MAIN ON TEST' AND 'BACK-UP ON TEST'.
4. ALL BREAKER FAIL OUTPUT CONTACTS ARE MASKED/SET TO 'NON-LATCHED'.

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: A. BRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY: K. STEYNBERG	DRAWN BY: C. CONNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 3
BACK-UP DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	09	00

AECOM

CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

LEVELS 1 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 09 OF 27 REVISION 00

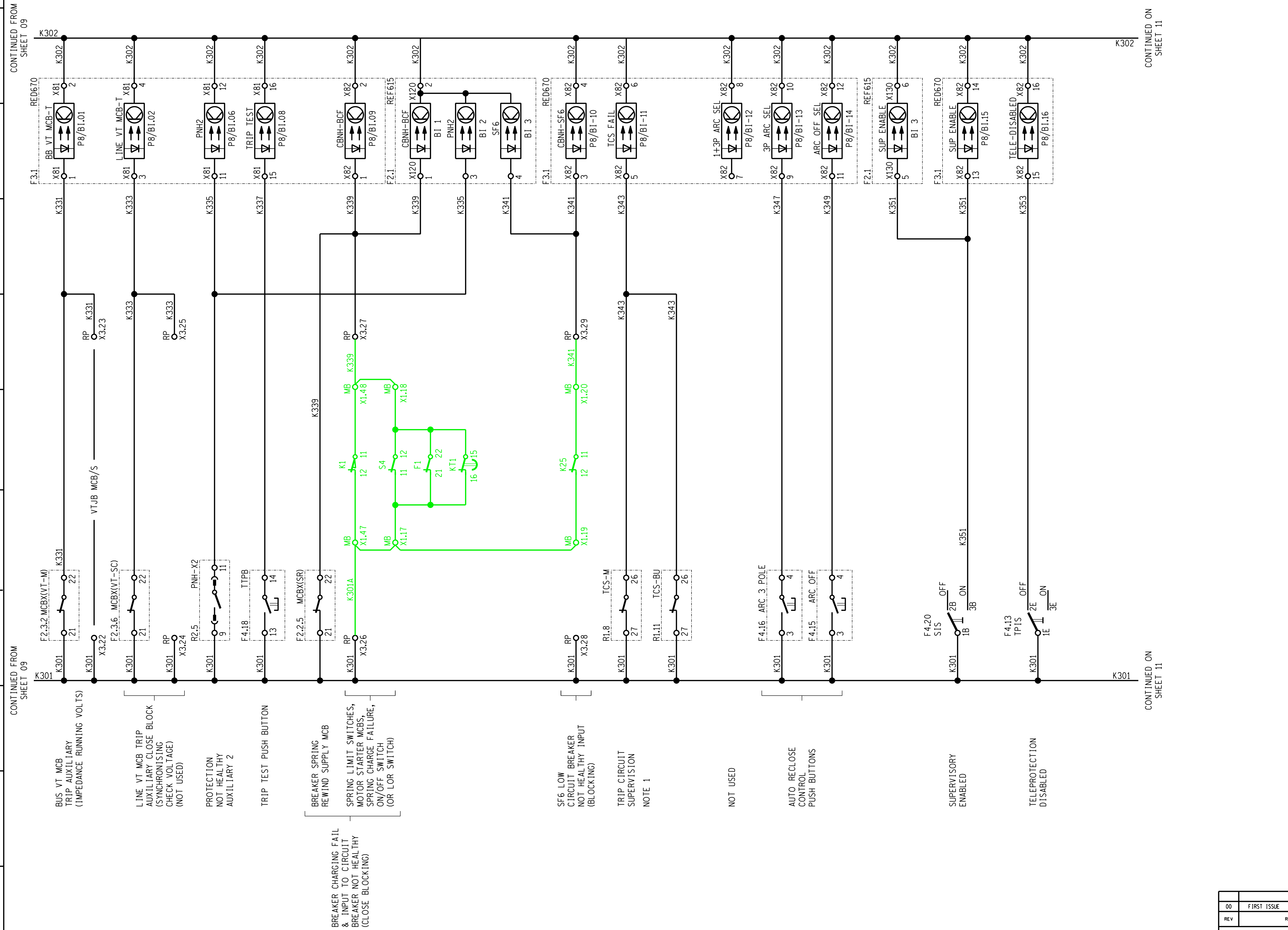


ABB 132kV THREE POLE BREAKER LEGEND	
ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

NOTE:

1. TCS FAIL BLOCKS A BREAKER CLOSE IF GATE 18 IS SET 'ON' IN 'PARAMETER SETTING/ MONOTORING'.
TCS FAIL WILL NOT BLOCK A CLOSE IF GATE 18 IS SET 'OFF' (UNLESS BOTH MAIN AND BACK-UP TCS ARE FAILED)
BUT IT WILL STILL ISSUE A CBNH ALARM.
A PNH ALARM WILL ALSO BE ISSUED FOR A TCS FAIL, IRRESPECTIVE OF GATE 18'S STATE
(GATE 18 DEFAULT = 'OFF').

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
BACK-UP DC KEY DIAGRAM

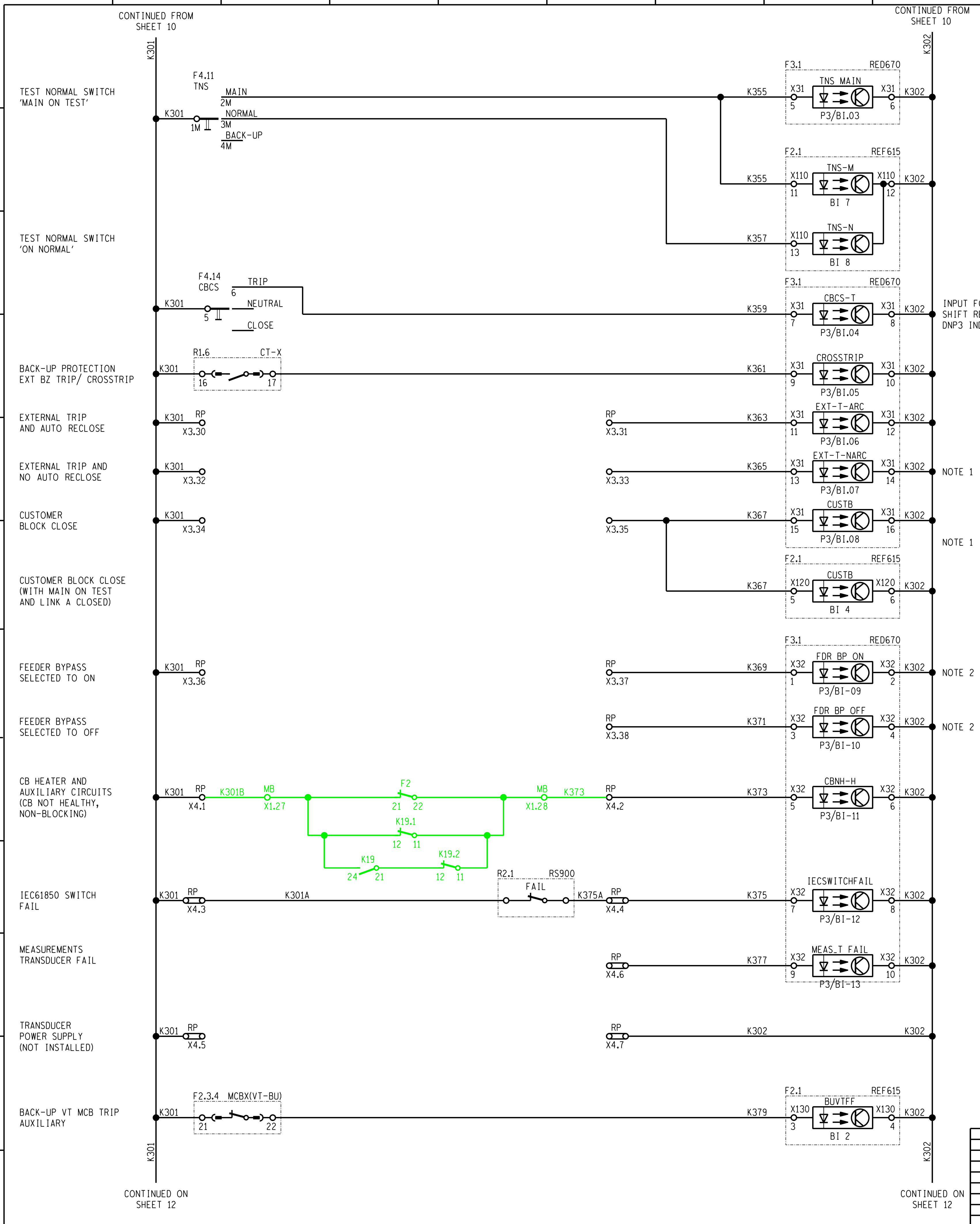
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	10	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 27 REVISION 00



NOTE:

1. A PERMANENT INPUT IS REQUIRED TO BLOCK AN EXTERNAL CLOSE.
2. THIS BYPASS LOGIC IS USED FOR THE SUPERVISORY DNP3 STATUS, THE HMI DISPLAY AND THE AUTOMATED REMOTE ARC BYPASS AND DIFF OUT OF SERVICE SELECTION LOGIC. NOTE THAT A 'G' ISOLATOR CONTACT MUST BE USED FOR THE 'ON' SELECTION AND A 'N' ISOLATOR CONTACT MUST BE USED FOR THE 'OFF' SELECTION.

ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 27 REVISION 00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

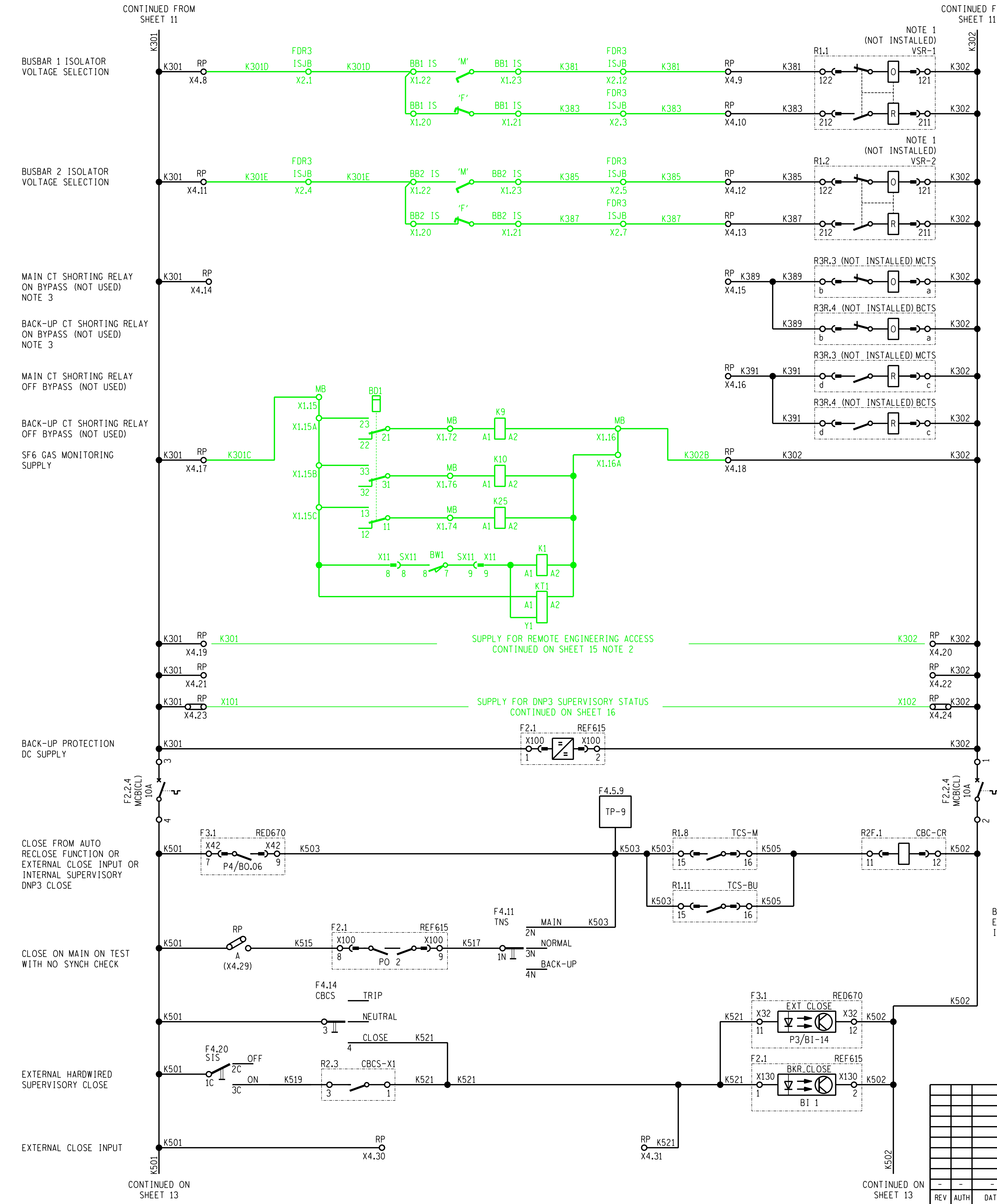
YSTERVARK SUBSTATION
66kV FEEDER 3
BACK-UP DC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	11	00

LEVELS 1 2 5 10 11 12 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L



BACK-UP IED CLOSE FROM EXTERNAL CLOSE INPUT OR INTERNAL SUPERVISORY DNP3 CLOSE

NOTE:

1. ALL OPTIONS ARE WIRED IN, ONLY THE OPTIONAL RELAYS NEED TO BE INSERTED TO SELECT THE SPECIFIC OPTION.
2. ESKOM TO INSTALL JUMPERS TO BACKPLATE MODULES ON SITE IF THE OPTION IS ORDERED.
3. FOR CT SHORTING ON BYPASS, 'GS' CONTACTS AND 'N' CONTACTS OF THE ISOLATOR MUST BE USED.

ABB 132kV THREE POLE BREAKER LEGEND	
ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
CLOSE DC KEY DIAGRAM

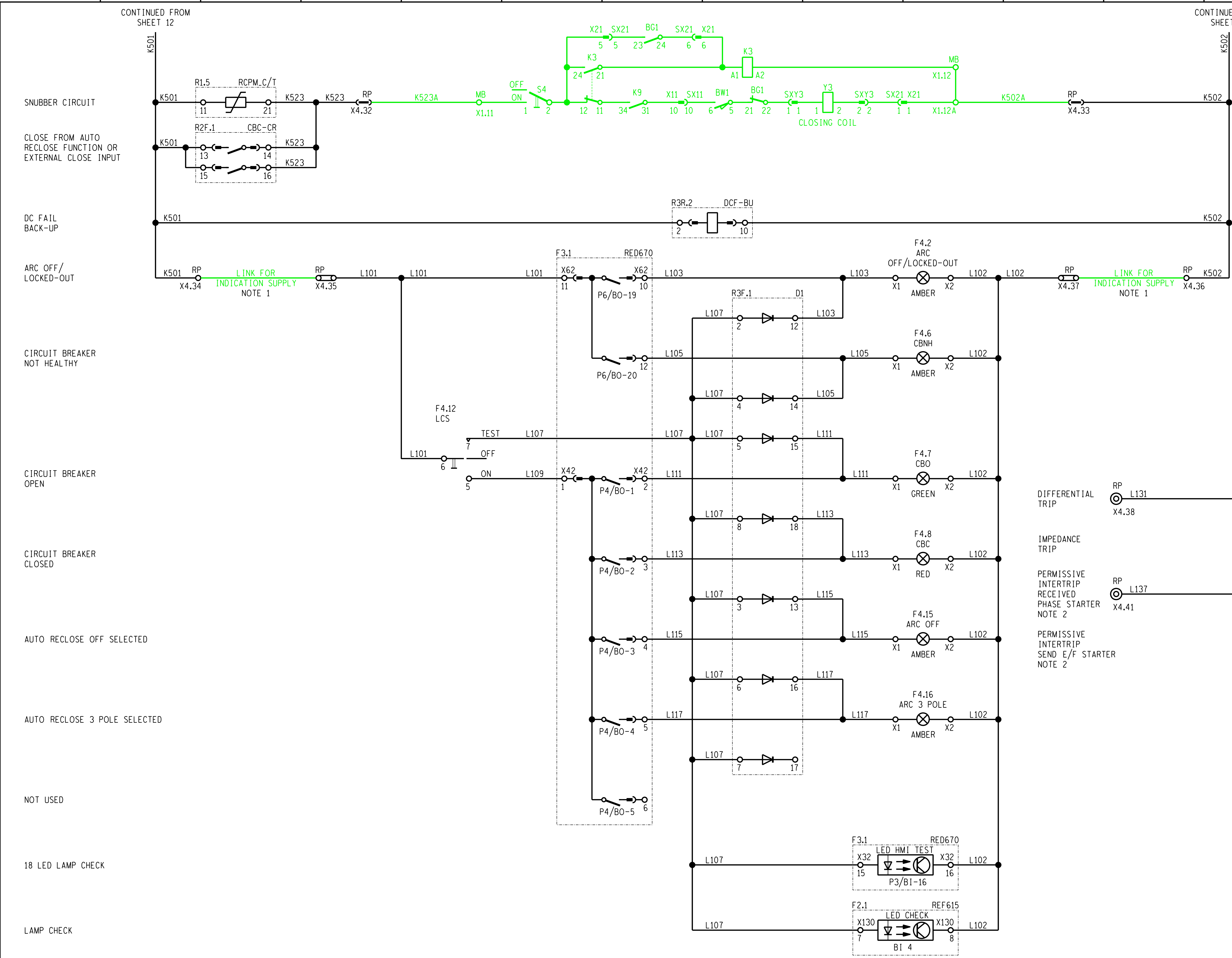
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	12	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 27 REVISION 00



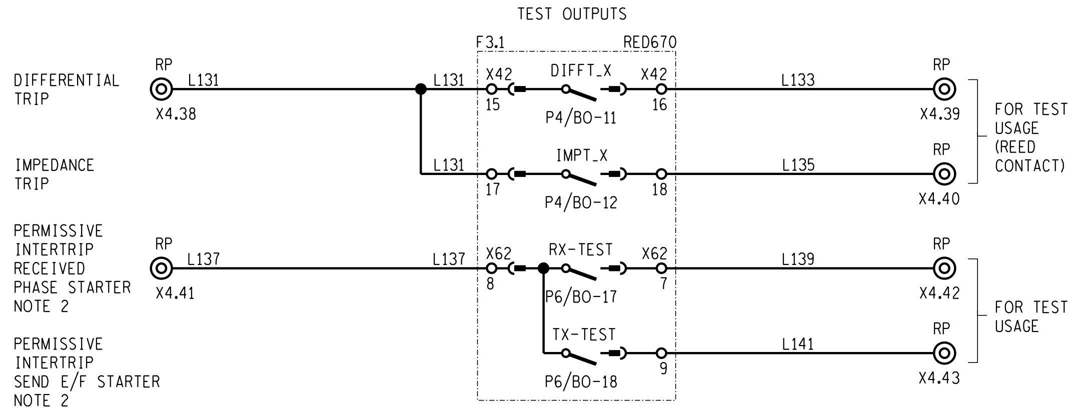


ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

NOTE:

1. JUMPERS TO BE INSTALLED BY ESKOM PERSONNEL OR AN ALTERNATIVE DC SUPPLY TO BE CONNECTED.
2. TO OBTAIN DISTANCE PHASE AND EARTH-FAULT STARTERS DURING TESTING, SET GATE 2 TO 'ON'. TO OBTAIN PERMISSIVE TEST POINTS, SET GATE 2 TO 'OFF' (THE DEFAULT).

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY: K. STEYNBERG	DRAWN BY: C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
INDICATION DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	13	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 13 OF 27 REVISION 00

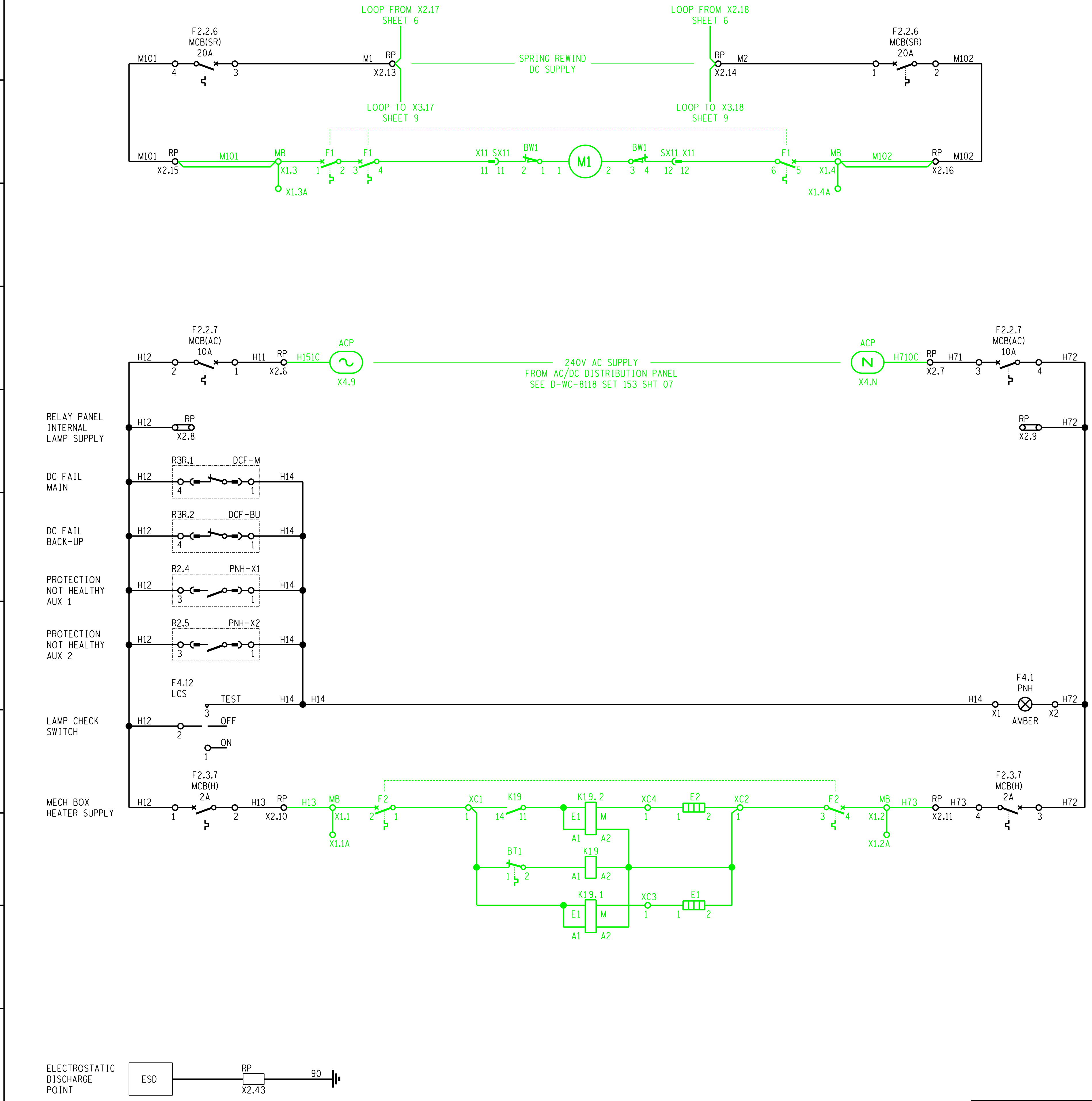


ABB 132kV THREE POLE BREAKER LEGEND

ITEM	DESCRIPTION
BD1	DENSITY SWITCH
BG1	BREAKER AUXILIARY CONTACTS
BT1	HEATER THERMOSTAT
BW1	SPRING LIMIT SWITCH
E1	HEATER (PERMANENTLY CONNECTED)
E2	HEATER (THERMOSTAT CONTROLLED)
F1	DIRECT ON LINE MOTOR STARTER MCB
F2	MINATURE CIRCUIT BREAKER (HEATER)
K1	AUXILIARY RELAY (SPRING LIMIT SWITCH)
K3	ANTIPUMPING RELAY
K9	SF6 INTERLOCKING RELAY (CLOSE)
K10	SF6 INTERLOCKING RELAY (MAIN TRIP)
K19	AUXILIARY RELAY (THERMOSTAT)
K19.1 & K19.2	CURRENT RELAY (HEATER)
K25	SF6 AUXILIARY RELAY (SF6 LOW GAS ALARM)
KT1	TIME DELAYED RELAY (SPRING CHARGE FAILURE)
M1	SPRING REWIND MOTOR
S4	BREAKER ISOLATOR SWITCH (LOR)
SX11 - SX22	CONNECTION TERMINALS
SXY1 - SXY3	CONNECTION TERMINALS
X1	TERMINAL BLOCK FOR CONNECTIONS
X11 - X22	CONNECTION TERMINALS
XC1 - XC7	CONNECTION POINT
Y1	MAIN TRIP COIL
Y2	BACK-UP TRIP COIL
Y3	CLOSE COIL

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE NUMBERS
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION

66kV FEEDER 3

SPRING REWIND AND AC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	14	00

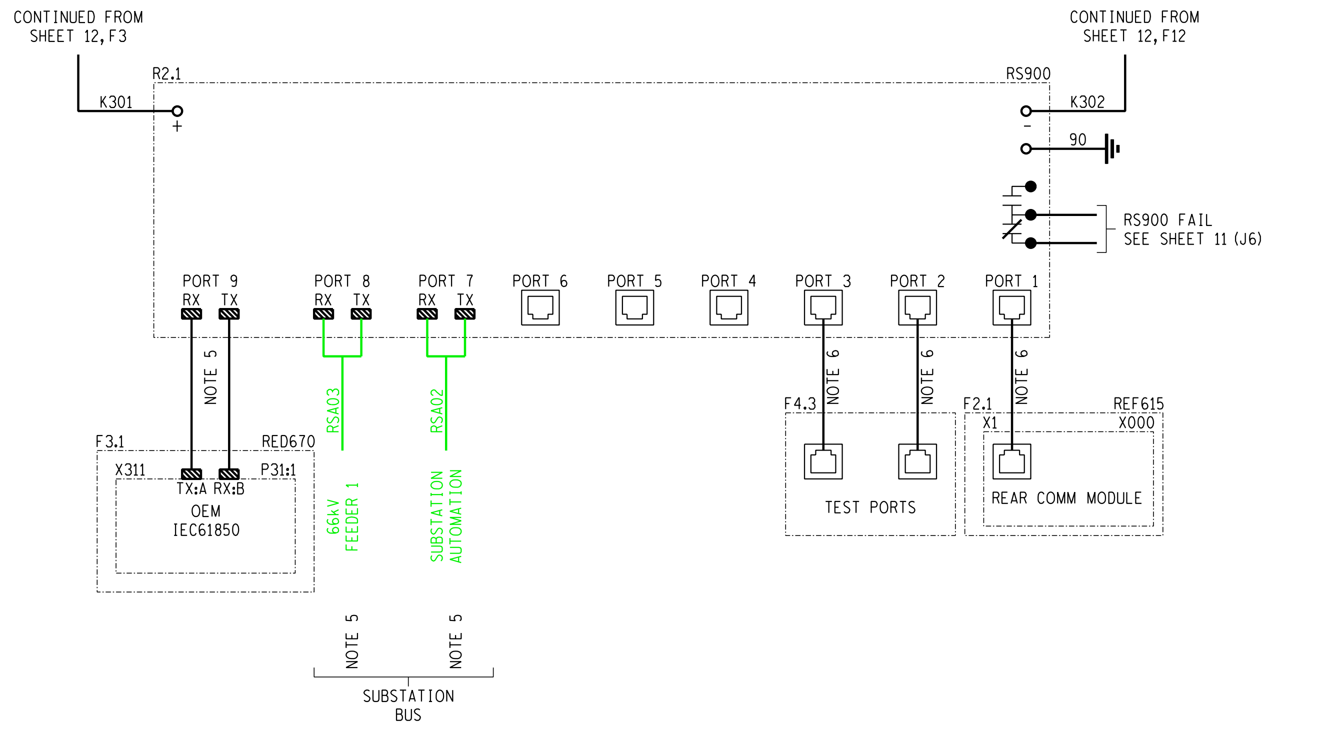
LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

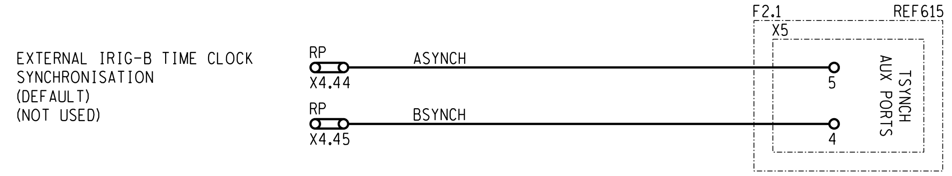
MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 27 REVISION 00

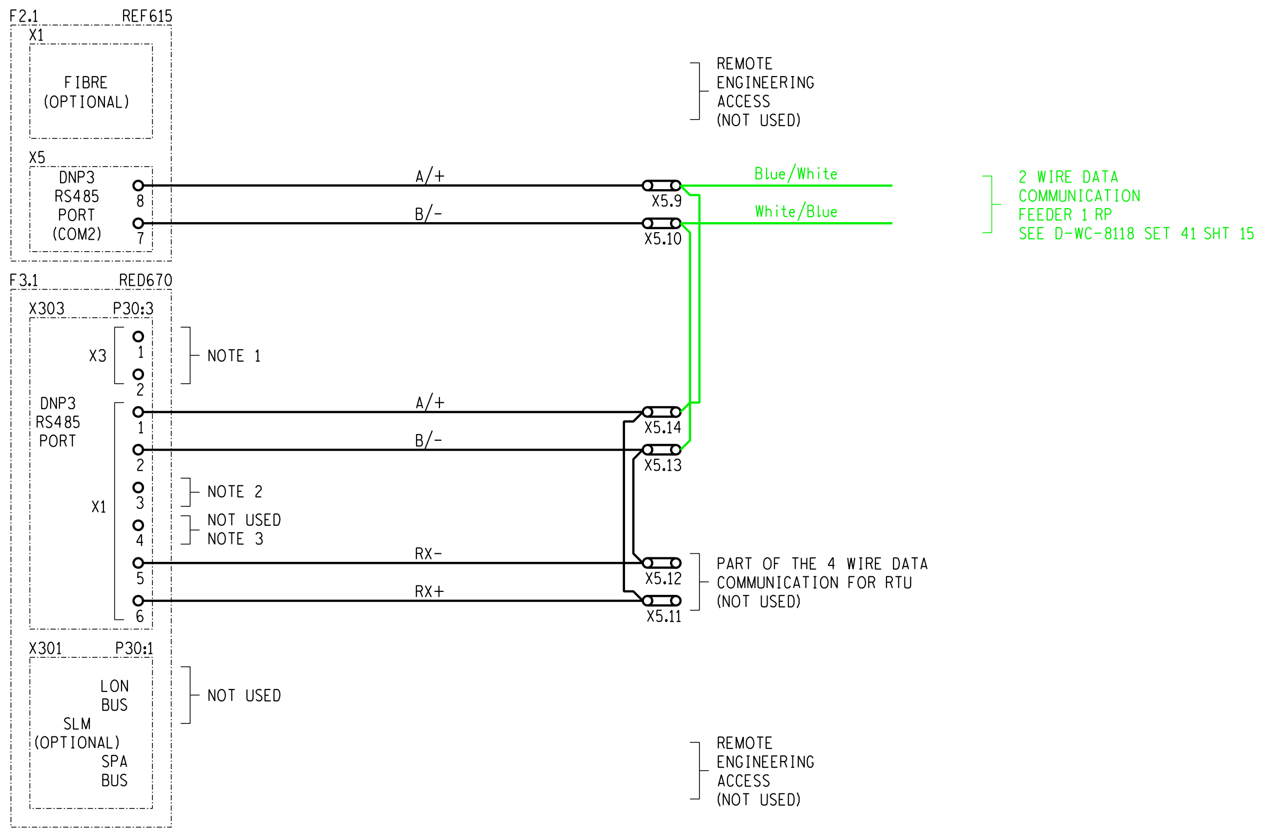
REMOTE ENGINEERING ACCESS IEC61850



TIME SYNCHRONISATION

NOTE 4





NOTE:

1. X3 OF THE RED670 IS THE SOFT GROUND CONNECTOR. IT MAY BE UNCONNECTED OR IT CAN BE CONNECTED TO THE GND WITH AN RC NET PARALLEL WITH A MOV.
2. TERMINATION RESISTOR FOR TRANSMITTER AND RECEIVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
3. TERMINATION RESISTOR FOR RECEIVER IN THE 4 WIRE CASE (CONNECT TO RX+).
4. IF ACCURATE TIMING IS STILL REQUIRED BUT NEITHER OF THE GPS TIMING OPTIONS ARE CHOSEN, THEN USE SNTP TIMING VIA THE IEC61850 OPTIONAL CONNECTION (NOT AS ACCURATE AS GPS TIMING).
5. 100 BASE FX MULTIMODE 1300nm (GLASS), ST CONNECTORS
6. STANDARD RJ45 PORT 100 BASE TX

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
REA AND MEASUREMENTS KEY DIAG

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
43	15	00

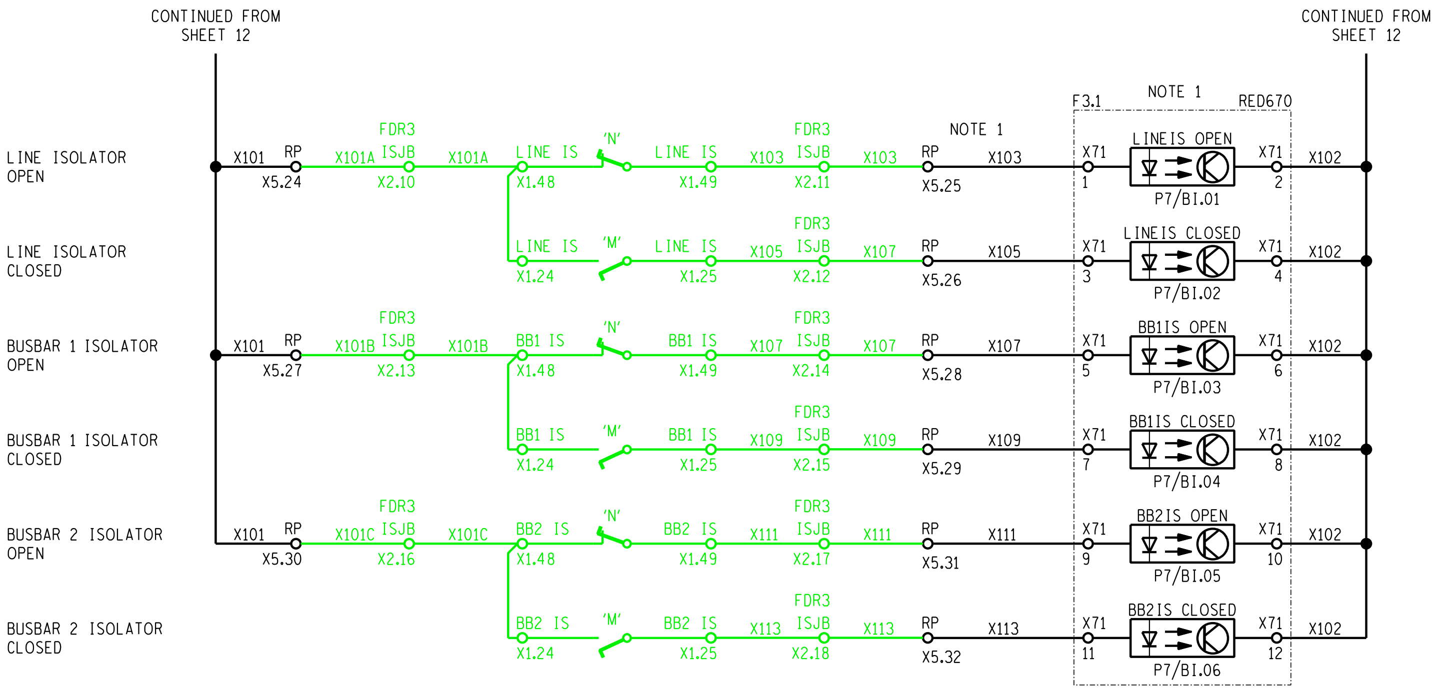
LEVELS 1 2 5 10 23 24 28

PANEL TYPE DESIGNATION 4FZD-3920

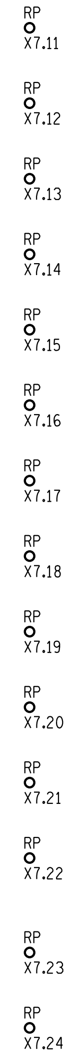
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 15 OF 27 REVISION 00

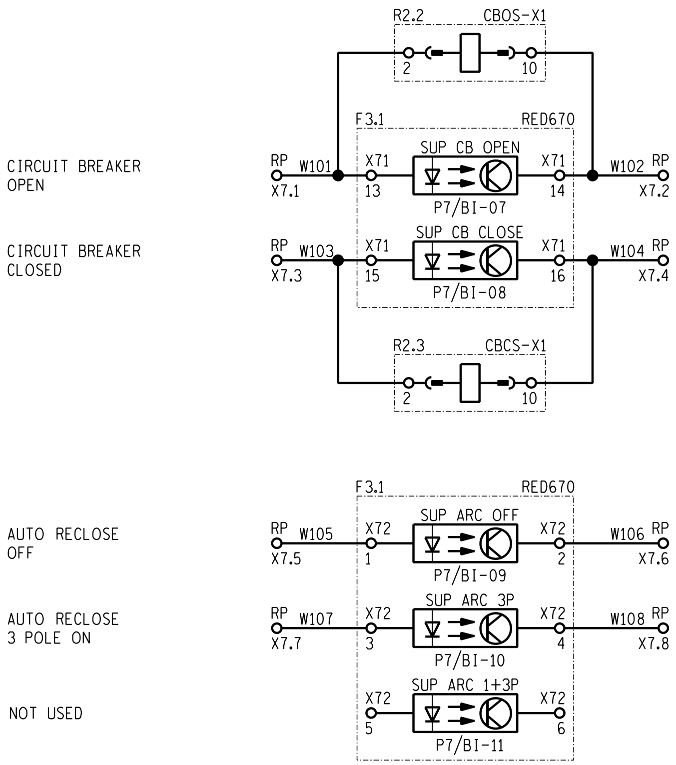
SUPERVISORY STATUS 48V DC (DNP3 OPTIONAL & HMI DISPLAY)



SUPERVISORY STATUS (HARDWIRED OPTIONAL)



SUPERVISORY CONTROLS 48V DC (HARDWIRED OPTIONAL)



NOTE:

1. THESE INDICATIONS MUST ALWAYS BE WIRED IN BY ESKOM.
THE RED670 IED HMI GRAPHICAL DISPLAY EDITOR SINGLE LINE DIAGRAM (SLD) SHOULD BE ALTERED BY ESKOM COMMISSIONING STAFF TO REFLECT THE BUSBAR ARRANGEMENT ON SITE - IN PCM600, GO TO 'GRAPHIC DISPLAY EDITOR'.
COMMISSIONING STAFF MUST ALSO DEFAULT THE HMI DISPLAY TO THE SLD BY SELECTING ON THE RED670 HMI MAIN MENU, SETTINGS, GENERAL SETTINGS, HMI, SCREEN, DEFAULT SCREEN = SINGLE LINE DIAGRAM.
NOTE THAT THE BYPASS ISOLATOR STATUS MAY BE FOUND ON THE BACK-UP DC KEY DIAGRAM.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

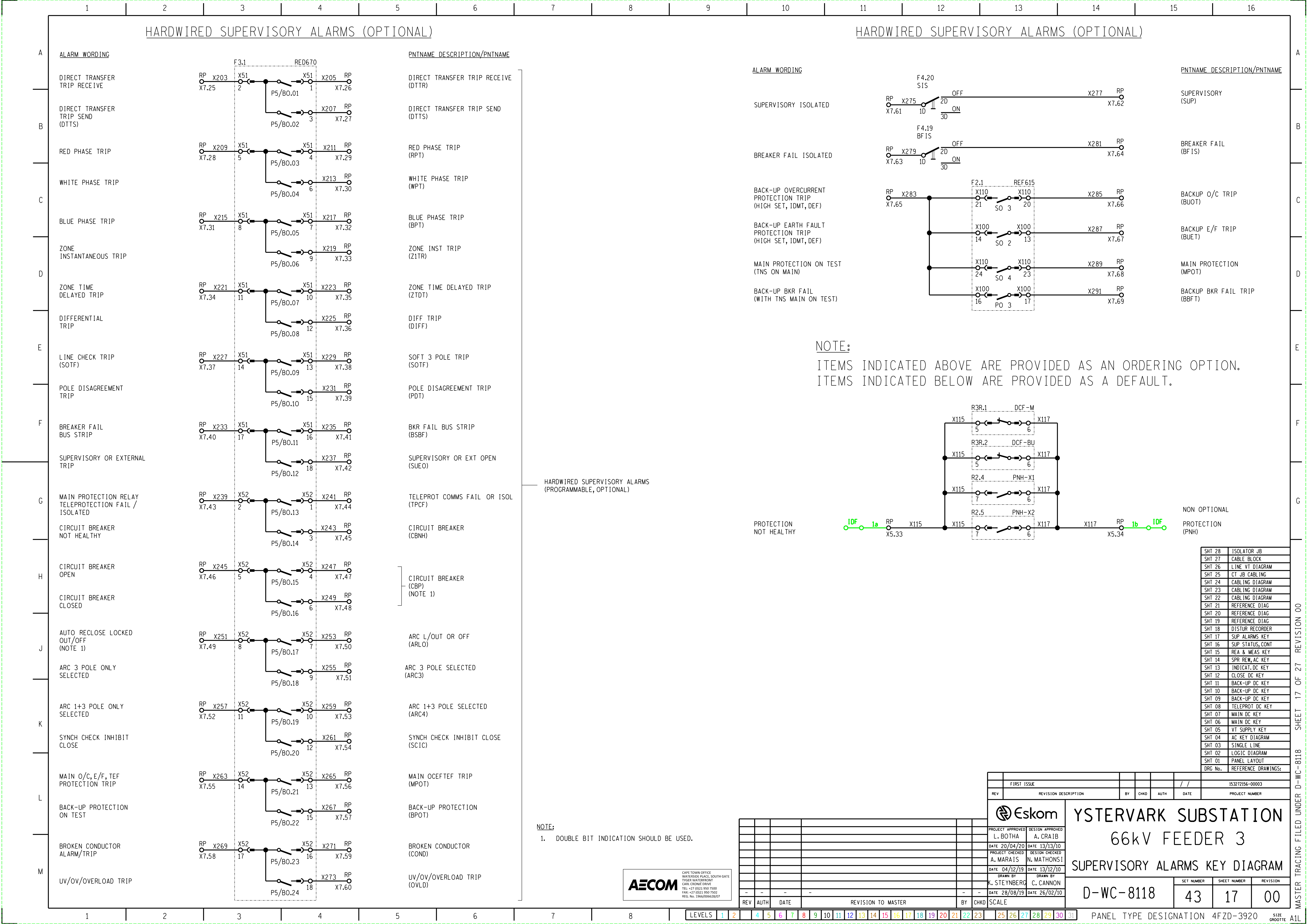
YSTERVARK SUBSTATION
66kV FEEDER 3
SUPERVIS. STATUS & CONTROL KEY

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	16	00

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L


HARDWIRED SUPERVISORY ALARMS (OPTIONAL)
ALARM WORDING
F3.1
RED670
PNTNAME DESCRIPTION/PNTNAME
DIRECT TRANSFER TRIP RECEIVE
P5/BO.01
DIRECT TRANSFER TRIP RECEIVE (DTTR)
DIRECT TRANSFER TRIP SEND (DTTS)
P5/BO.02
DIRECT TRANSFER TRIP SEND (DTTS)
RED PHASE TRIP
P5/BO.03
RED PHASE TRIP (RPT)
WHITE PHASE TRIP
P5/BO.04
WHITE PHASE TRIP (WPT)
BLUE PHASE TRIP
P5/BO.05
BLUE PHASE TRIP (BPT)
ZONE INSTANTANEOUS TRIP
P5/BO.06
ZONE INST TRIP (Z1TR)
ZONE TIME DELAYED TRIP
P5/BO.07
ZONE TIME DELAYED TRIP (ZTDT)
DIFFERENTIAL TRIP
P5/BO.08
DIFF TRIP (DIFF)
LINE CHECK TRIP (SOTF)
P5/BO.09
SOFT 3 POLE TRIP (SOTF)
POLE DISAGREEMENT TRIP
P5/BO.10
POLE DISAGREEMENT TRIP (PDT)
BREAKER FAIL BUS STRIP
P5/BO.11
BKR FAIL BUS STRIP (BSBF)
SUPERVISORY OR EXTERNAL TRIP
P5/BO.12
SUPERVISORY OR EXT OPEN (SUEO)
MAIN PROTECTION RELAY TELEPROTECTION FAIL / ISOLATED
P5/BO.13
TELEPROT COMMS FAIL OR ISOL (TPCF)
CIRCUIT BREAKER NOT HEALTHY
P5/BO.14
CIRCUIT BREAKER (CBNH)
CIRCUIT BREAKER OPEN
P5/BO.15
CIRCUIT BREAKER CLOSED
P5/BO.16
CIRCUIT BREAKER (CBP) (NOTE 1)
AUTO RECLOSE LOCKED OUT/OFF (NOTE 1)
P5/BO.17
ARC L/OUT OR OFF (ARLO)
ARC 3 POLE ONLY SELECTED
P5/BO.18
ARC 3 POLE SELECTED (ARC3)
ARC 1+3 POLE ONLY SELECTED
P5/BO.19
ARC 1+3 POLE SELECTED (ARC4)
SYNCH CHECK INHIBIT CLOSE
P5/BO.20
SYNCH CHECK INHIBIT CLOSE (SCIC)
MAIN O/C, E/F, TEF PROTECTION TRIP
P5/BO.21
MAIN OCEFTEF TRIP (MPOT)
BACK-UP PROTECTION ON TEST
P5/BO.22
BACK-UP PROTECTION (BPOT)
BROKEN CONDUCTOR ALARM/TRIP
P5/BO.23
BROKEN CONDUCTOR (COND)
UV/OV/OVERLOAD TRIP
P5/BO.24
UV/OV/OVERLOAD TRIP (OVLD)
HARDWIRED SUPERVISORY ALARMS (PROGRAMMABLE, OPTIONAL)
HARDWIRED SUPERVISORY ALARMS (OPTIONAL)
ALARM WORDING
PNTNAME DESCRIPTION/PNTNAME
F4.20 SIS
SUPERVISORY ISOLATED
OFF
ON
SUPERVISORY (SUP)
F4.19 BFIS
BREAKER FAIL ISOLATED
BREAKER FAIL (BFIS)
F2.1
REF615
BACK-UP OVERCURRENT PROTECTION TRIP (HIGH SET, IDMT, DEF)
SO 3
BACKUP O/C TRIP (BUOT)
BACK-UP EARTH FAULT PROTECTION TRIP (HIGH SET, IDMT, DEF)
SO 2
BACKUP E/F TRIP (BUET)
MAIN PROTECTION ON TEST (TNS ON MAIN)
SO 4
MAIN PROTECTION (MPOT)
BACK-UP BKR FAIL (WITH TNS MAIN ON TEST)
PO 3
BACKUP BKR FAIL TRIP (BBFT)
NOTE:
ITEMS INDICATED ABOVE ARE PROVIDED AS AN ORDERING OPTION.
ITEMS INDICATED BELOW ARE PROVIDED AS A DEFAULT.
R3R.1 DCF-M
R3R.2 DCF-BU
R2.4 PNH-X1
R2.5 PNH-X2
PROTECTION NOT HEALTHY
NON OPTIONAL
PROTECTION (PNH)
NOTE:
1. DOUBLE BIT INDICATION SHOULD BE USED.
SHT 28 ISOLATOR JB
SHT 27 CABLE BLOCK
SHT 26 LINE VT DIAGRAM
SHT 25 CT JB CABLING
SHT 24 CABLING DIAGRAM
SHT 23 CABLING DIAGRAM
SHT 22 CABLING DIAGRAM
SHT 21 REFERENCE DIAG
SHT 20 REFERENCE DIAG
SHT 19 REFERENCE DIAG
SHT 18 DISTUR RECORDER
SHT 17 SUP ALARMS KEY
SHT 16 SUP STATUS, CONT
SHT 15 REA & MEAS KEY
SHT 14 SPR REW, AC KEY
SHT 13 INDICAT. DC KEY
SHT 12 CLOSE DC KEY
SHT 11 BACK-UP DC KEY
SHT 10 BACK-UP DC KEY
SHT 09 BACK-UP DC KEY
SHT 08 TELEPROT DC KEY
SHT 07 MAIN DC KEY
SHT 06 MAIN DC KEY
SHT 05 VT SUPPLY KEY
SHT 04 AC KEY DIAGRAM
SHT 03 SINGLE LINE
SHT 02 LOGIC DIAGRAM
SHT 01 PANEL LAYOUT
DRG No. REFERENCE DRAWINGS:
FIRST ISSUE
153272156-00003
PROJECT NUMBER
Eskom
YSTERVARK SUBSTATION
66kV FEEDER 3
SUPERVISORY ALARMS KEY DIAGRAM
PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19
DRAWN BY C. CANNON DATE 26/02/10
AECOM
D-WC-8118
SET NUMBER 43
SHEET NUMBER 17
REVISION 00
REVISION TO MASTER
MASTER TRACING FILED UNDER D-WC-8118 SHEET 17 OF 27 REVISION 00
PANEL TYPE DESIGNATION 4FZD-3920

DISTURBANCE RECORDER/ ADDITIONAL SUPERVISORY ALARMS (OPTIONAL)

(NOT INSTALLED)

SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
DISTURBANCE RECORDER KEY DIAG

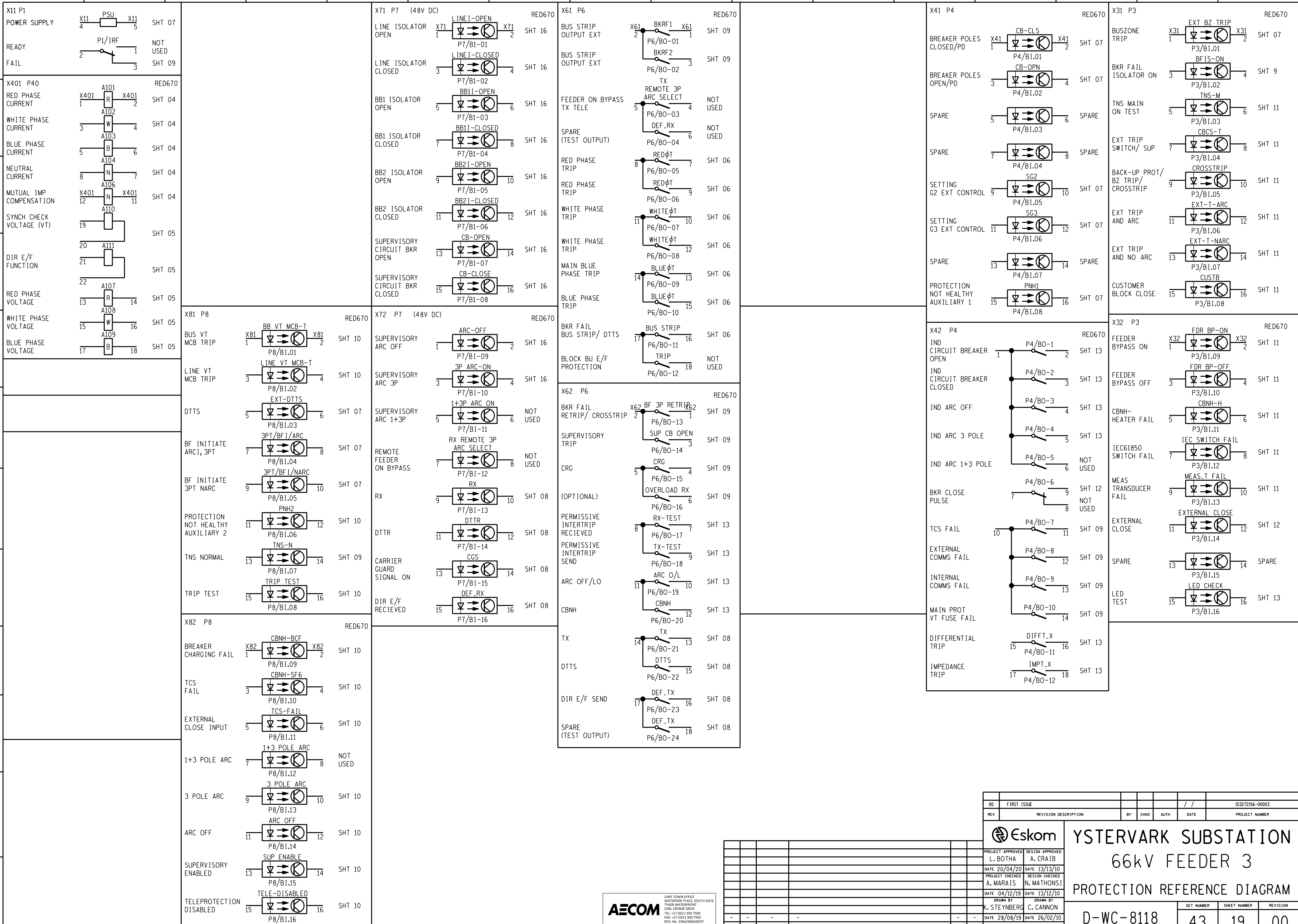
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	18	00

LEVELS 1 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 27 REVISION 00



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20 — DESIGN APPROVED A. CRAIB DATE 13/13/10
PROJECT CHECKED A. MARAIS DATE 04/12/19 — DESIGN CHECKED N. MATHONSI DATE 13/12/10
DRAWN BY K. STEYNBERG DATE 28/08/19 — DRAWN BY C. CANNON DATE 26/02/10
SCALE

YSTERVARK SUBSTATION
66kV FEEDER 3
PROTECTION REFERENCE DIAGRAM

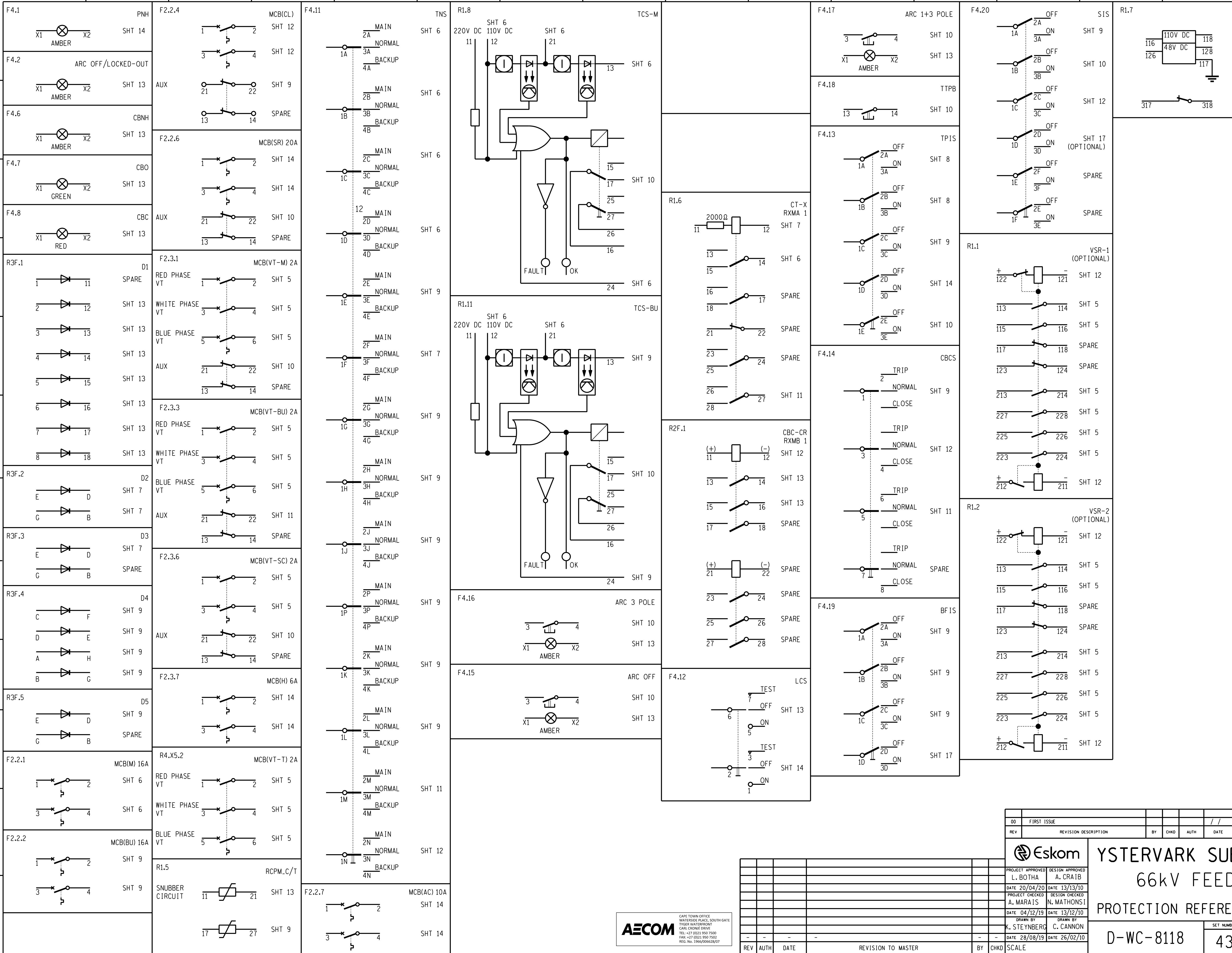
D-WC-8118 — SET NUMBER 43 — SHEET NUMBER 19 — REVISION 00

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE. TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07

REV | AUTH | DATE | REVISION TO MASTER | BY | CHKD

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 — SIZE GROOTTE A1L



SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS,CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW,AC KEY
SHT 13	INDICAT.DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10

YSTERVARK SUBSTATION
66kV FEEDER 3
PROTECTION REFERENCE DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	43	20	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
-	-	-	-	-	-	

AECOM

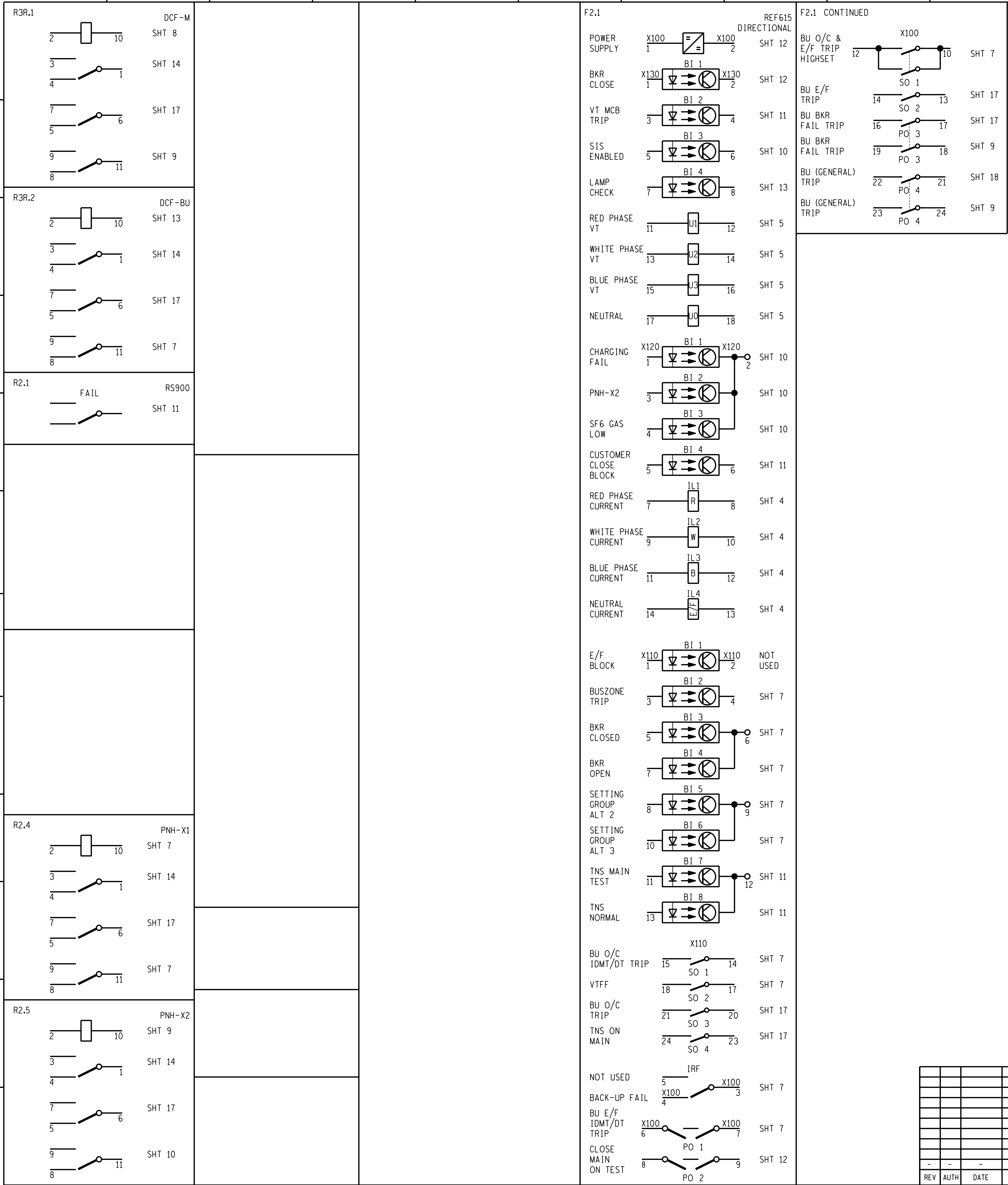
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 20 OF 27 REVISION 00



DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
PROTECTION REFERENCE DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	43	21	00

LEVELS 1 2 5 10 11 12 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 21 OF 27 REVISION 00

X1

Function	Lead	Terminal	Core	AC104	AC112	AC113
SYNCHRONISING CHECK VOLTAGE	G92	⊙44				
	G91	⊙43				
MEASUREMENTS VT SUPPLY	E372	⊙42				
	E252	⊙41				
	E232	⊙40				
	E212	⊙39				
BUSBAR 2 MEASUREMENTS VT INPUTS (VT SELECTION)	E372	38	E472AC			30
	E252	37	E452AC			29
	E232	36	E432AC			28
	E212	35	E412AC			27
BUSBAR 1 MEASUREMENTS VT INPUTS (VT SELECTION)	E372	34	E272AC		30	
	E252	33	E252AC		29	
	E232	32	E232AC		28	
	E212	31	E212AC		27	
MAIN PROTECTION VT INPUT	E70	30				
	E51	29				
	E31	28				
	E11	27				
BUSBAR 2 PROTECTION VT INPUTS (VT SELECTION)	E70	26	E70AC			26
	E51	25	E61AC			25
	E31	24	E41AC			24
	E11	23	E21AC			23
BUSBAR 1 PROTECTION VT INPUTS (VT SELECTION)	E70	22	E71AC		26	
	E51	21	E51AC		25	
	E31	20	E31AC		24	
	E11	19	E11AC		23	
		●18	90			
PARALLEL FDR FLD COMPENSATION (IF REQUIRED)	A173	⊙17				
	A172	⊙16				
		●15	90			
DISTURBANCE RECORDER CT CCT	A74	⊙14				
	A54	⊙13				
	A34	⊙12				
	A14	⊙11				
		●10	90			
BACK-UP PROTECTION CT INPUT	C72	9	C72	58*		
	C52	8	C52	57		
	C32	7	C32	56		
	C12	6	C12	55		
		●5	90			
MAIN PROTECTION CT INPUT	A72	4	A72	40*		
	A52	3	A52	39		
	A32	2	A32	38		
	A12	1	A12	37		
		D-RAIL				

CABLE NUMBER	AC104	AC112	AC113
CABLE SIZE	12	12	12
NUMBER OF SPARES	4	4	4
DESTINATION	CT JUNCTION BOX	66kV BUSBAR 1 VTJB 1	66kV BUSBAR 2 VTJB 1

X2

Function	Lead	Terminal	Core	AC122	AC107	AC117	AC105	AC106
DISCHARGE RESISTOR	ESD		90					
METERING PANEL VT OUTPUT	E372	⊙42	E372AC		13			
	E252	⊙41	E252AC		MCB-6			
	E232	⊙40	E232AC		MCB-5			
	E212	⊙39	E212AC		MCB-4			
SG3	K177	38						
	K101	37						
SG2	K175	36						
	K101	35						
CB OPEN IND	K171	34	K171				X1.40	
	K101	33						
CB CLOSED IND	K169	32	K169				X1.32	
	K101	31	K101A				X1.31	
EXT BUSZONE TRIP	K167	30	P125AC			X5.2		
	K101	29	P121AC			X5.1		
BKR FAIL INITIATE BACK-UP PROTECTION AND BZ CROSSTRIP	K163	28						
	K161	27						
	K159	26						
	K157	25						
	K155	24						
EXT DTTS	K151	23						
	K101	22						
MAIN TRIP	K109	⊙21	K109A				X1.61	
	K102	⊙20	K102A				X1.6	
	K107	⊙19	K107A				X1.5	
MAIN DC SUPPLY	J2	⊠18	J12A	X8.6				
	J1	⊠17	J11A	X8.5				
SPRING REWIND SUPPLY	M102	16	M102 (2)					X1.4
	M101	15	M101 (2)					X1.3
	M2	14	TO X3.18					
	M1	13	TO X3.17					
	SPARE	12						
HEATER SUPPLY	H73	11	H73					X1.2
	H13	10	H13					X1.1
LAMP SUPPLY	H72	●9						
	H12	●8						
220V AC SCHEME SUPPLY	H71	7	H710	X4.N				
	H11	6	H151C	X4.11				
	SPARE	5						
DISTURBANCE RECORDER VT OUTPUT	E172	⊙4						
	E152	⊙3						
	E132	⊙2						
	E112	⊙1						
		D-RAIL						

CABLE NUMBER	AC122	AC107	AC117	AC105	AC106
CABLE SIZE	4	4	4	19	12
NUMBER OF SPARES	0	0	0	1	6
DESTINATION	AC/DC DISTRIBUTION BOARD	STATISTICAL METERING PANEL	BUSZONE PANEL	HV CIRCUIT-BREAKER	HV CIRCUIT-BREAKER

X3

Function	Lead	Terminal	Core	AC105
FDR BYPASS	K371	38		
	K369	37		
	K301	36		
CUSTOMER BLOCK CLOSE	K367	35		
	K301	34		
EXT TRIP NO ARC	K365	33		
	K301	32		
EXT TRIP AND ARC	K363	31		
	K301	30		
SF6 LOW	K341	29	K341	X1.20
	K301	28		
BREAKER CHARGING FAIL	K339	27	K339	X1.48*
	K301	26	K301A	X1.47*
LINE VT SUPPLY FAIL	K333	25		
	K301	24		
BUS VT SUPPLY FAIL	K331	23		
	K301	22		
BACK-UP TRIP	K315	⊙21	K315A	X1.63
	K302	⊙20	K302A	X1.8
	K313A	⊙19	K313AC	X1.7
BACK-UP DC SUPPLY	J4	⊠18	FROM X2.14	
	J3	⊠17	FROM X2.13	
DIR E/F SEND	K204	Ø16		
	K221	Ø15		
DIRECT INTERTRIP SEND	K204	Ø14		
	K219	Ø13		
PERMISSIVE INTERTRIP SEND	K204	Ø12		
	K217	Ø11		
DIR E/F RECIEVE	K215	Ø10		
	K205	Ø9		
CARRIER GUARD SIGNAL ON	K213	Ø8		
	K205	Ø7		
DIRECT INTERTRIP RECIEVE	K211	Ø6		
	K205	Ø5		
PERMISSIVE INTERTRIP RECIEVE	K209	Ø4		
	K205	Ø3		
TELEPROTECTION POWER SUPPLY (48V DC)	K202	2		
	K201	1		
		D-RAIL		

CABLE NUMBER	AC105
CABLE SIZE	19
NUMBER OF SPARES	1
DESTINATION	HV CIRCUIT-BREAKER

TERMINAL LOOPS (*)

RP	X2.13 - X3.17; X2.14 - X3.18
CB MB	X1.18 - X1.48; X1.31 - X1.39;
	X1.17 - X1.19 - X1.47
CTJB	40 - 41 - 42; 46 - 47 - 48; 52 - 53 - 54;
	58 - 59 - 60; 61 - 62 - 63 - 64 - 65 - 66 - E; 70 - 71 - 72 - E

NOTE:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   K101 [K101] K101 INDICATES NO CHANGE IN LEAD NUMBER.
   K301 [ ] K305 INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.
   STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
   ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
   ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
   Ø M4/6 RS SPRING LOADED ENTRELEC
   * M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
   X D2.5/5 SN ADD ENTRELEC TERMINALS
   □ M4/8 SF ENTRELEC FUSE TERMINALS
   ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
   R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED
5. NOTE THAT D6/8 ST1 RS TERMINALS MAY BE USED IN PLACE OF D6/8-ST-RS TERMINALS. THE YELLOW INSULATED TEST POINTS MAY BE REMOVED FROM THE EARTH LINKS, AT THE COMMISSIONING TECHNICIANS DISCRETION.
6. FINE TOOTHED HORIZONTAL TRUNKING SHALL BE USED.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT

DRG No.	REFERENCE DRAWINGS:
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
PANEL CABLING DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
43	22	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

	1	2	3	4	5	6	

X4

Function	Wire	X4		AC115		AC117	AC105
VARS	W4	⁎ 49					
	W3	⁎ 48					
WATTS	W2	⁎ 47					
	W1	⁎ 46					
EXTERNAL TIME SYNCH INPUT	BSYNCH	⁎ 45					
	ASYNCH	⁎ 44					
COMMISSIONING TEST POINTS	L141	⊠ 43					
	L139	⊠ 42					
	L137	⊠ 41					
	L135	⊠ 40					
	L133	⊠ 39					
	L131	⊠ 38					
LINKS FOR INDICATION 110V DC SUPPLY	L102	● 37					
	K502	36					
	L101	● 35					
	K501	34					
BKR CLOSE OUTPUT	K502	● 33	K502A				X1.12A
	K523	● 32	K523A				X1.11
EXT CLOSE INPUT	K521	31					
	K501	30					
BU CLOSE, NO SYNCH	K501	●A29	K515				
BKR FAIL TRIP OUTPUT	P17	28	P17AC			X4.20	
	P7	27	P7AC			X4.19	
CURRENT REVERSAL GUARD OUTPUT	T7	26					
	T3	25					
DNP3 STATUS SUPPLY	K302	⊙ 24	X102				
	K301	⊙ 23	X101				
EXTERNAL RECORDER SUPPLY	K302	22					
	K301	21					
REA SUPPLY	K302	20					
	K301	19					
SF6 GAS SUPPLY	K302	18	K302B				X1.16
	K301	17	K301C				X1.15
BYPASS CT SHORTING INPUTS	K391	16					
	K389	15					
	K301	14					
BUSBAR VOLTAGE SELECTION INPUTS	K387	13	K387	X2.6			
	K385	12	K385	X2.5			
	K301	11	K301E	X2.4			
	K383	10	K383	X2.3			
	K381	9	K381	X2.2			
	K301	8	K301D	X2.1			
MEASUREMENTS TRANSDUCER	K302	● 7					
	K377	● 6					
	K301	● 5					
IEC61850 SWITCH FAIL	K375	● 4	K375A				
	K301	● 3	K301A				
CBNH HEATER FAIL	K373	2	K373				X1.28
	K301	1	K301B				X1.27

D-RAIL

CABLE NUMBER	AC115		AC117	AC105		
CABLE SIZE	19		4	19		
NUMBER OF SPARES	7		0	1		
DESTINATION	66kV FEEDER 3 ISOLATOR JB		BUSZONE PANEL	HV CIRCUIT-BREAKER		

X5

Function	Wire	X5			AC115			AA127		AC123
SUPERVISORY ALARM PNH HARDWIRED	X117	Ø 34	1b							
	X115	Ø 33	1a							
BUSBAR 2 ISOLATOR STATUS	X113	Ø 32	X113		X2.18					
	X111	Ø 31	X111		X2.17					
	X101	Ø 30	X101C		X2.16					
BUSBAR 1 ISOLATOR STATUS	X109	Ø 29	X109		X2.15					
	X107	Ø 28	X107		X2.14					
	X101	Ø 27	X101D		X2.13					
LINE ISOLATOR STATUS	X105	Ø 26	X105		X2.12					
	X103	Ø 25	X103		X2.11					
	X101	Ø 24	X101A		X2.10					
		⁎ 23								
		⁎ 22								
		⁎ 21								
		⁎ 20								
		⁎ 19								
		⁎ 18								
		⁎ 17								
		⁎ 16								
		⁎ 15								
MAIN IED DATA FOR RTU	A/+	⁎ 14								
	B/-	⁎ 13								
	RX-	⁎ 12								
	RX+	⁎ 11								
BACK-UP IED DATA FOR RTU	B/-	⁎ 10						X5.14		
	A/+	⁎ 9						X5.13		
MEASUREMENTS CT CIRCUITS	D72A	⊙ 8								
		⊙ 7								
		⊙ 6								
		● 5	90							
		⊙ 4								
		⊙ 3								
		⊙ 2								
		⊙ 1								

D-RAIL

DIN RAIL MOUNTED

X5.2 VT-T MCB

X5.1 TRANSDUCER (OPTIONAL)

CABLE NUMBER		AC115			AA127		AC123
CABLE SIZE		19			4Pr		10Pr
NUMBER OF SPARES		7			3Pr		9Pr
DESTINATION		66kV FEEDER 3 ISOLATOR JB			66kV FEEDER 1 RP		IDF

TERMINAL LOOPS (⁎)	
LINE IS MB	X1.24 - X1.48
BB1 IS MB	X1.24 - X1.48
BB2 IS MB	X1.24 - X1.48

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
- ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
- Ø M4/6 RS SPRING LOADED ENTRELEC
- ⁎ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
- X D2.5/5 SN ADD ENTRELEC TERMINALS
- □ M4/8 SF ENTRELEC FUSE TERMINALS
- ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
- 🄁 M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

2. NOTE THAT D6/8 ST1 RS TERMINALS MAY BE USED IN PLACE OF D6/8-ST-RS TERMINALS. THE YELLOW INSULATED TEST POINTS MAY BE REMOVED FROM THE EARTH LINKS, AT THE COMMISSIONING TECHNICIANS DISCRECTION.
3. THE DROPPING RESISTORS HAVE BEEN REMOVED FROM THE X5 RACK AT THE REQUEST OF ABB.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED A. MARAIS	DESIGN CHECKED N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY K. STEYNBERG	DRAWN BY C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
PANEL CABLING DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	23	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 23 OF 27 REVISION 00

LEVELS 1 2 5 10 11 12 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

Function	Wire	X7
SUPERVISORY ALARMS	X241	Ø 44
	X239	Ø 43
	X237	Ø 42
	X235	Ø 41
	X233	Ø 40
	X231	Ø 39
	X229	Ø 38
	X227	Ø 37
	X225	Ø 36
	X223	Ø 35
	X221	Ø 34
	X219	Ø 33
	X217	Ø 32
	X215	Ø 31
	X213	Ø 30
	X211	Ø 29
	X209	Ø 28
	X207	Ø 27
	X205	Ø 26
	X203	Ø 25
SF6 BREAKER ALARM STATUS	X145	Ø 24
	X143	Ø 23
BYPASS ISOLATOR STATUS	X141	Ø 22
	X139	Ø 21
	X137	Ø 20
BUSBAR 2 ISOLATOR STATUS	X135	Ø 19
	X133	Ø 18
	X131	Ø 17
BUSBAR 1 ISOLATOR STATUS	X129	Ø 16
	X127	Ø 15
	X125	Ø 14
LINE ISOLATOR STATUS	X123	Ø 13
	X121	Ø 12
	X119	Ø 11
	SPARE	Ø 10
	SPARE	Ø 9
SUPERVISORY CONTROL	W108	Ø 8
	W107	Ø 7
	W106	Ø 6
	W105	Ø 5
	W104	Ø 4
	W103	Ø 3
	W102	Ø 2
	W101	Ø 1
		D-RAIL

CABLE NUMBER						
CABLE SIZE						
NUMBER OF SPARES						
DESTINATION						

Function	Wire	X7
BACK-UP B/F TRIP	X291	Ø 69
TNS ON MAIN	X289	Ø 68
BACK-UP E/F TRIP	X287	Ø 67
BACK-UP O/C TRIP	X285	Ø 66
	X283	Ø 65
BREAKER FAILURE ISOLATED	X281	Ø 64
	X279	Ø 63
SUPERVISORY ISOLATED	X277	Ø 62
	X275	Ø 61
SUPERVISORY ALARMS	X273	Ø 60
	X271	Ø 59
	X269	Ø 58
	X267	Ø 57
	X265	Ø 56
	X263	Ø 55
	X261	Ø 54
	X259	Ø 53
	X257	Ø 52
	X255	Ø 51
	X253	Ø 50
	X251	Ø 49
	X249	Ø 48
	X247	Ø 47
	X245	Ø 46
	X243	Ø 45
		D-RAIL

CABLE NUMBER						
CABLE SIZE						
NUMBER OF SPARES						
DESTINATION						

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ● D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
- ⊙ D6/8 ST1 RS TEST AND SHORTING LINKS WITH SAFETY CONNECTIONS (YELLOW INSULATED TEST POINTS)
- Ø M4/6 RS SPRING LOADED ENTRELEC
- ⁎ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
- X D2.5/5 SN ADD ENTRELEC TERMINALS
- □ M4/8 SF ENTRELEC FUSE TERMINALS
- ⊠ ENTRELEC 1SNA168237R0500 TEST SOCKET - AL4 - DIA 4mm (INSTALLED IN CENTRE SPACING OF TERMINAL)
- R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
PANEL CABLING DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	43	24	00

LEVELS 1 2 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 24 OF 27 REVISION 00

TOP OF TERMINAL STRIP

To CURRENT TRANSFORMERs — X1

AC101	AC102	AC103		X1	
		6S2	D171B	36	36
		6S1	D151	35	35
		5S2	D71B	34	34
		5S1	D51	33	33
		4S2	C71B	32	32
		4S1	C51	31	31
		3S2	B71B	30	30
		3S1	B51	29	29
		2S2	B171B	28	28
		2S1	B150	27	27
		1S2	A71B	26	26
		1S1	A51	25	25
	6S2		D171W	24	24
	6S1		D131	23	23
	5S2		D71W	22	22
	5S1		D31	21	21
	4S2		C71W	20	20
	4S1		C31	19	19
	3S2		B71W	18	18
	3S1		B31	17	17
	2S2		B171W	16	16
	2S1		B130	15	15
	1S2		A71W	14	14
	1S1		A31	13	13
6S2			D171R	12	12
6S1			D111	11	11
5S2			D71R	10	10
5S1			D11	9	9
4S2			C71R	8	8
4S1			C11	7	7
3S2			B71R	6	6
3S1			B11	5	5
2S2			B171R	4	4
2S1			B110	3	3
1S2			A71R	2	2
1S1			A11	1	1

AC101	AC102	AC103	CABLE NUMBER
12	12	12	CABLE SIZE
0	0	0	NUMBER OF SPARES
66kV FEEDER 1 66kV RED PHASE CT	66kV FEEDER 1 66kV WHITE PHASE CT	66kV FEEDER 1 66kV BLUE PHASE CT	DESTINATION

To CONTROL ROOM — X2

	X2			AC104	AC119	AC118	AC126		
12	72	R							CORE 6
24	71	W							
36	70	B	D171AC			17			
35	69	B	D151AC			16			
23	68	W	D131AC			15			
11	67	R	D111AC			14			
10	66	R							CORE 5
22	65	W							
34	64	B							
33	63	B							
21	62	W							
9	61	R							
8	60	R							CORE 4
20	59	W							
32	58	B	C72	X1.9					
31	57	B	C52	X1.8					
19	56	W	C32	X1.7					
7	55	R	C12	X1.6					
6	54	R							CORE 3
18	53	W							
30	52	B	B71AC		X2.4				
29	51	B	B51AC		X2.3				
17	50	W	B31AC		X2.2				
5	49	R	B11AC		X2.1				
4	48	R							CORE 2
16	47	W							
28	46	B	B171AC				X1.7		
27	45	B	B150AC				X1.5		
15	44	W	B130AC				X1.3		
3	43	R	B110AC				X1.1		
2	42	R							CORE 1
14	41	W							
26	40	B	A72	X1.4					
25	39	B	A52	X1.3					
13	38	W	A32	X1.2					
1	37	R	A12	X1.1					

CABLE NUMBER	AC104	AC119	AC118	AC126
CABLE SIZE	12	4	4	4
NUMBER OF SPARES	4	0	0	0
DESTINATION	66kV FEEDER 1 RELAY PANEL	66kV BUSZONE RELAY PANEL	STATISTICAL METERING PANEL	66kV FEEDER 3 ISOLATOR JB

TERMINAL LOOPS (*)	
CT JB	40-41-42, 46-47-48, 52-53-54, 58-59-60, 61-62-63-64-65-66-E;
	70-71-72-E.

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
CTJB CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	25	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 25 OF 27 REVISION 00

(NOT USED)

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10

SCALE

YSTERVARK SUBSTATION
66kV FEEDER 3
LINE VTJB LAYOUT & KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	26	00

LEVELS 1 2 5 10 11 12 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920 SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 26 OF 27 REVISION 00

(NOT USED)

SEE D-WC-8118 SET 159

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
-	-	-	-	-	-

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	A. CRAIB
DATE 20/04/20	DATE 13/13/10
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	N. MATHONSI
DATE 04/12/19	DATE 13/12/10
DRAWN BY	DRAWN BY
K. STEYNBERG	C. CANNON
DATE 28/08/19	DATE 26/02/10
SCALE	

YSTERVARK SUBSTATION
66kV FEEDER 3
CABLE BLOCK DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	27	00

LEVELS 1 5 10 14 20 21 22 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 27 OF 27 REVISION 00

X2

			X1.22		K301D	1	K301D	X4.8				
			X1.23		K381	2	K381	X4.9				
			X1.21		K383	3	K383	X4.10				
		X1.22			K301E	4	K301E	X4.11				
		X1.23			K385	5	K385	X4.12				
		X1.21			K387	6	K387	X4.13				
						7						
						8						
						9						
		X1.48			K101A	10	K101A	X5.24				
		X1.49			X103	11	X103	X5.25				
		X1.25			X105	12	X105	X5.26				
				X1.48	X101B	13	X101B	X5.27				
				X1.49	X107	14	X107	X5.28				
				X1.25	X109	15	X109	X5.29				
			X1.48		X101C	16	X101C	X5.30				
			X1.49		X111	17	X111	X5.31				
			X1.25		X113	18	X113	X5.32				
						19						
						20						
						21						
						22						
						23						
						24						
						25						
						26						
						27						
						28						
						29						
						30						
						31						
						32						
						33						
		AC110	AC125	AC109	CABLE NUMBER			AC115				
		12	19	19	CABLE SIZE			19				
		6	5	5	NUMBER OF SPARES			4				
		66kV LINE ISMB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FEEDER 3 RP				

X1

					X1.32	B110AC	1	B110AC	43				
					X1.33	B111AC	2	B111AC		X1.1			
					X1.36	B130AC	3	B130AC	44				
					X1.37	B131AC	4	B131AC		X1.2			
					X1.40	B150AC	5	B150AC	45				
					X1.41	B151AC	6	B151AC		X1.3			
			48			B171AC	7	B171AC		X1.4			
				X1.32			8	B210AC					
				X1.33		B211AC	9	B211AC		X2.1			
				X1.36			10	B230AC					
				X1.37		B231AC	11	B231AC		X2.2			
				X1.40			12	B250AC					
				X1.41		B251AC	13	B251AC		X2.3			
							14	B271AC		X2.4			
					X1.44	P3AC	15	P3AC			X4.5		
					X1.45	P117AC	16	P117AC			X4.6		
				X1.44		P5AC	17	P5AC			X4.7		
				X1.45		P217AC	18	P217AC			X4.8		
							19						
							20						
							21						
							22						
							23						
							24						
							25						
							26						
							27						
							28						
							29						
							30						
			AC126	AC125	AC109	CABLE NUMBER			AC126	AC121	AC116		
			4	19	19	CABLE SIZE			4	12	4		
			-	5	6	NUMBER OF SPARES			-	4	-		
			66kV FEEDER 3 CTJB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FEEDR 3 CTJB	66kV BUSZONE RP	66kV BUSZONE RP		

LOOPED TERMINALS	
BP ISMB	
BB1 ISMB	X1.20-X1.22; X1.24-X1.48; X1.32-X1.34; X1.33-X1.35; X1.37-X1.39; X1.41-X1.43; X1.44-X1.46; X1.45-X1.47
BB2 ISMB	X1.20-X1.22; X1.24-X1.48; X1.32-X1.34; X1.33-X1.35; X1.37-X1.39; X1.41-X1.43; X1.44-X1.46; X1.45-X1.47
LINE ISMB	X1.20-X1.22; X1.24-X1.48
ISJB	X1.1-X1.8; X1.3-X1.10; X1.5-X1.12; X1.7-X1.14

DRG No.	REFERENCE DRAWINGS:
SHT 28	ISOLATOR JB
SHT 27	CABLE BLOCK
SHT 26	LINE VT DIAGRAM
SHT 25	CT JB CABLING
SHT 24	CABLING DIAGRAM
SHT 23	CABLING DIAGRAM
SHT 22	CABLING DIAGRAM
SHT 21	REFERENCE DIAG
SHT 20	REFERENCE DIAG
SHT 19	REFERENCE DIAG
SHT 18	DISTUR RECORDER
SHT 17	SUP ALARMS KEY
SHT 16	SUP STATUS, CONT
SHT 15	REA & MEAS KEY
SHT 14	SPR REW, AC KEY
SHT 13	INDICAT. DC KEY
SHT 12	CLOSE DC KEY
SHT 11	BACK-UP DC KEY
SHT 10	BACK-UP DC KEY
SHT 09	BACK-UP DC KEY
SHT 08	TELEPROT DC KEY
SHT 07	MAIN DC KEY
SHT 06	MAIN DC KEY
SHT 05	VT SUPPLY KEY
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE				/ /	153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 28/08/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 3

ISJB CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	43	28	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4FZD-3920

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 28 OF 28 REVISION 1

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	1	06/05/2016	NEW REVISION.
01	PANEL EQUIPMENT LAYOUT	1	06/05/2016	ADDED RELAY SIR-CCB-O.
02	SCHEME LOGIC DIAGRAM	1	06/05/2016	RELAY LABELS CHANGED.
03	SINGLE LINE DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
04	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
05	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
06	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
07	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPERVISORY CB CONTROL.
08	DC KEY DIAGRAM	1	06/05/2016	CB CLOSE FUNCTION NOT USED.
09	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPV. BREAKER OPEN.
10	INDICATIONS KEY DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL.
11	AC SUPPLY KEY & SPRING REWIND DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS. ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUST. TRIP & LOCK-OUT CONTACT ON SHEET 12.
12	SUPERVISORY KEY DIAGRAM	1	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM.
13	PROTECTION REFERENCE DIAGRAM	1	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.
14	PANEL CABLING DIAGRAM	1	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM.
15	PANEL CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
16	CTJB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
17	CUSTOMER INTERFACE JB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
18	CABLE BLOCK DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2		17	INDOOR SWITCHGEAR AS PER D-DT-5408r0 SHTs 1 - 6 (X1-X3 TERMINALS) WITH REMOTE PROTECTION SCHEME
3	SCHEME WITH HARDWIRED & SERIAL SCADA INTERFACE	18	OUTDOOR CONVENTIONAL CB & CTs
4	OPTIONAL SECOND REAR COMMS PORT & IRIG-B INPUT FOR P145 (USE WITH LEVEL 3)	19	STANDARD KIOSK TYPE CB & CTs AS PER D-DT-5407
5	SCHEME WITH SERIAL SCADA INTERFACE ONLY	20	
6	OPTIONAL SECOND REAR COMMS PORT & IRIG- B INPUT FOR P145 (USE WITH LEVEL 5)	21	
7		22	
8		23	
9		24	
10	STANDARD DESIGN DRAWING	25	
11		26	
12		27	
13		28	
14		29	
15		30	

θ

θ θ CIRCUIT-BREAKER OPTIONS

NOTE

AMP TRANSDUCER OPTION INCORPORATED INTO LEVELS 3, 5, 17, 18 & 19. DELETE IF NOT REQUIRED.
θ MUTUALLY EXCLUSIVE LEVELS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.

66kV FEEDER 4: MAIN INTAKE 2

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	NEW REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
COVER SHEET

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	00	00

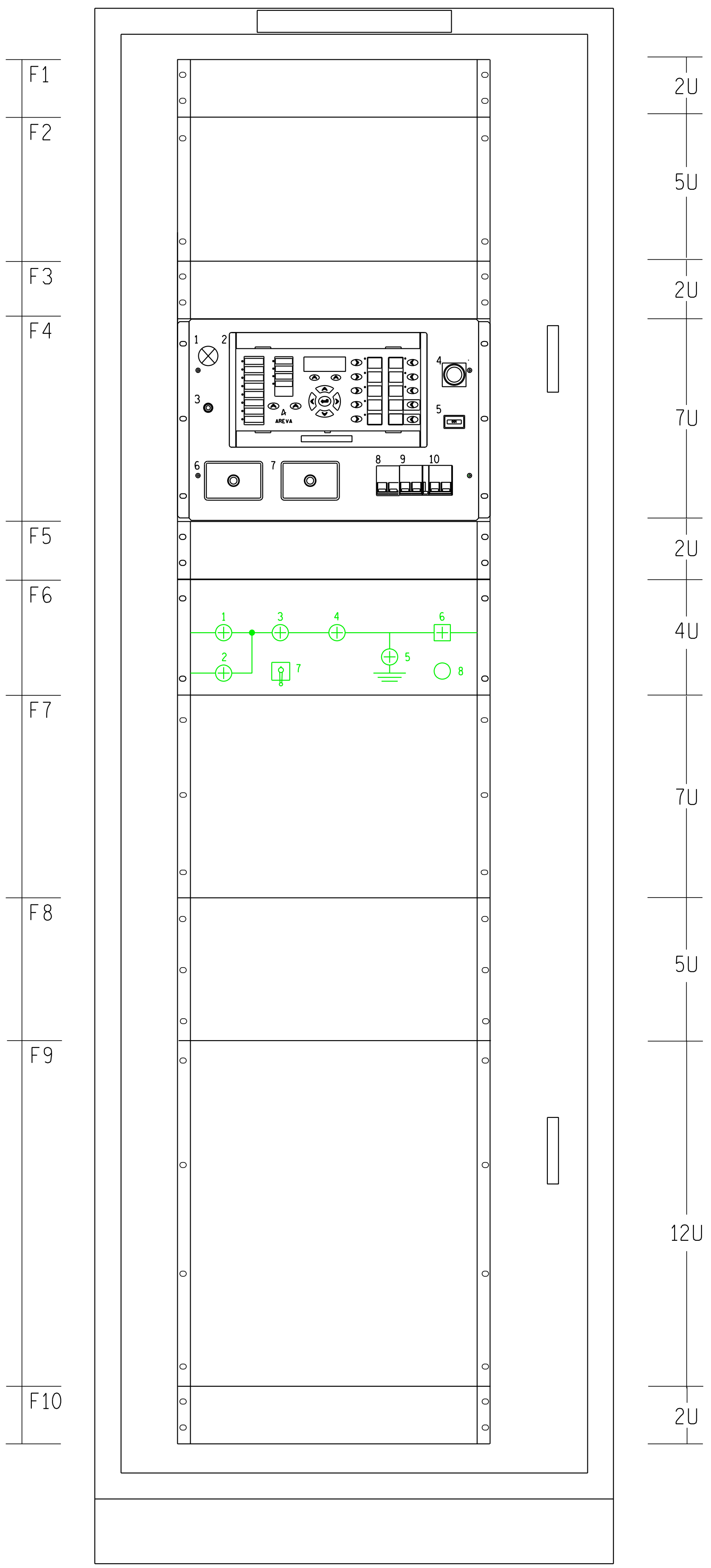
LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

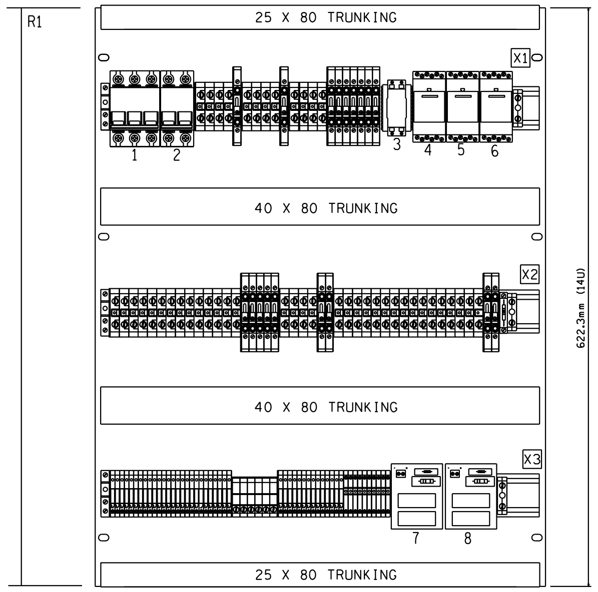
MASTER TRACING FILED UNDER D-WC-8118

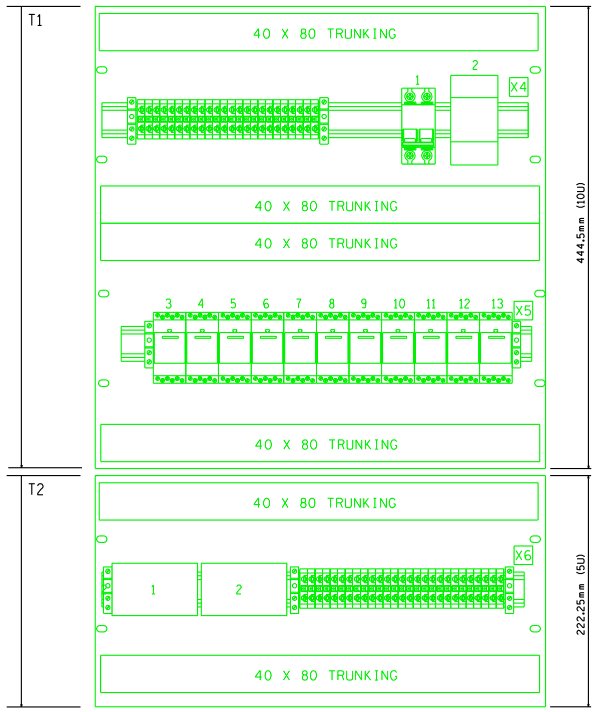
SHEET 0 OF 19 REVISION 1

FRONT VIEW

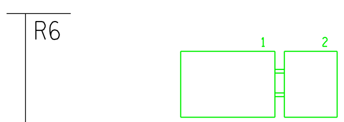


BACK PLATE





MOUNTED ON RADIO RACK OF MIMIC



LOCATION		DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW					
F1			2U BLANKING PLATE		
F2			5U BLANKING PLATE		
F3			2U BLANKING PLATE		
F4	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	ND-16-22B/2	CHNT
	2	P145	FEEDER MANAGEMENT RELAY	MiCOM P145	SCHNEIDER ELECTRIC
	3	ESD	ELECTROSTATIC DISCHARGE POINT	TEST POINT	HIRSCHMAN
	4	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	YSF & COVER	ADDA INDICATORS
	5	FC	FAULT COUNTER (6 DIGIT)	ZR6-2600-20✱0	FOX
				✱ = 6 (110Vdc), 7 (220Vdc)	
	6	CTTB	CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	7	VTTB	VOLTAGE TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	8	DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER (16A)	EP102UC(C16)	GE
	9	DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER (20A)	EP102UC(C20) & CA H	GE
	10	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G61NC(C10)	GE
F5			2U BLANKING PLATE		
F6	1	BB1-S	66kV FEEDER 4 BUSBAR 1 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	2	BB2-S	66kV FEEDER 4 BUSBAR 2 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	3	MIS-S	66kV FEEDER 4 MOTORISED ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	4	IS-S	TRANSFORMER 2 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	5	ES-S	TRANSFORMER 2 EARTHSWITCH SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	6	CB-S	TRANSFORMER 2 CIRCUIT BREAKER SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	7	CS	66kV FEEDER 4 MOTORISED ISOLATOR CONTROL SWITCH	A714-600	KRAUS & NAIMER
	8	RPBI	RESET PUSH BUTTON INDICATION (AMBER)		ADDA INDICATORS
F7			7U BLANKING PLATE		
F8			5U BLANKING PLATE		
F9			12U BLANKING PLATE		
F10			2U BLANKING PLATE		
BACK PLATE					
R1	1	MCB (VT)	VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02)	GE
	2	MCB (H)	MECHANISM BOX AC HEATER MINIATURE CIRCUIT-BREAKER (5A)	G61NC(C05)	GE
	3	DM	DIODE MODULE	KCH	ELMEX
		D1, D2	DIODES WITHIN DIODE MODULE (2)	DDSA9-16F	ACTOM
	4	CL-X	CLOSE AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	5	APT-X	ANTI-PUMP TIMER AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	6	PNH-X	PROTECTION NOT HEALTHY AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	7	AS-1	TRIPPING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
	8	AS-2	CLOSING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
T1	1	DCI MCB (I)	INDICATIONS DC ISOLATE MINIATURE CIRCUIT-BREAKER (6A)	EP102UC(C6)	GE
	2	TR-X	TRIP REPEAT AUXILIARY RELAY (110V DC)	BFT3	ARTECHE
	3	BF-X	BREAKER FAIL AUXILIARY RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	4	LC-X	LAMP CHECK AUXILIARY RELAY (230V AC)	MK3P5-S 230Vac	OMRON
	5	CB-X	CIRCUIT-BREAKER INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	6	BB1-X	BUSBAR 1 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	7	BB2-X	BUSBAR 2 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	8	MIS-X	MOTORISED ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	9	IS-X	TRANSFORMER 3 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	10	ES-X	TRANSFORMER 3 EARTHSWITCH INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	11	SIR-O	SUPERVISORY OPEN CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	12	SIR-C	SUPERVISORY CLOSE CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	13	SIR-CCB-O	CIRCUIT BREAKER SUPERVISORY CONTROL OPEN (48V DC)	MK3P5-S 48Vdc	OMRON
	14	MCB (VT2)	BUSBAR VOLTAGE SUPPLY MINIATURE CIRCUIT-BREAKER + AUX (2A)	G63(C02) + AUX	GE
T2	1	VSR-1	ISOLATOR 1 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
	2	VSR-2	ISOLATOR 2 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
REAR SIDE OF FRONT VIEW					
R6	1	DB-1	DIODE MODULE - 10 COMMONLY CONNECTED DIODES		MIMIC CRAFT
	2	DB-2	DIODE MODULE - 5 COMMONLY CONNECTED DIODES		MIMIC CRAFT

REFER TO SHEET 13 FOR DETAILS OF TERMINAL BLOCK MAKES AND TYPES.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED RELAY SIR-CCB-O	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
PANEL EQUIPMENT LAYOUT

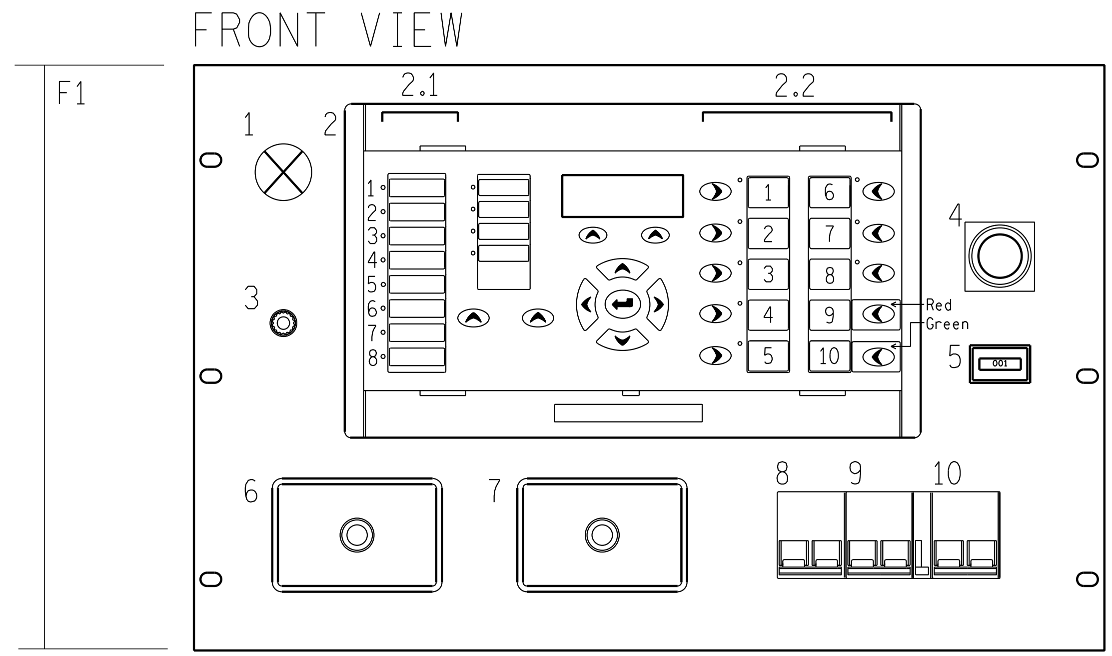
D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	44	01	00

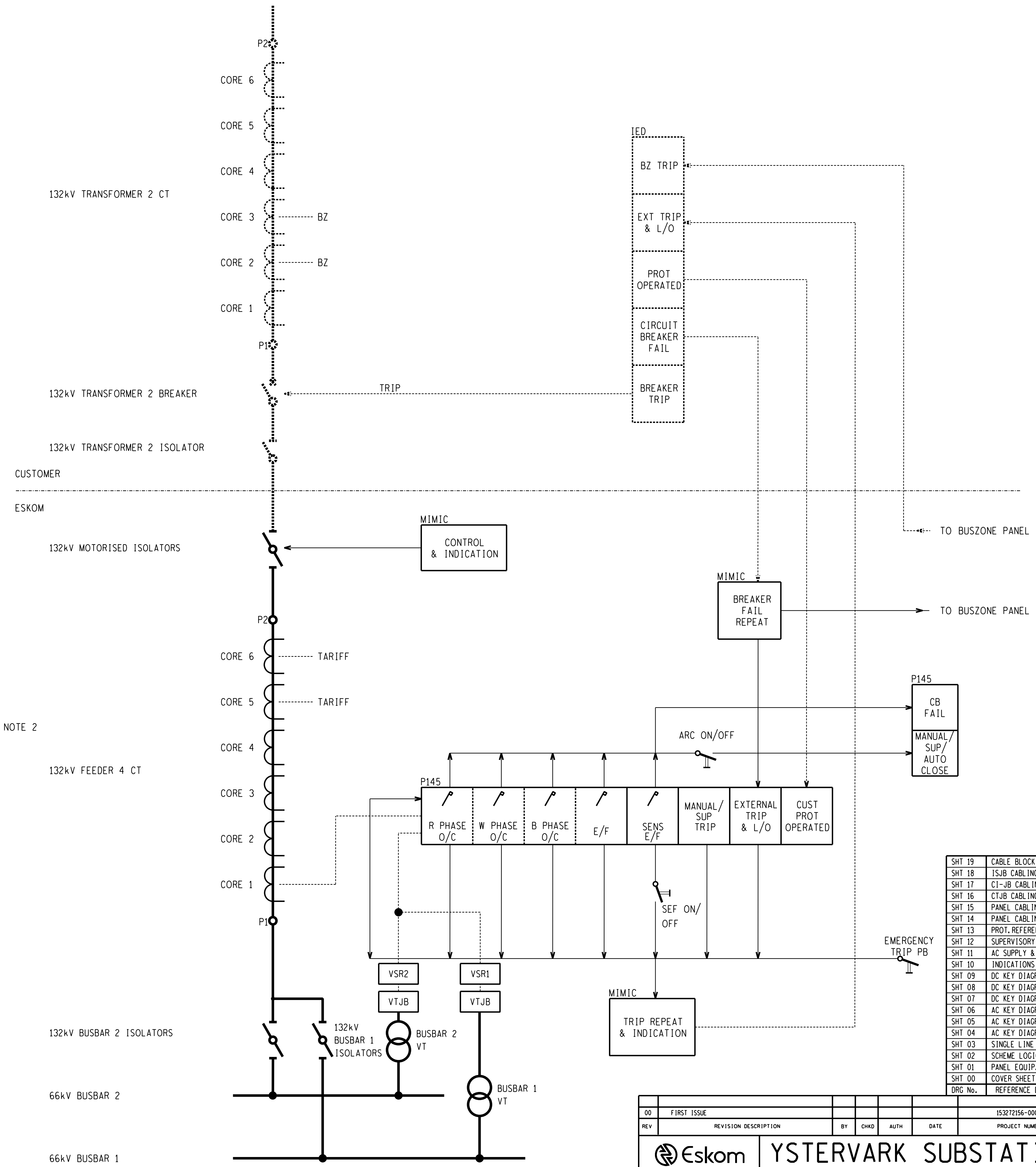
LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 1 OF 19 REVISION 1

FRONT VIEW





LOCATION		DESIGNATION	DESCRIPTION	LABEL
FRONT VIEW				
F1				
1		PNH-I	PROTECTION NOT HEALTHY INDICATION	PROTECTION NOT HEALTHY
2		P145	FEEDER MANAGEMENT RELAY	
2.1			PROGRAMMABLE LEDs	
	1		CIRCUIT-BREAKER CLOSED INDICATION (RED)	CB CLOSED
	2		CIRCUIT-BREAKER OPEN INDICATION (GREEN)	CB OPEN
	3		CIRCUIT-BREAKER NOT HEALTHY INDICATION	MOTORISED ISOL ALARM
	4		OVERCURRENT TRIP INDICATION	O/C TRIP (NOT USED)
	5		EARTH FAULT TRIP INDICATION	E/F TRIP (NOT USED)
	6		SENSITIVE EARTH FAULT TRIP INDICATION	SEF TRIP (NOT USED)
	7		OTHER TRIP	OTHER TRIP✱ (NOT USED)
	8		CIRCUIT-BREAKER FAIL ISOLATED ALARM	CB FAIL ISOL (NOT USED)
2.2			PROGRAMMABLE FUNCTION KEYs WITH LEDs	
	1		AUTO RECLOSE ON PUSH BUTTON & INDICATION	ARC ON (NOT USED)
	2		AUTO RECLOSE OFF PUSH BUTTON & INDICATION	ARC OFF (NOT USED)
	3		ARC LOCKED OUT INDICATION (PUSH BUTTON NOT USED)	ARC LOCKOUT (NOT USED)
	4		SENSITIVE EARTH FAULT ON PUSH BUTTON & INDICATION	SEF ON (NOT USED)
	5		SENSITIVE EARTH FAULT OFF PUSH BUTTON & INDICATION	SEF OFF (NOT USED)
	6		SUPERVISORY ISOLATE SWITCH ON PUSH BUTTON & INDICATION	SIS ON (NOT USED)
	7		SUPERVISORY ISOLATE SWITCH OFF PUSH BUTTON & INDICATION	SIS OFF (NOT USED)
	8		LAMP CHECK / TARGET RESET PUSH BUTTON & INDICATION	RESET / LAMP CH
	9		CIRCUIT-BREAKER CLOSE CONTROL (RED)	CLOSE✱✱ (NOT USED)
	10		CIRCUIT-BREAKER TRIP CONTROL (GREEN)	TRIP✱✱ (NOT USED)
3		ESD	ELECTROSTATIC DISCHARGE POINT	ESD
4		ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER	CUST BREAKER EMERGENCY TRIP
5		FC	FAULT COUNTER	FAULT COUNTER
6		CTTB	CURRENT TRANSFORMER TEST BLOCK	CURRENT TRANSFORMER TEST BLOCK
7		VTTB	VOLTAGE TRANSFORMER TEST BLOCK	VOLTAGE TRANSFORMER TEST BLOCK
8		DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER	MAIN DC SUPPLY MCB (16A)
9		DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER	SPRING REWIND DC MCB (20A)
10		MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER	AC SUPPLY MCB (10A)

✱ CB FAIL, FREQUENCY, VOLTAGE, POWER PROTECTION TRIP - SEE LCD DISPLAY FOR DETAILED ALARM DESCRIPTION.
✱✱ PRESS TWICE IN 3s TO OPERATE

NOTE:

1. DOWNLOAD THE ✱.PSL FILE FROM THE P145 RELAY FOR FULL SCHEME LOGIC.
2. LED SHOWS RED FOR "ARC LOCK-OUT" AND GREEN FOR "ARC IN PROGRESS"

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	RELAY LABELS CHANGED	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

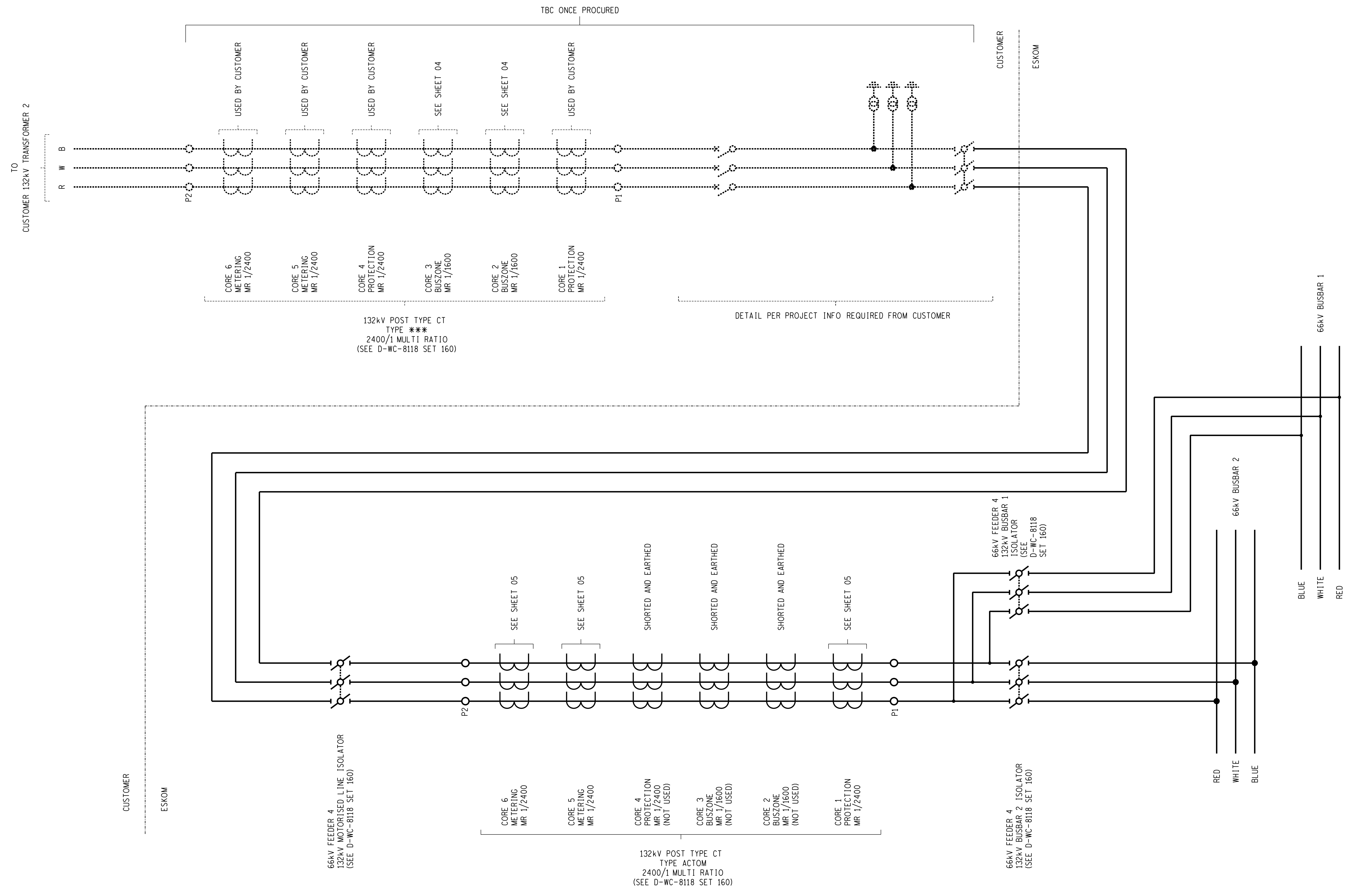
YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
SCHEME LOGIC DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	02	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 2 OF 19 REVISION 1



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME SINGLE LINE DIAGRAM

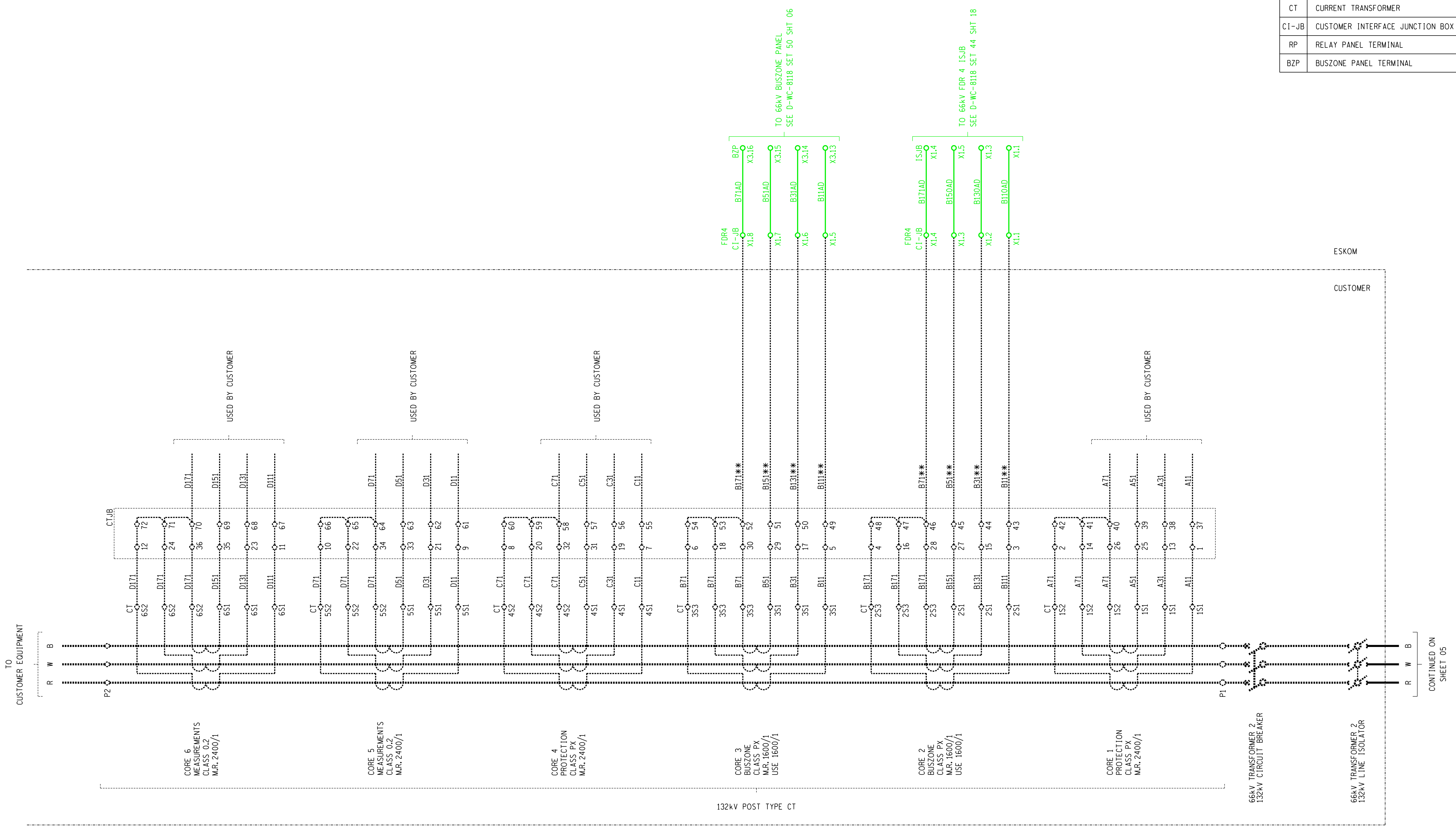
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	03	00

LEVELS 1 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 3 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CI-JB	CUSTOMER INTERFACE JUNCTION BOX
RP	RELAY PANEL TERMINAL
BZP	BUSZONE PANEL TERMINAL



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

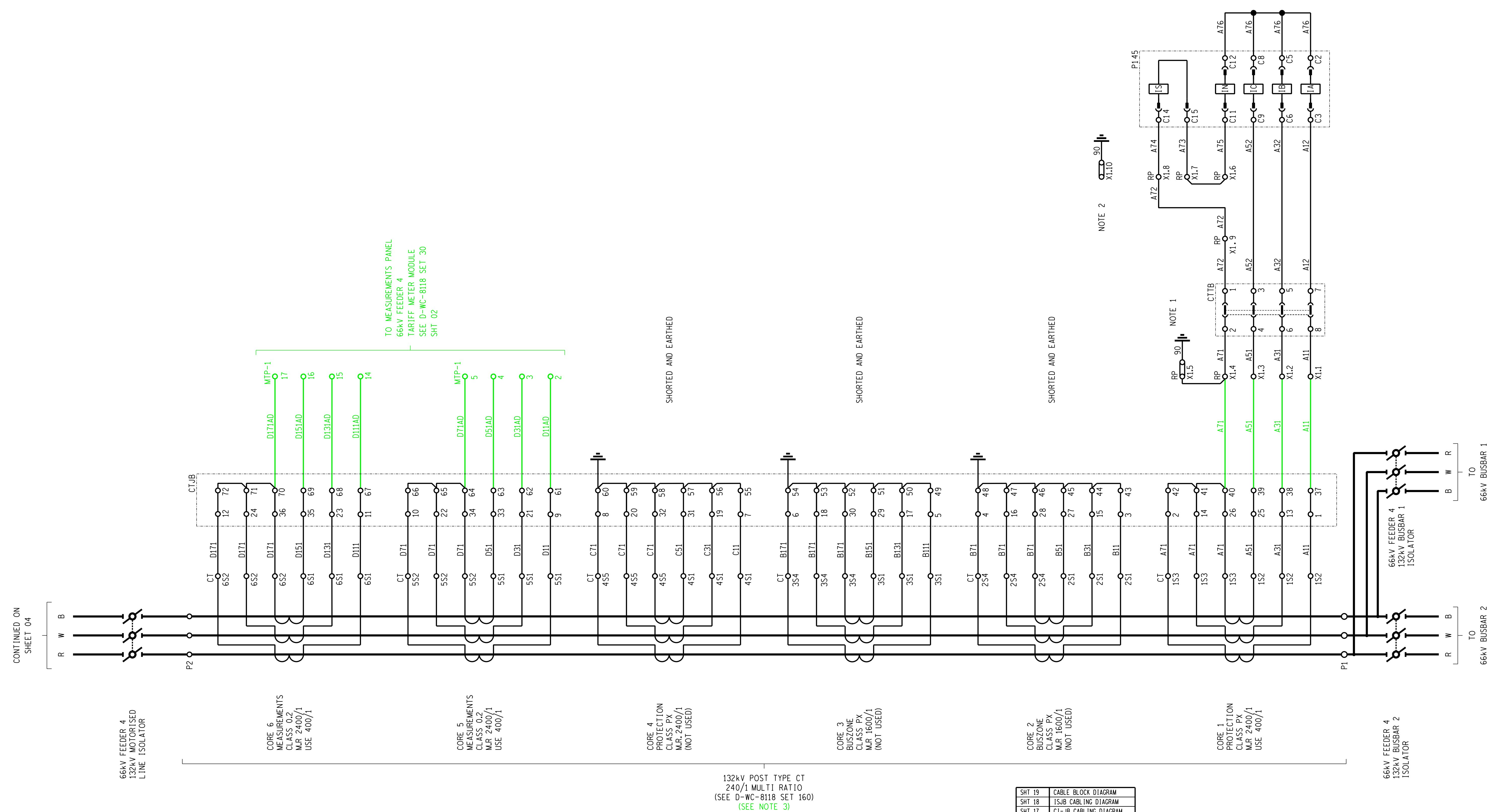
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	04	00

LEVELS:
LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 4 OF 19 REVISION 1

	TERMINAL DESCRIPTION
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
BZJB	BUSZONE JUNCTION BOX
RP	RELAY PANEL TERMINAL



NOTES:

1. FOR CONNECTION TO CORE BALANCE CT, LOOP:
   X1.6 - X1.9
   X1.7 - CT
   X1.8 - CT

   REMOVE LOOPS
   X1.6 - X1.7
   X1.8 - X1.9

2. THE LINK BETWEEN X1.8 AND X1.10 SHOULD BE INSTALLED IF A SEPARATE CORE BALANCE CT IS USED.

   THERE SHOULD ONLY BE ONE EARTH POINT ON EACH CT CIRCUIT.

3. REFER TO SETTING SHEET FOR CORRECT RATIO.

4. THE P145 RELAY IS SUITABLE FOR 1A OR 5A RATED CTs (VIA DIFFERENT TERMINAL INPUTS). THE STANDARD DRAWING INDICATES THE RELAY WIRED FOR 1A RATED CTs. USE THE TABLE BELOW TO DETERMINE THE CORRECT WIRING FOR 5A RATED CTs. SCHEMES ORDERED FOR 5A RATED CTs WILL BE WIRED AS SUCH IN THE FACTORY.

	P145 TERMINAL NUMBER	
WIRE FERRULE NUMBER	1A RATED	5A RATED
A12	C3	C1
A32	C6	C4
A52	C9	C7
A76	C12	C10
A73	C15	C13

AECOM

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

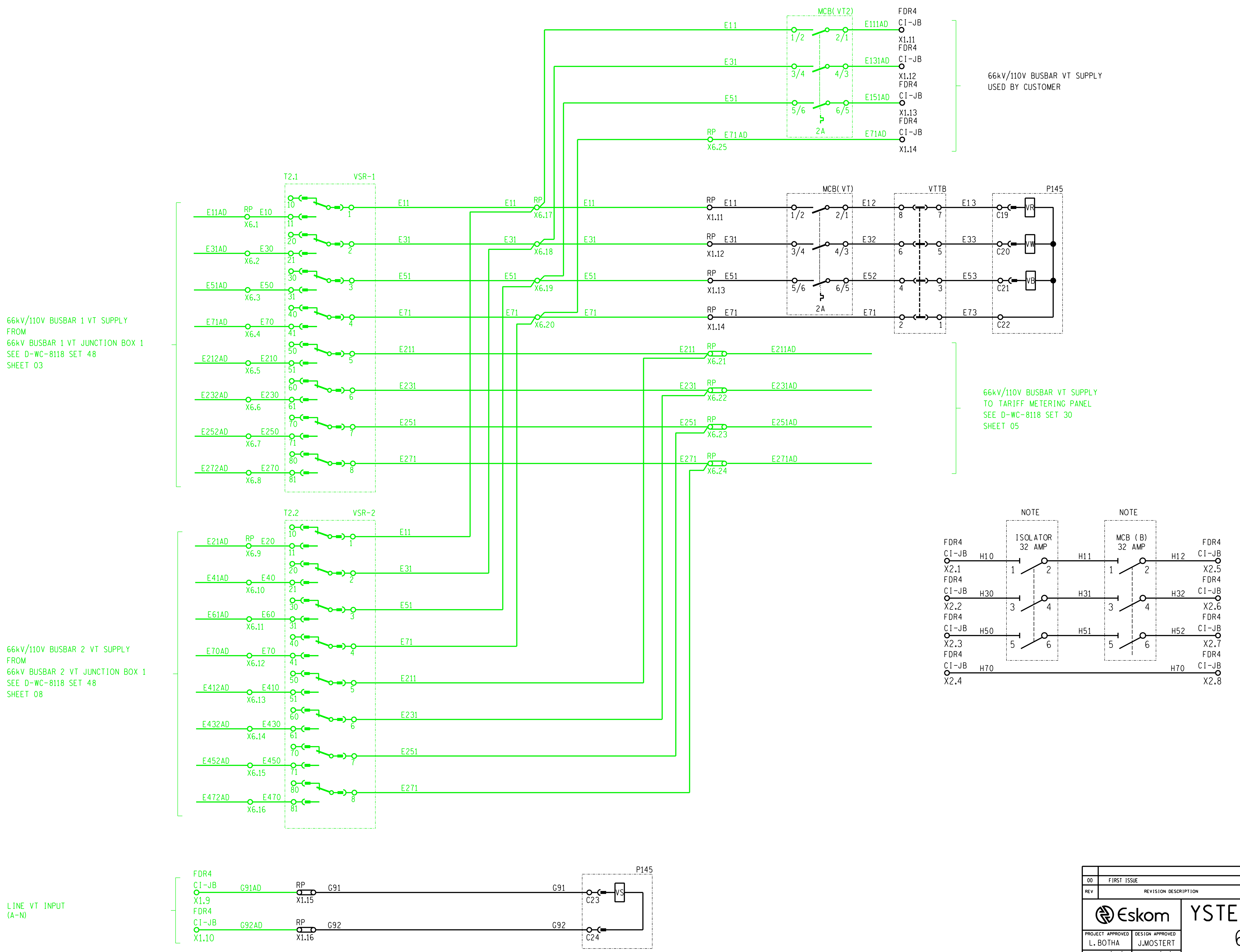
YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	05	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 5 OF 19 REVISION 1



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F. KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	06	00

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

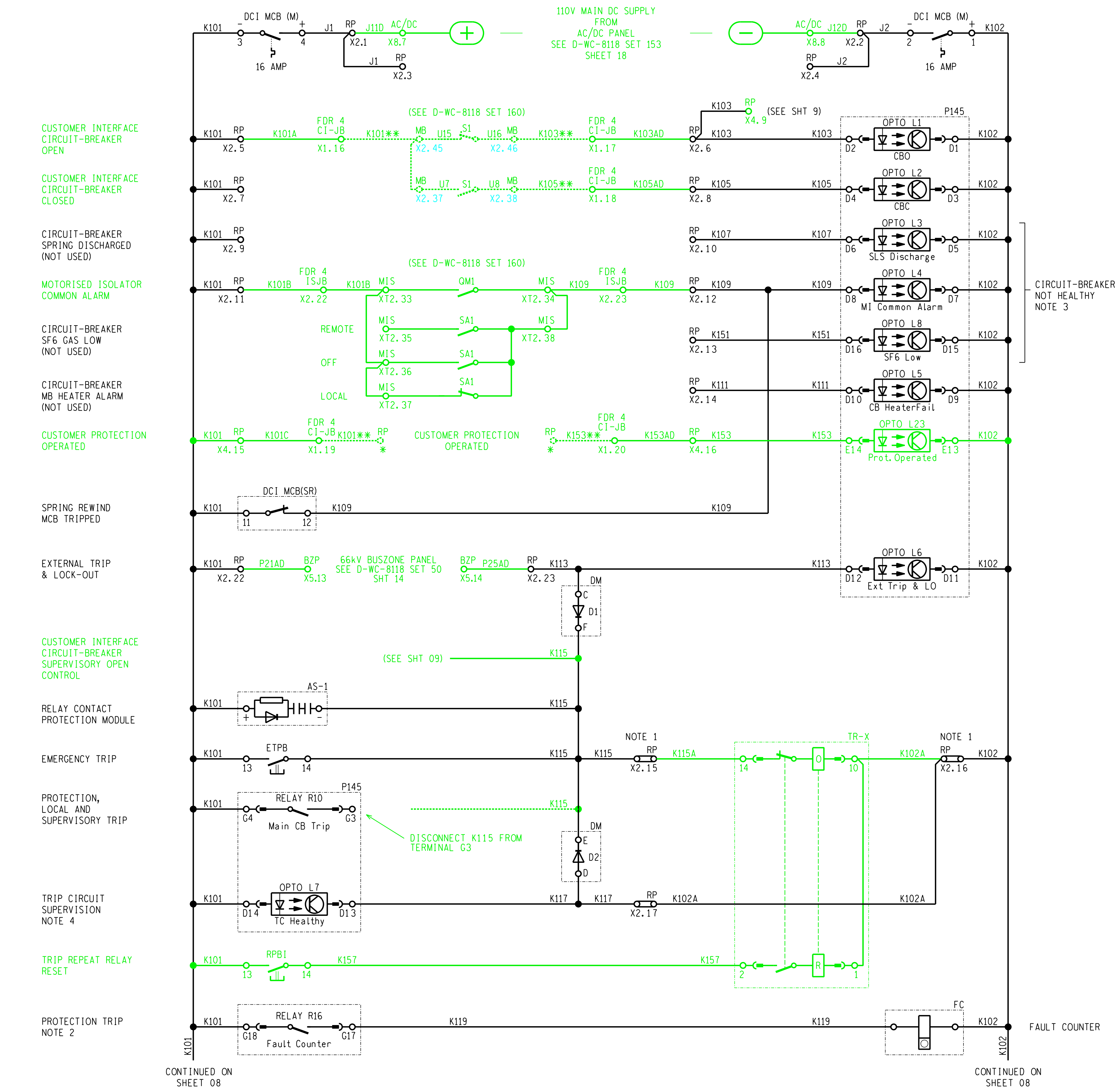
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

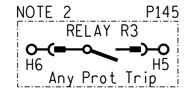
LEVELS:

LEVELS 1 2 3 4 5 6 7 8 9 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 6 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L





NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.
2. OPERATION OF P145 RELAY 3 RAISES THE LATCHED 'TRIP' LED ON THE RELAY AND INITIATES THE CIRCUIT-BREAKER FAIL FUNCTION. RELAY 3 MUST ALSO BE ASSERTED FOR ARC TO INITATE SUCCESSFULLY. RELAY 3 IS THUS CRITICAL TO THE CORRECT OPERATION OF THE SCHEME, EVEN THOUGH IT IS NOT WIRED. THE MASKING FOR RELAY 16 IS SIMILAR TO THAT FOR RELAY 3, BUT THE FORMER MAY BE BLOCKED BY A CONTROL INPUT DURING TESTING.
3. THE P145 WILL NOT ISSUE A CLOSE COMMAND TO THE CIRCUIT-BREAKER IF OPTO L3 IS ASSERTED (SLS DISCHARGED) OR OPTO L7 IS DE-ASSERTED (TRIP COIL FAILED). THE AUTO-RECLOSE LOGIC WAITS UNTIL THE END OF THE DEAD TIME BEFORE CHECKING THE SLS STATUS. IF THE SPRING IS DISCHARGED THE DEAD TIME IS EXTENDED UNTIL THE SPRING CHARGES, OR UNTIL A SETTABLE TIMER EXPIRES. EXPIRY OF THE TIMER CANCELS ARC.
4. ALL CLOSE COMMANDS TO THE CIRCUIT-BREAKER ARE BLOCKED IN THE EVENT THAT THE TRIP CIRCUIT IS UNHEALTHY (OPTO L7 DE-ASSERTED). IT IS THUS IMPERATIVE THAT PROVISION IS MADE FOR TRIP CIRCUIT SUPERVISION WHILST THE CIRCUIT-BREAKER IS IN THE OPEN POSITION. IF THE CIRCUIT-BREAKER DESIGN DOES NOT CATER FOR THIS, WIRE A N/C (52b) STATUS CONTACT BETWEEN X2.16 AND X2.17.

SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

AECOM — CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST. SUPERVISORY CB CONTROL	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

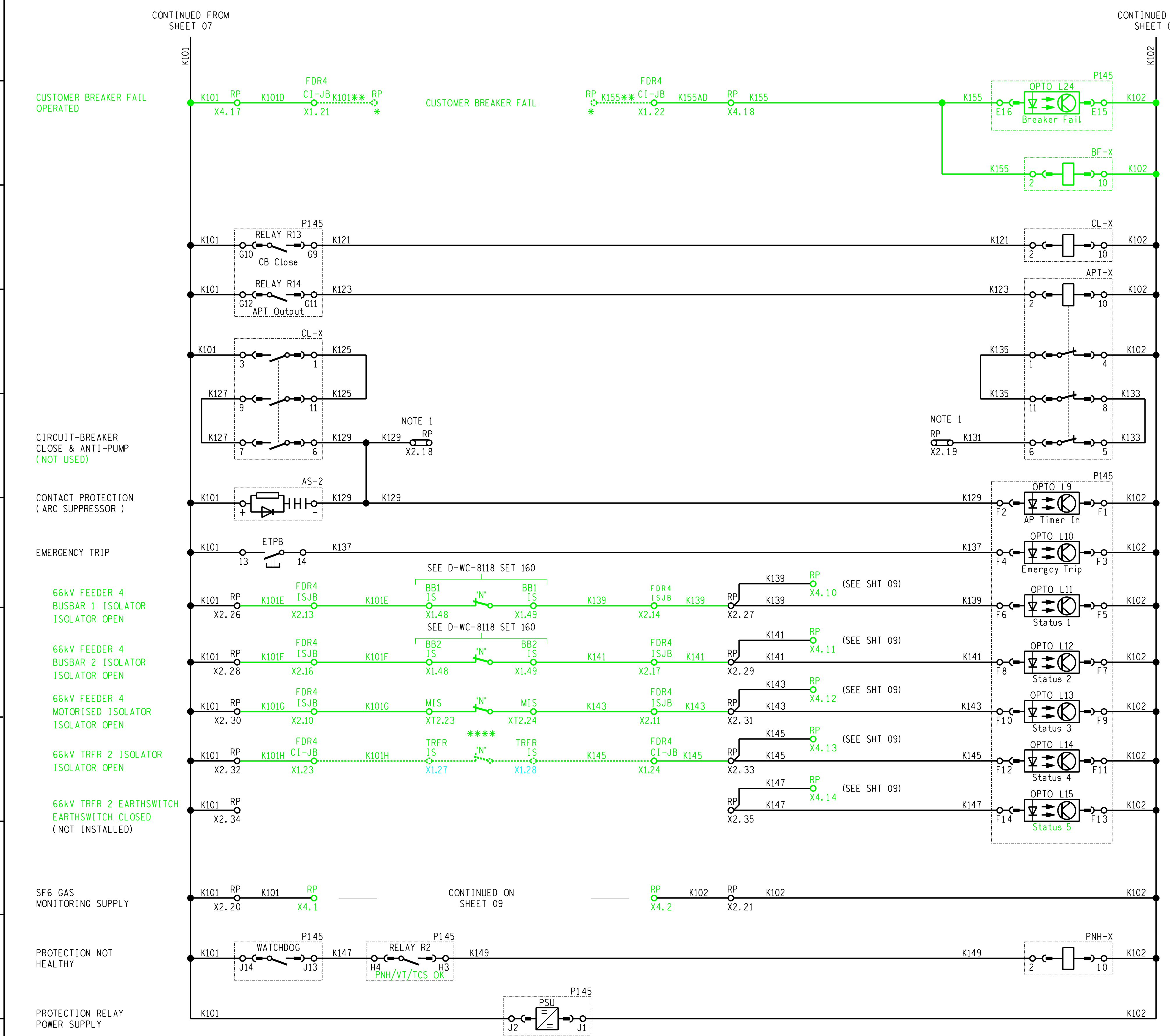
YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME DC KEY DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	07	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 7 OF 19 REVISION 1



NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CB CLOSE FUNCTION NOT USED	AB	RB

Eskom

PROJECT APPROVED L.BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A.MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K.STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME AC KEY DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
44	08	00

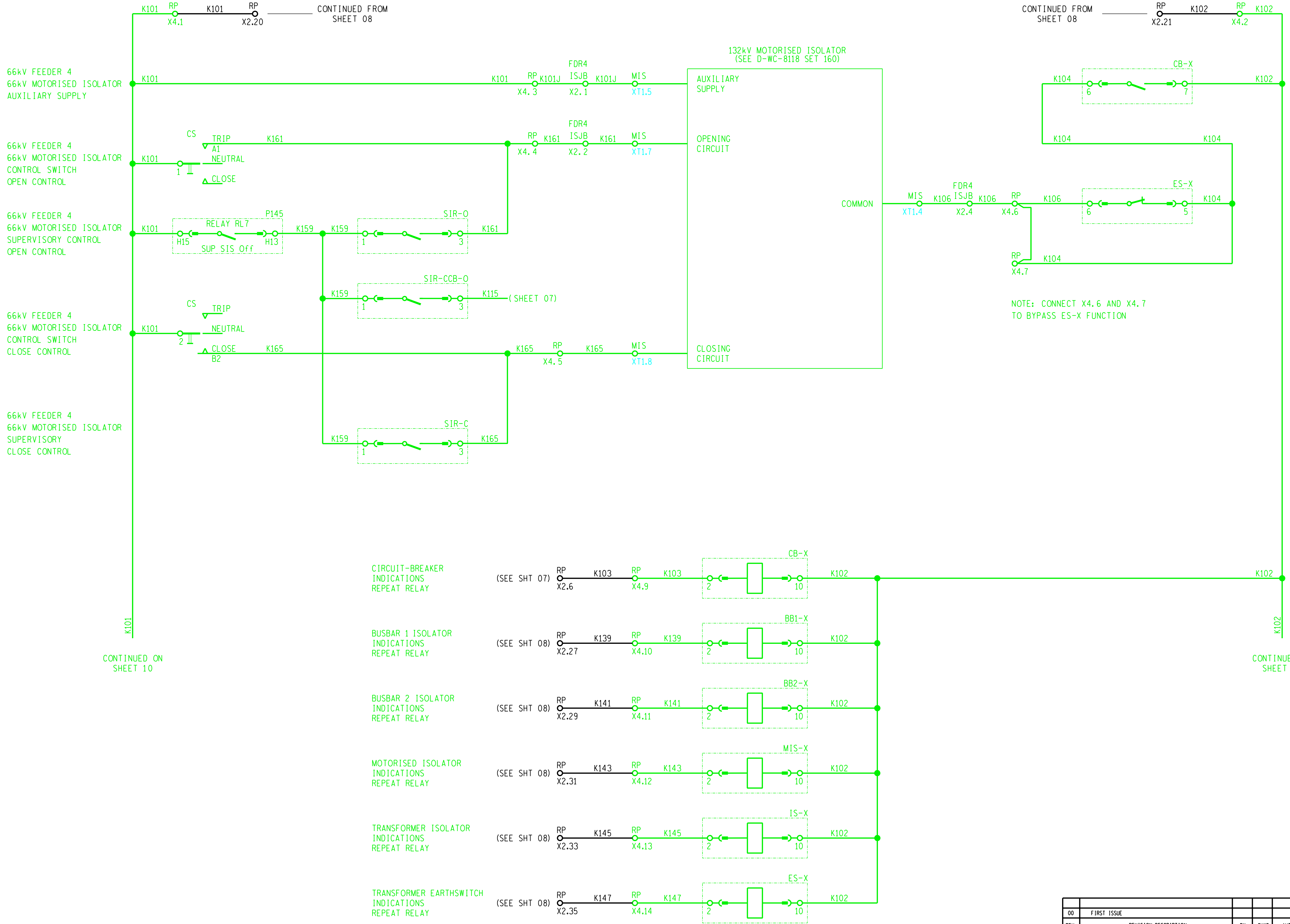
LEVELS:

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

SHEET 8 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST. SUPV. BREAKER OPEN	AB	RB

LEVELS:

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

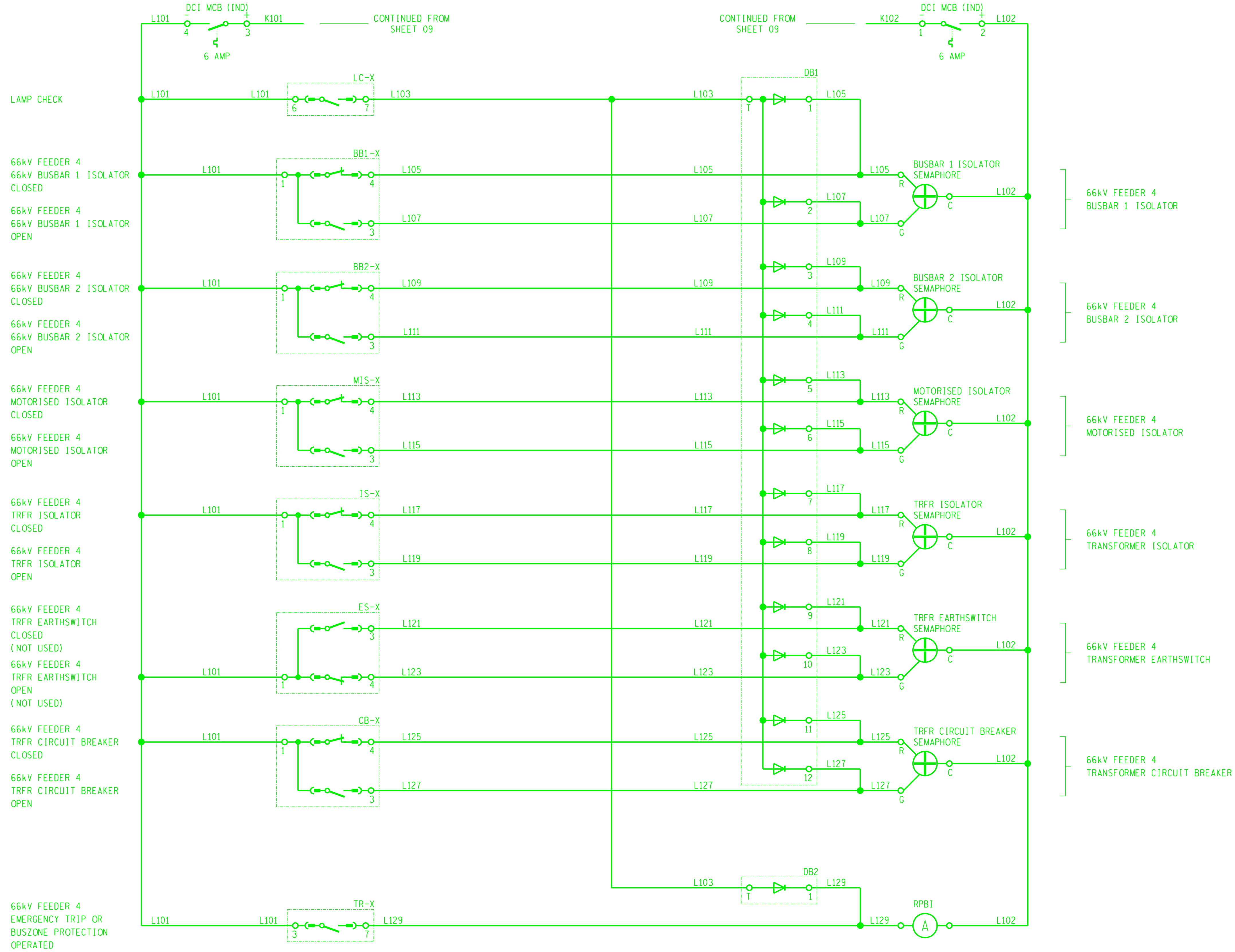
YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME DC KEY DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	44	09	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 9 OF 19 REVISION 1

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15
LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

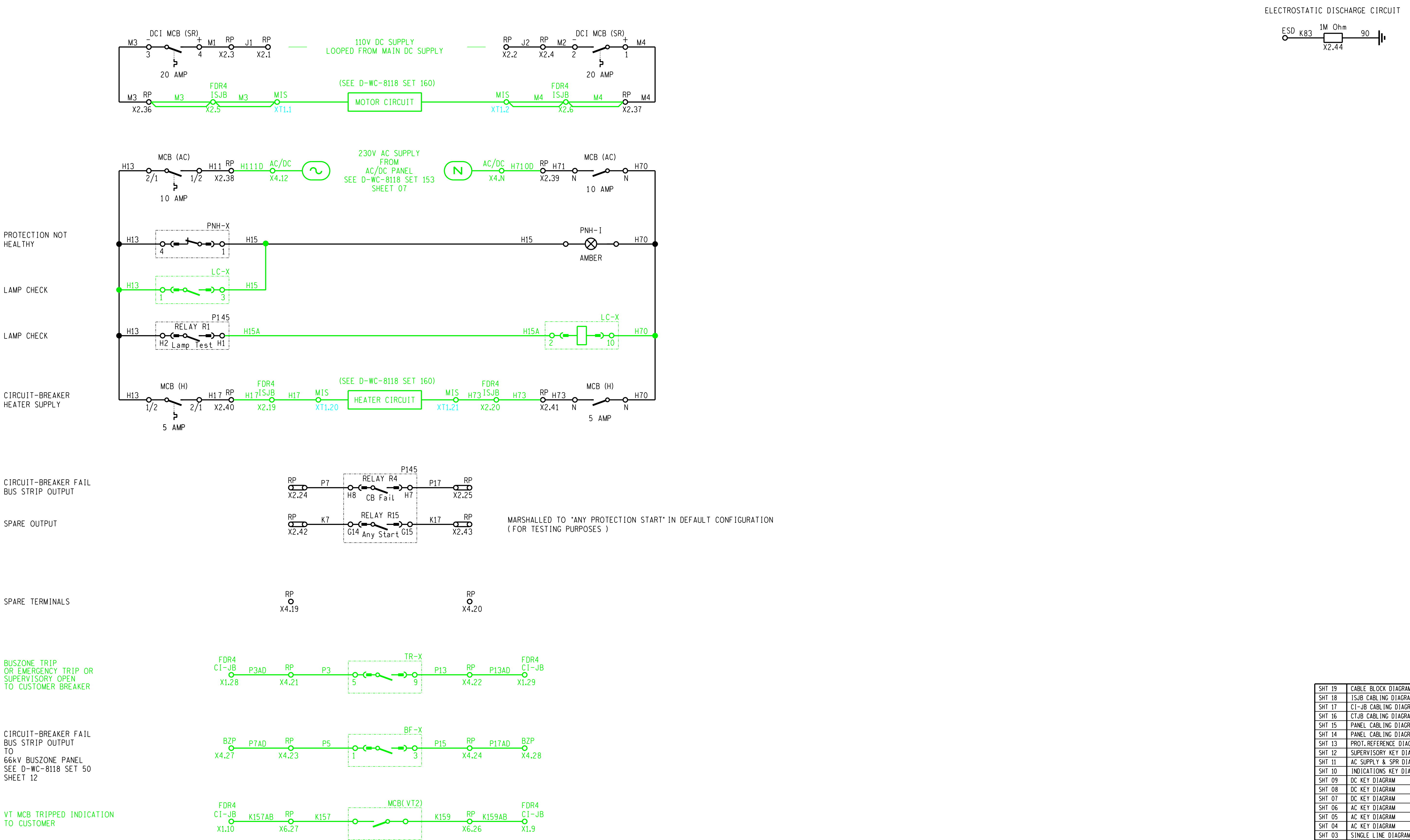
D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
44	10	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUSTOMER TRIP & L/OUT CONTACT ON SHT 12	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED: L. BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
AC SUPPLY KEY & SPRING REWIND DIAGRAM

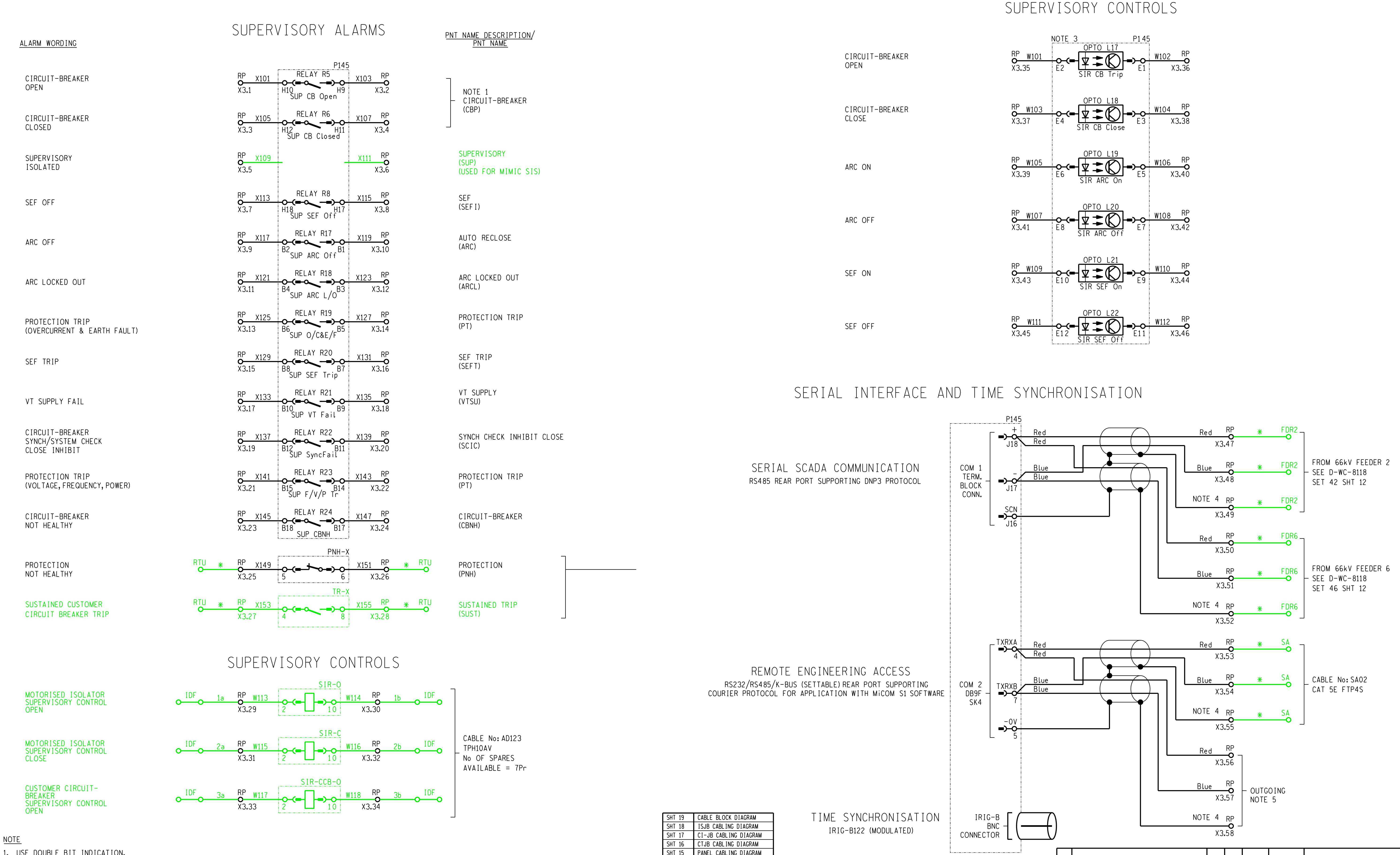
D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
44	11	00

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 19 REVISION 1

LEVELS 1 10



NOTE

1. USE DOUBLE BIT INDICATION.
2. IN THE EVENT THAT HARDWIRED SUPERVISORY INDICATION OF AN UNDER FREQUENCY TRIP OR A CIRCUIT-BREAKER FAIL BUS STRIP IS REQUIRED, THE ALARMS "ARC OFF" AND "ARC LOCKED-OUT" MAY BE COMBINED INTO A SINGLE ALARM OF DESCRIPTION (POINT NAME):

   ARC L/OUT OR OFF (ARCLO)

   THE SPARE CONTACT CAN THEN BE MARSHALLED AS:

   BKR FAIL BUS STRIP (BFBS); OR

   FREQUENCY TRIP (FRT)
3. THE P145's OPTO INPUTS ARE RATED FROM 19Vdc TO 265Vdc, WITH THE PICK-UP RANGE OF EACH OPTO INDIVIDUALLY SELECTABLE BY SETTINGS.
4. RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
5. INSERT 120 OHM TERMINATING RESISTOR BETWEEN + AND - IF DAISY CHAIN TERMINATES AT THIS RELAY PANEL.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20 — DESIGN APPROVED J.MOSTERT DATE 11/12/15

PROJECT CHECKED A. MARAIS DATE 04/12/19 — DESIGN CHECKED R.BUFFKINS DATE 11/12/15

DRAWN BY K. STEYNBERG DATE 06/09/19 — DRAWN BY N.F. KNOETZEN DATE 11/12/15

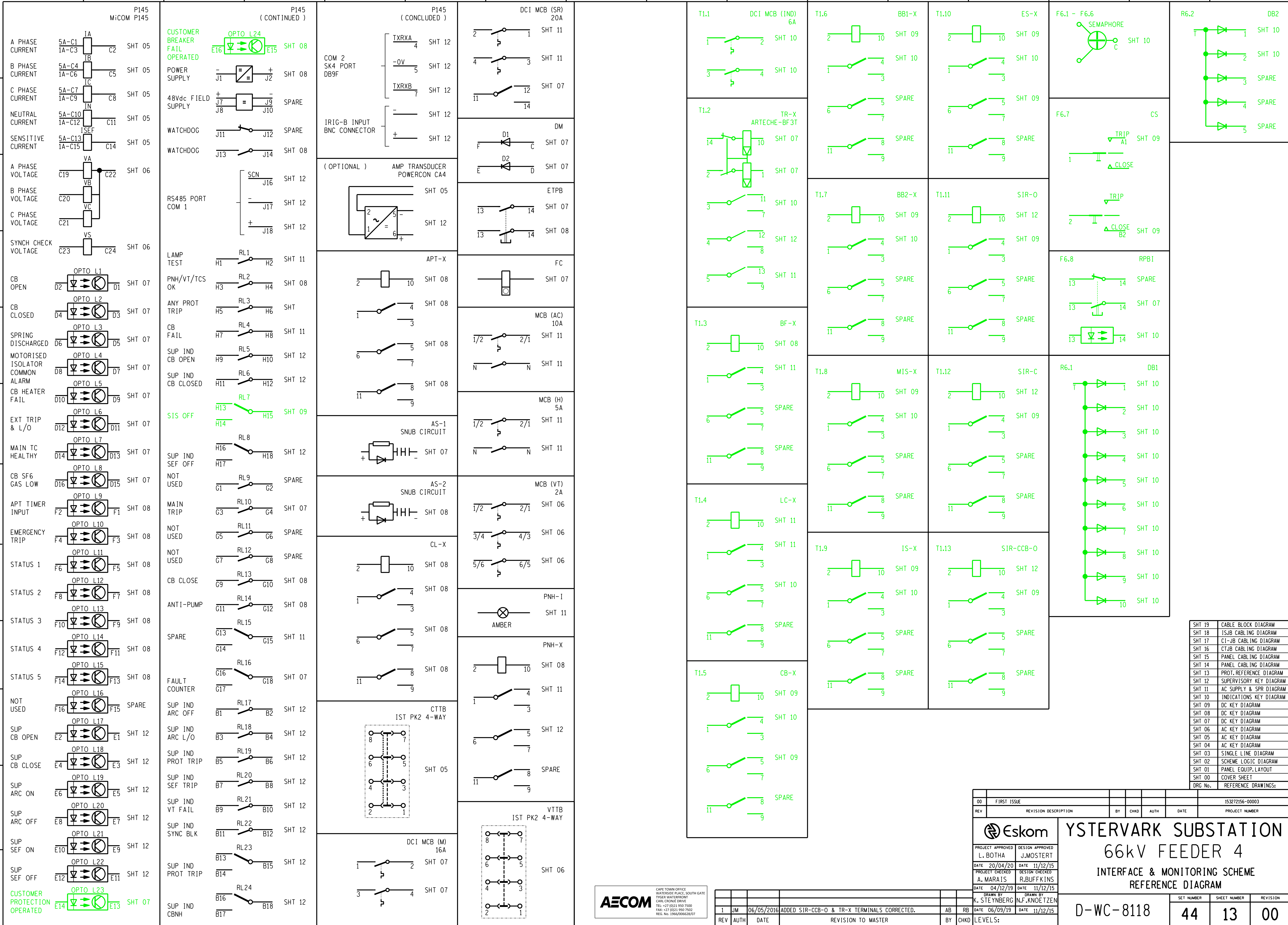
YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME SUPERVISORY ALARMS AND CONTROLS

D-WC-8118 — SET NUMBER 44 — SHEET NUMBER 12 — REVISION 00

LEVELS: 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 19 REVISION 1



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.	AB	RB

LEVELS:

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

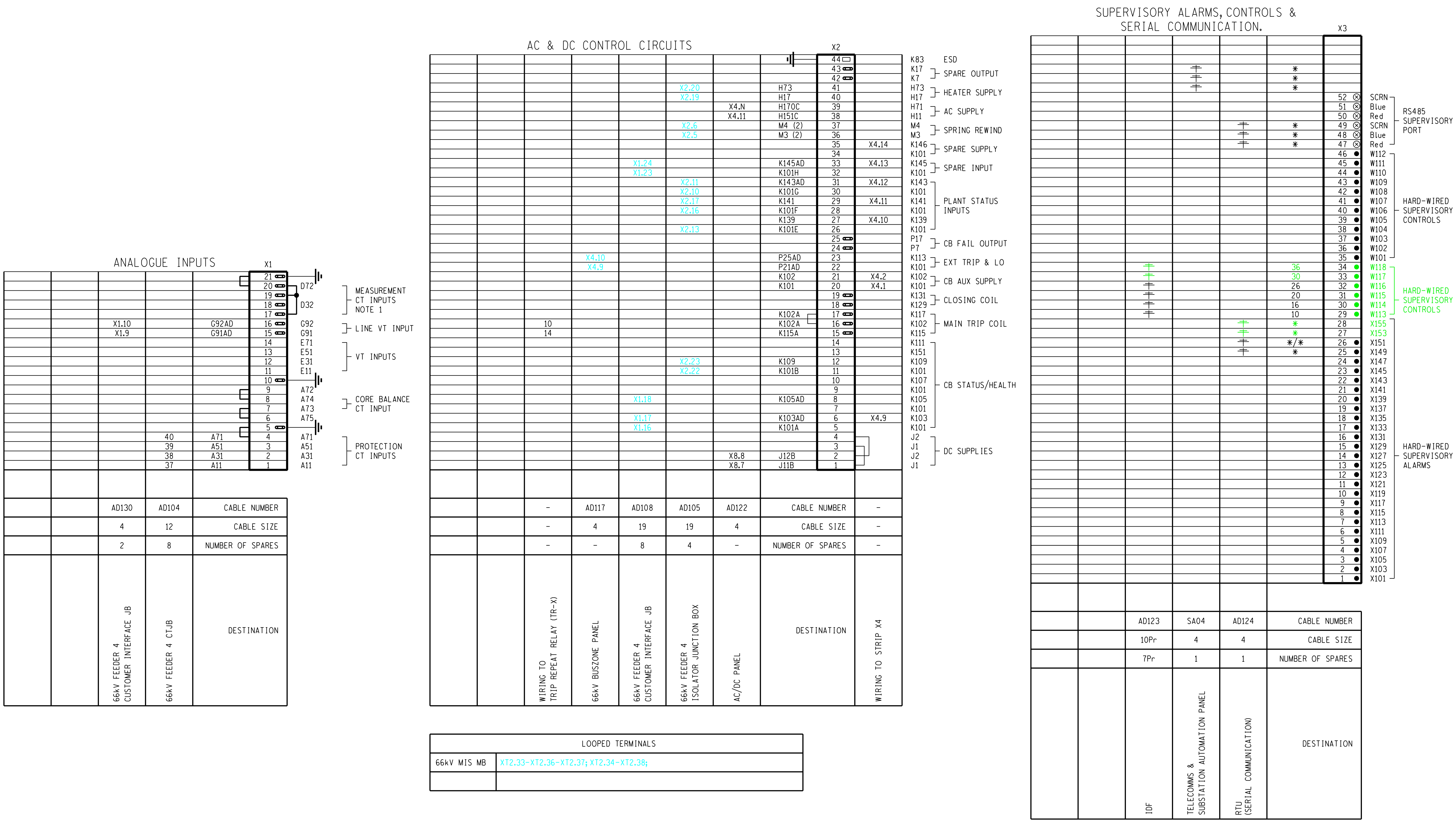
PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME REFERENCE DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	44	13	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 13 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



NOTES:

1. TERMINALS X1.15 - X1.19 ONLY PROVIDED IF AMP TRANSDUCER OPTION IS TAKEN.
2. (2) INDICATES TWO LEADS IN PARALLEL.
3. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
4. LEAD NUMBERS SHOWN THUS
   P7 [ ] INDICATES NO CHANGE IN LEAD NUMBER.
   P7 [ ] P7A INDICATES CHANGE IN LEAD NUMBER.
5. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
6. THE SYMBOL '*' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).

STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
- ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
- ⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
- ● ENTRELEC D2,5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
- ○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
- ▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
- TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
- TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE

REV	AUTH	DATE	REVISION DESCRIPTION	BY	CHKD
1	JM	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM	AB	RB
			REVISION TO MASTER		

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED: L. BOTHA, DATE 20/04/20	DESIGN APPROVED: J.MOSTERT, DATE 11/12/15
PROJECT CHECKED: A. MARAIS, DATE 04/12/19	DESIGN CHECKED: R.BUFFKINS, DATE 11/12/15
DRAWN BY: K. STEYNBERG, DATE 06/09/19	DRAWN BY: N.F. KNOETZEN, DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME PANEL CABLING DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	14	00

LEVELS: 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 19 REVISION 1

MIMIC INDICATIONS & CONTROL CIRCUITS

						X4				
		X4.12			P17AD	24			P15	CUSTOMER BREAKER FAIL (BF-X)
		X4.11			P7AD	23			P5	
				X1.29	P13AD	22			P13	BUS ZONE TRIP (TR-X) & EMERGENCY TRIP TEST PUSH BUTTON
				X1.28	P3AD	21			P3	
						20				SPARE
						19				
				X1.22	K155AD	18			K155	CUSTOMER BREAKER FAIL OPERATED
				X1.21	K101D	17			K101	
				X1.20	K153AD	16			K153	CUSTOMER PROTECTION OPERATED
				X1.19	K101C	15			K101	
	X2.35				K147	14				
	X2.33				K145	13			K145	INDICATION CIRCUITS
	X2.31				K143	12			K143	
	X2.29				K141	11			K141	
	X2.27				K139	10			K139	
	X2.6				K103	9			K103	
						8				
						7			K104	CONTROL CIRCUITS
			X2.4		K106	6			K106	
			X2.3		K165	5			K165	
			X2.2		K161	4			K161	
			X2.1		K101J	3			K101	
	X2.21				K102	2			K102	DC SUPPLIES
	X2.20				K101	1			K101	
X1.11					E111AD	MCB VT2	E11	X6.17	E11	CUSTOMER VT SUPPLY
X1.12					E131AD		E31	X6.18	E31	
X1.13					E151AD		E51	X6.19	E51	
AD136	-	AD117	AD115	AD108	CABLE NUMBER			-		
4	-	4	19	19	CABLE SIZE			-		
-	-	-	4	8	NUMBER OF SPARES			-		
FEEDER 4 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV BUSZONE PANEL	66kV FEEDER 4 ISOLATOR JB	66kV FEEDER 4 CUSTOMER INTERFACE JB	DESTINATION			INTERNAL WIRING		

VOLTAGE SELECTION AND DISTRIBUTION

						X6			
X1.32					X157AD	27	K157		
X131					X159AD	26	K159		
	X1.14				E171AD	25	E71		
		1			E271AD	24	E271		
		MCB-3			E251AD	23	E251		
		MCB-2			E231AD	22	E231		
		MCB-1			E211AD	21	E211		
					E71	20	E71	X1.14	
					E51	19	E51	X1.13	MCB(VT2).5
					E31	18	E31	X1.12	MCB(VT2).3
					E11	17	E11	X1.11	MCB(VT2).1
			38		E472AD	16	E470		
			37		E452AD	15	E450		
			36		E432AD	14	E430		
			35		E412AD	13	E410		
			34		E70AD	12	E70		
			33		E61AD	11	E60		
			32		E41AD	10	E40		
			31		E21AD	9	E20		
				38	E272AD	8	E270		
				37	E252AD	7	E250		
				36	E232AD	6	E230		
				35	E212AD	5	E210		
				34	E71AD	4	E70		
				33	E51AD	3	E50		
				32	E31AD	2	E30		
				31	E11AD	1	E10		
AD108	*	AD114	AD111	AD112	CABLE NUMBER			-	-
19	4	4	12	12	CABLE SIZE			-	-
5	-	-	4	4	NUMBER OF SPARES			-	-
FEEDER 4 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV TARIFF METERING	66kV BUSBAR 2 VTJB 1	66kV BUSBAR 1 VTJB 1	DESTINATION			INTERNAL WIRING	INTERNAL WIRING

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 [ ] INDICATES NO CHANGE IN LEAD NUMBER.
   P7 [ ] P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
5. THE SYMBOL '*' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).
6. STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
   - ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
   - ⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
   - ● ENTRELEC D2.5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
   - ○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
   - ▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
   - TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
   - TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	X4.19 & X4.20 NOT USED.	AB	RB

LEVELS 1 3 4 10

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
PANEL CABLING DIAGRAM

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	15	00

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 15 OF 19 REVISION 1

To CURRENT TRANSFORMERs

TOP OF TERMINAL STRIP

				X1	
		6S2	D171	36	36
		6S1	D151	35	35
		5S2	D71	34	34
		5S1	D51	33	33
		4S5	C71	32	32
		4S1	C51	31	31
		3S4	B171	30	30
		3S1	B151	29	29
		2S4	B71	28	28
		2S1	B51	27	27
		1S3	A71	26	26
		1S2	A51	25	25
	6S2		D171	24	24
	6S1		D131	23	23
	5S2		D71	22	22
	5S1		D31	21	21
	4S5		C71	20	20
	4S1		C31	19	19
	3S4		B171	18	18
	3S1		B131	17	17
	2S4		B71	16	16
	2S1		B31	15	15
	1S3		A71	14	14
	1S2		A31	13	13
6S2			D171	12	12
6S1			D111	11	11
5S2			D71	10	10
5S1			D11	9	9
4S5			C71	8	8
4S1			C11	7	7
3S4			B171	6	6
3S1			B111	5	5
2S4			B71	4	4
2S1			B11	3	3
1S3			A71	2	2
1S2			A11	1	1
AD101	AD102	AD103	CABLE NUMBER		
12	12	12	CABLE SIZE		
-	-	-	NUMBER OF SPARES		
66kV FEEDER 4 RED PHASE CT	66kV FEEDER 4 WHITE PHASE CT	66kV FEEDER 4 BLUE PHASE CT	DESTINATION		

To CONTROL ROOM & BZJB

	X2				
12	72 R				CORE 6
24	71 W				
36	70 B	D171AD		17	
35	69 B	D151AD		16	
23	68 W	D131AD		15	
11	67 R	D111AD		14	
10	66 R				CORE 5
22	65 W				
34	64 B	D71AD		5	
33	63 B	D51AD		4	
21	62 W	D31AD		3	
9	61 R	D11AD		2	
8	60 R				CORE 4
20	59 W				
32	58 B				
31	57 B				
19	56 W				
7	55 R				
6	54 R				CORE 3
18	53 W				
30	52 B				
29	51 B				
17	50 W				
5	49 R				
4	48 R				CORE 2
16	47 W				
28	46 B				
27	45 B				
15	44 W				
3	43 R				
2	42 R				CORE 1
14	41 W				
26	40 B	A71	X1.4		
25	39 B	A51	X1.3		
13	38 W	A31	X1.2		
1	37 R	A11	X1.1		
		CABLE NUMBER	AD104	AD133	
		CABLE SIZE	12	12	
		NUMBER OF SPARES	8	4	
		DESTINATION	66kV FEEDER 4 RELAY PANEL	TARIFF METERING PANEL 1 66kV FEEDER 4 TARIFF METER MODULE	

TERMINAL LOOPS	
CT JB	40-41-42-43-44-45-46-47-48-EARTH, 49-50-51-52-53-54-EARTH,
	55-56-57-58-59-60-EARTH, 61-62-63-64-65-66-67-68-69-70-71-72

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
CTJB CABLING

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	16	00

LEVELS 1 3 4 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 16 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

X1

					X1.1	B110AD	1	*	*		
					X1.3	B130AD	2	*	*		
					X1.5	B150AD	3	*	*		
					X1.7	B171AD	4	*	*		
				X3.5		B11AD	5	*	*		
				X3.6		B31AD	6	*	*		
				X3.7		B51AD	7	*	*		
				X3.8		B71AD	8	*	*		
		X1.15				G91AD	9	*			*
		X1.16				G92AD	10	*			*
	2/1					E111AD	11	*		*	
	3/4					E131AD	12	*		*	
	5/6					E151AD	13	*		*	
X1.28						E171AD	14	*		*	
							15				
			X2.5			K101A	16	*		*	
			X2.6			K103AD	17	*		*	
			X2.8			K105AD	18	*		*	
			X4.15			K101C	19	*		*	
			X4.16			K153AD	20	*		*	
			X4.17			K101D	21	*		*	
			X4.18			K155AD	22	*		*	
			X2.32			K101H	23	*		*	
			X2.33			K145AD	24	*		*	
							25				
							26				
							27				
			X4.21			P3AD	28	*		*	
			X4.22			P13AD	29	*		*	
							30				
			X6.26			K159AD	31	*		*	
			X6.27			K157AD	32	*		*	
AD113	AD113	AD130	AD108	AD117	*	CABLE NUMBER			*	*	*
4	4	4	19	12	4	CABLE SIZE			*	*	*
-	-	7	7	4	-	NUMBER OF SPARES			*	*	*
66kV FEEDER 4 RELAY PANEL	66kV FEEDER 4 RELAY PANEL TERMINAL STRIP 4 MCB(VT2)	66kV FEEDER 4 RELAY PANEL	66kV FEEDER 4 RELAY PANEL	66kV BUSZONE PANEL	66kV FEEDER 4 ISOLATOR JUNCTION BOX	DESTINATION			66kV TRANSFORMER 3 CTJB (CUSTOMER CT)	66kV TRANSFORMER 3 RELAY PANEL (CUSTOMER PROTECTION PANEL)	66kV TRANSFORMER 3 VTJB

X2

H10	1			
H30	2			
H50	3			
H70	4			
H12	5			
H32	6			
H52	7			
H70	8			
CABLE NUMBER				
CABLE SIZE				
NUMBER OF SPARES				
DESTINATION				

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
CUSTOMER INTERFACE JB

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	17	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 17 OF 19 REVISION 1

X2

		XT1.5			K101J	1	K101J	X4.3				
		XT1.7			K161	2	K161	X4.4				
		XT1.8			K165	3	K165	X4.5				
		XT1.4			K106	4	K106	X4.6				
		XT1.1			M3 (2)	5	M3 (2)	X2.36				
		XT1.2			M4 (2)	6	M4 (2)	X2.37				
						7						
						8						
						9						
		XT2.23			K101G	10	K101G	X2.30				
		XT2.24			K143	11	K143	X2.31				
						12						
				X1.48	K101E	13	K101E	X2.26				
				X1.49	K139	14	K139	X2.27				
						15						
			X1.48		K101F	16	K101F	X2.29				
			X1.49		K141	17	K141	X2.30				
						18						
		XT2.20			H17	19	H17	X2.40				
		XT2.21			H73	20	H73	X2.41				
						21						
		XT2.33			K101B	22	K101B	X2.11				
		XT2.34			K109	23	K109	X2.12				
						24						
						25						
						26						
						27						
						28						
						29						
						30						
						31						
						32						
						33						
		AD110	AD125	AD109	CABLE NUMBER			AD115				
		19	12	12	CABLE SIZE			19				
		7	4	4	NUMBER OF SPARES			3				
		66kV MOT.LINE ISMB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 4 RP				

X1

					X1.32	B110AB	1	B110AB	X1.1				
					X1.33	B111AB	2	B111AB		X1.5			
					X1.36	B130AB	3	B130AB	X1.2				
					X1.37	B131AB	4	B131AB		X1.6			
					X1.40	B150AB	5	B150AB	X1.3				
					X1.41	B151AB	6	B151AB		X1.7			
			48			B171AB	7	B171AB		X1.8			
				X1.32			8	B210AB					
				X1.33		B211AB	9	B211AB		X2.5			
				X1.36			10	B230AB					
				X1.37		B231AB	11	B231AB		X2.6			
				X1.40			12	B250AB					
				X1.41		B251AB	13	B251AB		X2.7			
							14	B271AB		X2.8			
							15						
							16						
							17						
							18						
							19						
							20						
							21						
							22						
							23						
							24						
							25						
							26						
							27						
							28						
							29						
							30						
			AD132	AD125	AD109	CABLE NUMBER			AD132	AD126			
			4	12	12	CABLE SIZE			4	12			
			-	4	4	NUMBER OF SPARES			-	4			
			66kV FDR 4 CIJB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 4 CIJB	66kV BUSZONE RP			

LOOPED TERMINALS	
BB1 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
BB2 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
MOT. ISMB	XT2.33-XT2.36; XT2.34-XT2.38
ISJB	X1.1-X1.8; X1.3-X1.10; X1.5-X1.12; X1.7-X1.14

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

LEVELS: 1 ... 10

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K.STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
ISJB CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	18	00

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 19 REVISION 1

SEE D-WC-8118 SET 159

SEE D-WC-8118 SET 159

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 4
INTERFACE & MONITORING SCHEME
CABLE BLOCK DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	44	19	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 19 REVISION 1

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	1	06/05/2016	NEW REVISION.
01	PANEL EQUIPMENT LAYOUT	1	06/05/2016	ADDED RELAY SIR-CCB-O.
02	SCHEME LOGIC DIAGRAM	1	06/05/2016	RELAY LABELS CHANGED.
03	SINGLE LINE DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
04	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
05	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
06	AC KEY DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
07	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPERVISORY CB CONTROL.
08	DC KEY DIAGRAM	1	06/05/2016	CB CLOSE FUNCTION NOT USED.
09	DC KEY DIAGRAM	1	06/05/2016	ADDED CUST. SUPV. BREAKER OPEN.
10	INDICATIONS KEY DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL.
11	AC SUPPLY KEY & SPRING REWIND DIAGRAM	1	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS. ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUST. TRIP & LOCK-OUT CONTACT ON SHEET 12.
12	SUPERVISORY KEY DIAGRAM	1	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM.
13	PROTECTION REFERENCE DIAGRAM	1	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.
14	PANEL CABLING DIAGRAM	1	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM.
15	PANEL CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
16	CTJB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
17	CUSTOMER INTERFACE JB CABLING DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.
18	CABLE BLOCK DIAGRAM	1	06/05/2016	AS PREVIOUS REVISION.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2		17	INDOOR SWITCHGEAR AS PER D-DT-5408r0 SHTs 1 - 6 (X1-X3 TERMINALS) WITH REMOTE PROTECTION SCHEME
3	SCHEME WITH HARDWIRED & SERIAL SCADA INTERFACE	18	OUTDOOR CONVENTIONAL CB & CTs
4	OPTIONAL SECOND REAR COMMS PORT & IRIG-B INPUT FOR P145 (USE WITH LEVEL 3)	19	STANDARD KIOSK TYPE CB & CTs AS PER D-DT-5407
5	SCHEME WITH SERIAL SCADA INTERFACE ONLY	20	
6	OPTIONAL SECOND REAR COMMS PORT & IRIG- B INPUT FOR P145 (USE WITH LEVEL 5)	21	
7		22	
8		23	
9		24	
10	STANDARD DESIGN DRAWING	25	
11		26	
12		27	
13		28	
14		29	
15		30	

θ

θ θ CIRCUIT-BREAKER OPTIONS

NOTE

AMP TRANSDUCER OPTION INCORPORATED INTO LEVELS 3, 5, 17, 18 & 19. DELETE IF NOT REQUIRED.
θ MUTUALLY EXCLUSIVE LEVELS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.

66kV FEEDER 6: MAIN INTAKE 1

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	NEW REVISION	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
COVER SHEET

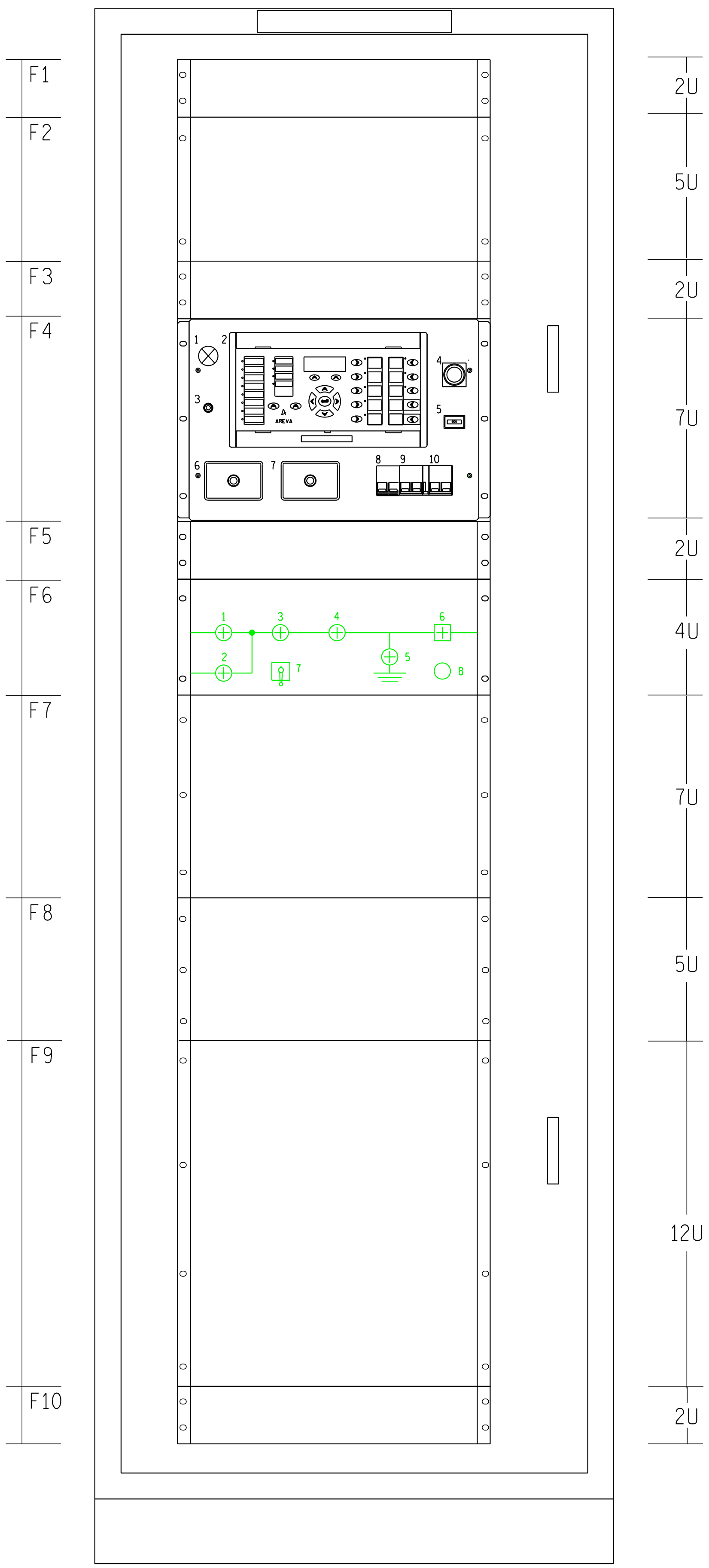
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	00	00

LEVELS 1 10

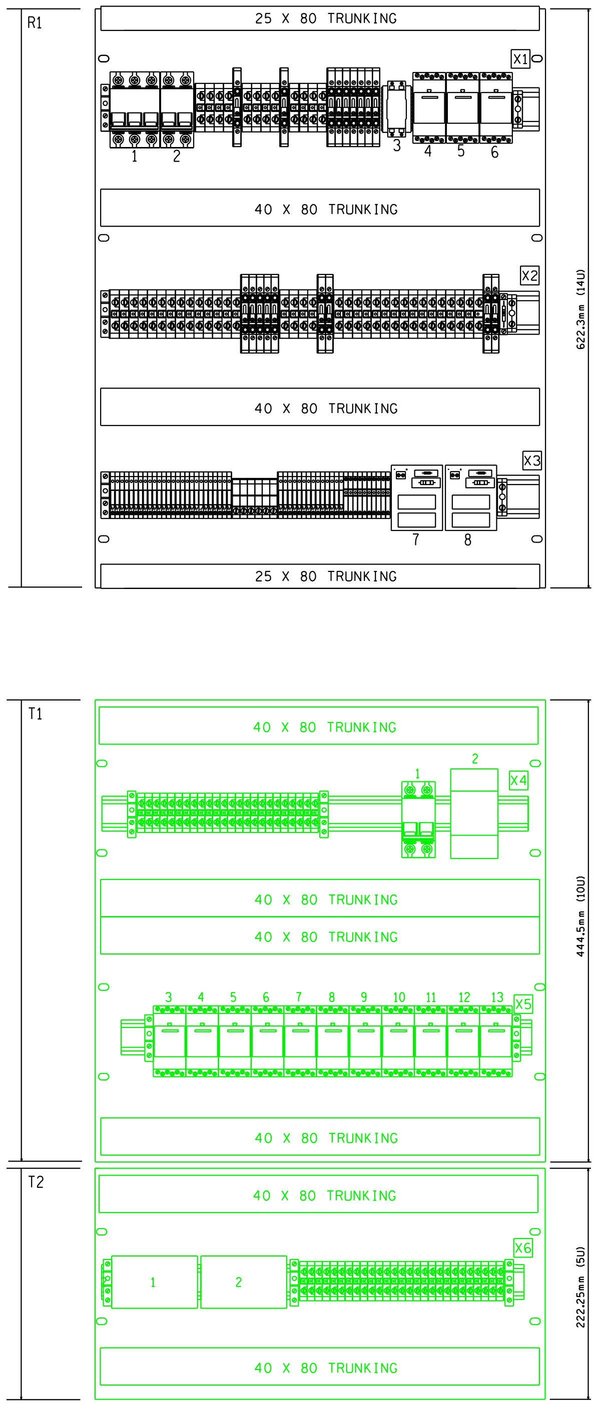
PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 0 OF 19 REVISION 1

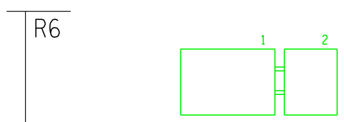
FRONT VIEW



BACK PLATE



MOUNTED ON RADIO RACK
OF MIMIC



LOCATION		DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW					
F1			2U BLANKING PLATE		
F2			5U BLANKING PLATE		
F3			2U BLANKING PLATE		
F4	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	ND-16-22B/2	CHNT
	2	P145	FEEDER MANAGEMENT RELAY	MiCOM P145	SCHNEIDER ELECTRIC
	3	ESD	ELECTROSTATIC DISCHARGE POINT	TEST POINT	HIRSCHMAN
	4	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	YSF & COVER	ADDA INDICATORS
	5	FC	FAULT COUNTER (6 DIGIT)	ZR6-2600-20✱0	FOX
				✱ = 6 (110Vdc), 7 (220Vdc)	
	6	CTTB	CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	7	VTTB	VOLTAGE TRANSFORMER TEST BLOCK	PK2 4-WAY	ALLBRO
	8	DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER (16A)	EP102UC(C16)	GE
	9	DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER (20A)	EP102UC(C20) & CA H	GE
	10	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G61NC(C10)	GE
F5			2U BLANKING PLATE		
F6	1	BB1-S	66kV FEEDER 6 BUSBAR 1 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	2	BB2-S	66kV FEEDER 6 BUSBAR 2 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	3	MIS-S	66kV FEEDER 6 MOTORISED ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	4	IS-S	TRANSFORMER 1 ISOLATOR SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	5	ES-S	TRANSFORMER 1 EARTHSWITCH SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	6	CB-S	TRANSFORMER 1 CIRCUIT BREAKER SEMAPHORE (GREEN/RED)		MIMIC CRAFT
	7	CS	66kV FEEDER 6 MOTORISED ISOLATOR CONTROL SWITCH	A714-600	KRAUS & NAIMER
	8	RPBI	RESET PUSH BUTTON INDICATION (AMBER)		ADDA INDICATORS
F7			7U BLANKING PLATE		
F8			5U BLANKING PLATE		
F9			12U BLANKING PLATE		
F10			2U BLANKING PLATE		
BACK PLATE					
R1	1	MCB (VT)	VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02)	GE
	2	MCB (H)	MECHANISM BOX AC HEATER MINIATURE CIRCUIT-BREAKER (5A)	G61NC(C05)	GE
	3	DM	DIODE MODULE	KCH	ELMEX
		D1, D2	DIODES WITHIN DIODE MODULE (2)	DDSA9-16F	ACTOM
	4	CL-X	CLOSE AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	5	APT-X	ANTI-PUMP TIMER AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	6	PNH-X	PROTECTION NOT HEALTHY AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	7	AS-1	TRIPPING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
	8	AS-2	CLOSING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ACTOM
T1	1	DCI MCB (I)	INDICATIONS DC ISOLATE MINIATURE CIRCUIT-BREAKER (6A)	EP102UC(C6)	GE
	2	TR-X	TRIP REPEAT AUXILIARY RELAY (110V DC)	BFT3	ARTECHE
	3	BF-X	BREAKER FAIL AUXILIARY RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	4	LC-X	LAMP CHECK AUXILIARY RELAY (230V AC)	MK3P5-S 230Vac	OMRON
	5	CB-X	CIRCUIT-BREAKER INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	6	BB1-X	BUSBAR 1 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	7	BB2-X	BUSBAR 2 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	8	MIS-X	MOTORISED ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	9	IS-X	TRANSFORMER 3 ISOLATOR INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	10	ES-X	TRANSFORMER 3 EARTHSWITCH INDICATIONS REPEAT RELAY (110V DC)	MK3P5-S 110/220Vdc	OMRON
	11	SIR-O	SUPERVISORY OPEN CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	12	SIR-C	SUPERVISORY CLOSE CONTROL AUXILIARY RELAY (48V DC)	MK3P5-S 48Vdc	OMRON
	13	SIR-CCB-O	CIRCUIT BREAKER SUPERVISORY CONTROL OPEN (48V DC)	MK3P5-S 48Vdc	OMRON
	14	MCB (VT2)	BUSBAR VOLTAGE SUPPLY MINIATURE CIRCUIT-BREAKER + AUX (2A)	G63(C02) + AUX	GE
T2	1	VSR-1	ISOLATOR 1 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
	2	VSR-2	ISOLATOR 2 REPEAT RELAY (110V DC)	BJ-8	ARTECHE
REAR SIDE OF FRONT VIEW					
R6	1	DB-1	DIODE MODULE - 10 COMMONLY CONNECTED DIODES		MIMIC CRAFT
	2	DB-2	DIODE MODULE - 5 COMMONLY CONNECTED DIODES		MIMIC CRAFT

REFER TO SHEET 13 FOR DETAILS OF TERMINAL BLOCK MAKES AND TYPES.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED RELAY SIR-CCB-O	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

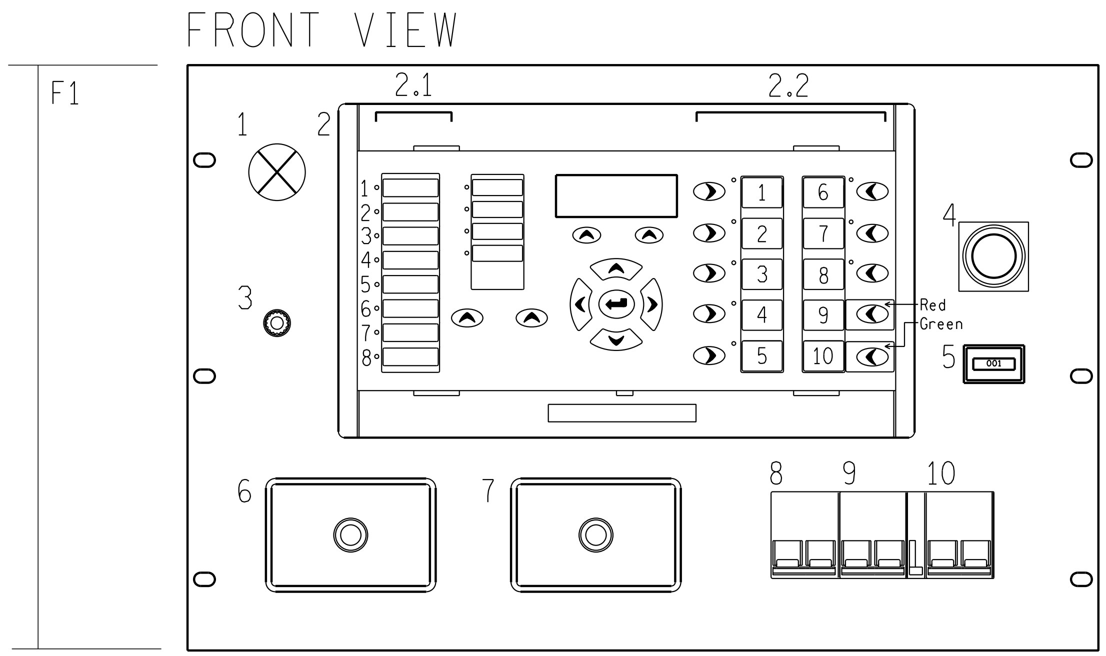
YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
PANEL EQUIPMENT LAYOUT

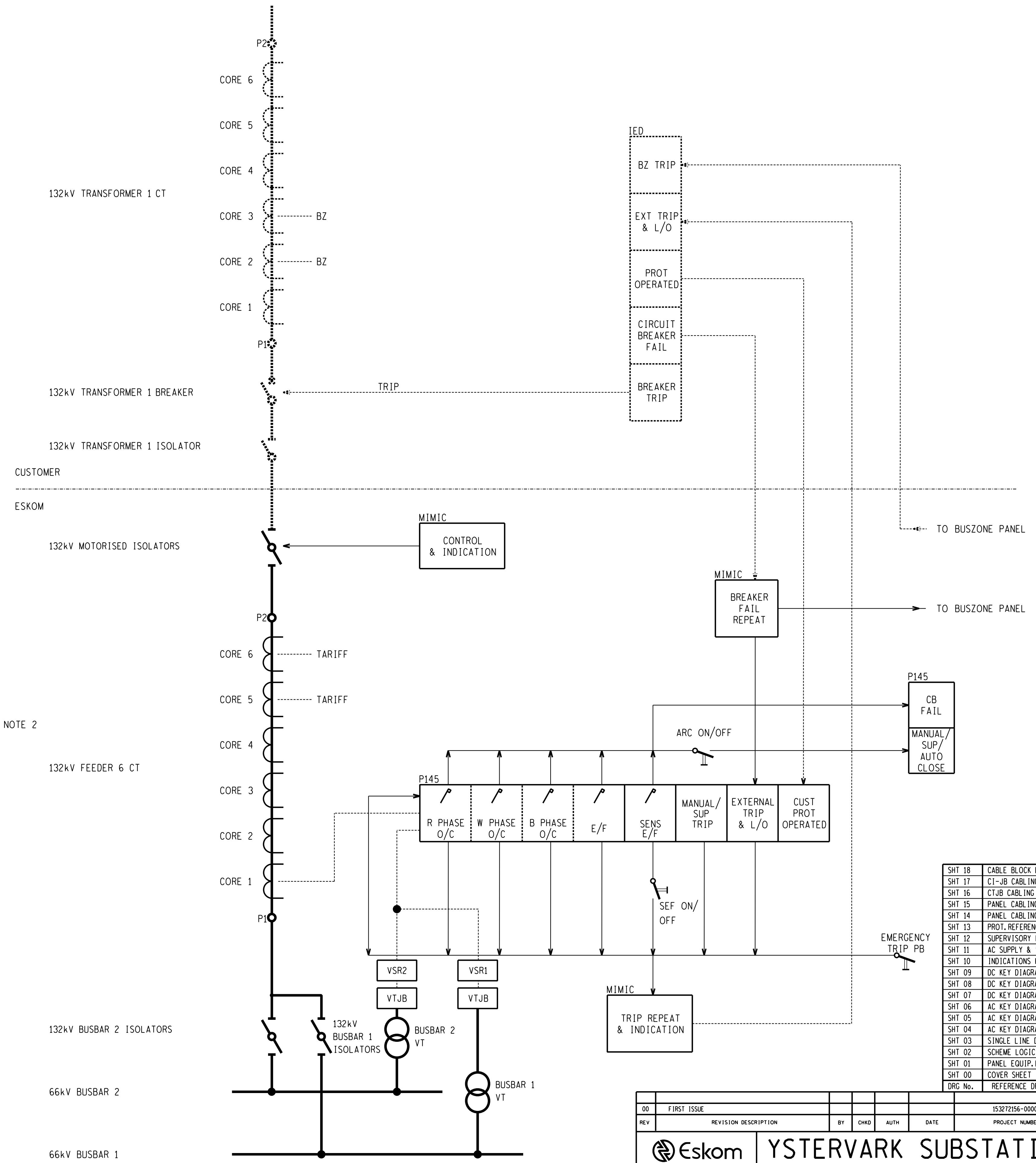
	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	01	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 1 OF 19 REVISION 1





LOCATION		DESIGNATION	DESCRIPTION	LABEL
FRONT VIEW				
F1				
1		PNH-I	PROTECTION NOT HEALTHY INDICATION	PROTECTION NOT HEALTHY
2		P145	FEEDER MANAGEMENT RELAY	
2.1			PROGRAMMABLE LEDs	
	1		CIRCUIT-BREAKER CLOSED INDICATION (RED)	CB CLOSED
	2		CIRCUIT-BREAKER OPEN INDICATION (GREEN)	CB OPEN
	3		CIRCUIT-BREAKER NOT HEALTHY INDICATION	MOTORISED ISOL ALARM
	4		OVERCURRENT TRIP INDICATION	O/C TRIP (NOT USED)
	5		EARTH FAULT TRIP INDICATION	E/F TRIP (NOT USED)
	6		SENSITIVE EARTH FAULT TRIP INDICATION	SEF TRIP (NOT USED)
	7		OTHER TRIP	OTHER TRIP* (NOT USED)
	8		CIRCUIT-BREAKER FAIL ISOLATED ALARM	CB FAIL ISOL (NOT USED)
2.2			PROGRAMMABLE FUNCTION KEYs WITH LEDs	
	1		AUTO RECLOSE ON PUSH BUTTON & INDICATION	ARC ON (NOT USED)
	2		AUTO RECLOSE OFF PUSH BUTTON & INDICATION	ARC OFF (NOT USED)
	3		ARC LOCKED OUT INDICATION (PUSH BUTTON NOT USED)	ARC LOCKOUT (NOT USED)
	4		SENSITIVE EARTH FAULT ON PUSH BUTTON & INDICATION	SEF ON (NOT USED)
	5		SENSITIVE EARTH FAULT OFF PUSH BUTTON & INDICATION	SEF OFF (NOT USED)
	6		SUPERVISORY ISOLATE SWITCH ON PUSH BUTTON & INDICATION	SIS ON (NOT USED)
	7		SUPERVISORY ISOLATE SWITCH OFF PUSH BUTTON & INDICATION	SIS OFF (NOT USED)
	8		LAMP CHECK / TARGET RESET PUSH BUTTON & INDICATION	RESET / LAMP CH
	9		CIRCUIT-BREAKER CLOSE CONTROL (RED)	CLOSE** (NOT USED)
	10		CIRCUIT-BREAKER TRIP CONTROL (GREEN)	TRIP** (NOT USED)
3		ESD	ELECTROSTATIC DISCHARGE POINT	ESD
4		ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER	CUST BREAKER EMERGENCY TRIP
5		FC	FAULT COUNTER	FAULT COUNTER
6		CTTB	CURRENT TRANSFORMER TEST BLOCK	CURRENT TRANSFORMER TEST BLOCK
7		VTTB	VOLTAGE TRANSFORMER TEST BLOCK	VOLTAGE TRANSFORMER TEST BLOCK
8		DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER	MAIN DC SUPPLY MCB (16A)
9		DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER	SPRING REWIND DC MCB (20A)
10		MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER	AC SUPPLY MCB (10A)

* CB FAIL, FREQUENCY, VOLTAGE, POWER PROTECTION TRIP - SEE LCD DISPLAY FOR DETAILED ALARM DESCRIPTION.
** PRESS TWICE IN 3s TO OPERATE

NOTE:

1. DOWNLOAD THE *.PSL FILE FROM THE P145 RELAY FOR FULL SCHEME LOGIC.
2. LED SHOWS RED FOR "ARC LOCK-OUT" AND GREEN FOR "ARC IN PROGRESS"

DRG No.	REFERENCE DRAWINGS:
SHT 18	CABLE BLOCK DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	RELAY LABELS CHANGED	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

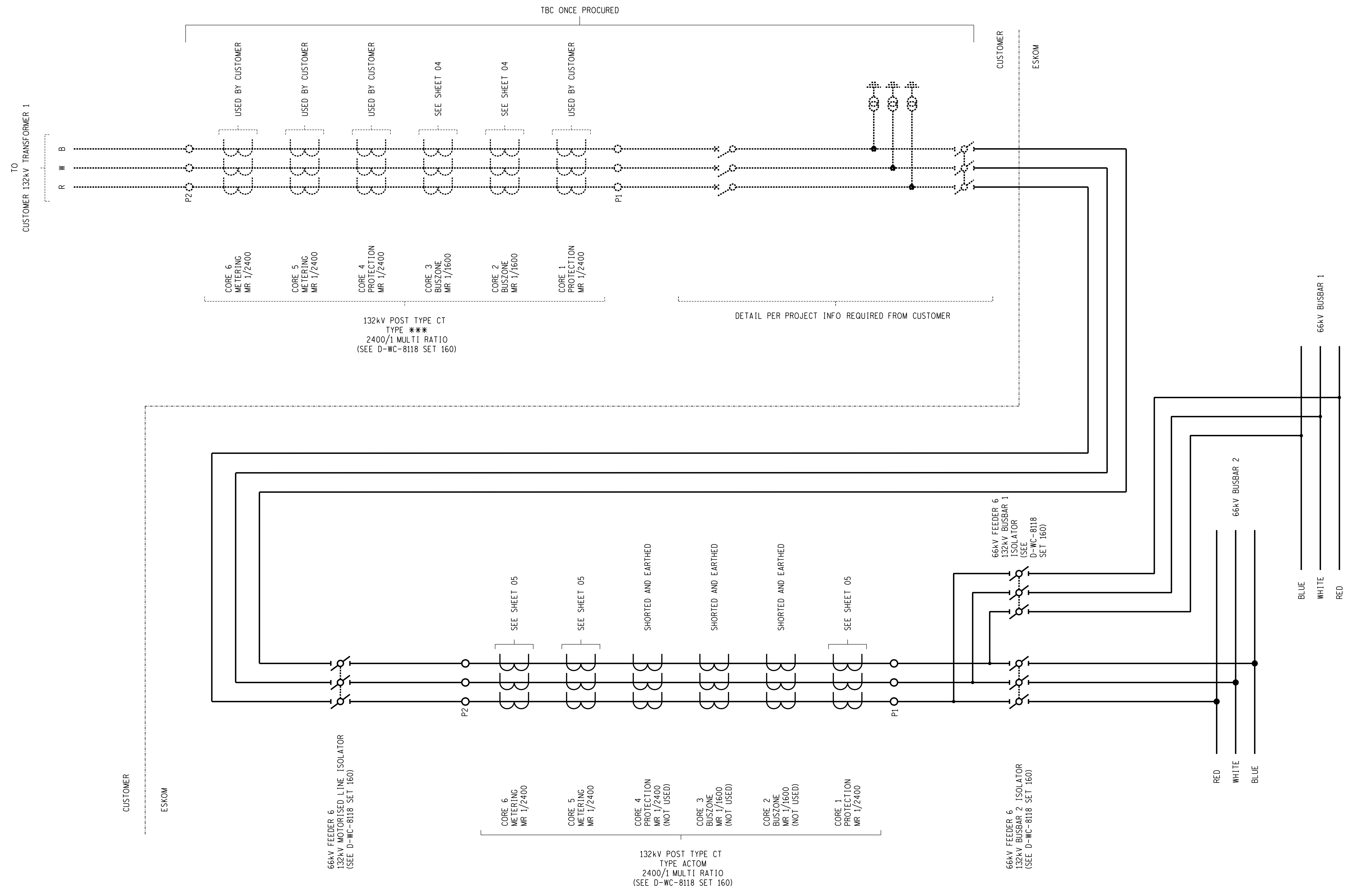
YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
SCHEME LOGIC DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	02	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 2 OF 18 REVISION 1



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
SINGLE LINE DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	03	00

LEVELS 1 10

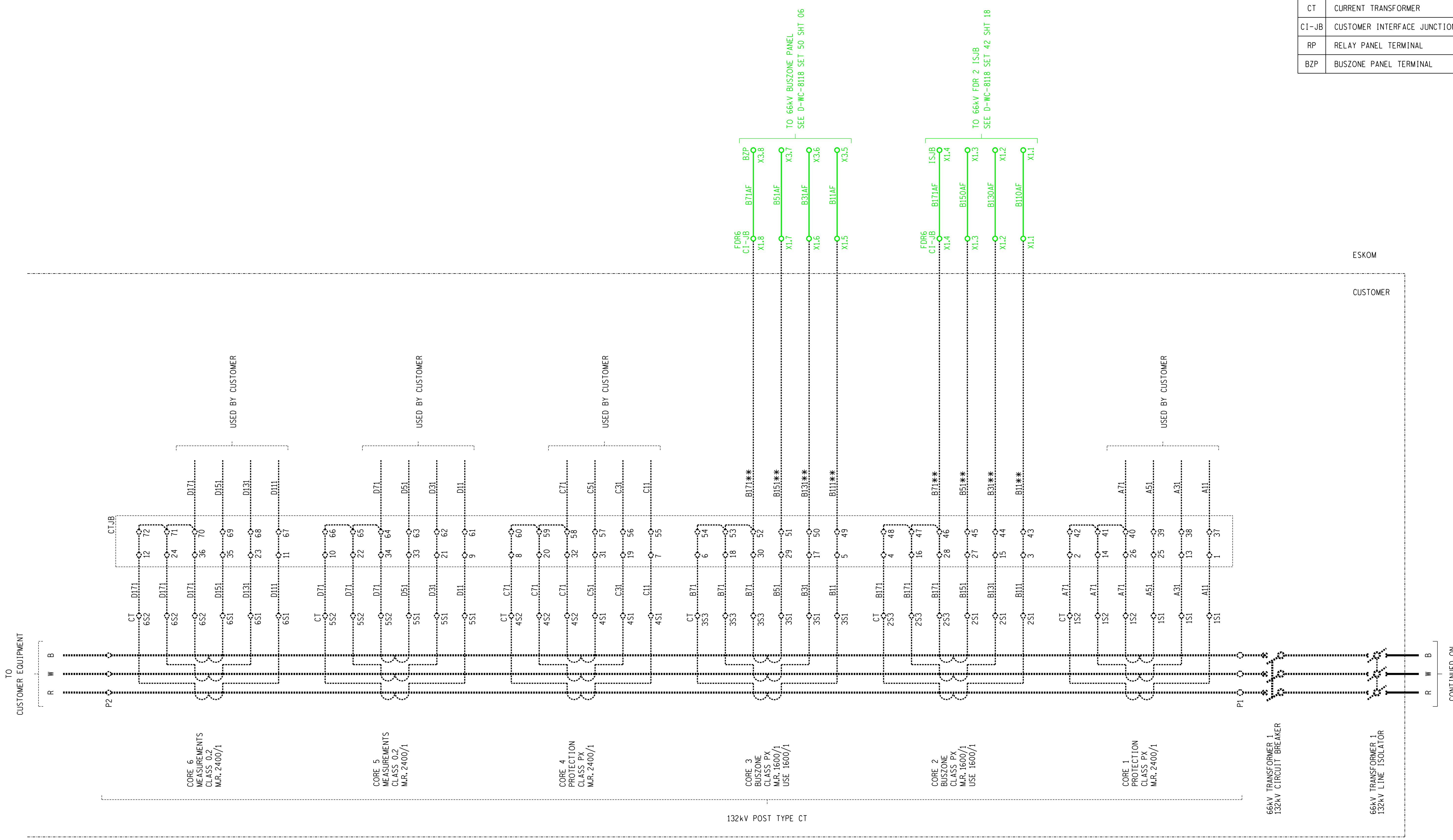
PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118

SHEET 3 OF 19 REVISION 1

TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CI-JB	CUSTOMER INTERFACE JUNCTION BOX
RP	RELAY PANEL TERMINAL
BZP	BUSZONE PANEL TERMINAL



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME AC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	04	00

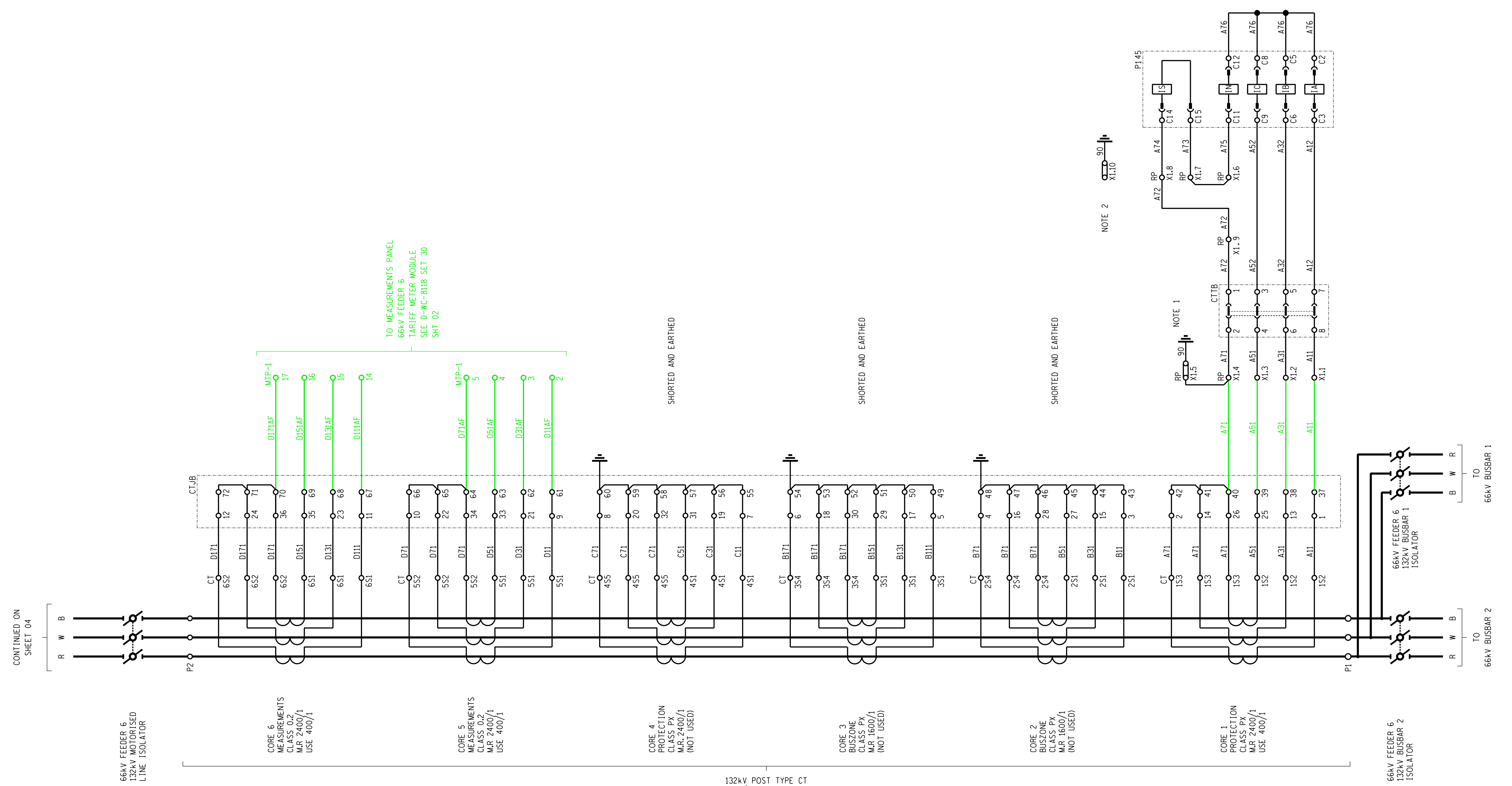
LEVELS:

LEVELS 1 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 4 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
BZJB	BUSZONE JUNCTION BOX
RP	RELAY PANEL TERMINAL



132kV POST TYPE CT
240/1 MULTI RATIO
(SEE D-WC-8118 SET 160)
(SEE NOTE 3)

NOTES:

1. FOR CONNECTION TO CORE BALANCE CT, LOOP:
   X1.6 - X1.9
   X1.7 - CT
   X1.8 - CT

   REMOVE LOOPS
   X1.6 - X1.7
   X1.8 - X1.9

2. THE LINK BETWEEN X1.8 AND X1.10 SHOULD BE INSTALLED IF A SEPARATE CORE BALANCE CT IS USED.

   THERE SHOULD ONLY BE ONE EARTH POINT ON EACH CT CIRCUIT.

3. REFER TO SETTING SHEET FOR CORRECT RATIO.

4. THE P145 RELAY IS SUITABLE FOR 1A OR 5A RATED CTs (VIA DIFFERENT TERMINAL INPUTS). THE STANDARD DRAWING INDICATES THE RELAY WIRED FOR 1A RATED CTs. USE THE TABLE BELOW TO DETERMINE THE CORRECT WIRING FOR 5A RATED CTs. SCHEMES ORDERED FOR 5A RATED CTs WILL BE WIRED AS SUCH IN THE FACTORY.

WIRE FERRULE NUMBER	P145 TERMINAL NUMBER 1A RATED	P145 TERMINAL NUMBER 5A RATED
A12	C3	C1
A32	C6	C4
A52	C9	C7
A76	C12	C10
A73	C15	C13

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

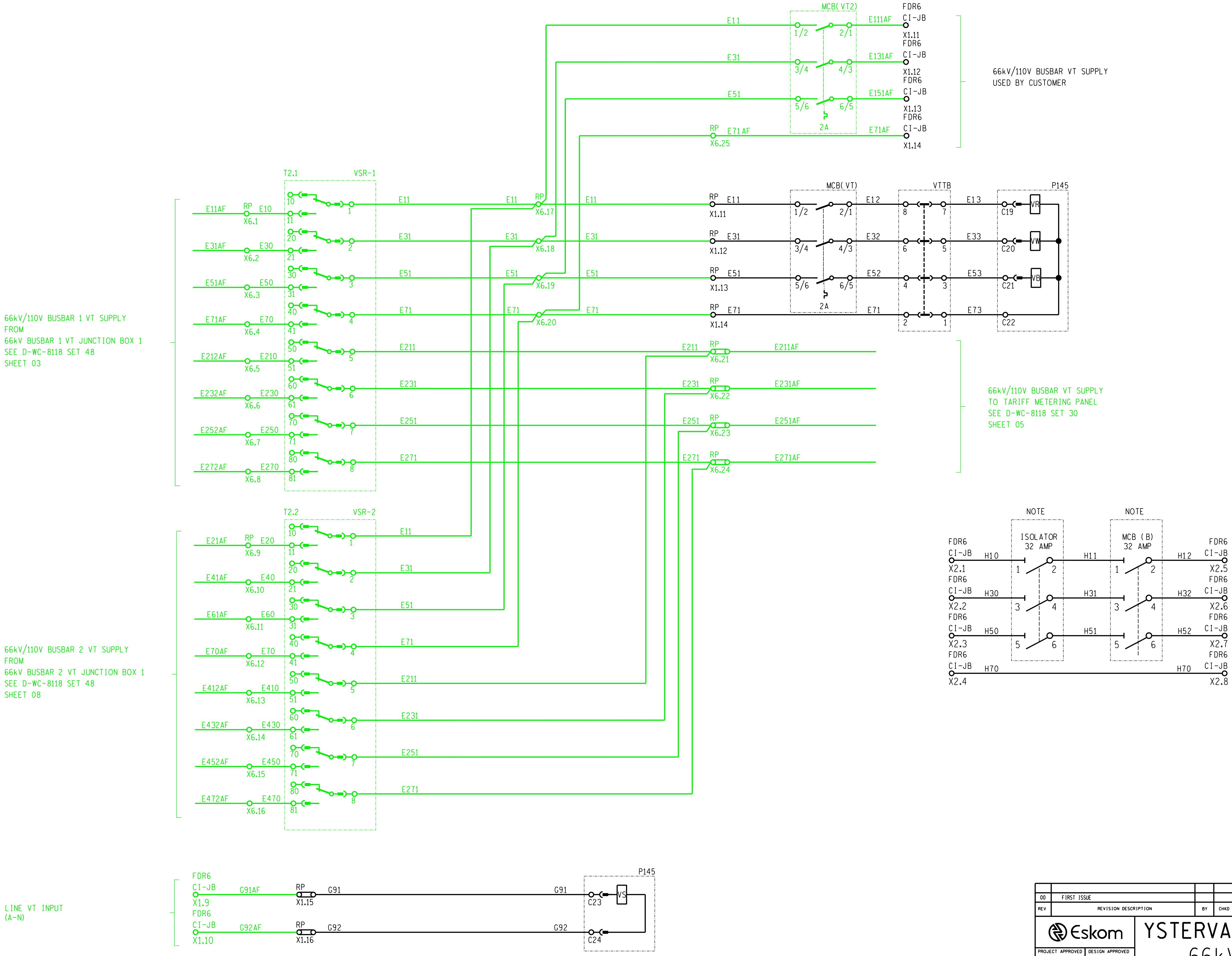
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	05	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 5 OF 19 REVISION 1



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6

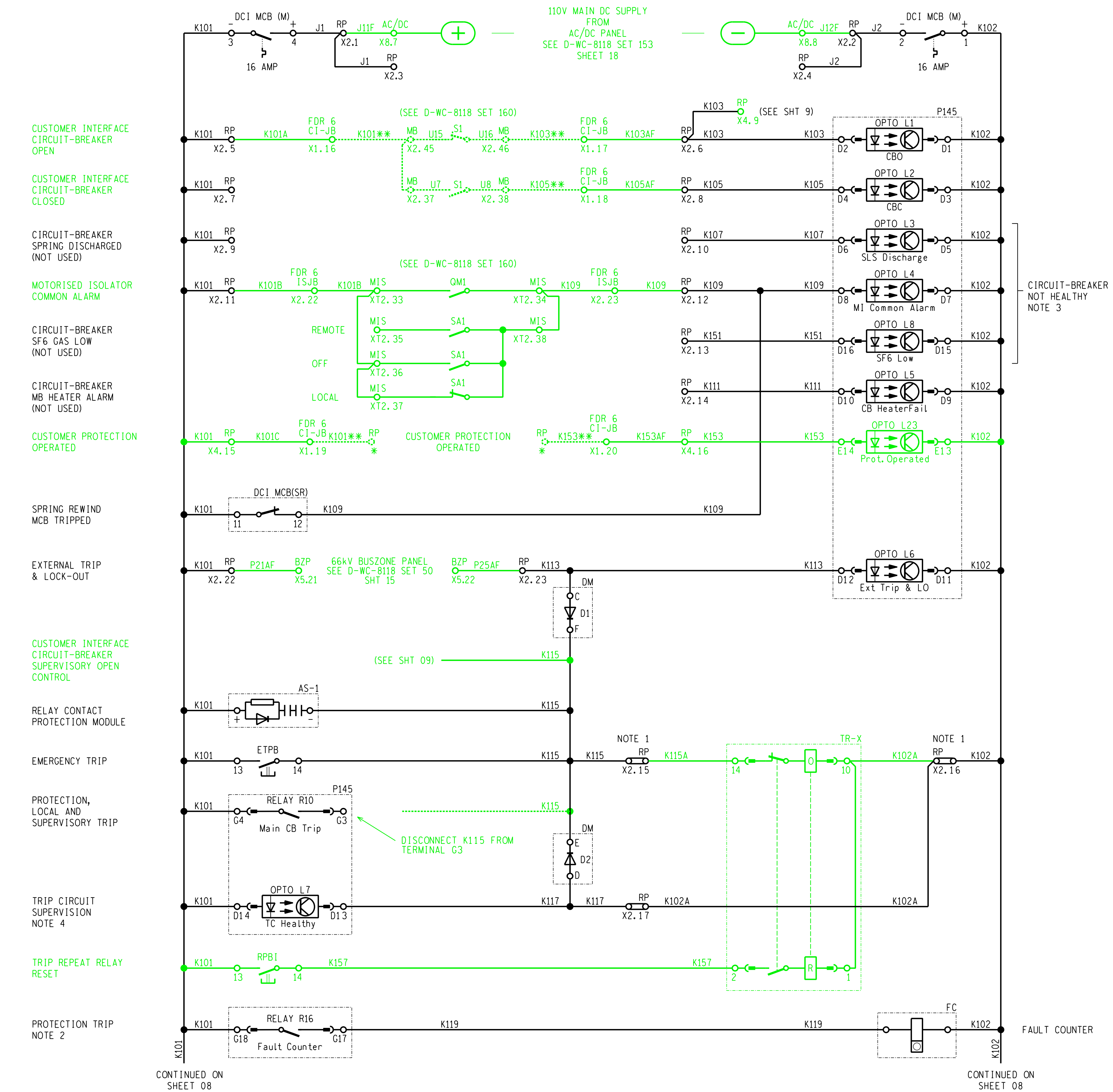
INTERFACE & MONITORING SCHEME
AC KEY DIAGRAM

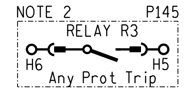
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	06	00

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

MASTER TRACING FILED UNDER D-WC-8118 SHEET 6 OF 19 REVISION 1

A1L





NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.
2. OPERATION OF P145 RELAY 3 RAISES THE LATCHED 'TRIP' LED ON THE RELAY AND INITIATES THE CIRCUIT-BREAKER FAIL FUNCTION. RELAY 3 MUST ALSO BE ASSERTED FOR ARC TO INITATE SUCCESSFULLY. RELAY 3 IS THUS CRITICAL TO THE CORRECT OPERATION OF THE SCHEME, EVEN THOUGH IT IS NOT WIRED. THE MASKING FOR RELAY 16 IS SIMILAR TO THAT FOR RELAY 3, BUT THE FORMER MAY BE BLOCKED BY A CONTROL INPUT DURING TESTING.
3. THE P145 WILL NOT ISSUE A CLOSE COMMAND TO THE CIRCUIT-BREAKER IF OPTO L3 IS ASSERTED (SLS DISCHARGED) OR OPTO L7 IS DE-ASSERTED (TRIP COIL FAILED). THE AUTO-RECLOSE LOGIC WAITS UNTIL THE END OF THE DEAD TIME BEFORE CHECKING THE SLS STATUS. IF THE SPRING IS DISCHARGED THE DEAD TIME IS EXTENDED UNTIL THE SPRING CHARGES, OR UNTIL A SETTABLE TIMER EXPIRES. EXPIRY OF THE TIMER CANCELS ARC.
4. ALL CLOSE COMMANDS TO THE CIRCUIT-BREAKER ARE BLOCKED IN THE EVENT THAT THE TRIP CIRCUIT IS UNHEALTHY (OPTO L7 DE-ASSERTED). IT IS THUS IMPERATIVE THAT PROVISION IS MADE FOR TRIP CIRCUIT SUPERVISION WHILST THE CIRCUIT-BREAKER IS IN THE OPEN POSITION. IF THE CIRCUIT-BREAKER DESIGN DOES NOT CATER FOR THIS, WIRE A N/C (52b) STATUS CONTACT BETWEEN X2.16 AND X2.17.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV		REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00		FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST.SUPERVISORY CB CONTROL	AB	RB

LEVELS:

LEVELS 1 … 10

Eskom

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

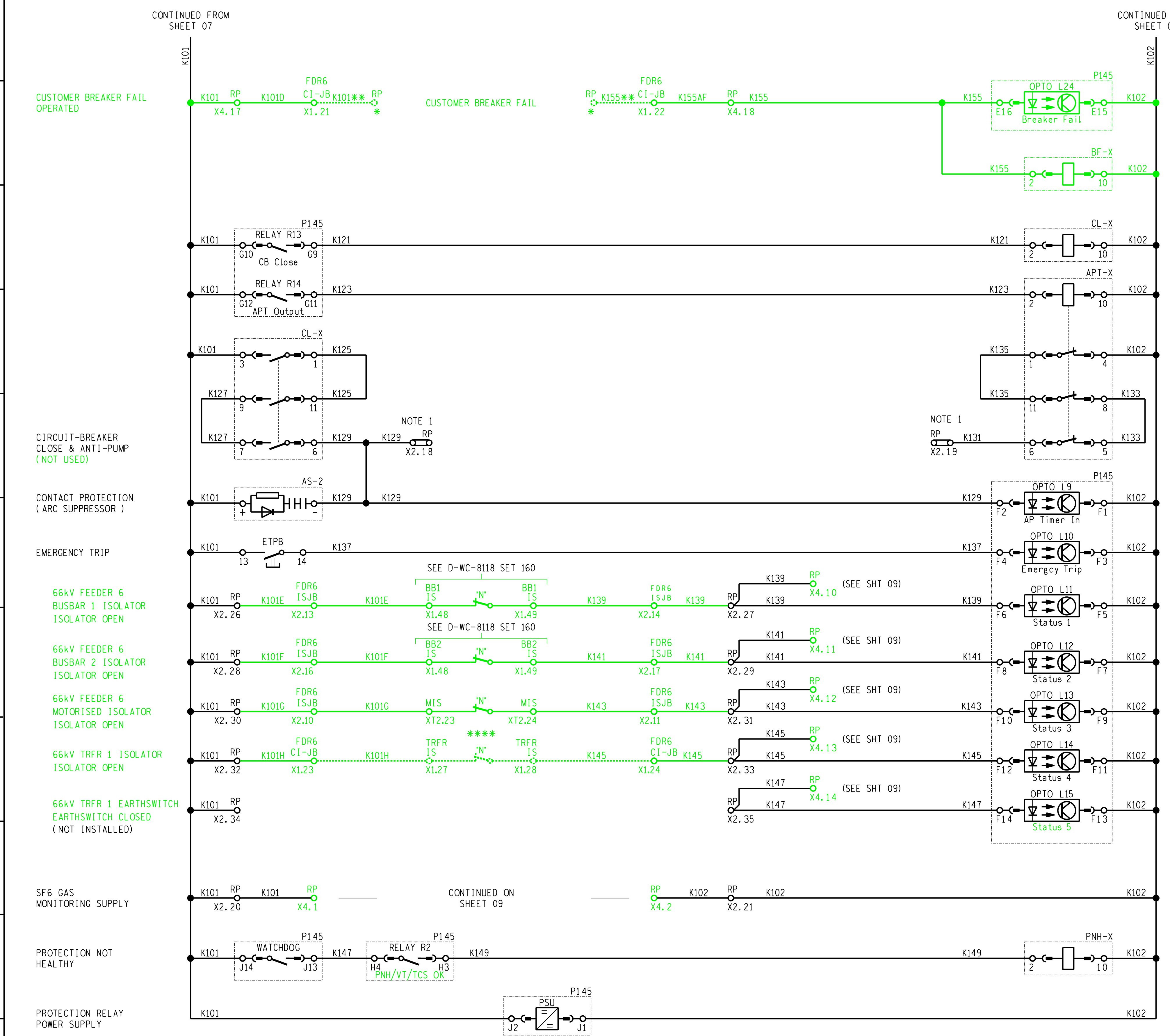
PROJECT APPROVED	DESIGN APPROVED
L.BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A.MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K.STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	07	00

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 7 OF 19 REVISION 1



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

SHEET 8 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CB CLOSE FUNCTION NOT USED	AB	RB

Eskom

PROJECT APPROVED: L.BOTHA, DATE 20/04/20	DESIGN APPROVED: J.MOSTERT, DATE 11/12/15
PROJECT CHECKED: A.MARAIS, DATE 04/12/19	DESIGN CHECKED: R.BUFFKINS, DATE 11/12/15
DRAWN BY: K.STEYNBERG, DATE 06/09/19	DRAWN BY: N.F.KNOETZEN, DATE 11/12/15

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME AC KEY DIAGRAM

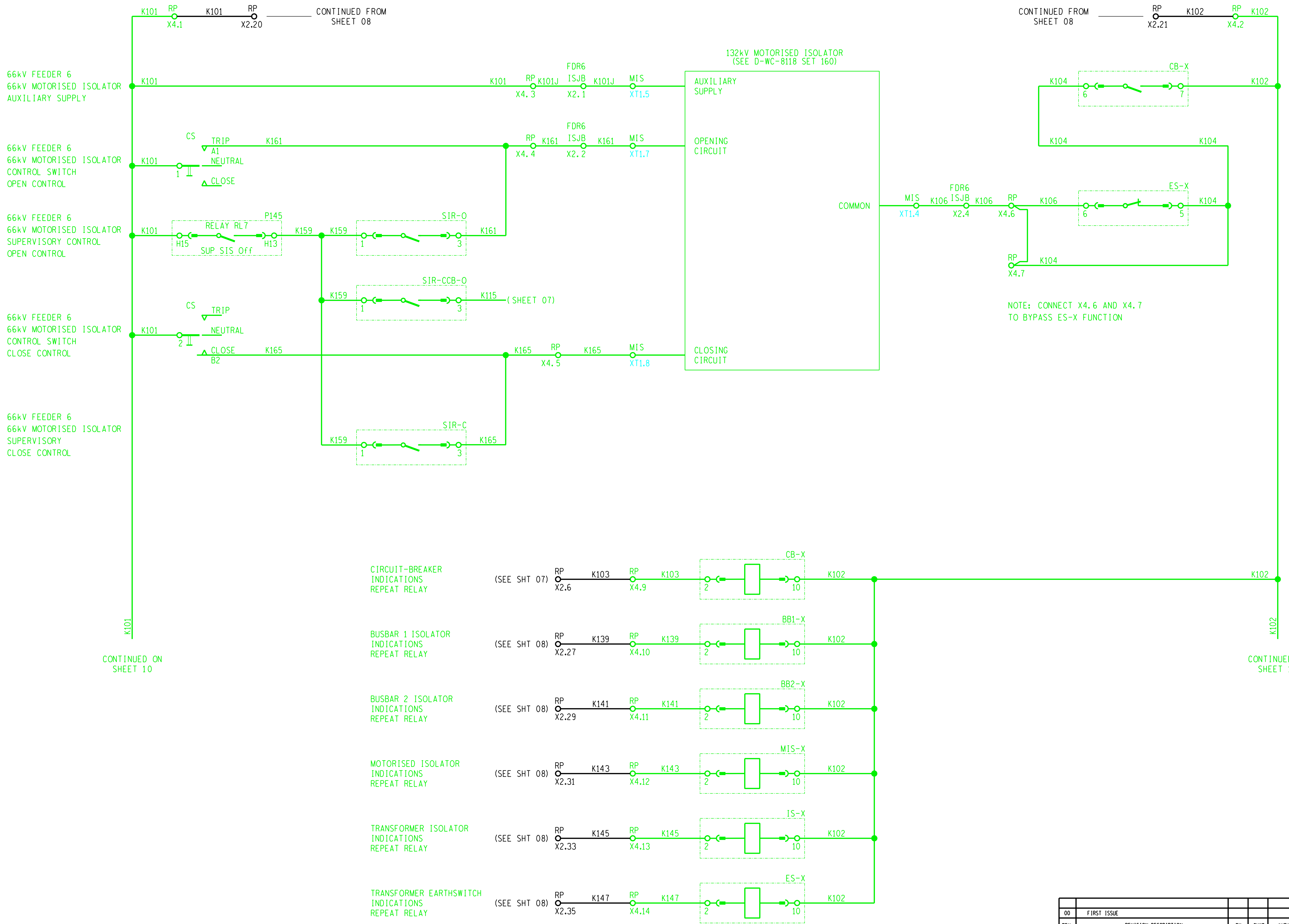
DRG No.	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	08	00

LEVELS:

AECOM

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST.SUPV.BREAKER OPEN	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A.MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

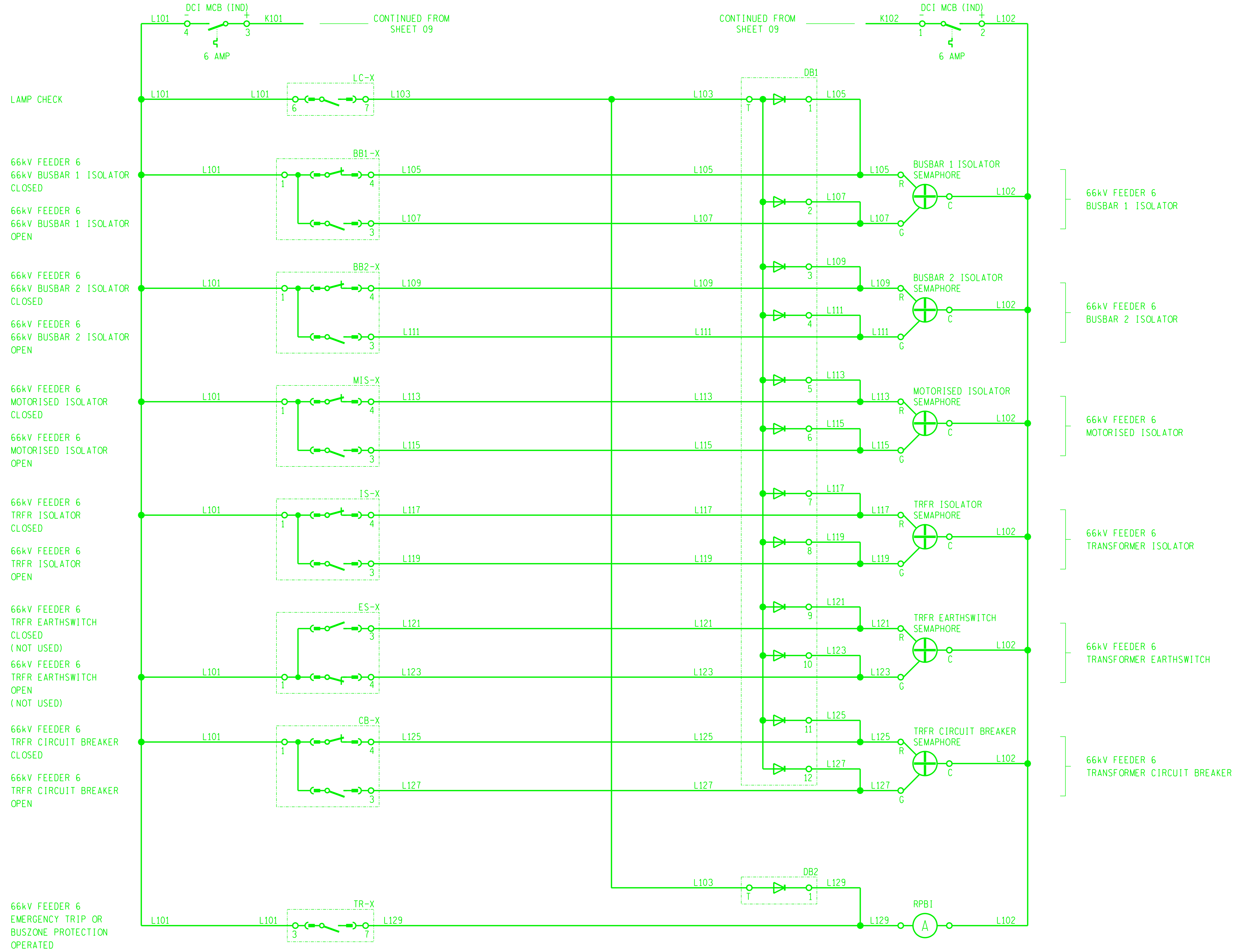
YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	09	00

LEVELS:
LEVELS 1 10

MASTER TRACING FILED UNDER D-WC-8118 SHEET 9 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL	AB	RB

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
DC KEY DIAGRAM

D-WC-8118

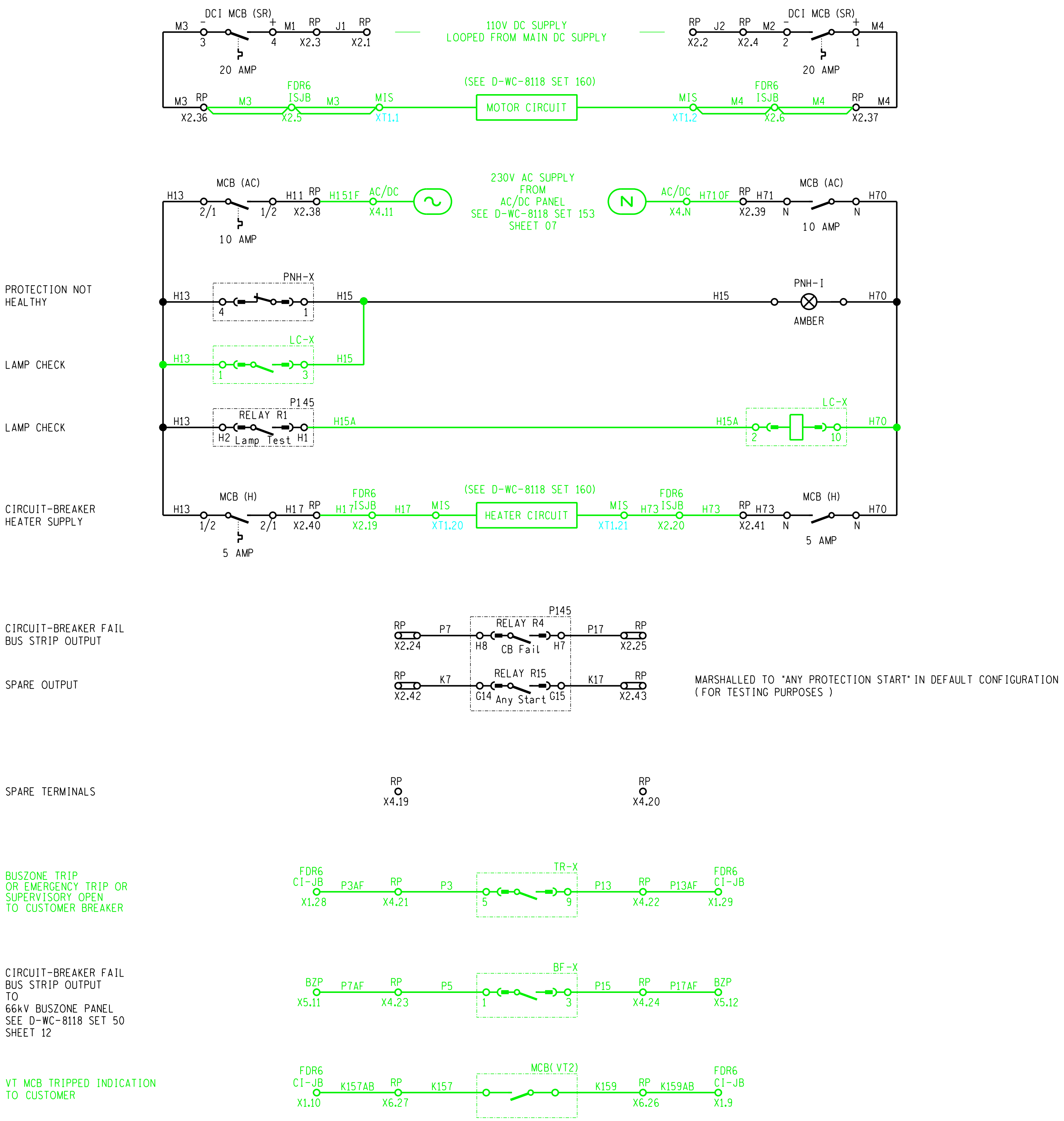
SET NUMBER	SHEET NUMBER	REVISION
46	10	00

LEVELS 1 10

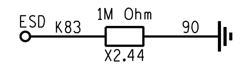
PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 19 REVISION 1



ELECTROSTATIC DISCHARGE CIRCUIT



DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	CORRECTED TR-X TERMINAL NUMBERS ADDED EMERGENCY TRIP & SUPV. TO BZ TRIP REPURPOSED CUSTOMER TRIP & L/OUT CONTACT ON SHT 12	AB	RB

LEVELS:

Eskom

AECOM

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

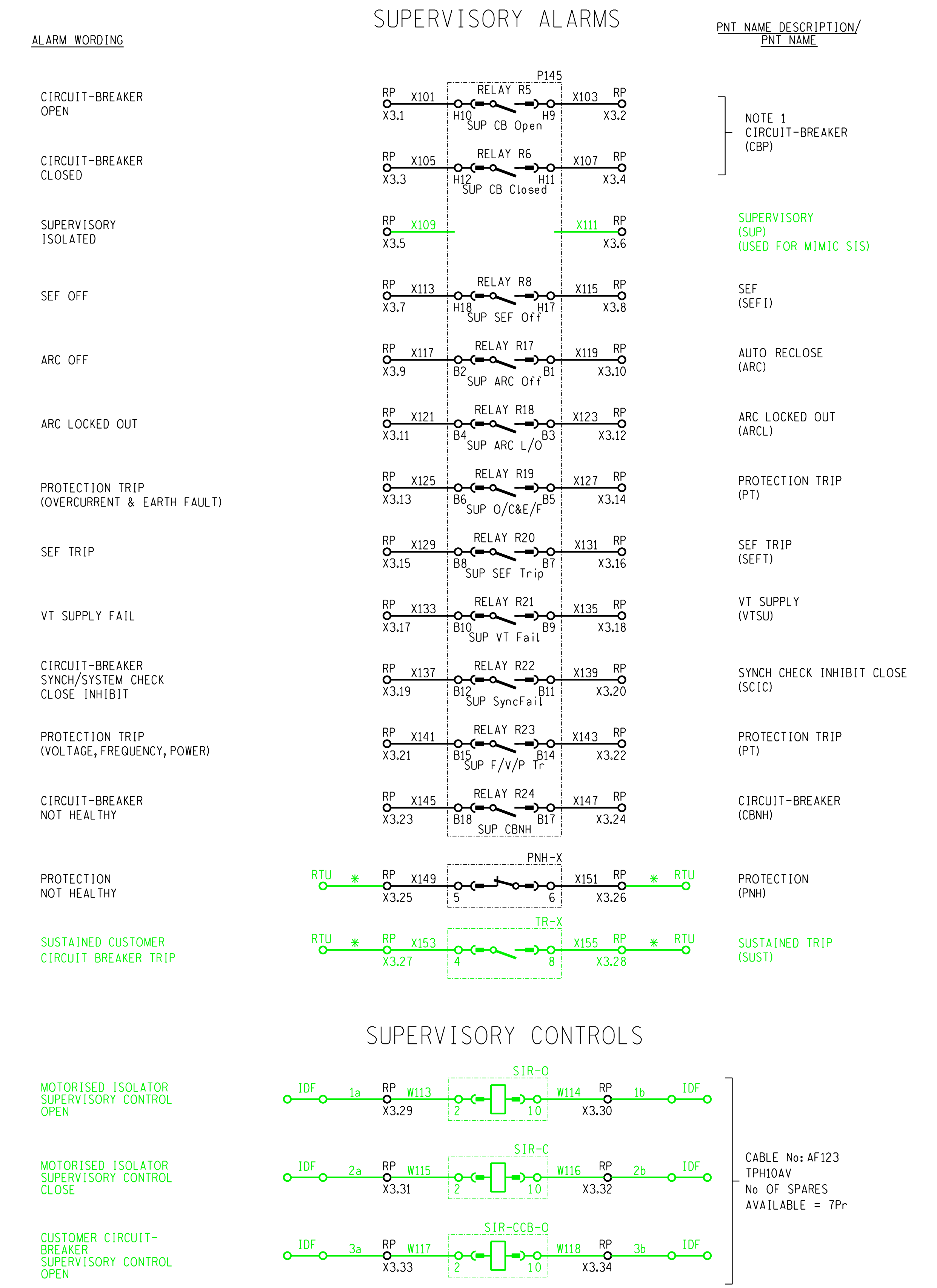
YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
AC SUPPLY KEY & SPRING REWIND DIAGRAM

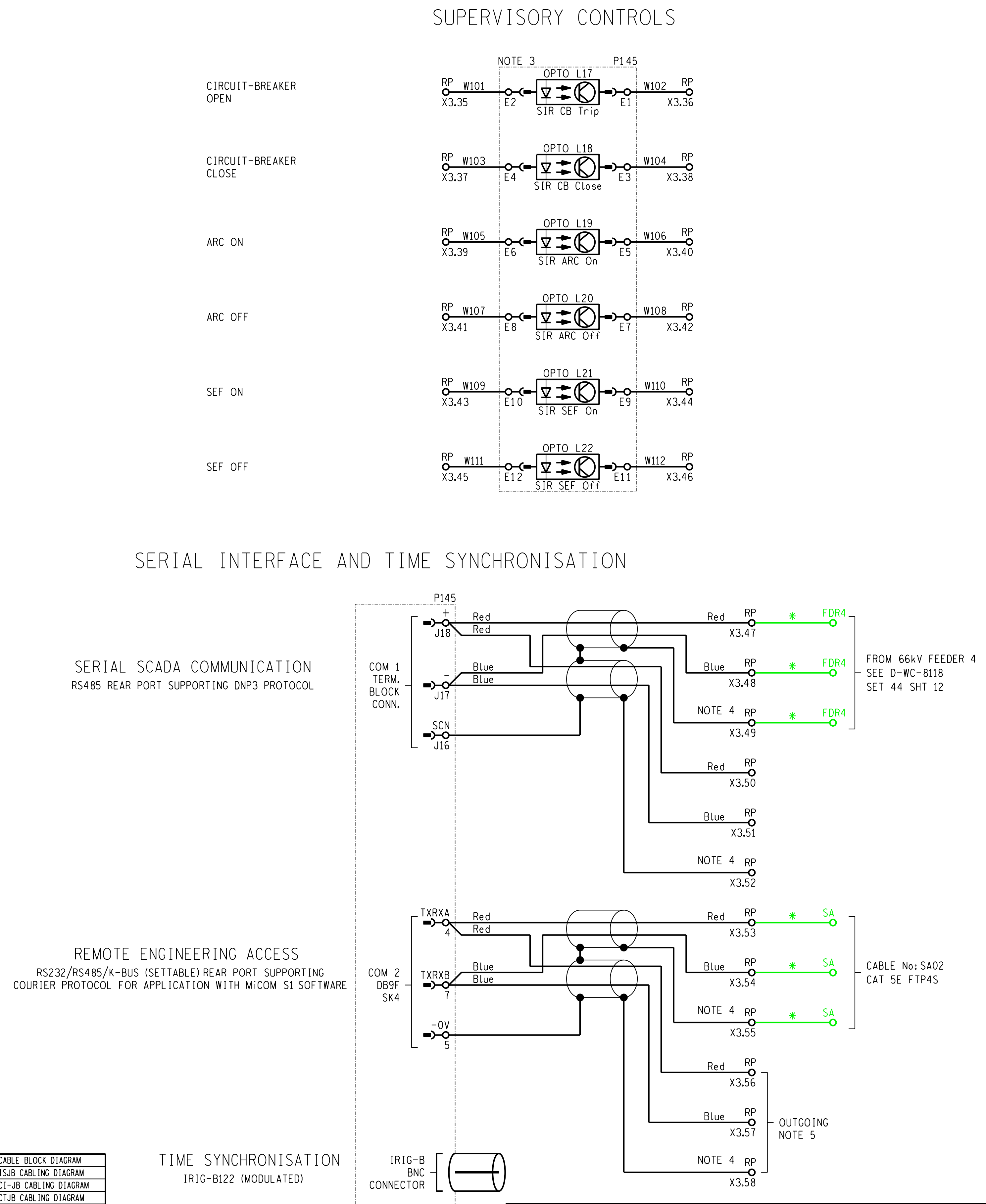
DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	11	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 19 REVISION 1

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

SUPERVISORY ALARMS





NOTE

1. USE DOUBLE BIT INDICATION.
2. IN THE EVENT THAT HARDWIRED SUPERVISORY INDICATION OF AN UNDER FREQUENCY TRIP OR A CIRCUIT-BREAKER FAIL BUS STRIP IS REQUIRED, THE ALARMS "ARC OFF" AND "ARC LOCKED-OUT" MAY BE COMBINED INTO A SINGLE ALARM OF DESCRIPTION (POINT NAME):

   ARC L/OUT OR OFF (ARCLO)

   THE SPARE CONTACT CAN THEN BE MARSHALLED AS:

   BKR FAIL BUS STRIP (BFBS); OR

   FREQUENCY TRIP (FRT)
3. THE P145's OPTO INPUTS ARE RATED FROM 19Vdc TO 265Vdc, WITH THE PICK-UP RANGE OF EACH OPTO INDIVIDUALLY SELECTABLE BY SETTINGS.
4. RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
5. INSERT 120 OHM TERMINATING RESISTOR BETWEEN + AND - IF DAISY CHAIN TERMINATES AT THIS RELAY PANEL.

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED CUST. CB SUPERVISORY CONTROL & SUSTAINED TRIP ALARM	AB	RB

AECOM

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F. KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

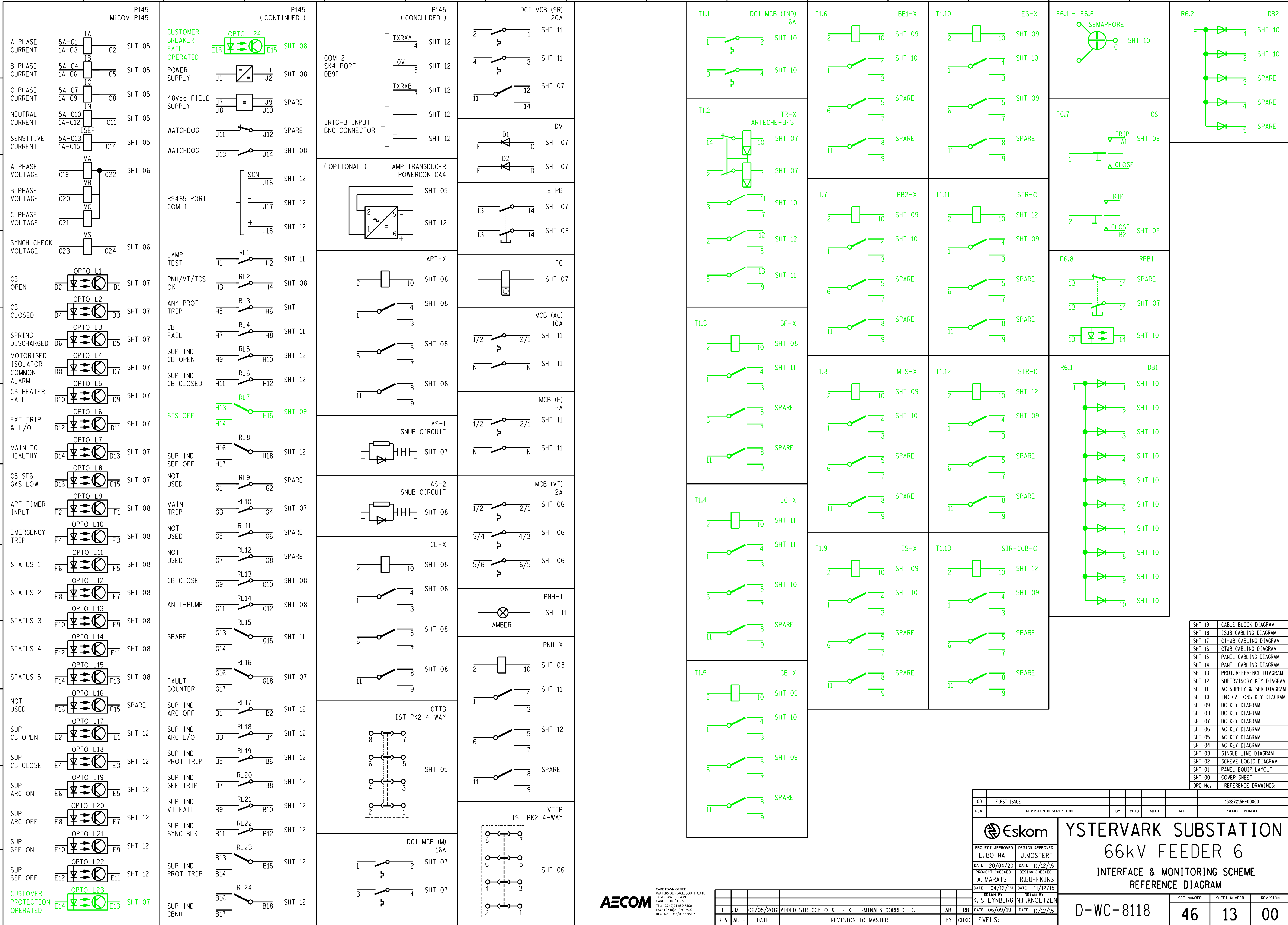
YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
SUPERVISORY ALARMS AND CONTROLS

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	12	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 19 REVISION 1



SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED SIR-CCB-O & TR-X TERMINALS CORRECTED.	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME REFERENCE DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	13	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 13 OF 19 REVISION 1

ANALOGUE INPUTS

X1

Terminal	Lead	Function
21		
20		D72
19		MEASUREMENT CT INPUTS NOTE 1
18		D32
17		
16	G92AF (X1.10)	G92 LINE VT INPUT
15	G91AF (X1.9)	G91
14		E71 VT INPUTS
13		E51
12		E31
11		E11
10		
9		A72 CORE BALANCE CT INPUT
8		A74
7		A73
6		A75
5		
4	A71 (40)	A71 PROTECTION CT INPUTS
3	A51 (39)	A51
2	A31 (38)	A31
1	A11 (37)	A11

CABLE NUMBER	AF130	AF104
CABLE SIZE	4	12
NUMBER OF SPARES	2	8
DESTINATION	66kV FEEDER 6 CUSTOMER INTERFACE JB	66kV FEEDER 6 CTJB

AC & DC CONTROL CIRCUITS

X2

Terminal	Leads	Lead	Link	Function
44				K83 ESD
43				K17 / K7 SPARE OUTPUT
42				
41	X2.20	H73		H73 / H17 HEATER SUPPLY
40	X2.19	H17		
39	X4.N	H170C		H71 / H11 AC SUPPLY
38	X4.11	H151C		
37	X2.6	M4 (2)		M4 / M3 SPRING REWIND
36	X2.5	M3 (2)		
35			X4.14	K146 / K101 SPARE SUPPLY
34				
33	X1.24	K145AF	X4.13	K145 / K101 SPARE INPUT
32	X1.23	K101H		
31	X2.11	K143AF	X4.12	K143, K101, K141, K101, K139, K101 PLANT STATUS INPUTS
30	X2.10	K101G		
29	X2.17	K141	X4.11	
28	X2.16	K101F		
27		K139	X4.10	
26	X2.13	K101E		
25				P17 / P7 CB FAIL OUTPUT
24				
23	X4.10	P25AF		K113 / K101 EXT TRIP & LO
22	X4.9	P21AF		
21		K102	X4.2	K102 / K101 CB AUX SUPPLY
20		K101	X4.1	
19				K131 / K129 CLOSING COIL
18				
17		K102A		K117 / K102 / K115 MAIN TRIP COIL
16	10	K102A		
15	14	K115A		
14				K111, K151, K109, K101, K107, K101, K105, K101, K103, K101 CB STATUS/HEALTH
13				
12	X2.23	K109		
11	X2.22	K101B		
10				
9				
8	X1.18	K105AF		
7				
6	X1.17	K103AF	X4.9	
5	X1.16	K101A		
4				J2, J1, J2, J1 DC SUPPLIES
3				
2	X8.8	J12B		
1	X8.7	J11B		

CABLE NUMBER	-	AF117	AF108	AF115	AF122	-
CABLE SIZE	-	4	19	19	4	-
NUMBER OF SPARES	-	-	8	4	-	-
DESTINATION	WIRING TO TRIP REPEAT RELAY (TR-X)	66kV BUSZONE PANEL	66kV FEEDER 6 CUSTOMER INTERFACE JB	66kV FEEDER 6 ISOLATOR JUNCTION BOX	AC/DC PANEL	WIRING TO STRIP X4

LOOPED TERMINALS	
66kV MIS MB	XT2.33-XT2.36-XT2.37; XT2.34-XT2.38;

SUPERVISORY ALARMS, CONTROLS & SERIAL COMMUNICATION.

X3

Terminal	Lead	Function
52	SCRN	RS485 SUPERVISORY PORT
51	Blue	
50	Red	
49	SCRN	
48	Blue	
47	Red	
46	W112	HARD-WIRED SUPERVISORY CONTROLS
45	W111	
44	W110	
43	W109	
42	W108	
41	W107	
40	W106	
39	W105	
38	W104	
37	W103	
36	W102	
35	W101	
34 (36)	W118	HARD-WIRED SUPERVISORY CONTROLS
33 (30)	W117	
32 (26)	W116	
31 (20)	W115	
30 (16)	W114	
29 (10)	W113	
28	X155	HARD-WIRED SUPERVISORY ALARMS
27	X153	
26	X151	
25	X149	
24	X147	
23	X145	
22	X143	
21	X141	
20	X139	
19	X137	
18	X135	
17	X133	
16	X131	
15	X129	
14	X127	
13	X125	
12	X123	
11	X121	
10	X119	
9	X117	
8	X115	
7	X113	
6	X111	
5	X109	
4	X107	
3	X105	
2	X103	
1	X101	

CABLE NUMBER	AF123	SA04	AF124
CABLE SIZE	10Pr	4	4
NUMBER OF SPARES	7Pr	1	1
DESTINATION	IDF	TELECOMMS & SUBSTATION AUTOMATION PANEL	RTU (SERIAL COMMUNICATION)

NOTES:

1. TERMINALS X1.15 - X1.19 ONLY PROVIDED IF AMP TRANSDUCER OPTION IS TAKEN.
2. (2) INDICATES TWO LEADS IN PARALLEL.
3. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
4. LEAD NUMBERS SHOWN THUS
   P7 [ ] INDICATES NO CHANGE IN LEAD NUMBER.
   P7 [ ] P7A INDICATES CHANGE IN LEAD NUMBER.
5. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
6. THE SYMBOL '*' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).

STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
● ENTRELEC D2,5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT. REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP. LAYOUT
SHT 00	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	ADDED HARDWIRED CONTROLS & SUSTAINED TRIP ALARM	AB	RB

LEVELS 1 3 4 10

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED: L. BOTHA, DATE 20/04/20
DESIGN APPROVED: J.MOSTERT, DATE 11/12/15
PROJECT CHECKED: A. MARAIS, DATE 04/12/19
DESIGN CHECKED: R.BUFFKINS, DATE 11/12/15
DRAWN BY: K. STEYNBERG, DATE 06/09/19
DRAWN BY: N.F. KNOETZEN, DATE 11/12/15
LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME PANEL CABLING DIAGRAM

D-WC-8118 | SET NUMBER 46 | SHEET NUMBER 14 | REVISION 00

A1L

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 19 REVISION 1

MIMIC INDICATIONS & CONTROL CIRCUITS

FEEDER 6 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV BUSZONE PANEL	66kV FEEDER 6 ISOLATOR JB	66kV FEEDER 6 CUSTOMER INTERFACE JB	DESTINATION	X4		INTERNAL WIRING	
		X4.12			P17AF	24			P15
		X4.11			P7AF	23			P5
				X1.29	P13AF	22			P13
				X1.28	P3AF	21			P3
						20			
						19			
				X1.22	K155AF	18			K155
				X1.21	K101D	17			K101
				X1.20	K153AF	16			K153
				X1.19	K101C	15			K101
	X2.35				K147	14			
	X2.33				K145	13			K145
	X2.31				K143	12			K143
	X2.29				K141	11			K141
	X2.27				K139	10			K139
	X2.6				K103	9			K103
						8			
						7			K104
			X2.4		K106	6			K106
			X2.3		K165	5			K165
			X2.2		K161	4			K161
			X2.1		K101J	3			K101
	X2.21				K102	2			K102
	X2.20				K101	1			K101
X1.11					E111AF	MCB VT2	E11	X6.17	E11
X1.12					E131AF		E31	X6.18	E31
X1.13					E151AF		E51	X6.19	E51
AF136	-	AF117	AF115	AF108	CABLE NUMBER			-	
4	-	4	19	19	CABLE SIZE			-	
-	-	-	4	8	NUMBER OF SPARES			-	

- P15, P5: CUSTOMER BREAKER FAIL (BF-X)
- P13, P3: BUS ZONE TRIP (TR-X) & EMERGENCY TRIP TEST PUSH BUTTON
- SPARE
- K155, K101: CUSTOMER BREAKER FAIL OPERATED
- K153, K101: CUSTOMER PROTECTION OPERATED
- K145, K143, K141, K139, K103: INDICATION CIRCUITS
- K104, K106, K165, K161, K101: CONTROL CIRCUITS
- K102, K101: DC SUPPLIES
- E11, E31, E51: CUSTOMER VT SUPPLY

VOLTAGE SELECTION AND DISTRIBUTION

FEEDER 6 CUSTOMER INTERFACE JB	WIRING TO STRIP X2	66kV TARIFF METERING	66kV BUSBAR 2 VTJB 1	66kV BUSBAR 1 VTJB 1	DESTINATION	X6		INTERNAL WIRING	INTERNAL WIRING
X1.32					X157AF	27	K157		
X131					X159AF	26	K159		
	X1.14				E171AF	25	E71		
		1			E271AF	24	E271		
		MCB-3			E251AF	23	E251		
		MCB-2			E231AF	22	E231		
		MCB-1			E211AF	21	E211		
					E71	20	E71	X1.14	
					E51	19	E51	X1.13	MCB(VT2).5
					E31	18	E31	X1.12	MCB(VT2).3
					E11	17	E11	X1.11	MCB(VT2).1
			38		E472AF	16	E470		
			37		E452AF	15	E450		
			36		E432AF	14	E430		
			35		E412AF	13	E410		
			34		E70AF	12	E70		
			33		E61AF	11	E60		
			32		E41AF	10	E40		
			31		E21AF	9	E20		
				38	E272AF	8	E270		
				37	E252AF	7	E250		
				36	E232AF	6	E230		
				35	E212AF	5	E210		
				34	E71AF	4	E70		
				33	E51AF	3	E50		
				32	E31AF	2	E30		
				31	E11AF	1	E10		
AF108	*	AF114	AF111	AF112	CABLE NUMBER			-	-
19	4	4	12	12	CABLE SIZE			-	-
5	-	-	4	4	NUMBER OF SPARES			-	-

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 INDICATES NO CHANGE IN LEAD NUMBER.
   P7 P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR CABLE PREFIXING.
5. THE SYMBOL '*' FOLLOWING A DEVICE TERMINAL NUMBER INDICATES THE PRESENCE OF LOOPS (SEE LOOP TABLE).
6. STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
   - ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
   - ⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
   - ● ENTRELEC D2.5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
   - ○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
   - ▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
   - TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
   - TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	X4.19 & X4.20 NOT USED.	AB	RB

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K. STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
PANEL CABLING DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	15	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 15 OF 19 REVISION 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

TOP OF TERMINAL STRIP

To CURRENT TRANSFORMERs

AF101	AF102	AF103		X1	
		6S2	D171	36	36
		6S1	D151	35	35
		5S2	D71	34	34
		5S1	D51	33	33
		4S5	C71	32	32
		4S1	C51	31	31
		3S4	B171	30	30
		3S1	B151	29	29
		2S4	B71	28	28
		2S1	B51	27	27
		1S3	A71	26	26
		1S2	A51	25	25
	6S2		D171	24	24
	6S1		D131	23	23
	5S2		D71	22	22
	5S1		D31	21	21
	4S5		C71	20	20
	4S1		C31	19	19
	3S4		B171	18	18
	3S1		B131	17	17
	2S4		B71	16	16
	2S1		B31	15	15
	1S3		A71	14	14
	1S2		A31	13	13
6S2			D171	12	12
6S1			D111	11	11
5S2			D71	10	10
5S1			D11	9	9
4S5			C71	8	8
4S1			C11	7	7
3S4			B171	6	6
3S1			B111	5	5
2S4			B71	4	4
2S1			B11	3	3
1S3			A71	2	2
1S2			A11	1	1

AF101	AF102	AF103	CABLE NUMBER
12	12	12	CABLE SIZE
-	-	-	NUMBER OF SPARES
66kV FEEDER 6 RED PHASE CT	66kV FEEDER 6 WHITE PHASE CT	66kV FEEDER 6 BLUE PHASE CT	DESTINATION

To CONTROL ROOM & BZJB

	X2			AF104	AF133	
12	72	R				CORE 6
24	71	W				
36	70	B	D171AF		17	
35	69	B	D151AF		16	
23	68	W	D131AF		15	
11	67	R	D111AF		14	
10	66	R				CORE 5
22	65	W				
34	64	B	D71AF		5	
33	63	B	D51AF		4	
21	62	W	D31AF		3	
9	61	R	D11AF		2	
8	60	R				CORE 4
20	59	W				
32	58	B				
31	57	B				
19	56	W				
7	55	R				
6	54	R				CORE 3
18	53	W				
30	52	B				
29	51	B				
17	50	W				
5	49	R				
4	48	R				CORE 2
16	47	W				
28	46	B				
27	45	B				
15	44	W				
3	43	R				
2	42	R				CORE 1
14	41	W				
26	40	B	A71	X1.4		
25	39	B	A51	X1.3		
13	38	W	A31	X1.2		
1	37	R	A11	X1.1		

CABLE NUMBER	AF104	AF133
CABLE SIZE	12	12
NUMBER OF SPARES	8	4
DESTINATION	66kV FEEDER 6 RELAY PANEL	TARIFF METERING PANEL 1 66kV FEEDER 6 TARIFF METER MODULE

TERMINAL LOOPS	
CT JB	40-41-42-43-44-45-46-47-48-EARTH, 49-50-51-52-53-54-EARTH, 55-56-57-58-59-60-EARTH, 61-62-63-64-65-66-67-68-69-70-71-72

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 06/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15
LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
CTJB CABLING

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	16	00

LEVELS 1 3 4 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 16 OF 19 REVISION 1

X1

					X1.1	B110AF	1	*	*		
					X1.3	B130AF	2	*	*		
					X1.5	B150AF	3	*	*		
					X1.7	B171AF	4	*	*		
				X3.5		B11AF	5	*	*		
				X3.6		B31AF	6	*	*		
				X3.7		B51AF	7	*	*		
				X3.8		B71AF	8	*	*		
		X1.15				G91AF	9	*			*
		X1.16				G92AF	10	*			*
	2/1					E111AF	11	*		*	
	3/4					E131AF	12	*		*	
	5/6					E151AF	13	*		*	
X1.28						E171AF	14	*		*	
							15				
			X2.5			K101A	16	*		*	
			X2.6			K103AF	17	*		*	
			X2.8			K105AF	18	*		*	
			X4.15			K101C	19	*		*	
			X4.16			K153AF	20	*		*	
			X4.17			K101D	21	*		*	
			X4.18			K155AF	22	*		*	
			X2.32			K101H	23	*		*	
			X2.33			K145AF	24	*		*	
							25				
							26				
							27				
			X4.21			P3AF	28	*		*	
			X4.22			P13AF	29	*		*	
							30				
			X6.26			K159AF	31	*		*	
			X6.27			K157AF	32	*		*	
AF113	AF113	AF130	AF108	AF117	AF120	CABLE NUMBER			*	*	*
4	4	4	19	12	4	CABLE SIZE			*	*	*
-	-	-	7	4	-	NUMBER OF SPARES			*	*	*
66kV FEEDER 6 RELAY PANEL	66kV FEEDER 6 RELAY PANEL TERMINAL STRIP 4 MCB(VT2)	66kV FEEDER 6 RELAY PANEL	66kV FEEDER 6 RELAY PANEL	66kV BUSZONE PANEL	66kV FEEDER 6 ISOLATOR JUNCTION BOX	DESTINATION			66kV TRANSFORMER 3 CTJB (CUSTOMER CT)	66kV TRANSFORMER 3 RELAY PANEL (CUSTOMER PROTECTION PANEL)	66kV TRANSFORMER 3 VTJB

X2

H10	1			
H30	2			
H50	3			
H70	4			
H12	5			
H32	6			
H52	7			
H70	8			
CABLE NUMBER				
CABLE SIZE				
NUMBER OF SPARES				
DESTINATION				

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A. MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
CUSTOMER INTERFACE JB

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	17	00

LEVELS	1		3	4						10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

SHEET 17 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

						X2						
		XT1.5			K101J	1	K101J	X4.3				
		XT1.7			K161	2	K161	X4.4				
		XT1.8			K165	3	K165	X4.5				
		XT1.4			K106	4	K106	X4.6				
		XT1.1			M3 (2)	5	M3 (2)	X2.36				
		XT1.2			M4 (2)	6	M4 (2)	X2.37				
						7						
						8						
						9						
		XT2.23			K101G	10	K101G	X2.30				
		XT2.24			K143	11	K143	X2.31				
						12						
				X1.48	K101E	13	K101E	X2.26				
				X1.49	K139	14	K139	X2.27				
						15						
			X1.48		K101F	16	K101F	X2.29				
			X1.49		K141	17	K141	X2.30				
						18						
		XT2.20			H17	19	H17	X2.40				
		XT2.21			H73	20	H73	X2.41				
						21						
		XT2.33			K101B	22	K101B	X2.11				
		XT2.34			K109	23	K109	X2.12				
						24						
						25						
						26						
						27						
						28						
						29						
						30						
						31						
						32						
						33						
		AF110	AF125	AF109	CABLE NUMBER			AF115				
		19	12	12	CABLE SIZE			19				
		7	4	4	NUMBER OF SPARES			3				
		66kV MOT.LINE ISMB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 6 RP				

							X1						
					X1.32	B110AB	1	B110AB	X1.1				
					X1.33	B111AB	2	B111AB		X1.5			
					X1.36	B130AB	3	B130AB	X1.2				
					X1.37	B131AB	4	B131AB		X1.6			
					X1.40	B150AB	5	B150AB	X1.3				
					X1.41	B151AB	6	B151AB		X1.7			
			48			B171AB	7	B171AB		X1.8			
				X1.32			8	B210AB					
				X1.33		B211AB	9	B211AB		X2.5			
				X1.36			10	B230AB					
				X1.37		B231AB	11	B231AB		X2.6			
				X1.40			12	B250AB					
				X1.41		B251AB	13	B251AB		X2.7			
							14	B271AB		X2.8			
							15						
							16						
							17						
							18						
							19						
							20						
							21						
							22						
							23						
							24						
							25						
							26						
							27						
							28						
							29						
							30						
			AF132	AF125	AF109	CABLE NUMBER			AF132	AF126			
			4	12	12	CABLE SIZE			4	12			
			-	4	4	NUMBER OF SPARES			-	4			
			66kV FDR 6 CIJB	66kV BUSBAR 2 ISMB	66kV BUSBAR 1 ISMB	DESTINATION			66kV FDR 6 CIJB	66kV BUSZONE RP			

LOOPED TERMINALS	
BP ISMB	
BB1 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
BB2 ISMB	X1.32-X1.34; X1.36-X1.38; X1.40-X1.42
LINE ISMB	XT2.33-XT2.36; XT2.34-XT2.38
ISJB	X1.1-X1.8; X1.3-X1.10; X1.5-X1.12; X1.7-X1.14

DRG No.	REFERENCE DRAWINGS:
SHT 19	CABLE BLOCK DIAGRAM
SHT 18	ISJB CABLING DIAGRAM
SHT 17	CI-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L.BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A.MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K.STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
ISJB CABLING DIAGRAM

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	42	18	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS) A1L

SHEET 18 OF 19 REVISION 1

MASTER TRACING FILED UNDER D-WC-8118

SEE D-WC-8118 SET 159

DRG No.	REFERENCE DRAWINGS:
SHT 18	CABLE BLOCK DIAGRAM
SHT 17	CT-JB CABLING DIAGRAM
SHT 16	CTJB CABLING DIAGRAM
SHT 15	PANEL CABLING DIAGRAM
SHT 14	PANEL CABLING DIAGRAM
SHT 13	PROT.REFERENCE DIAGRAM
SHT 12	SUPERVISORY KEY DIAGRAM
SHT 11	AC SUPPLY & SPR DIAGRAM
SHT 10	INDICATIONS KEY DIAGRAM
SHT 09	DC KEY DIAGRAM
SHT 08	DC KEY DIAGRAM
SHT 07	DC KEY DIAGRAM
SHT 06	AC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	SINGLE LINE DIAGRAM
SHT 02	SCHEME LOGIC DIAGRAM
SHT 01	PANEL EQUIP.LAYOUT
SHT 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
1	JM	06/05/2016	AS PREVIOUS REVISION	AB	RB

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L.BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED	DESIGN CHECKED
A.MARAIS	R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY	DRAWN BY
K.STEYNBERG	N.F.KNOETZEN
DATE 06/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV FEEDER 6
INTERFACE & MONITORING SCHEME
CABLE BLOCK DIAGRAM

	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	46	19	00

LEVELS 1 10

PANEL TYPE DESIGNATION 4RF-1101 (WR-IMS)

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 18 REVISION 1

SHEET NUMBER	DT TEMPLATE	REVISION	DATE	DESIGN CHANGE DETAILS
00	BUSBAR 1 COVER SHEET			
01	BUSBAR 1 VRW20 JUNCTION BOX TRAY LAYOUT	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
02	BUSBAR 1 VRW20 JUNCTION BOX TRAY WIRING KEY DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
03	BUSBAR 1 VTJB 1 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
04	BUSBAR 1 VTJB 2 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
05	BUSBAR 1 POWER VTJB VRW20 JUNCTION BOX TRAY LAYOUT			
06	BUSBAR 1 POWER VTJB VT INSERT WIRING KEY DIAGRAM			
07	BUSBAR 1 POWER VTJB CABLING DIAGRAM			
08	BUSBAR 2 COVER SHEET			
09	BUSBAR 2 VRW20 JUNCTION BOX TRAY LAYOUT	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
10	BUSBAR 2 VRW20 JUNCTION BOX TRAY WIRING KEY DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
11	BUSBAR 2 VTJB 1 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
12	BUSBAR 2 VTJB 2 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
13	BUSBAR 2 POWER VTJB VRW20 JUNCTION BOX TRAY LAYOUT			
14	BUSBAR 2 POWER VTJB VT INSERT WIRING KEY DIAGRAM			
15	BUSBAR 2 POWER VTJB CABLING DIAGRAM			

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION
66kV BUSBAR 1 VTJB 1 & 2
COVER SHEET

D-WC-8118

SET	SHEET	REVISION
48	00	00

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

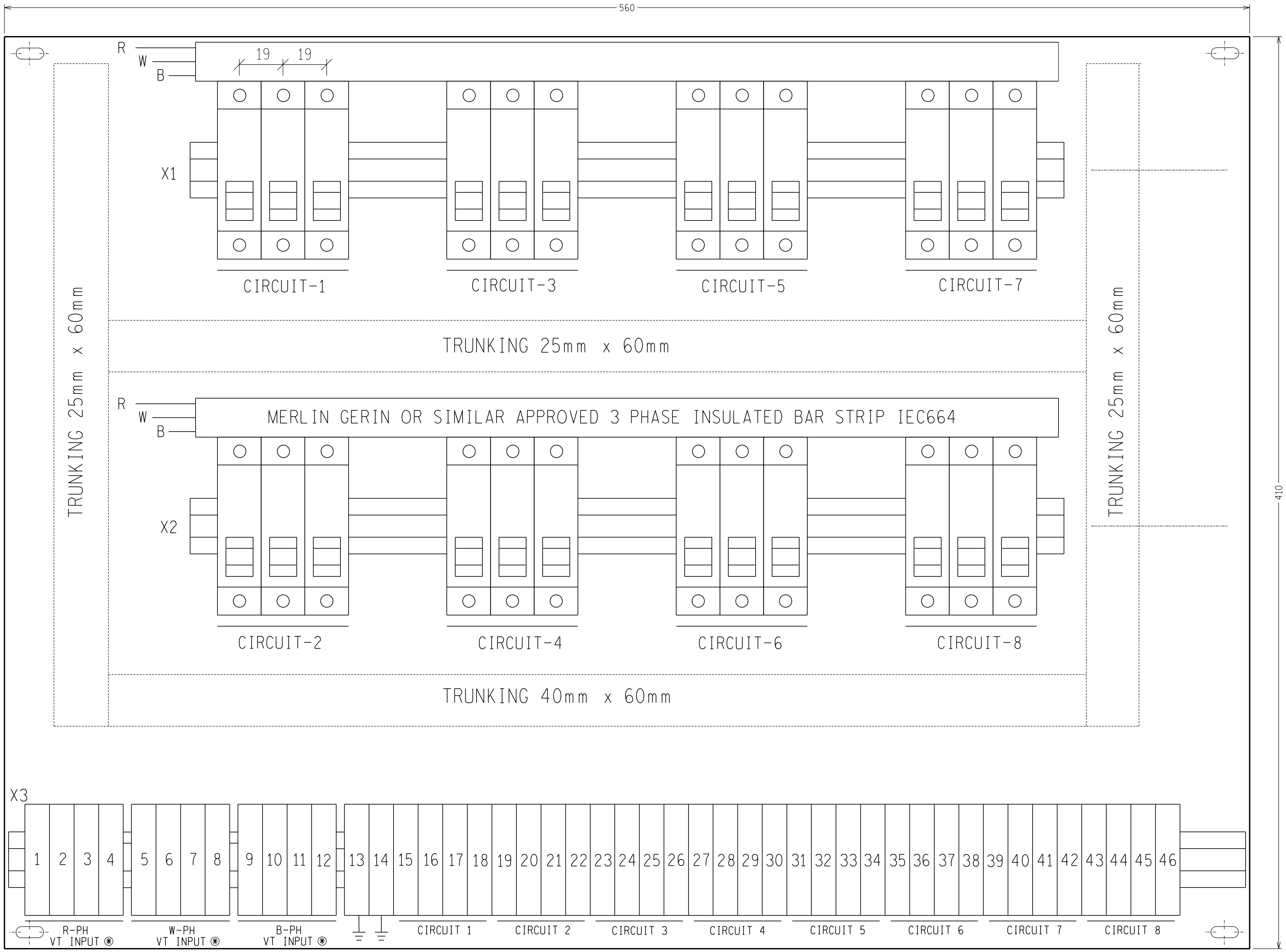
LEVELS 1 5 10

SHEET 00 OF 15 REVISION 0

A1L

PROTECTION SUPPLY
MCBs MERLIN GERIN
MULTI 9 10A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA

PROTECTION SUPPLY
MCB's MERLIN GERIN
MULTI 9 10A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA



NOTES :

1. TRAY MUST BE MADE OF 316L STAINLESS STEEL. REFER TO FDP FOR DETAILS.

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV BUSBAR 1
VTJB 1 & 2 VRW20 INSERT
VT TRAY LAYOUT

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

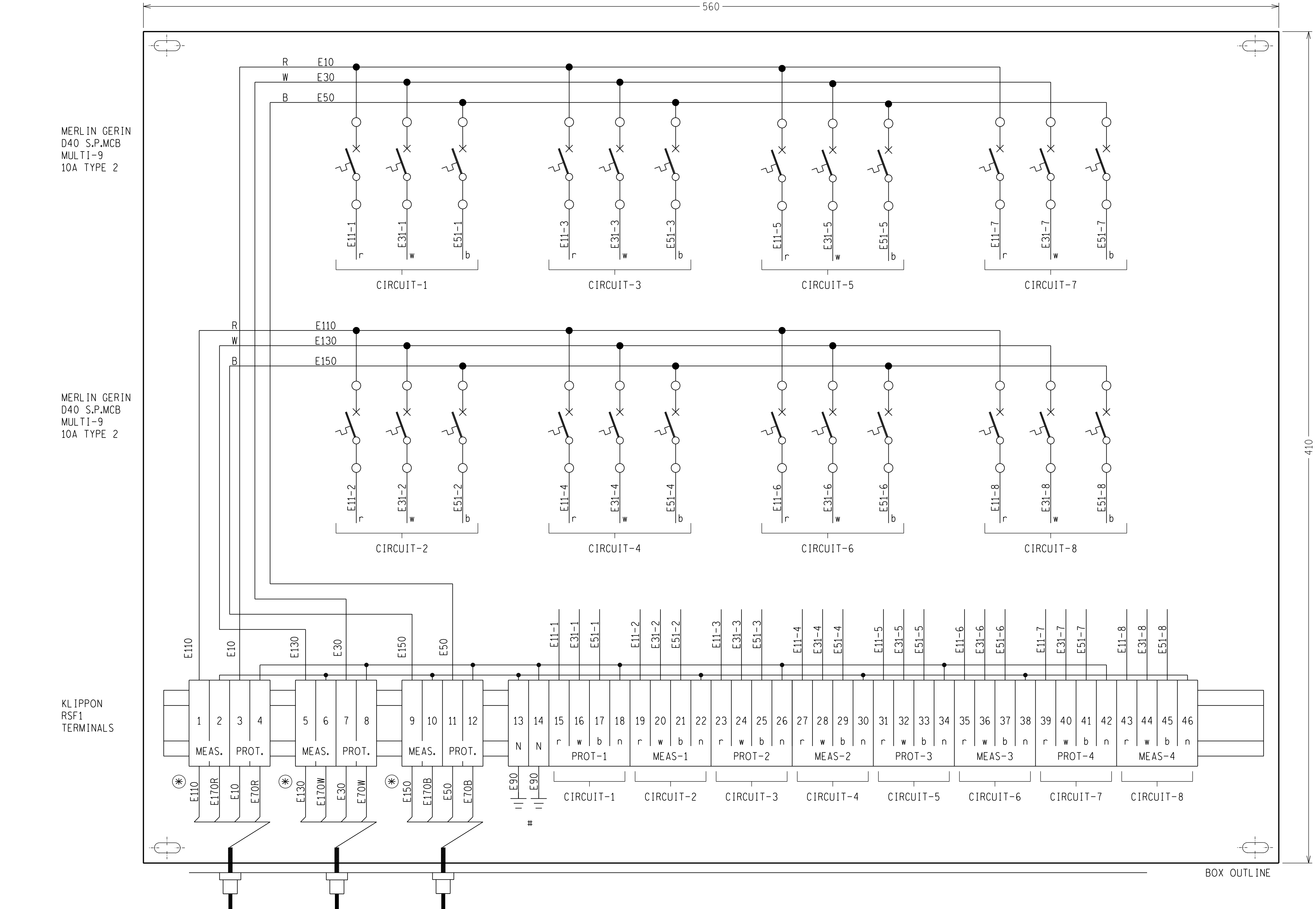
SCALE :

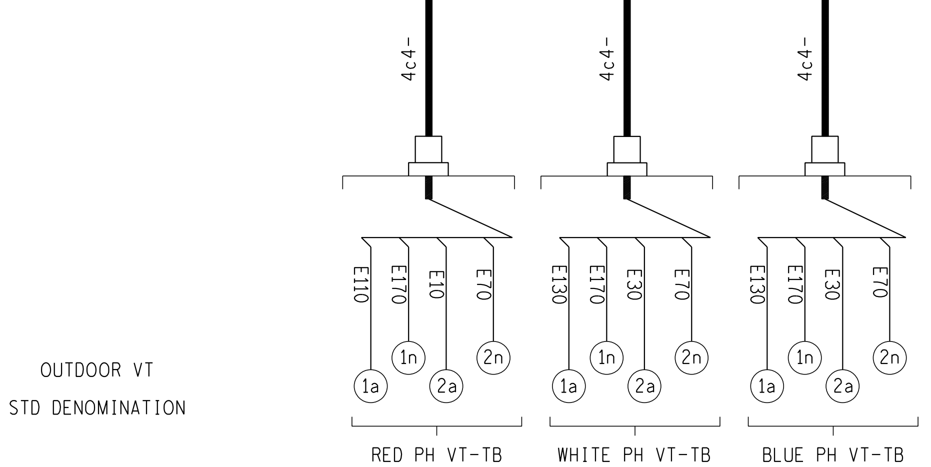
D-WC-8118

SET	SHEET	REVISION
48	01	00

LEVELS 1 5 10

A1L





NOTES:

1. ALL WIRING TO BE DONE WITH 4mm2 CONDUCTOR INSULATED AT 100 VOLTS AC.
2. ALL LUGS TO BE DONE WITH YELLOW INSULATED HOOK BLADE LUGS TO THE REQUIRED STANDARD.

\# EARTHING WIRING ON TERMINAL BLOCKS 13 & 14 TO BE CONNECTED TO THE BRASS EARTHING STUD.

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 1
VTJB 1 & 2 VRW20 VT INSERT
TRAY WIRING KEY DIAGRAM

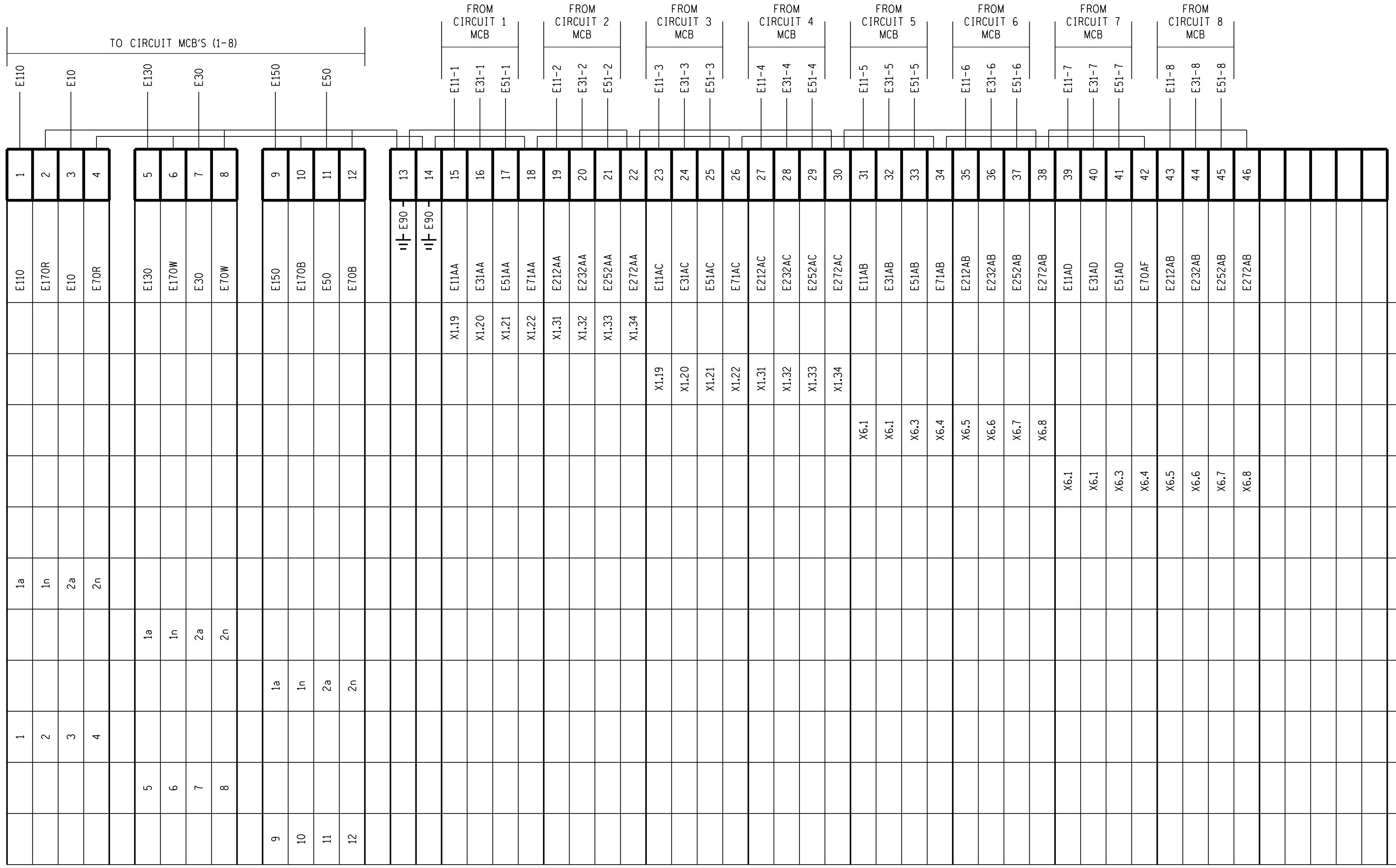
D-WC-8118

SET	SHEET	REVISION
48	02	00

SHEET 02 OF 15 REVISION 0

A1L

LEVELS 1 5 10



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
AA112	12	4	BLOUWATER/ISCOR 2 66kV FEEDER 1 RP
AC112	12	4	BLOUWATER/ISCOR 1 66kV FEEDER 3 RP
AB112	12	4	MAIN INTAKE 3 66kV FEEDER 2 RP
AD112	12	4	MAIN INTAKE 2 66kV FEEDER 4 RP
28	4	-	66kV BUSBAR 1 RED PHASE VT
29	4	-	66kV BUSBAR 1 WHITE PHASE VT
30	4	-	66kV BUSBAR 1 BLUE PHASE VT
-	-	-	RED PHASE VT LOOP TO BUSBAR 1 VTJB 2
-	-	-	WHITE PHASE VT LOOP TO BUSBAR 1 VTJB 2
-	-	-	BLUE PHASE VT LOOP TO BUSBAR 1 VTJB 2

NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV BUSBAR 1 VT JUNCTION BOX 1
CIRCUIT 1 : BLOUWATER/ISCOR 2 66kV FEEDER 1 RP
CIRCUIT 2 : BLOUWATER/ISCOR 2 66kV FEEDER 1 RP
CIRCUIT 3 : BLOUWATER/ISCOR 1 66kV FEEDER 3 RP
CIRCUIT 4 : BLOUWATER/ISCOR 1 66kV FEEDER 3 RP
CIRCUIT 5 : MAIN INTAKE 3 66kV FEEDER 2 RP
CIRCUIT 6 : MAIN INTAKE 3 66kV FEEDER 2 RP
CIRCUIT 7 : MAIN INTAKE 2 66kV FEEDER 4 RP
CIRCUIT 8 : MAIN INTAKE 2 66kV FEEDER 4 RP

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 1
VTJB 1
CABLING DIAGRAM

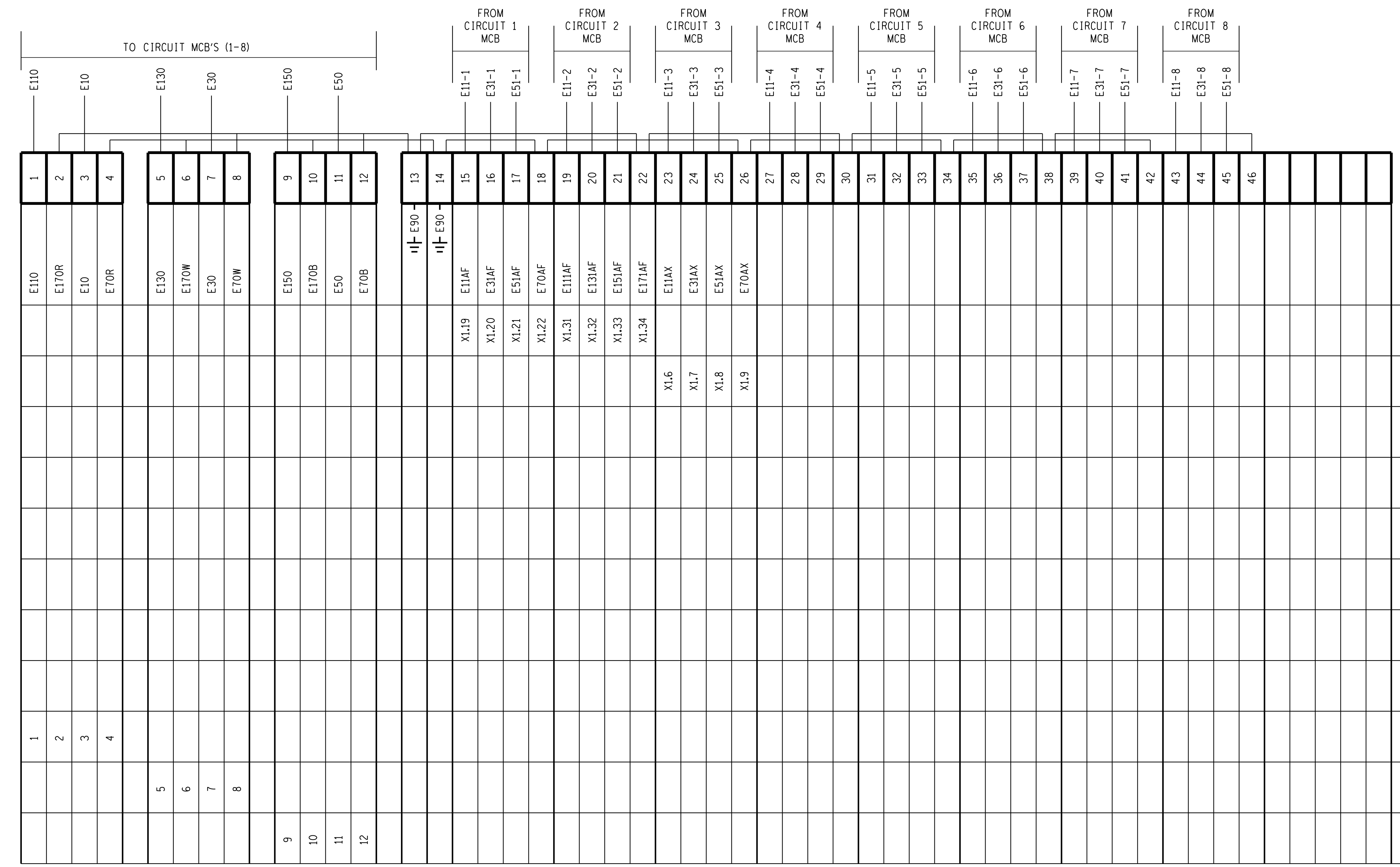
D-WC-8118

SET	SHEET	REVISION
48	03	00

SHEET 03 OF 15 REVISION 0

LEVELS 1 5 10

A1L



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
AF112	12	4	MAIN INTAKE 1 66kV FEEDER 6 RP
AX112	12	8	66kV BUSCOUPLER RP
-	-	-	RED PHASE VT LOOP FROM BUSBAR 1 VTJB 1
-	-	-	WHITE PHASE VT LOOP FROM BUSBAR 1 VTJB 1
-	-	-	BLUE PHASE VT LOOP FROM BUSBAR 1 VTJB 1

NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV BUSBAR 1 VT JUNCTION BOX 2
CIRCUIT 1 : MAIN INTAKE 2 66kV FEEDER 6 RP
CIRCUIT 2 : MAIN INTAKE 2 66kV FEEDER 6 RP
CIRCUIT 3 : 66kV BUSCOUPLER RP
CIRCUIT 4 : SPARE
CIRCUIT 5 : SPARE
CIRCUIT 6 : SPARE
CIRCUIT 7 : SPARE
CIRCUIT 8 : SPARE

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 1
VTJB 2
CABLING DIAGRAM

AECOM

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

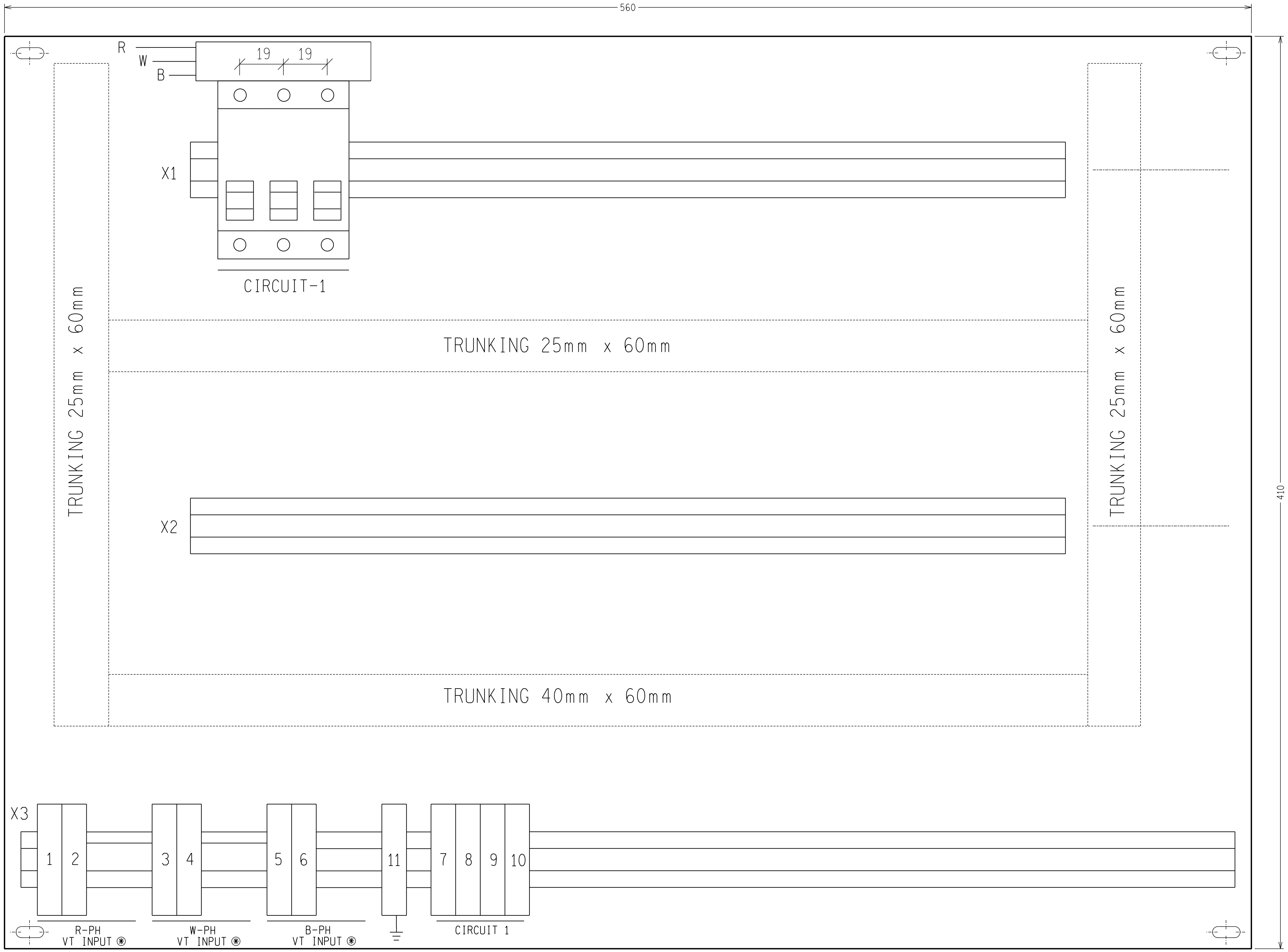
D-WC-8118	SET	SHEET	REVISION
	48	04	00

LEVELS 1 5 10

SHEET 04 OF 15 REVISION 0

A1L

ac SUPPLY
MCBs MERLIN GERIN
MULTI 9 20A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA



NOTE :

1.TRAY MUST BE MADE OF 316L STAINLESS STEEL.REFER TO FDP FOR DETAILS.

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION
66kV BUSBAR 1
VRW20 INSERT
POWER VT TRAY LAYOUT

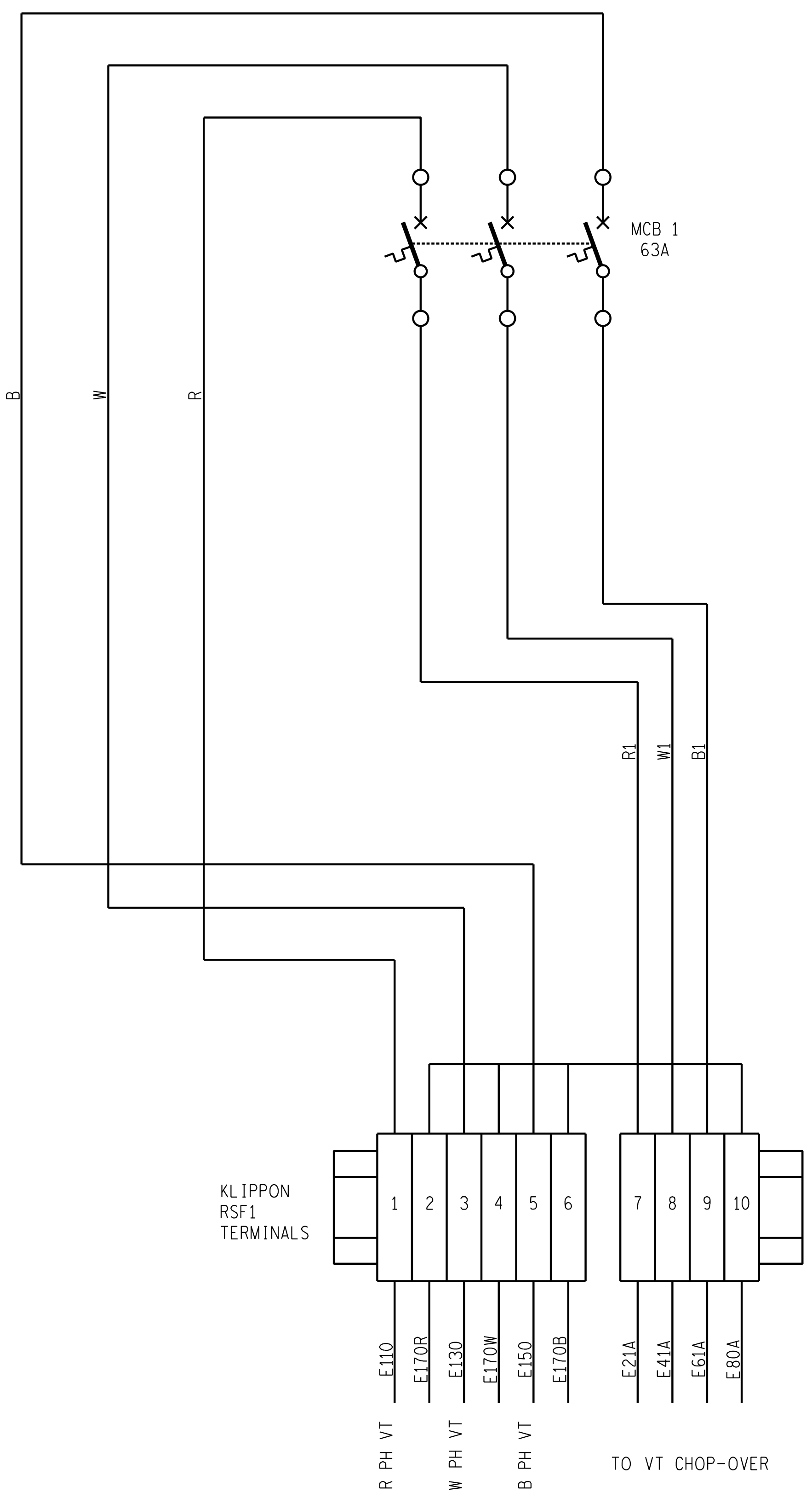
D-WC-8118

SET	SHEET	REVISION
48	05	00

SHEET 05 OF 15 REVISION 0

LEVELS 1 5 10

A1L



DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV BUSBAR 1 POWER VT
VRW20 VT INSERT
TRAY WIRING KEY DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

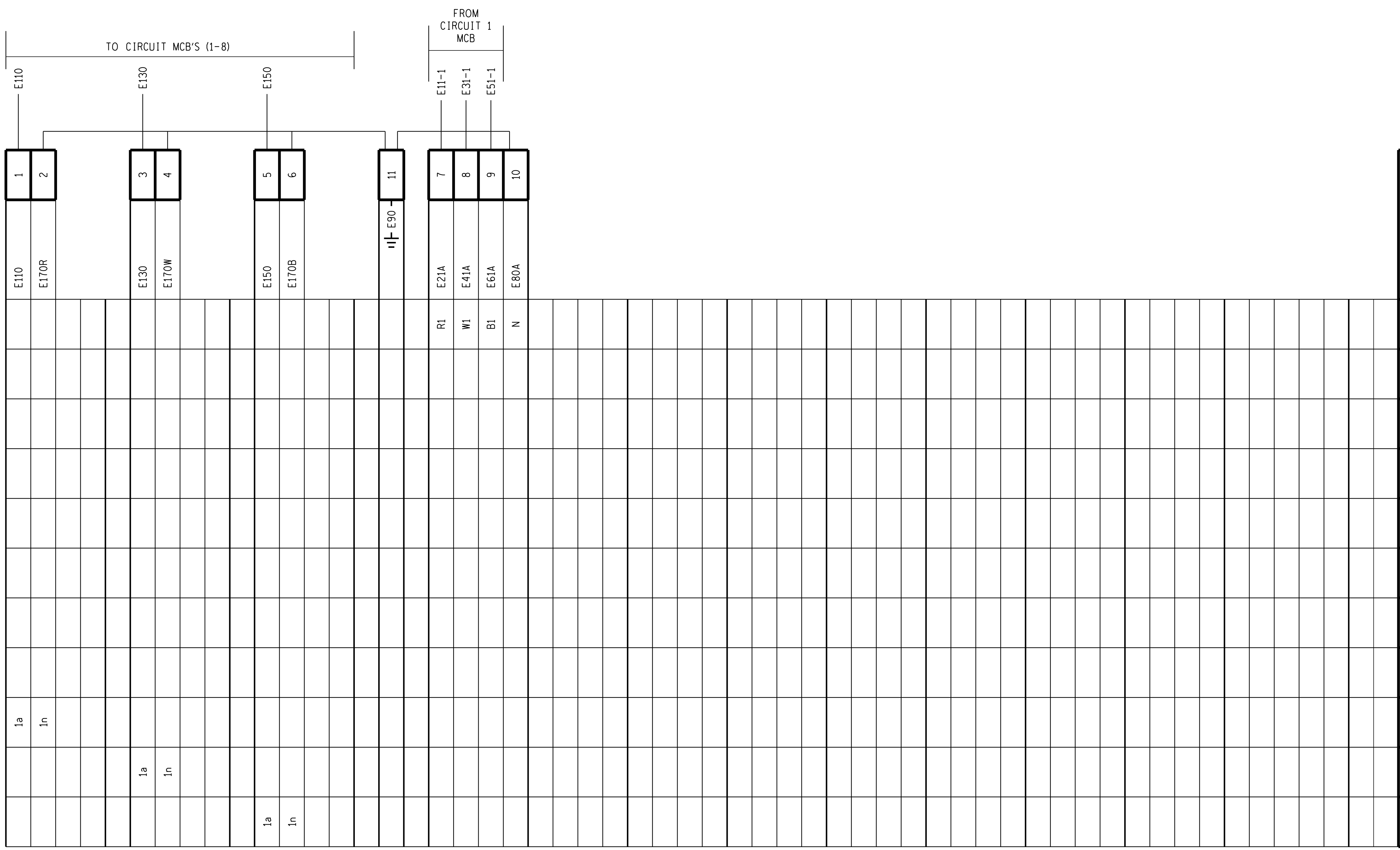
AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

SET	SHEET	REVISION
48	06	00

D-WC-8118

LEVELS 1 5 10



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
20	4	-	VT CHOP-OVER
22	4	2	66kV POWER VT RED PHASE VT
23	4	2	66kV POWER VT WHITE PHASE VT
24	4	2	66kV POWER VT BLUE PHASE VT

NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV POWER VT JUNCTION BOX

CIRCUIT 1 : YARD AC DISTRIBUTION PANEL 2

CIRCUIT 2 : SPARE

CIRCUIT 3 : SPARE

CIRCUIT 4 : SPARE

CIRCUIT 5 : SPARE

CIRCUIT 6 : SPARE

CIRCUIT 7 : SPARE

CIRCUIT 8 : SPARE

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV BUSBAR 1 POWER VTJB

CABLING DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

D-WC-8118

SET	SHEET	REVISION
48	07	00

LEVELS 1 5 10

A1L

SHEET NUMBER	DT TEMPLATE	REVISION	DATE	DESIGN CHANGE DETAILS
00	BUSBAR 1 COVER SHEET			
01	BUSBAR 1 VRW20 JUNCTION BOX TRAY LAYOUT	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
02	BUSBAR 1 VRW20 JUNCTION BOX TRAY WIRING KEY DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
03	BUSBAR 1 VTJB 1 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
04	BUSBAR 1 VTJB 2 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
05	BUSBAR 1 POWER VTJB VRW20 JUNCTION BOX TRAY LAYOUT			
06	BUSBAR 1 POWER VTJB VT INSERT WIRING KEY DIAGRAM			
07	BUSBAR 1 POWER VTJB CABLING DIAGRAM			
08	BUSBAR 2 COVER SHEET			
09	BUSBAR 2 VRW20 JUNCTION BOX TRAY LAYOUT	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
10	BUSBAR 2 VRW20 JUNCTION BOX TRAY WIRING KEY DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
11	BUSBAR 2 VTJB 1 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
12	BUSBAR 2 VTJB 2 CABLING DIAGRAM	3	11/12/2007	TRUNKING ADDED, KLIPPON TEXT CHANGED TO REFLECT ESKOM SPEC
13	BUSBAR 2 POWER VTJB VRW20 JUNCTION BOX TRAY LAYOUT			
14	BUSBAR 2 POWER VTJB VT INSERT WIRING KEY DIAGRAM			
15	BUSBAR 2 POWER VTJB CABLING DIAGRAM			

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 2 VTJB 1&2

COVER SHEET

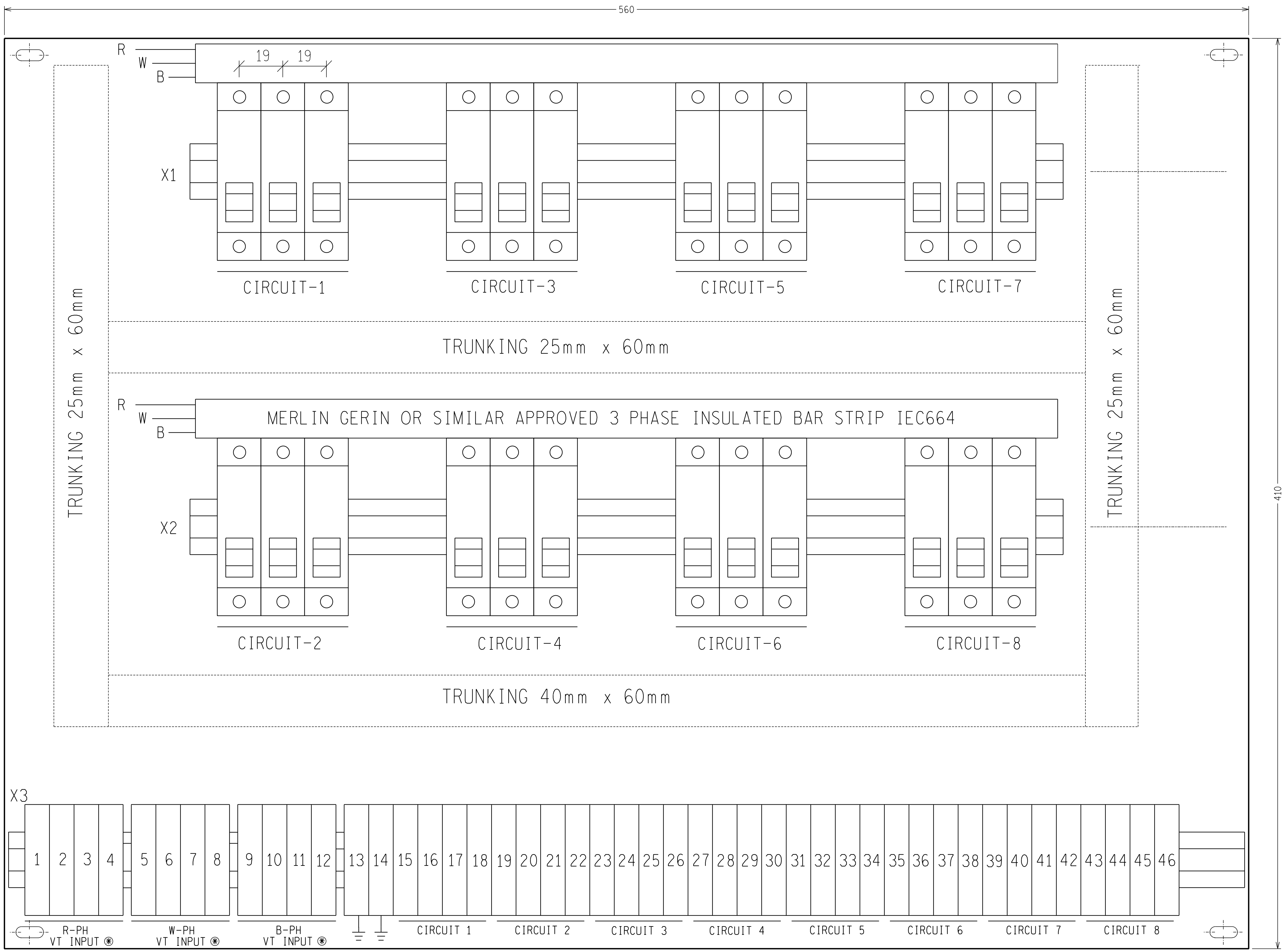
DRAWING No.	SET	SHEET	REVISION
D-WC-8118	48	08	00

LEVELS 1 5 10

A1L

PROTECTION SUPPLY
MCBs MERLIN GERIN
MULTI 9 10A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA

PROTECTION SUPPLY
MCB's MERLIN GERIN
MULTI 9 10A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA



DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

NOTES :

1.TRAY MUST BE MADE OF 316L STAINLESS STEEL.REFER TO FDP FOR DETAILS.

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 2
VTJB 1&2 VRW20 INSERT
VT TRAY LAYOUT

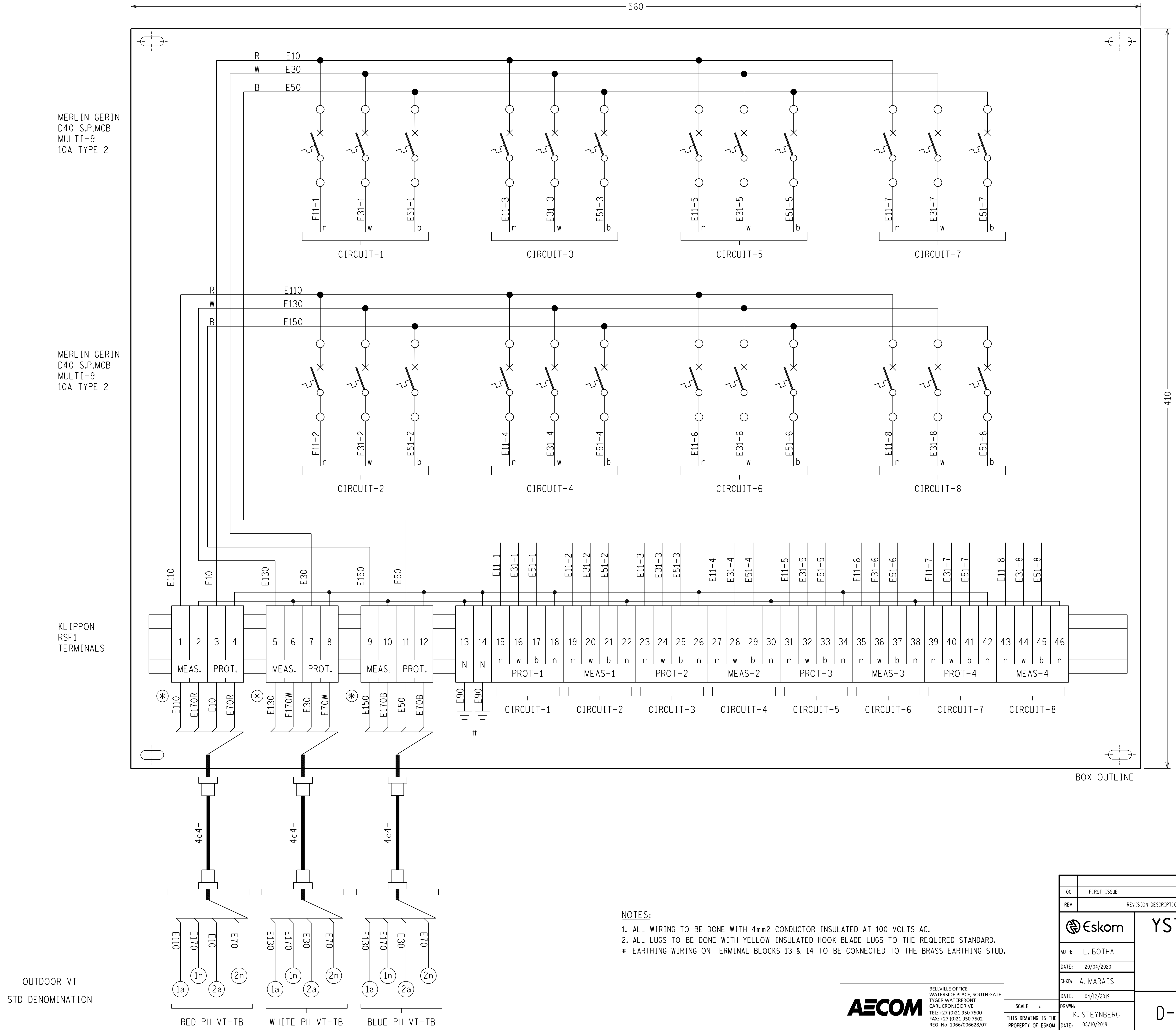
D-WC-8118

SET	SHEET	REVISION
48	09	00

SHEET 09 OF 15 REVISION 0

LEVELS 1 5 10

A1L



NOTES:

1. ALL WIRING TO BE DONE WITH 4mm2 CONDUCTOR INSULATED AT 100 VOLTS AC.
2. ALL LUGS TO BE DONE WITH YELLOW INSULATED HOOK BLADE LUGS TO THE REQUIRED STANDARD.
EARTHING WIRING ON TERMINAL BLOCKS 13 & 14 TO BE CONNECTED TO THE BRASS EARTHING STUD.

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV BUSBAR 2
VTJB 1&2 VRW20 VT INSERT
TRAY WIRING KEY DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

SET	SHEET	REVISION
48	10	00

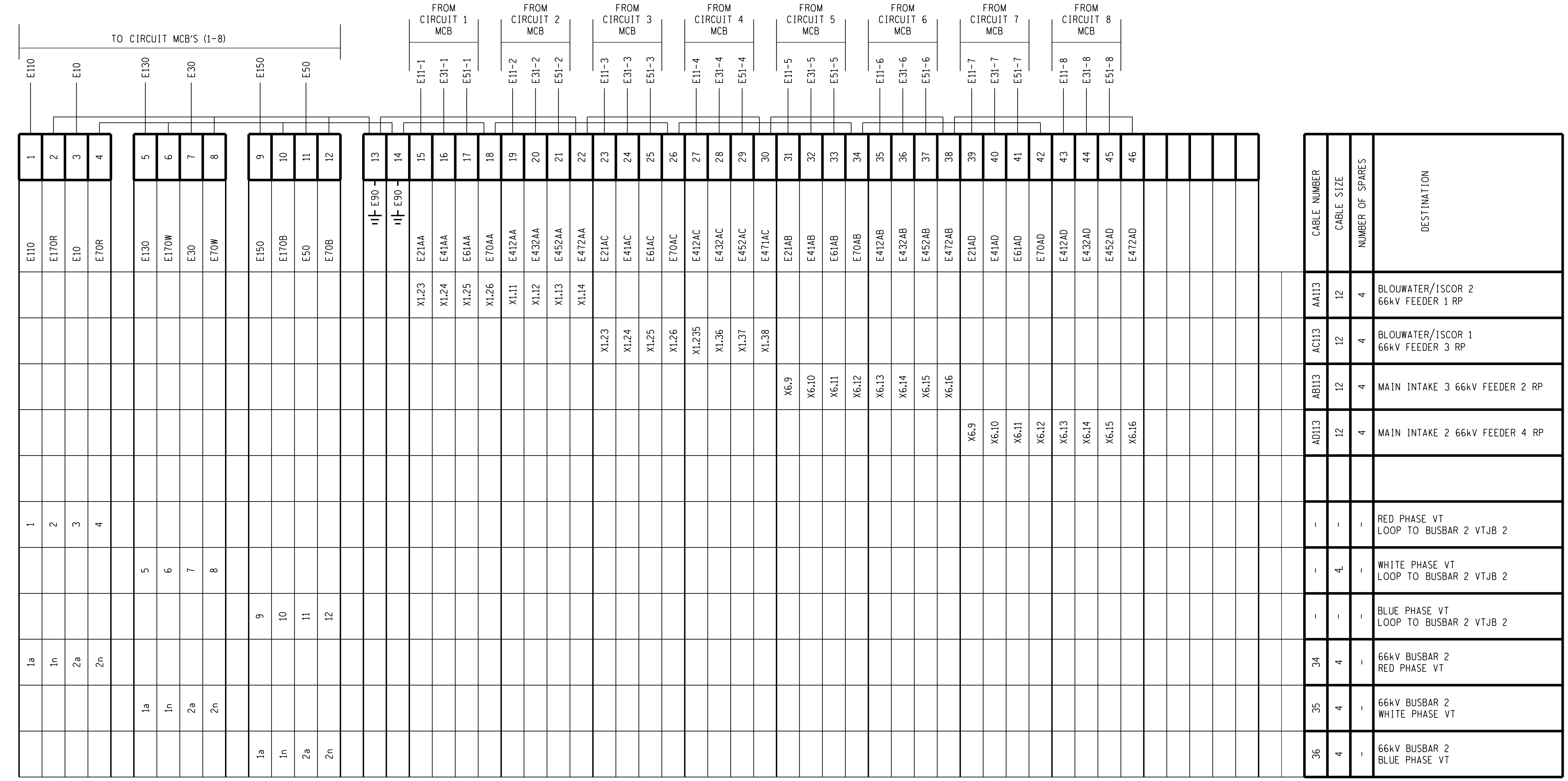
D-WC-8118

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

LEVELS 1 5 10

A1L



NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV BUSBAR 2 VT JUNCTION BOX 1
CIRCUIT 1 : BLOUWATER/ISCOR 2 66kV FEEDER 1 RP
CIRCUIT 2 : BLOUWATER/ISCOR 2 66kV FEEDER 1 RP
CIRCUIT 3 : BLOUWATER/ISCOR 1 66kV FEEDER 3 RP
CIRCUIT 4 : BLOUWATER/ISCOR 1 66kV FEEDER 3 RP
CIRCUIT 5 : MAIN INTAKE 3 66kV FEEDER 2 RP
CIRCUIT 6 : MAIN INTAKE 3 66kV FEEDER 2 RP
CIRCUIT 7 : MAIN INTAKE 2 66kV FEEDER 4 RP
CIRCUIT 8 : MAIN INTAKE 2 66kV FEEDER 4 RP

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

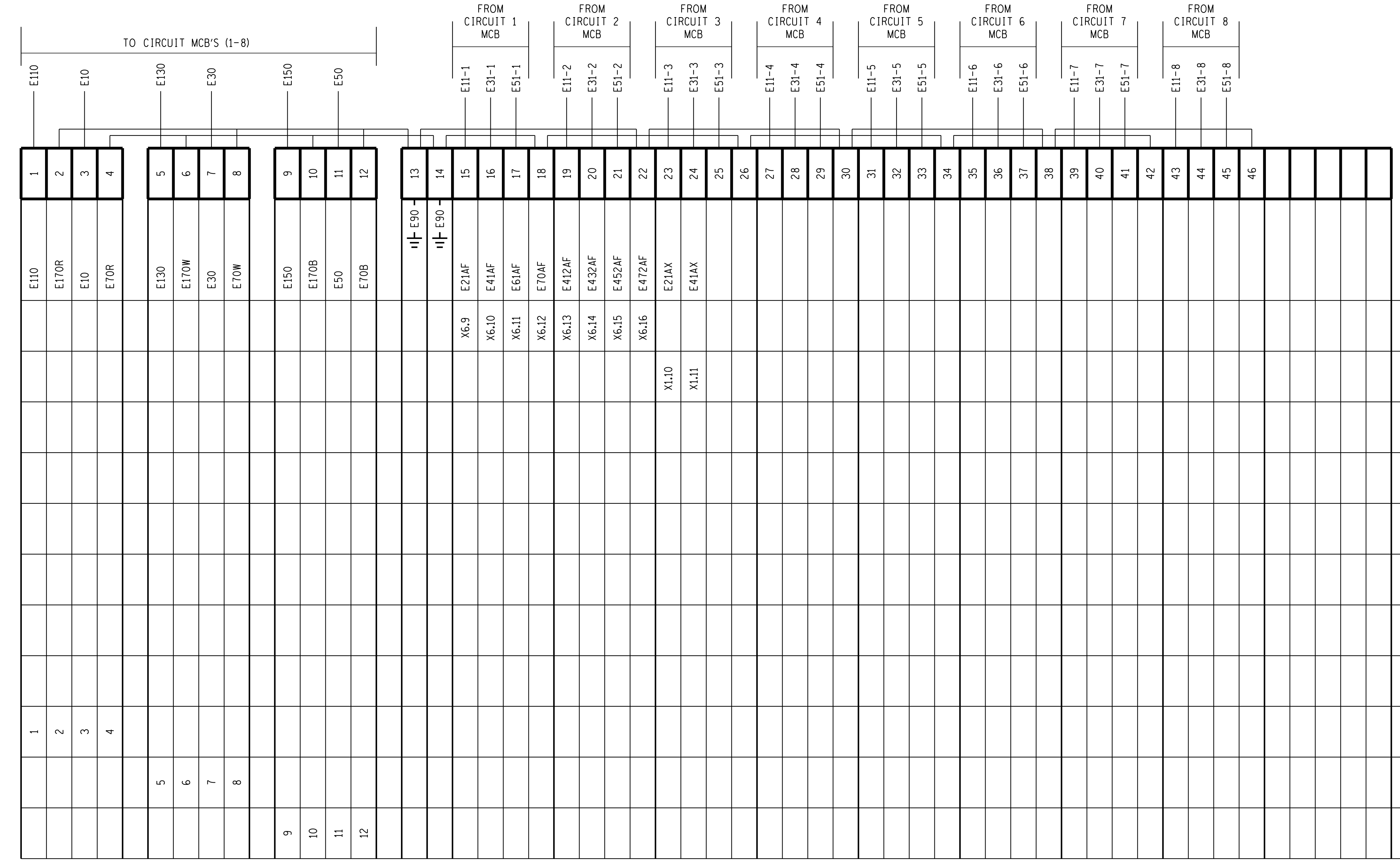
66kV BUSBAR 2
VTJB 1
CABLING DIAGRAM

D-WC-8118

SET	SHEET	REVISION
48	11	00

LEVELS 1 5 10

A1L



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
AF112	12	4	MAIN INTAKE 1 66kV FEEDER 6 RP
AX112	12	10	66kV BUSCOUPLER RP
-	4	-	RED PHASE VT LOOP TO BUSBAR 2 VTJB 2
-	-	-	WHITE PHASE VT LOOP TO BUSBAR 2 VTJB 2
-	-	-	BLUE PHASE VT LOOP TO BUSBAR 2 VTJB 2

NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV BUSBAR 2 VT JUNCTION BOX 2
CIRCUIT 1 : MAIN INTAKE 1 66kV FEEDER 6 RP
CIRCUIT 2 : MAIN INTAKE 1 66kV FEEDER 6 RP
CIRCUIT 3 : 66kV BUSCOUPLER RP
CIRCUIT 4 : SPARE
CIRCUIT 5 : SPARE
CIRCUIT 6 : SPARE
CIRCUIT 7 : SPARE
CIRCUIT 8 : SPARE

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

66kV BUSBAR 2
VTJB 2
CABLING DIAGRAM

D-WC-8118

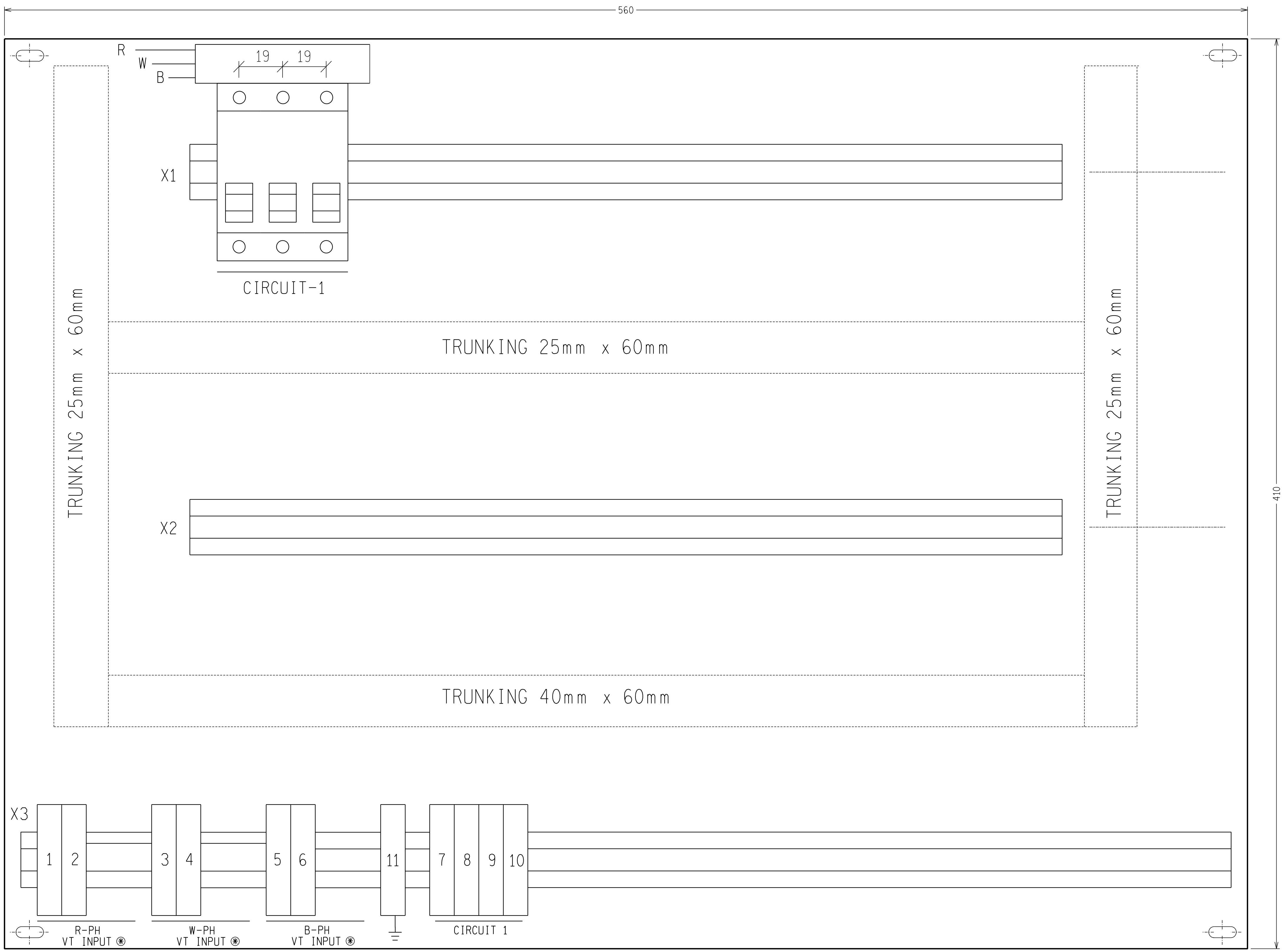
SET	SHEET	REVISION
48	12	00

LEVELS 1 5 10

SHEET 12 OF 15 REVISION 0

A1L

AC SUPPLY
MCBs MERLIN GERIN
MULTI 9 20A TYPE 2/
OR SIMILAR APPROVED
D40 110 5KA



NOTE :

⊛ CIRCUIT-2, 4, 6, 8 MUST BE MADE AVAILABLE FOR MEASUREMENTS.

TRAY MUST BE MADE OF 316L STAINLESS STEEL. REFER TO FDP FOR DETAILS.

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

YSTERVARK SUBSTATION

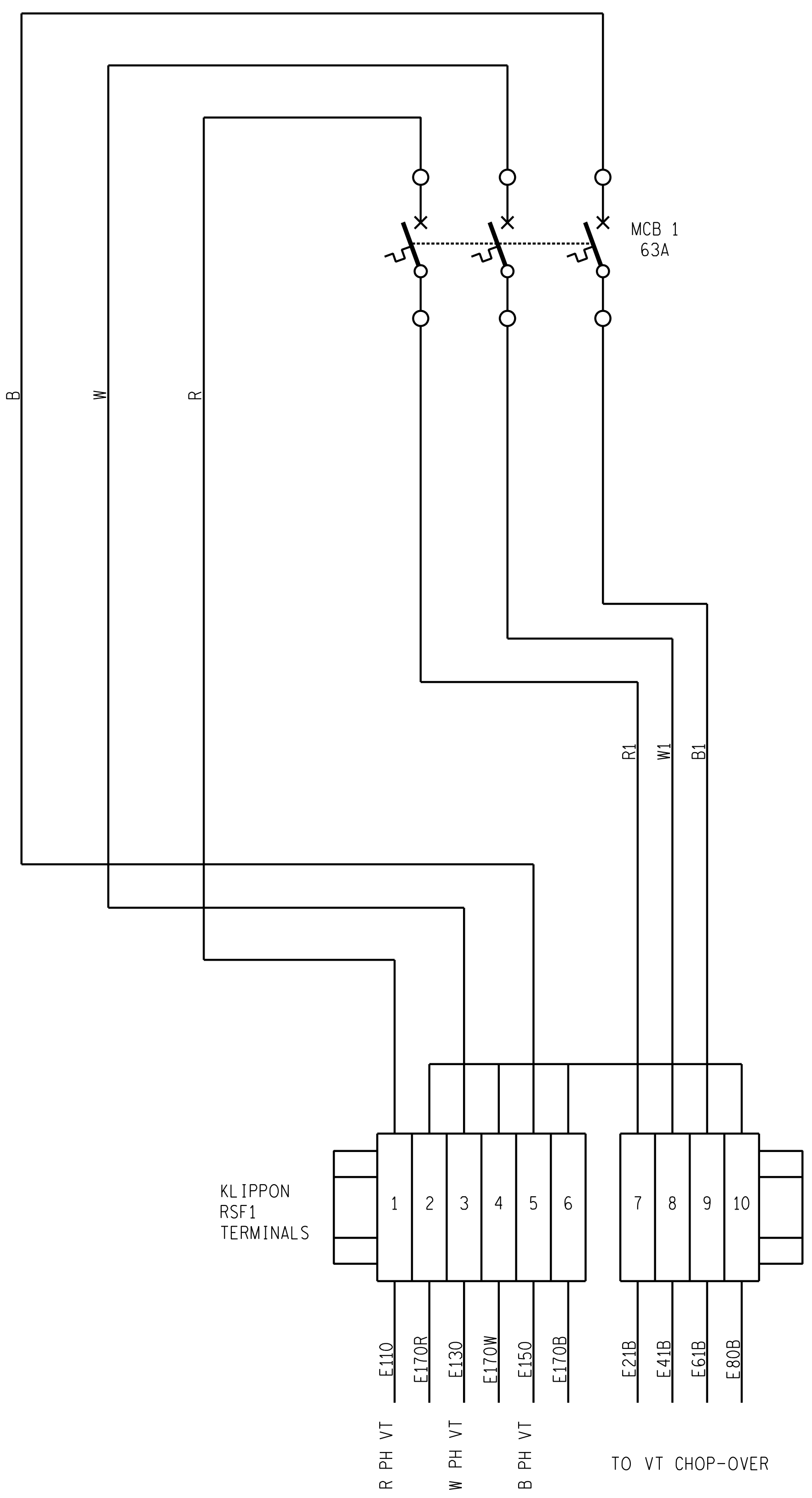
66kV BUSBAR 2
VRW20 INSERT
POWER VT TRAY LAYOUT

D-WC-8118

SET	SHEET	REVISION
48	13	00

LEVELS 1 5 10

A1L



DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV BUSBAR 2 POWER VT
VRW20 VT INSERT
TRAY WIRING KEY DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

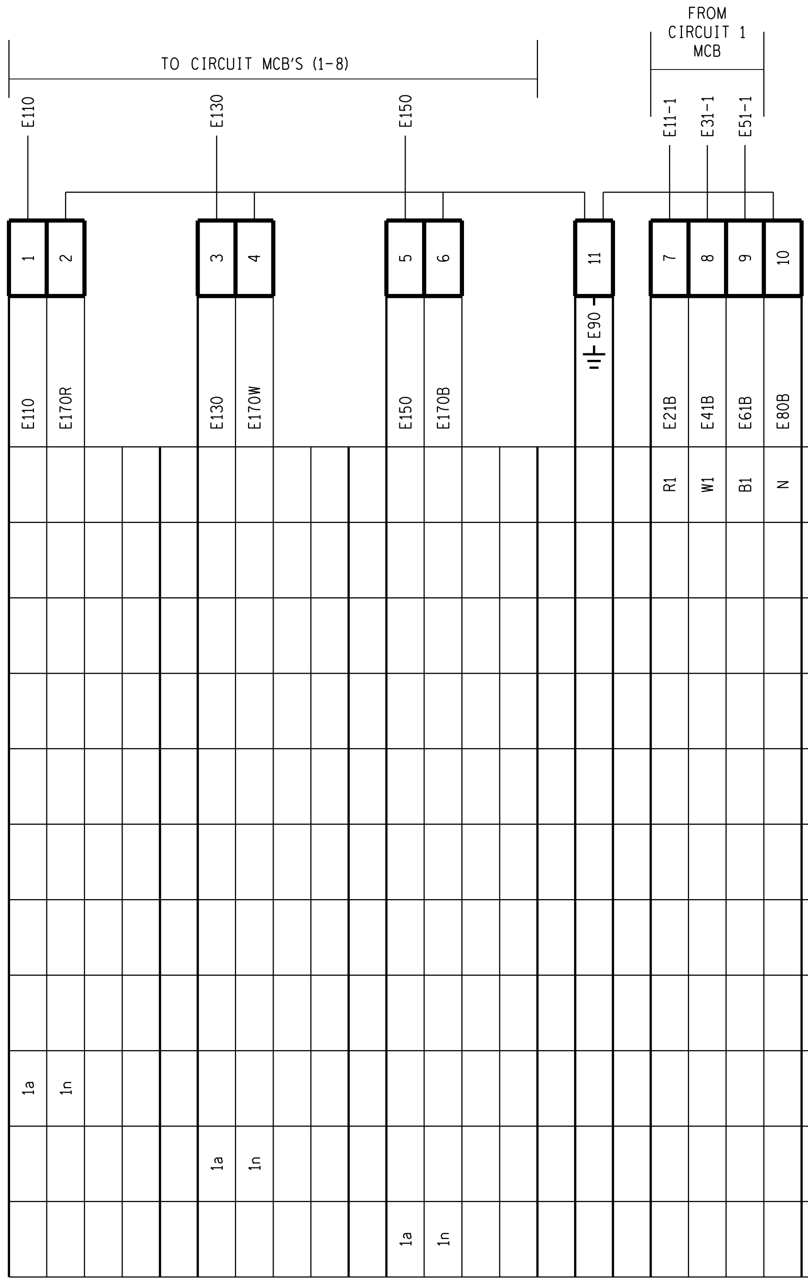
	SET	SHEET	REVISION
D-WC-8118	48	14	00

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

LEVELS 1 5 10

A1L



CABLE NUMBER	CABLE SIZE	NUMBER OF SPARES	DESTINATION
21	4	-	VT CHOP-OVER
25	4	2	66kV POWER VT RED PHASE VT
26	4	2	66kV POWER VT WHITE PHASE VT
27	4	2	66kV POWER VT BLUE PHASE VT

NOTE: VRW20 VT INSERT TO BE WIRED
FOR 4 PROTECTION & 4 METERING CCTS

PROVIDE THE FOLLOWING LABELS:

VTJB DOOR : 66kV POWER VT JUNCTION BOX
CIRCUIT 1 : YARD AC DISTRIBUTION PANEL 2
CIRCUIT 2 : SPARE
CIRCUIT 3 : SPARE
CIRCUIT 4 : SPARE
CIRCUIT 5 : SPARE
CIRCUIT 6 : SPARE
CIRCUIT 7 : SPARE
CIRCUIT 8 : SPARE

DRG No.	REFERENCE DRAWINGS:
SHT 15	CABLING DIAGRAM (PVT BUSBAR 2)
SHT 14	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 2)
SHT 13	VT TRAY LAYOUT (PVT BUSBAR 2)
SHT 12	VTJB2 CABLING DIAGRAM (BUSBAR 2)
SHT 11	VTJB1 CABLING DIAGRAM (BUSBAR 2)
SHT 10	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 2)
SHT 09	VT TRAY LAYOUT (BUSBAR 2)
SHT 08	COVER SHEET (BUSBAR 2)
SHT 07	CABLING DIAGRAM (PVT BUSBAR 1)
SHT 06	TRAY WIRING KEY DIAGRAM (PVT BUSBAR 1)
SHT 05	VT TRAY LAYOUT (PVT BUSBAR 1)
SHT 04	VTJB2 CABLING DIAGRAM (BUSBAR 1)
SHT 03	VTJB1 CABLING DIAGRAM (BUSBAR 1)
SHT 02	VTJB1&2 TRAY WIRING KEY DIAGRAM (B/B 1)
SHT 01	VT TRAY LAYOUT (BUSBAR 1)
SHT 00	COVER SHEET (BUSBAR 1)

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV BUSBAR 2 POWER VTJB
CABLING DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 08/10/2019

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

D-WC-8118

SET	SHEET	REVISION
48	15	00

LEVELS 1 5 10

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	2	06/11/2009	REVISION 2 CHANGES INDICATED.
1	PANEL EQUIPMENT LAYOUT	2	06/11/2009	AS PER PREVIOUS ISSUE.
2	SCHEME LOGIC DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
3	AC KEY DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
4	AC KEY DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
5	AC KEY DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
6	DC KEY DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
7	DC KEY DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
8	AC SUPPLY KEY & SPRING REWIND DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
9	SUPERVISORY KEY DIAGRAM	2	06/11/2009	LEVEL 14: VOLTMETER POLARITY CORRECTED.
10	REFERENCE DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
11	CABLING DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.
12	CABLE BLOCK DIAGRAM	2	06/11/2009	AS PER PREVIOUS ISSUE.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2		17	
3	BUS COUPLER APPLICATION (DOUBLE BUSBAR) θ	18	STANDARD OUTDOOR CIRCUIT-BREAKER AS PER D-DT-5407
4	BUS SECTION APPLICATION (SINGLE BUSBAR, 2 SECTIONS) θ	19	
5	CONVENTIONAL APPLICATION WITH TWO SETS OF CTs θ	20	
6	NON-STANDARD APPLICATION WITH ONE SET OF CTs θ	21	SCHEME WITH HARDWIRED AND SERIAL SCADA INTERFACE θ
7		22	OPTIONAL SECOND REAR COMMS PORT & IRIG-B INPUT FOR P145 (HARDWIRED & SERIAL SCADA)
8		23	SCHEME WITH SERIAL SCADA INTERFACE ONLY θ
9		24	OPTIONAL SECOND REAR COMMS PORT & IRIG-B INPUT FOR P145 (SERIAL SCADA ONLY)
10	STANDARD DESIGN DRAWING	25	
11	NO AMP TRANSDUCER θ	26	
12	AMP TRANSDUCER (ORDERING OPTION) θ	27	
13	VOLTAGE TRANSDUCERS (ORDERING OPTION)	28	
14	TRANSDUCER-FED VOLTMETER MODULE (ORDERING OPTION) APPLY IN CONJUNCTION WITH LEVEL 13	29	
15	VT-FED VOLTMETER MODULE (ORDERING OPTION) APPLY IN CONJUNCTION WITH LEVEL 23 (SERIAL SCADA)	30	

θ MUTUALLY EXCLUSIVE LEVELS. SELECT ONE AND ONLY ONE OF EACH PAIR PER APPLICATION.

PLEASE NOTE ΩΩΩΩΩΩΩΩΩΩΩ

WHEN USING THIS SCHEME PLEASE MAKE SURE THAT REFERENCE FILE title4BC1800r2 IS ATTACHED ON ALL THE SHEETS AT ALL TIMES.

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED: L. BOTHA, DATE 20/04/20
DESIGN APPROVED: J.MOSTERT, DATE 11/12/15
PROJECT CHECKED: A. MARAIS, DATE 04/12/19
DESIGN CHECKED: R.BUFFKINS, DATE 11/12/15
DRAWN BY: K. STEYNBERG, DATE 20/09/19
DRAWN BY: N.F.KNOETZEN, DATE 11/12/15
LEVELS:

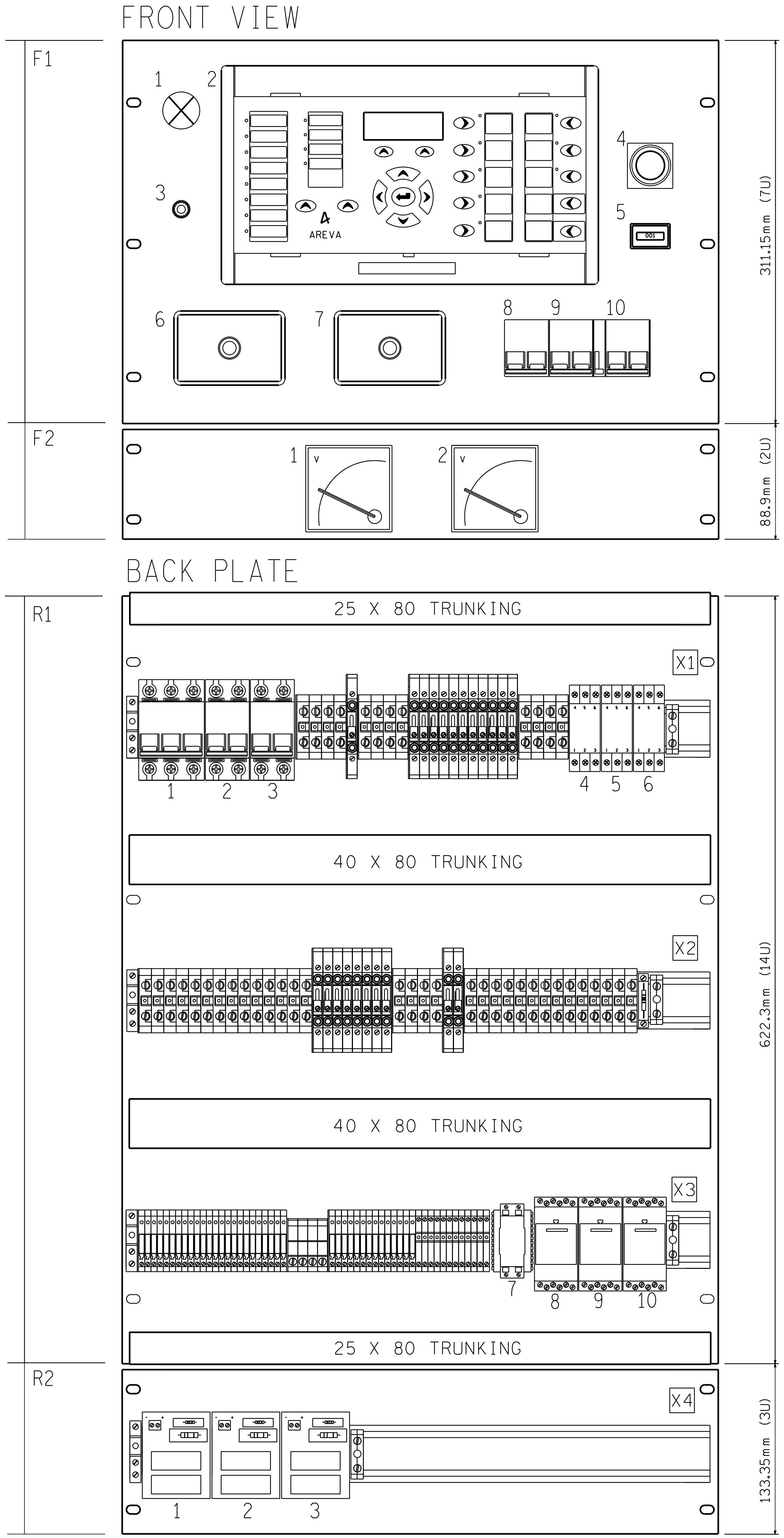
YSTERVARK SUBSTATION
66kV BUS COUPLER
COVER SHEET

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	49	00	00

LEVELS 1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 0 OF 12 REVISION 2

A1L



LOCATION		DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW					
F1	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	ND-16-22B/2	CHNT
	2	P145	FEEDER MANAGEMENT RELAY	MiCOM P145	AREVA T&D
	3	ESD	ELECTROSTATIC DISCHARGE POINT	TEST POINT	HIRSCHMAN
	4	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	YSF & COVER	ADDA INDICATORS
	5	FC	FAULT COUNTER (6 DIGIT)	ZR6-2600-20*0	FOX
				* = 6 (110Vdc), 7 (220Vdc)	
	6	CTTB	CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	IST
	7	VTTB	VOLTAGE TRANSFORMER TEST BLOCK	PK2 4-WAY	IST
	8	DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER (16A)	EP102UC(C16)	GE
	9	DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER (20A)	EP102UC(C20) & CA H	GE
	10	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G61NC(C10)	GE
F2	1	VOLTM (BB1)	VT-FED BUSBAR 1 VOLTMETER (0 - 137.5V = 90deg)	FV72	PYRAMID
	2	VOLTM (BB2)	VT-FED BUSBAR 2 VOLTMETER (0 - 137.5V = 90deg)	FV72	PYRAMID
BACK PLATE					
R1	1	MCB (VT1)	BB1 VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02)	GE
	2	MCB (VT2)	BB2 VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G62(C02)	GE
	3	MCB (H)	MECHANISM BOX AC HEATER MINIATURE CIRCUIT-BREAKER (5A)	G61NC(C05)	GE
	4	AMP Tx	SINGLE PHASE CURRENT TRANSDUCER (OPTIONAL)	CA4	POWERCON
	5	VOLT Tx (BB1)	BB1 SINGLE PHASE VOLTAGE TRANSDUCER (OPTIONAL)	VA4	POWERCON
	6	VOLT Tx (BB2)	BB2 SINGLE PHASE VOLTAGE TRANSDUCER (OPTIONAL)	VA4	POWERCON
	7	DM	DIODE MODULE	KCH	ELMEX
		D1, D2, D3	DIODES WITHIN DIODE MODULE (3)	DDSA9-16F	ALSTOM
	8	CL-X	CLOSE AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	9	APT-X	ANTI-PUMP TIMER AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
	10	PNH-X	PROTECTION NOT HEALTHY AUXILIARY RELAY	MK3P5-S 110/220Vdc	OMRON
R2	1	AS-1	MAIN TRIP CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ALSTOM
	2	AS-2	BACK-UP TRIP CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ALSTOM
	3	AS-3	CLOSING CIRCUIT ARC SUPPRESSOR (SNUBBER CIRCUIT)	SNUB CIRCUIT	ALSTOM

REFER TO SHEET 11 FOR DETAILS OF TERMINAL BLOCK MAKES AND TYPES.

SHT 12	CABLE BLOCK DIAGRAM
SHT 11	CABLING DIAGRAM
SHT 10	REFERENCE DIAG
SHT 09	SUPERVISORY KEY
SHT 08	AC SUPPLY & SPR
SHT 07	DC KEY DIAGRAM
SHT 06	DC KEY DIAGRAM
SHT 05	AC KEY DIAGRAM
SHT 04	AC KEY DIAGRAM
SHT 03	AC KEY DIAGRAM
SHT 02	LOGIC DIAGRAM
SHT 01	PANEL LAYOUT DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A. MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K. STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV BUS COUPLER
PANEL LAYOUT DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
49	01	00

LEVELS 1 2 3 4 5 6 7 8 9 11 12 13 15 16 17 18 19 20 21 22 24 25 26 27 28 29 30 31 PANEL TYPE DESIGNATION 4BC-1800

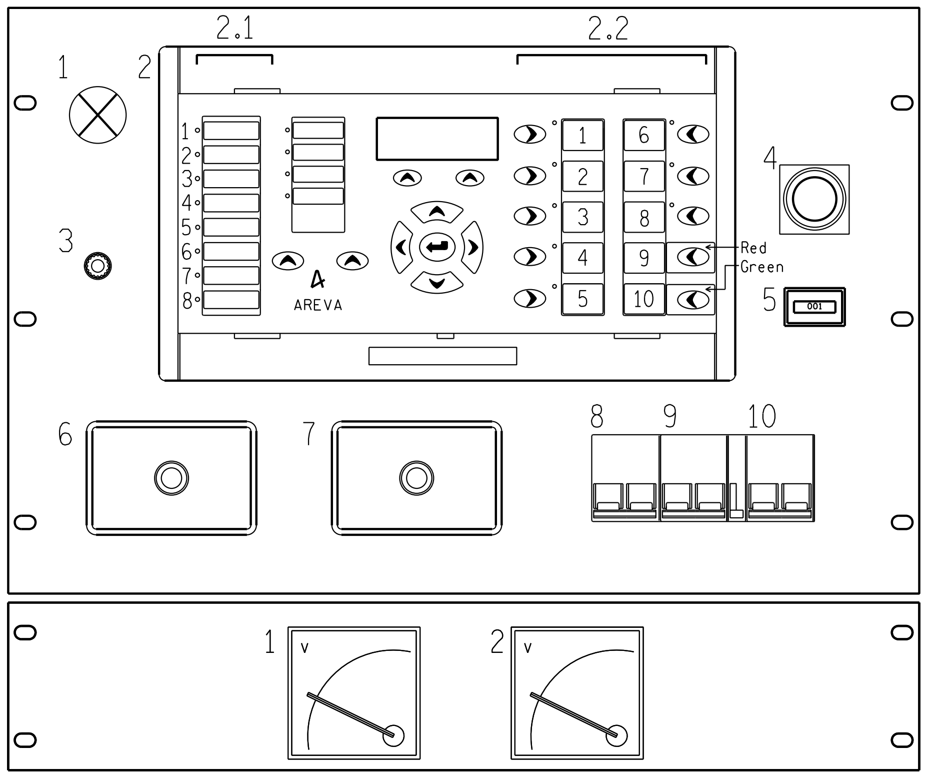
A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 1 OF 12 REVISION 2

FRONT VIEW

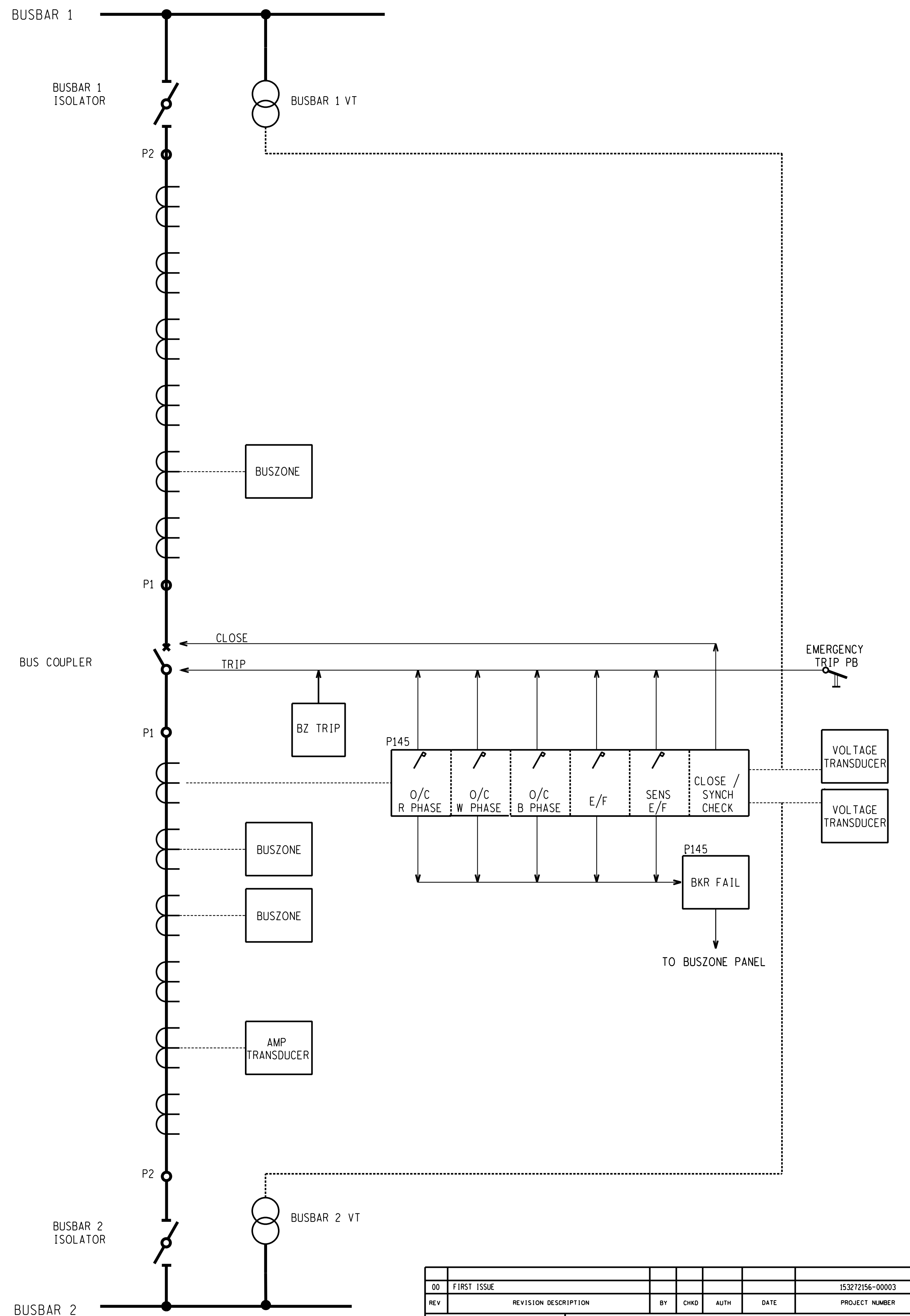
F1

F2



LOCATION		DESIGNATION	DESCRIPTION	LABEL
FRONT VIEW				
F1				
1		PNH-I	PROTECTION NOT HEALTHY INDICATION	PROTECTION NOT HEALTHY
2		P145	FEEDER MANAGEMENT RELAY	
2.1			PROGRAMMABLE LEDs	
	1		CIRCUIT-BREAKER CLOSED INDICATION (RED)	CB CLOSED
	2		CIRCUIT-BREAKER OPEN INDICATION (GREEN)	CB OPEN
	3		CIRCUIT-BREAKER NOT HEALTHY INDICATION	CB NOT HEALTHY
	4		OVERCURRENT TRIP INDICATION	O/C TRIP
	5		EARTH FAULT TRIP INDICATION	E/F TRIP
	6		CIRCUIT-BREAKER FAIL INDICATION	CB FAIL TRIP
	7		VT SUPPLY FAIL	VT FAIL
	8		ANY TRIP CIRCUIT FAIL	TC FAIL
2.2			PROGRAMMABLE FUNCTION KEYs WITH LEDs	
	1		PROTECTION ON PUSH BUTTON & INDICATION	PROT ON
	2		PROTECTION OFF PUSH BUTTON & INDICATION	PROT OFF
	3		ALTERNATIVE SETTINGS PUSH BUTTON & INDICATION	ALT SETTINGS
	4		CIRCUIT-BREAKER FAIL ON PUSH BUTTON & INDICATION	CB FAIL ON
	5		CIRCUIT-BREAKER FAIL OFF PUSH BUTTON & INDICATION	CB FAIL OFF
	6		SUPERVISORY ISOLATE SWITCH ON PUSH BUTTON & INDICATION	SIS ON
	7		SUPERVISORY ISOLATE SWITCH OFF PUSH BUTTON & INDICATION	SIS OFF
	8		LAMP CHECK / TARGET RESET PUSH BUTTON & INDICATION	RESET / LAMP CH
	9		CIRCUIT-BREAKER CLOSE CONTROL (RED)	CLOSE*
	10		CIRCUIT-BREAKER TRIP CONTROL (GREEN)	TRIP*
3		ESD	ELECTROSTATIC DISCHARGE POINT	ESD
4		ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER	EMERGENCY TRIP
5		FC	FAULT COUNTER	FAULT COUNTER
6		CTTB	CURRENT TRANSFORMER TEST BLOCK	CURRENT TRANSFORMER TEST BLOCK
7		VTTB	VOLTAGE TRANSFORMER TEST BLOCK	VOLTAGE TRANSFORMER TEST BLOCK
8		DCI MCB (M)	MAIN DC ISOLATE MINIATURE CIRCUIT-BREAKER	MAIN DC SUPPLY MCB (16A)
9		DCI MCB (SR)	SPRING REWIND DC ISOLATE MINIATURE CIRCUIT-BREAKER	SPRING REWIND DC MCB (20A)
10		MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER	AC SUPPLY MCB (10A)
F2				
1		VOLTMETER (BB1)	BUSBAR 1 VOLTMETER	BUSBAR 1 VOLTMETER
2		VOLTMETER (BB2)	BUSBAR 2 VOLTMETER	BUSBAR 2 VOLTMETER

* PRESS TWICE IN 3s TO OPERATE



NOTE:

1. DOWNLOAD THE *.PSL FILE FROM THE P145 RELAY FOR FULL SCHEME LOGIC.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA, DATE 20/04/20 — DESIGN APPROVED J.MOSTERT, DATE 11/12/15

PROJECT CHECKED A.MARAIS, DATE 04/12/19 — DESIGN CHECKED R.BUFFKINS, DATE 11/12/15

DRAWN BY K.STEYNBERG, DATE 20/09/19 — DRAWN BY N.F.KNOETZEN, DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV BUS COUPLER
SCHEME LOGIC DIAGRAM

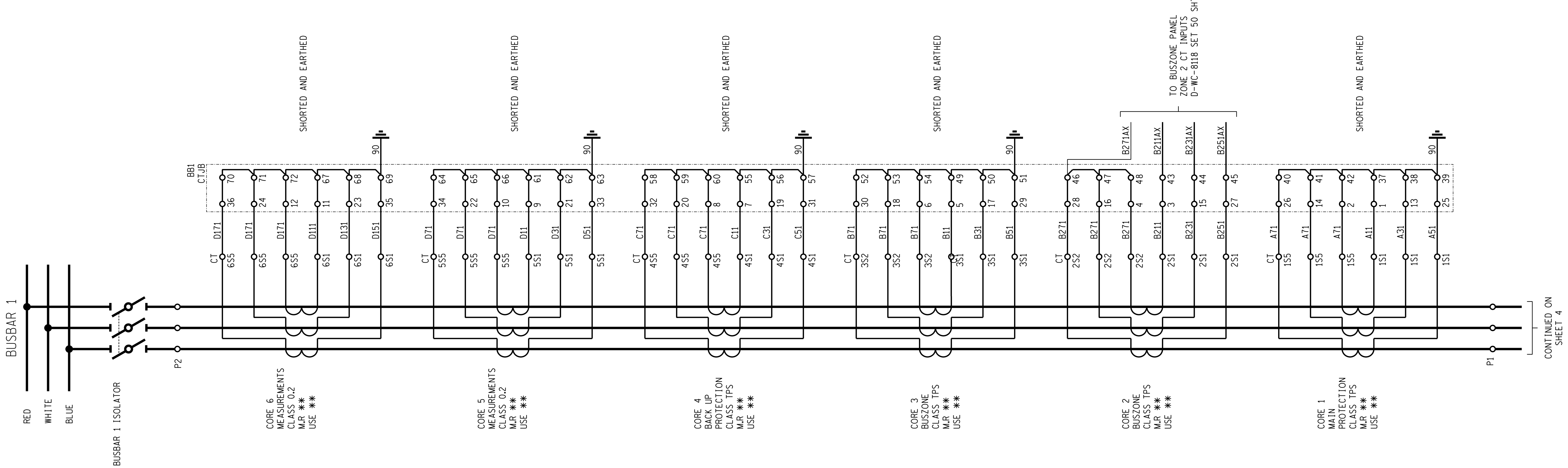
D-WC-8118 — SET NUMBER 49 — SHEET NUMBER 02 — REVISION 00

LEVELS 1 3 5 6 11 12 13 14 15 21 22 23 24

PANEL TYPE DESIGNATION 4BC-1800

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 2 OF 12 REVISION 2



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 20/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
AC KEY DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
49	03	00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

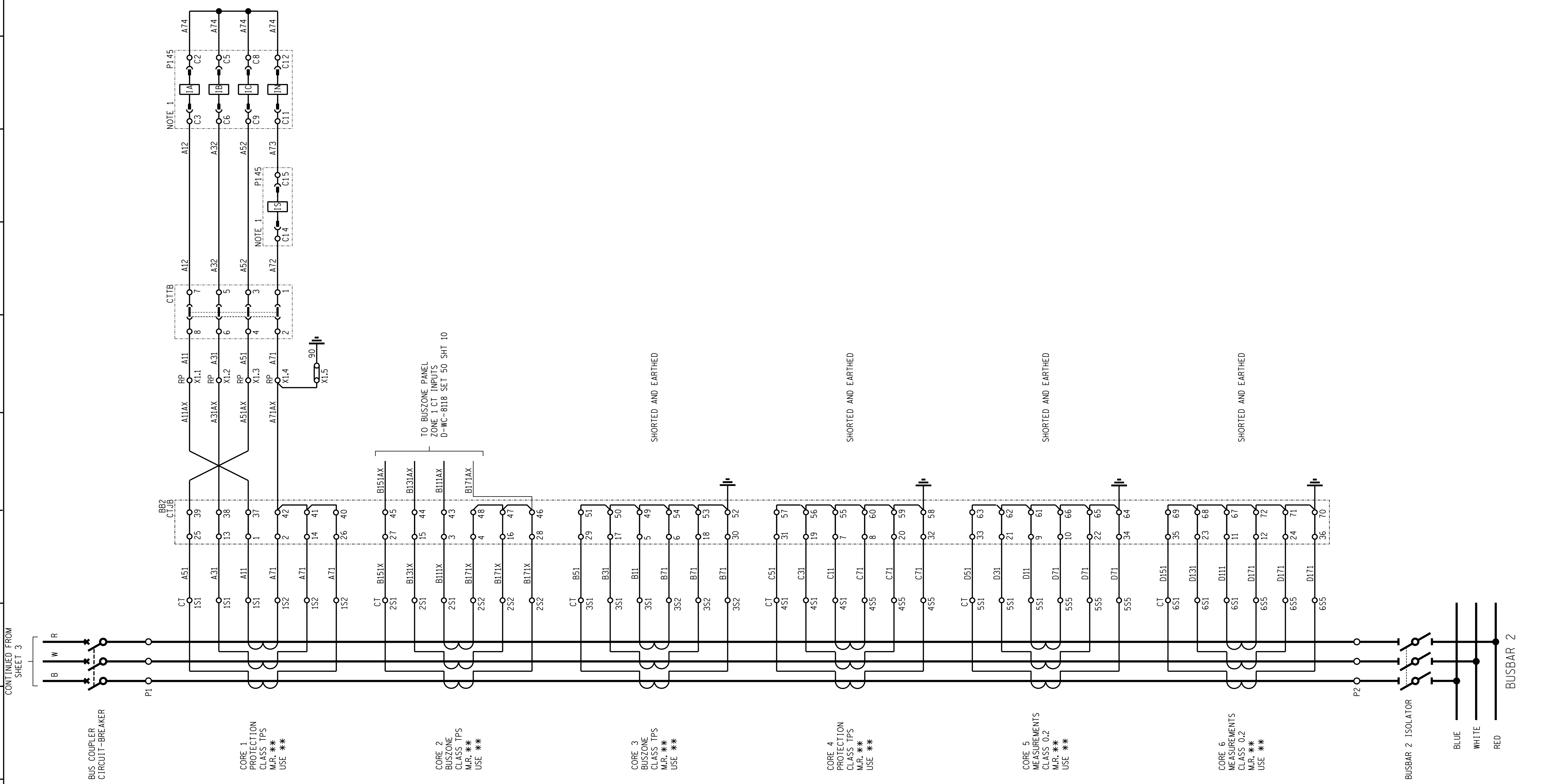
LEVELS:

LEVELS 1 2 3 5 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4BC-1800

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 3 OF 12 REVISION 2



NOTES:

1. THE P145 RELAY IS SUITABLE FOR 1A OR 5A RATED CTs (VIA DIFFERENT TERMINAL INPUTS).
   THE STANDARD DRAWING INDICATES THE RELAY WIRED FOR 1A RATED CTs.
   USE THE TABLE BELOW TO DETERMINE THE CORRECT WIRING FOR 5A RATED CTs.
   SCHEMES ORDERED FOR 5A RATED CTs WILL BE WIRED AS SUCH IN THE FACTORY.

	P145 TERMINAL NUMBER	
WIRE FERRULE NUMBER	1A RATED	5A RATED
A12	C3	C1
A32	C6	C4
A52	C9	C7
A74	C12	C10
A73	C15	C13

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJÉ DRIVE, TEL: +27 (0)21 950 7500, FAX: +27 (0)21 950 7502, REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA, DATE 20/04/20 — DESIGN APPROVED J.MOSTERT, DATE 11/12/15
PROJECT CHECKED A.MARAIS, DATE 04/12/19 — DESIGN CHECKED R.BUFFKINS, DATE 11/12/15
DRAWN BY K.STEYNBERG, DATE 20/09/19 — DRAWN BY N.F.KNOETZEN, DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
AC KEY DIAGRAM

D-WC-8118 — SET NUMBER 49 — SHEET NUMBER 04 — REVISION 00

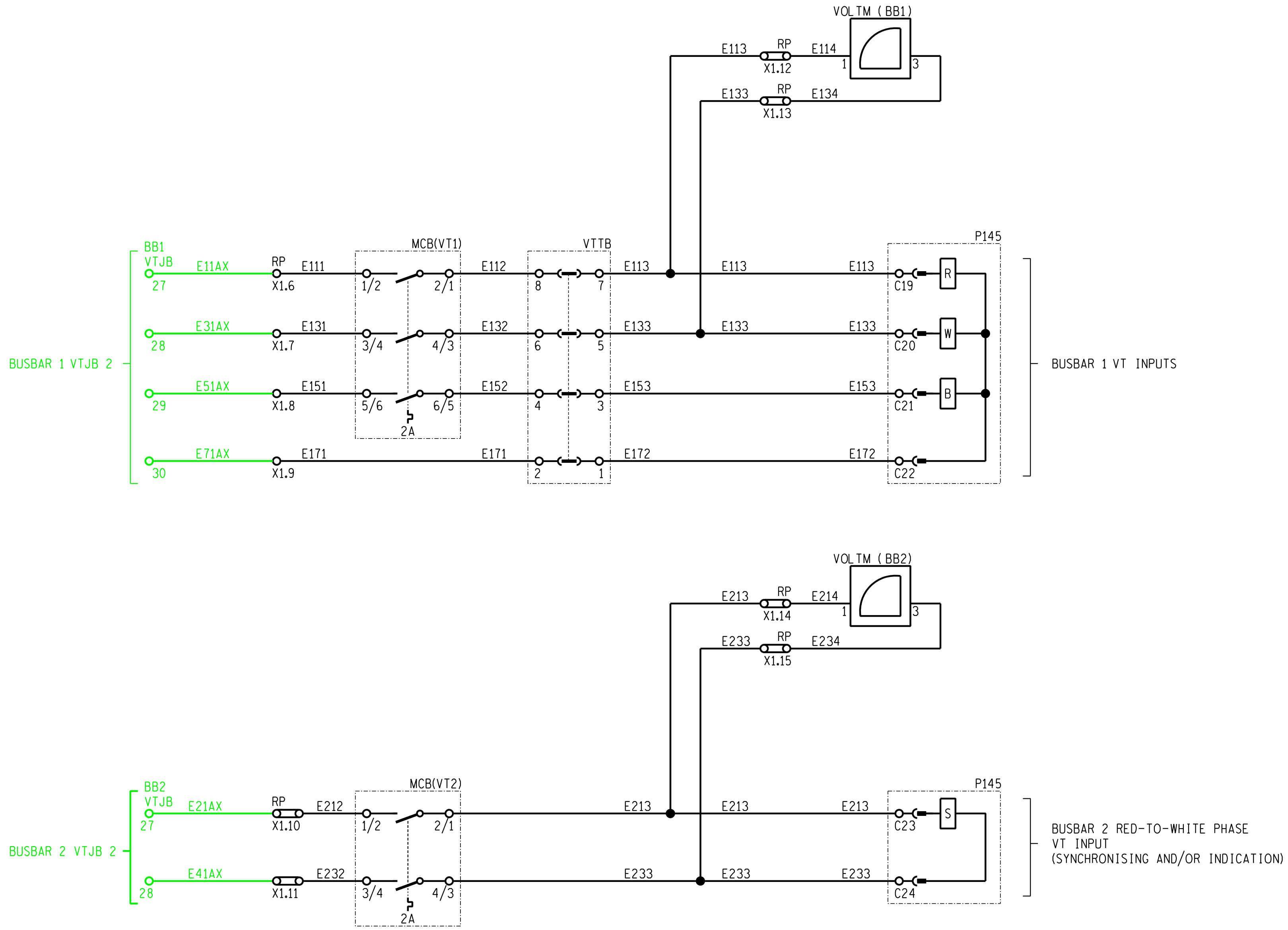
LEVELS: 1 2 3 5 7 8 9 11 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4BC-1800

SHEET 4 OF 12 REVISION 2

MASTER TRACING FILED UNDER D-WC-8118

A1L



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
AC KEY DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	49	05	00

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

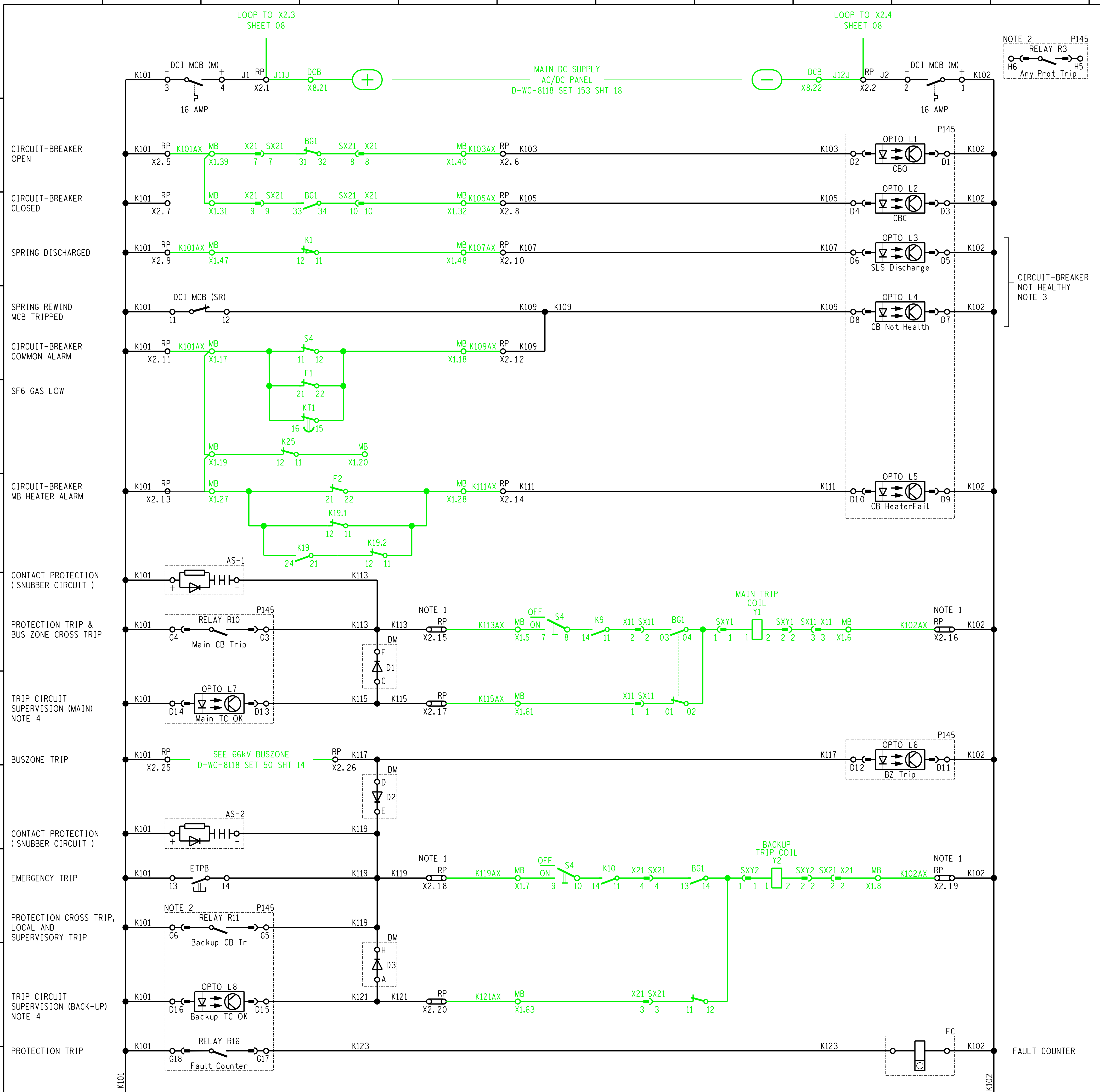
LEVELS:

LEVELS 1 2 3 5 6 7 8 9 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 5 OF 12 REVISION 2

A1L



CONTINUED ON SHEET 07

CONTINUED ON SHEET 07

NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.

2. OPERATION OF P145 RELAY 3 RAISES THE LATCHED 'TRIP' LED ON THE RELAY AND INITIATES THE CIRCUIT-BREAKER FAIL FUNCTION. RELAY 3 MUST ALSO BE ASSERTED FOR ARC TO INITIATE SUCCESSFULLY (WHERE USED). RELAY 3 IS THUS CRITICAL TO THE CORRECT OPERATION OF THE SCHEME, EVEN THOUGH IT IS NOT WIRED. THE MASKING FOR RELAY 16 IS SIMILAR TO THAT FOR THE RELAY 3, BUT THE FORMER MAY BE BLOCKED BY A CONTROL INPUT DURING TESTING.

3. THE P145 WILL NOT ISSUE A CLOSE COMMAND TO THE CIRCUIT-BREAKER IF OPTO 3 IS ASSERTED (SLS DISCHARGED) OR BOTH OPTO 7 AND OPTO 8 ARE DE-ASSERTED (TRIP COILS FAILED). WHERE USED, THE AUTO-RECLOSE LOGIC WAITS UNTIL THE END OF THE DEAD TIME BEFORE CHECKING THE SLS STATUS. IF THE SPRING IS DISCHARGED, THE DEAD TIME IS EXTENDED UNTIL THE SPRING CHARGES, OR UNTIL A SETTABLE TIMER EXPIRES. EXPIRY OF THE TIMER CANCELS ARC.

4. ALL CLOSE COMMANDS TO THE CIRCUIT-BREAKER ARE BLOCKED IN THE EVENT THAT BOTH TRIP CIRCUITS ARE UNHEALTHY (OPTOS L7 & L8 DE-ASSERTED). THE PROTECTION NOT HEALTHY ALARM IS RAISED IF EITHER TRIP CIRCUITS FAILS. IT IS THUS IMPERATIVE THAT PROVISION IS MADE FOR TRIP CIRCUIT SUPERVISION WHILST THE CIRCUIT-BREAKER IS IN THE OPEN POSITION. IF THE CIRCUIT-BREAKER DESIGN DOES NOT CATER FOR THIS, WIRE A N/C (52b) STATUS CONTACT BETWEEN X2.16 AND X2.17 AND BETWEEN X2.19 AND X2.20. THE RELAY'S PSL CONFIGURATION FILE MUST BE MODIFIED IN THE EVENT THAT ONLY ONE TRIP CIRCUIT IS USED.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

YSTERVARK SUBSTATION
66kV BUS COUPLER
DC KEY DIAGRAM

PROJECT APPROVED L. BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

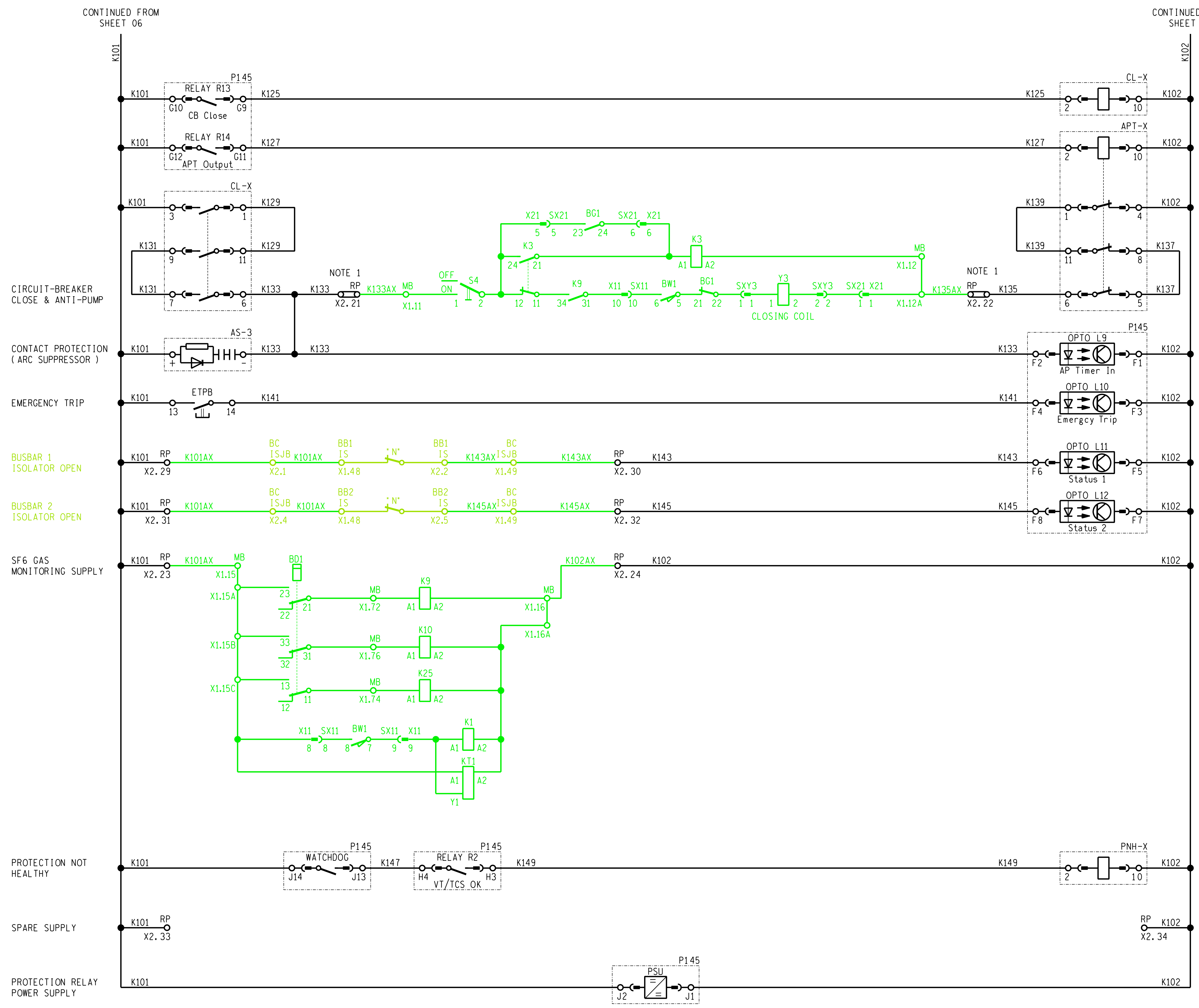
LEVELS:

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	49	06	00

LEVELS 1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 6 OF 12 REVISION 2

A1L



NOTES :

1. LINKS USED IN ORDER TO ALLOW TESTING OF COILS.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM

Eskom

PROJECT APPROVED L.BOTHA DATE 20/04/20
DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A.MARAIS DATE 04/12/19
DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K.STEYNBERG DATE 20/09/19
DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
DC KEY DIAGRAM

D-WC-8118

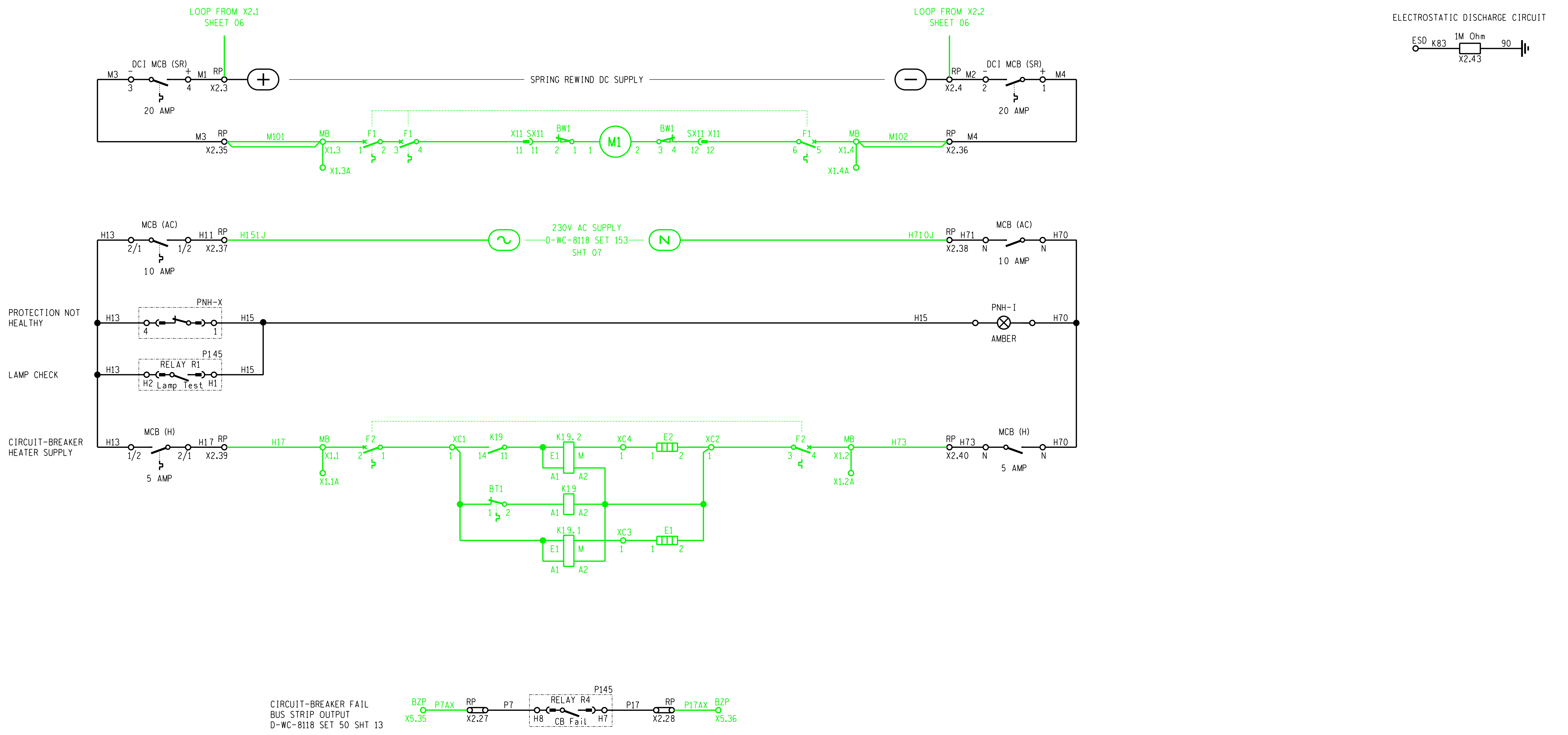
SET NUMBER 49 — SHEET NUMBER 07 — REVISION 00

LEVELS: 1 2 3 5 6 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 7 OF 12 REVISION 2

A1L



REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE

Eskom

PROJECT APPROVED: L.BOTHA DATE 20/04/20
DESIGN APPROVED: J.MOSTERT DATE 11/12/15
PROJECT CHECKED: A. MARAIS DATE 04/12/19
DESIGN CHECKED: R.BUFFKINS DATE 11/12/15
DRAWN BY: K. STEYNBERG DATE 20/09/19
DRAWN BY: N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
AC SUPPLY KEY & S/REWIND DIA

D-WC-8118

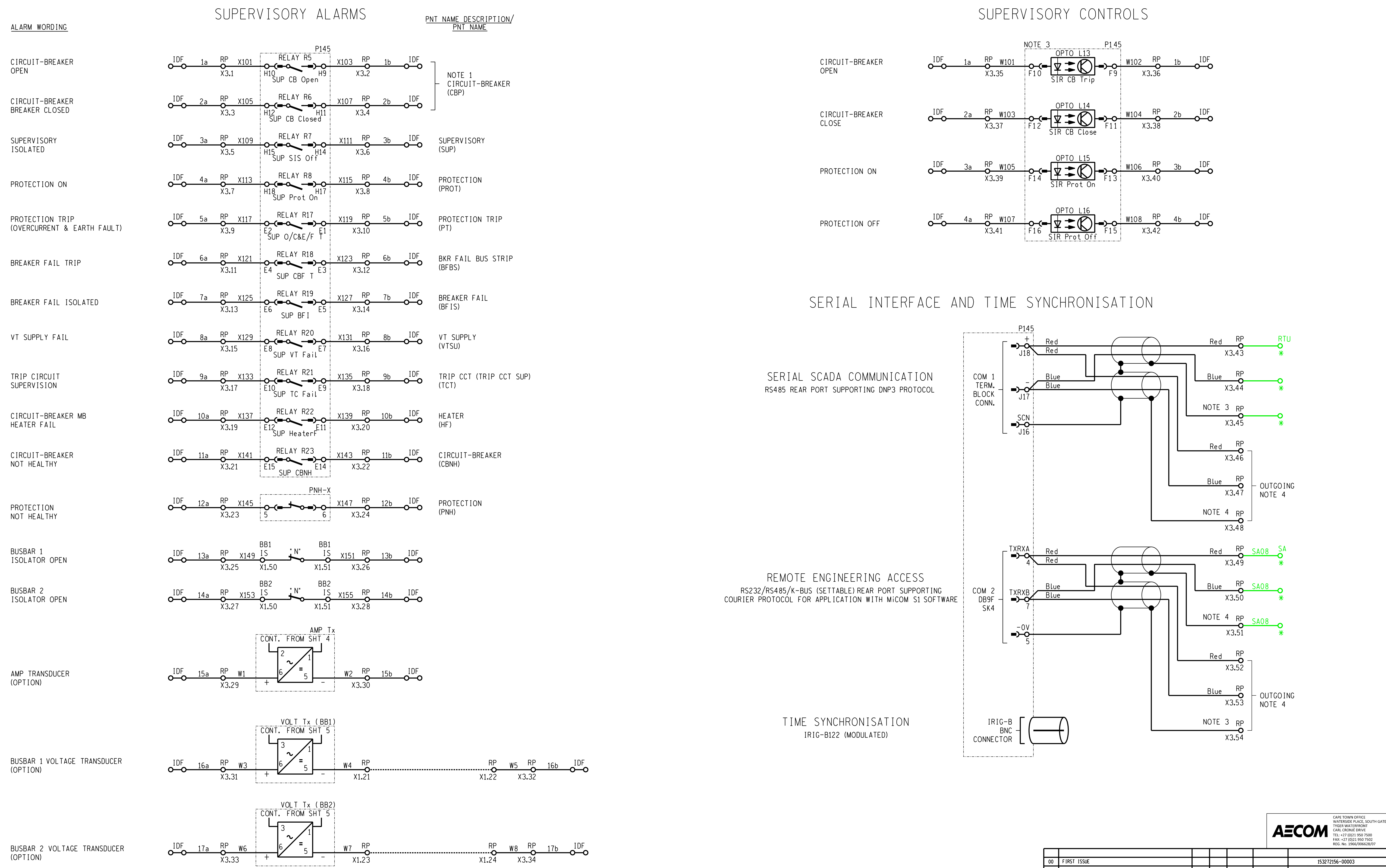
SET NUMBER	SHEET NUMBER	REVISION
49	08	00

LEVELS:

PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 8 OF 12 REVISION 2

A1L



NOTE

1. USE DOUBLE BIT INDICATION.
2. THE P145's OPTO INPUTS ARE RATED FROM 19Vdc TO 265Vdc, WITH THE PICK-UP RANGE OF EACH OPTO INDIVIDUALLY SELECTABLE BY SETTINGS.
3. RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
4. INSERT 120 OHM TERMINATING RESISTOR BETWEEN + AND - IF DAISY CHAIN TERMINATES AT THIS RELAY PANEL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE, WATERSIDE PLACE, SOUTH GATE, TYGER WATERFRONT, CARL CRONJE DRIVE

Eskom

PROJECT APPROVED: L.BOTHA	DESIGN APPROVED: J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED: A.MARAIS	DESIGN CHECKED: R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY: K.STEYNBERG	DRAWN BY: N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

LEVELS:

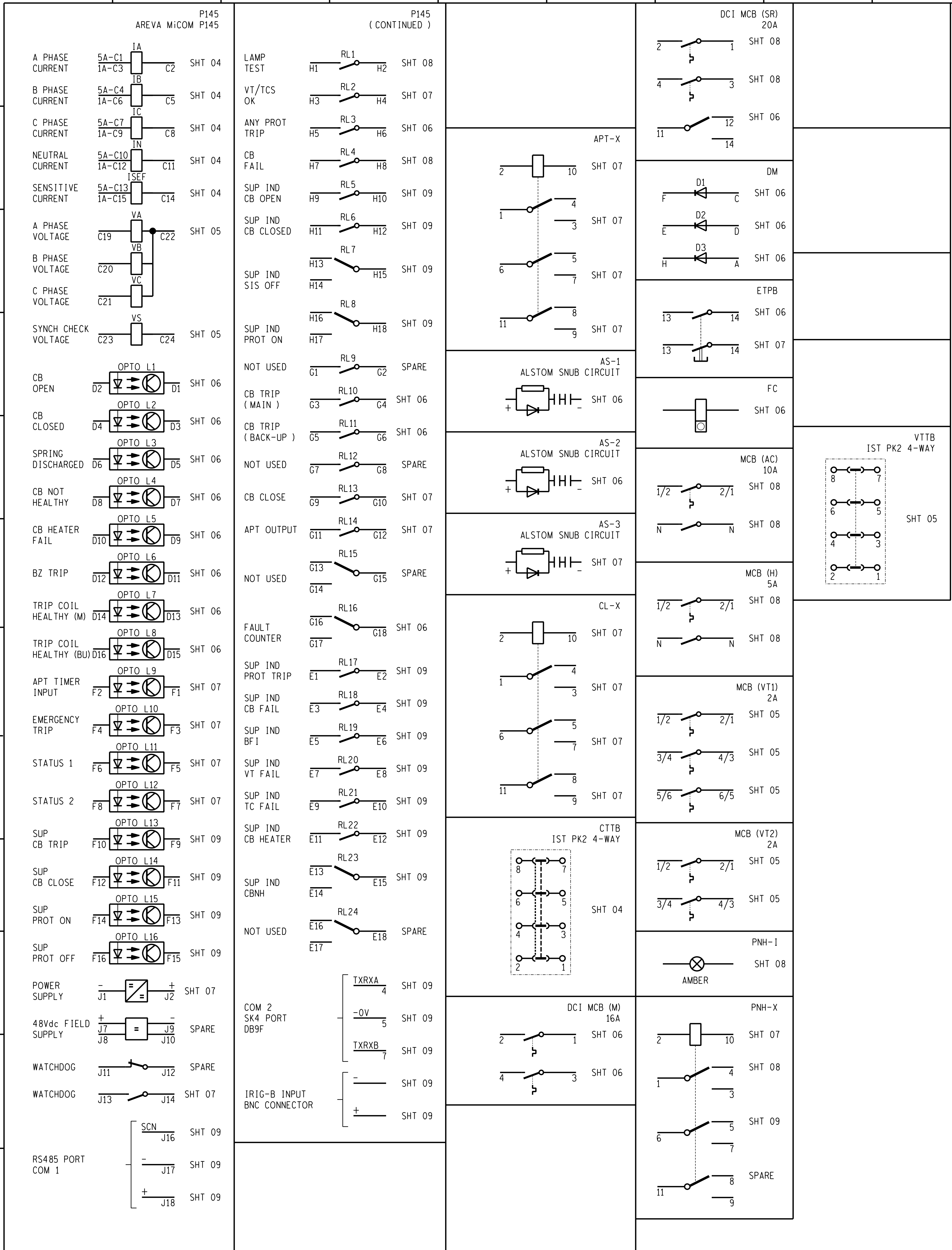
YSTERVARK SUBSTATION
66kV BUS COUPLER
SUP ALARMS AND CONTROLS

DRAWING	SET NUMBER	SHEET NUMBER	REVISION
D-WC-8118	49	09	00

LEVELS 1 2 3 5 6 7 8 9 11 12 13 15 16 17 18 19 20 21 22 25 26 27 28 29 30 31 PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 9 OF 12 REVISION 2

A1L



AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

Eskom

PROJECT APPROVED L.BOTHA	DESIGN APPROVED J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K.STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
REFERENCE DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

LEVELS:

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
49	10	00

LEVELS 1 2 3 4 5 6 7 8 9 11 16 17 18 19 20 21 24 25 26 27 28 29 30 31 PANEL TYPE DESIGNATION 4BC-1800

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 12 REVISION 2

ANALOGUE INPUTS

Function	Lead	X1	Lead no.	AX103	AX106	AX107
		24				
		23				
		22				
		21				
		20				
		19				
		18				
		17				
		16				
		15				
		14				
		13				
		12				
BUSBAR 2 VT INPUTS	E231	11	E41AX			*
	E211	10	E21AX			*
BUSBAR 1 VT INPUTS	E171	9	E71AX		*	
	E151	8	E51AX		*	
	E131	7	E31AX		*	
	E111	6	E11AX		*	
		5				
PROTECTION CT INPUTS	A71	4	A71AX	42*		
	A51	3	A51AX	39		
	A31	2	A31AX	38		
	A11	1	A11AX	37		
CABLE NUMBER				AX103	AX106	AX107
CABLE SIZE				12	4	4
NUMBER OF SPARES				4	0	2
DESTINATION				66kV BUS COUPLER BUSBAR 2 CT JUNCTION BOX	66kV BUSBAR 1 VT JUNCTION BOX 2	66kV BUSBAR 2 VT JUNCTION BOX 2

AC & DC CONTROL CIRCUITS

Function	Lead	X2	Lead no.	42		AX104	AX105	AX108	AX109	AX115	
ESD	K83	43									
	SPARE	42									
	SPARE	41									
HEATER SUPPLY	H73	40					X1.2				
	H17	39					X1.1				
AC SUPPLY	H71	38	H71J	X4.N							
	H11	37	H151J	X4.17							
SPRING REWIND	M4	36	M102				X1.4				
	M3	35	M101				X1.3				
SPARE SUPPLY	K102	34									
	K101	33									
PLANT STATUS INPUTS	K145	32	K145AX						X1.49		
	K101	31	K101AX						X1.48		
	K143	30	K143AX					X1.49			
	K101	29	K101AX					X1.48			
CB FAIL OUTPUT	P17	28	P17AX							X5.36	
	P7	27	P7AX							X5.35	
BUSZONE TRIP	K117	26	P25AX							X5.34	
	K101	25	P21AX							X5.33	
CB AUX SUPPLY	K102	24	K102AX			X1.16					
	K101	23	K101AX			X1.15					
CLOSING COIL	K135	22	K135AX			X1.12					
	K133	21	K133AX			X1.11					
BACK-UP TRIP COIL	K121	20	K121AX			X1.63					
	K102	19	K102AX			X1.8					
	K119	18	K119AX			X1.7					
MAIN TRIP COIL	K115	17	K115AX			X1.61					
	K102	16	K102AX			X1.6					
	K113	15	K113AX			X1.5					
CB HEATER FAIL	K111	14	K111AX			X1.28					
	K101	13									
CBNH INPUTS	K109	12	K109AX			X1.18*					
	K101	11	K101AX			X1.17*					
	K107	10	K107AX			X1.48					
	K101	9	K109AX			X1.47					
CB STATUS	K105	8	K105AX			X1.32					
	K101	7									
	K103	6	K103AX			X1.40					
	K101	5	K101AX			X1.39*					
DC SUPPLIES	M2	4									
	M1	3									
	J2	2	J12J	K8.22							
	J1	1	J11J	K8.21							
CABLE NUMBER				42		AX104	AX105	AX108	AX109	AX115	
CABLE SIZE				4		19	4	4	4	4	
NUMBER OF SPARES				0		1	0	0	0	0	
DESTINATION				AC/DC PANEL		CIRCUIT-BREAKER MECHANISM BOX	CIRCUIT-BREAKER MECHANISM BOX	66kV BUS COUPLER BUSBAR 1 ISOLATOR	66kV BUS COUPLER BUSBAR 2 ISOLATOR	BUSZONE RELAY PANEL	

SUPERVISORY ALARMS, CONTROLS & SERIAL COMMUNICATION.

Function	Lead	X3	Core	801	800	AX108	AX109
RS485 ENGINEERING PORT	SCRN	54					
	Blue	53					
	Red	52					
	SCRN	51					
	Blue	50					
	Red	49					
RS485 SUPERVISORY PORT	SCRN	48					
	Blue	47					
	Red	46					
	SCRN	45					
	Blue	44					
	Red	43					
HARD-WIRED SUPERVISORY CONTROLS	W108	42	4b				
	W107	41	4a				
	W106	40	3b				
	W105	39	3a				
	W104	38	2b				
	W103	37	2a				
	W102	36	1b				
	W101	35	1a				
BB2 VOLT TX	W8	34	17b				
	W6	33	17a				
BB1 VOLT TX	W5	32	16b				
	W3	31	16a				
AMP TX	W2	30	15b				
	W1	29	15a				
PLANT STATUS	X155	28	14b				X1.51
	X153	27	14a				X1.50
	X151	26	13b			X1.51	
	X149	25	13a			X1.50	
HARD-WIRED SUPERVISORY ALARMS	X147	24	12b				
	X145	23	12a				
	X143	22	11b				
	X141	21	11a				
	X139	20	10b				
	X137	19	10a				
	X135	18	9b				
	X133	17	9a				
	X131	16	8b				
	X129	15	8a				
	X127	14	7b				
	X125	13	7a				
	X123	12	6b				
	X121	11	6a				
	X119	10	5b				
	X117	9	5a				
	X115	8	4b				
	X113	7	4a				
	X111	6	3b				
	X109	5	3a				
	X107	4	2b				
	X105	3	2a				
	X103	2	1b				
	X101	1	1a				
CABLE NUMBER				801	800	AX108	AX109
CABLE SIZE				20Pr	10Pr	4	4
NUMBER OF SPARES				3Pr	6Pr	0	0
DESTINATION				IDF	IDF	66kV BUS COUPLER BUSBAR 1 ISOLATOR	66kV BUS COUPLER BUSBAR 2 ISOLATOR

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 INDICATES NO CHANGE IN LEAD NUMBER.
   P7 P7A INDICATES CHANGE IN LEAD NUMBER.
   SEE CABLE BLOCK DIAGRAM FOR PREFIXING.
4. STANDARD TERMINALS USED ARE ELMEX KULT1 10mm SPRING LOADED TERMINALS
   ELMEX KULTD6 8mm SPRING LOADED SLIDING LINK TEST TERMINAL
   ⊗ ELMEX KULT4 5mm SPRING LOADED TERMINAL
   ● ENTRELEC D2.5/5.SN.ADO INSULATION DISPLACEMENT TERMINAL WITH DISCONNECT
   ○ ENTRELEC D6/8.ADO.1 INSULATION DISPLACEMENT TERMINAL
   ▭ ELMEX KUDF4 8mm TERMINAL WITH 1MOHM RESISTOR
   TERMINAL RAIL END STOPS (LEFT END): ELMEX SCUN
   TERMINAL RAIL EATHING TERMINALS (RIGHT END STOPS): ELMEX ET10

* LOOPED TERMINALS	
BUSBAR 2 CTJB	40-41-42
CB MB	X1.31-X1.39; X1.17-X1.19-X1.27; X1.18-X1.20

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM

Eskom

PROJECT APPROVED L. BOTHA DATE 20/04/20	DESIGN APPROVED J.MOSTERT DATE 11/12/15
PROJECT CHECKED A. MARAIS DATE 04/12/19	DESIGN CHECKED R.BUFFKINS DATE 11/12/15
DRAWN BY K. STEYNBERG DATE 20/09/19	DRAWN BY N.F.KNOETZEN DATE 11/12/15

YSTERVARK SUBSTATION
66kV BUS COUPLER
CABLING DIAGRAM

D-WC-8118

SET NUMBER	SHEET NUMBER	REVISION
49	11	00

LEVELS:

PANEL TYPE DESIGNATION 4BC-1800

MASTER TRACING FILED UNDER D-WC-8118 SHEET 11 OF 12 REVISION 2

A1L

(NOT USED)

SEE D-WC-8118 SET 159

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
2	SvZ	06/11/2009	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-
1	SvZ	11/04/2008	CHANGES AS PER SHEET 00 - COVER SHEET	SvZ	-

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED	DESIGN APPROVED
L. BOTHA	J.MOSTERT
DATE 20/04/20	DATE 11/12/15
PROJECT CHECKED A. MARAIS	DESIGN CHECKED R.BUFFKINS
DATE 04/12/19	DATE 11/12/15
DRAWN BY K. STEYNBERG	DRAWN BY N.F.KNOETZEN
DATE 20/09/19	DATE 11/12/15

LEVELS:

YSTERVARK SUBSTATION
66kV BUS COUPLER
CABLE BLOCK DIAGRAM

D-WC-8118	SET NUMBER	SHEET NUMBER	REVISION
	49	12	00

LEVELS 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

PANEL TYPE DESIGNATION 4BC-1800

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 12 REVISION 2

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	2.1	23/03/2010	REVISION 2.1 CHANGES INDICATED. MINOR CORRECTIONS. NO CHANGES AFFECTING SCHEME MANUFACTURING OR OPERATION.
1	PANEL EQUIPMENT LAYOUT	2.1	23/03/2010	R1 ITEM 5 REMOVED FROM TERMINAL BACK PLATE DIAGRAM.
2	FRONT PANEL LABEL SCHEDULE	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
3	SCHEME LOGIC DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
4	RELAY LOGIC DIAGRAM	2.1	23/03/2010	ELEMENTS ON LEVELS 5, 6, 7 & 8 DELETED (NOT APPLICABLE TO THIS SCHEME).
5	RELAY LOGIC DIAGRAM	2.1	23/03/2010	ELEMENTS ON LEVELS 5, 6, 7 & 8 DELETED (NOT APPLICABLE TO THIS SCHEME).
6	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
7	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
8	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
9	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
10	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
11	AC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
12	DC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
13	DC KEY DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
14	TRIP OUTPUTS DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
15	AC & SUPERVISORY KEY DIAGRAMS	2.1	23/03/2010	AS PER PREVIOUS ISSUE.
16	PROTECTION REFERENCE DIAGRAM	2.1	23/03/2010	LEVEL INDICATOR ADDED IN SHEET BORDER.
17	PANEL CABLING DIAGRAM	2.1	23/03/2010	BUSCOUPLER CT CABLES CORRECTED FROM 12-CORE TO 4-CORE.
18	PANEL CABLING DIAGRAM	2.1	23/03/2010	X4 RAIL: WIRE NUMBERS BETWEEN RP AND ISOLATOR JBs CORRECTED.
19	PANEL CABLING DIAGRAM	2.1	23/03/2010	X5 RAIL: WIRE NUMBERS BETWEEN RP AND ISOLATOR JBs/ISOLATORS CORRECTED.
20	CABLE BLOCK DIAGRAM	2.1	23/03/2010	AS PER PREVIOUS ISSUE.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1	DRAWING SHEET BORDER	16	
2		17	
3		18	
4		19	
5	TITLE, LEVELS, REVISION BLOCKS & REFERENCE FILE	20	
6		21	
7		22	
8		23	
9		24	
10	STANDARD DESIGN DRAWING	25	
11		26	
12		27	
13		28	
14		29	
15		30	

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
COVER SHEET

D-WC-8118

SET	SHEET	REVISION
50	00	00

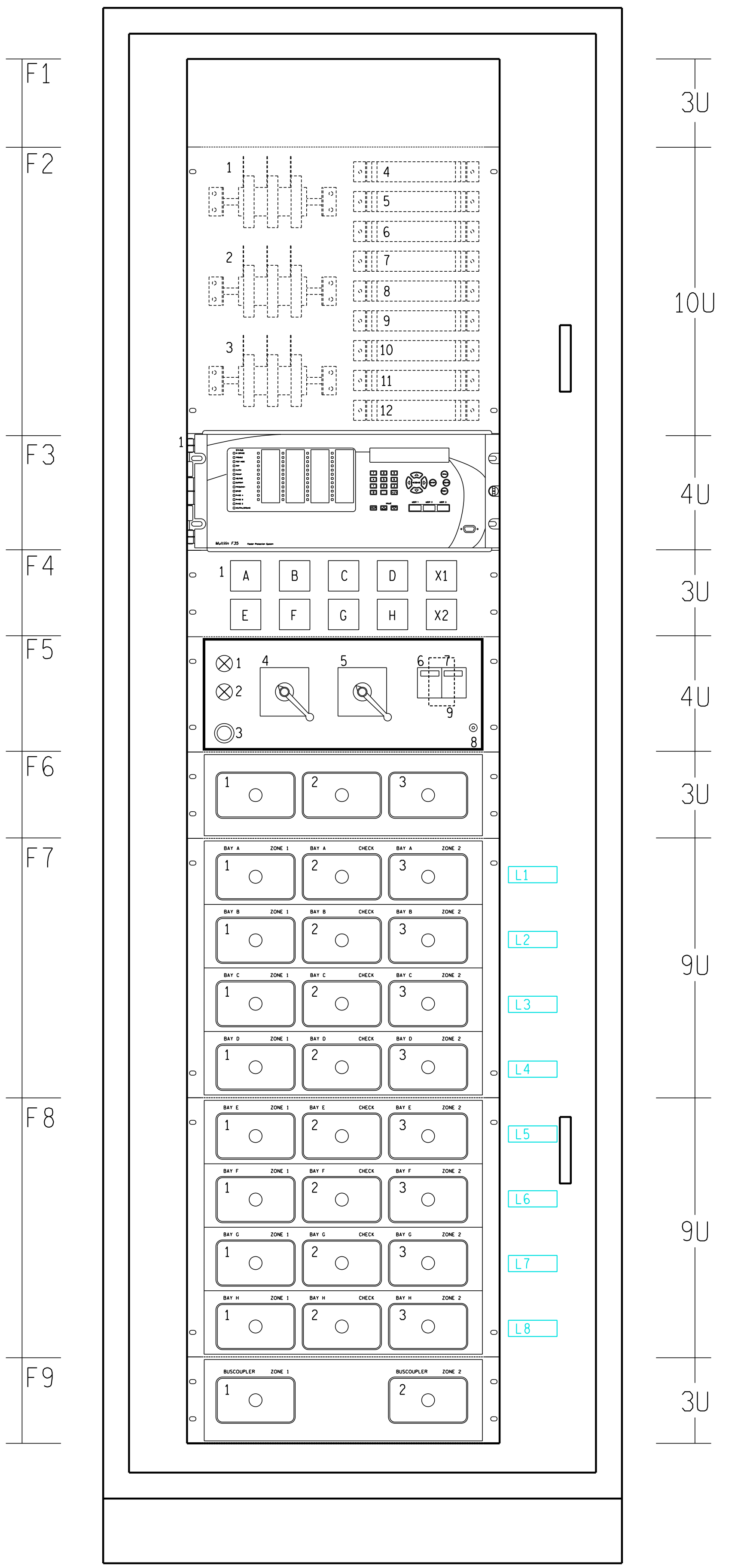
LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

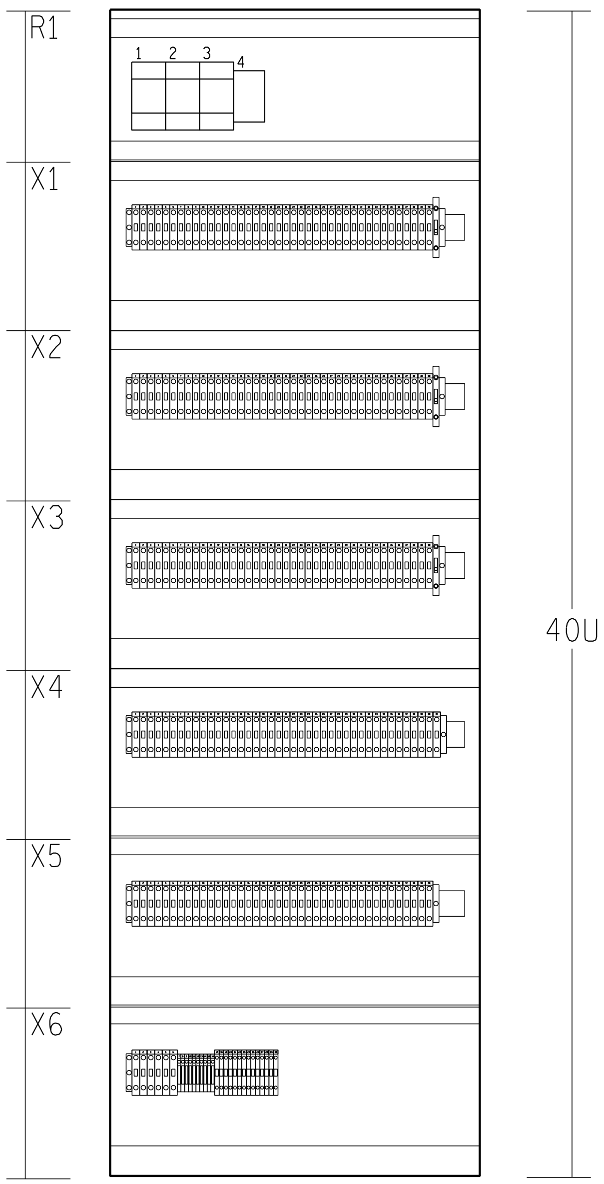
A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 0 OF 23 REVISION 2.1

FRONT VIEW



TERMINAL BACK PLATE



	LABELS
L1	66kV FEEDER 1
L2	66kV FEEDER 2
L3	66kV FEEDER 3
L4	66kV FEEDER 4
L5	SPARE
L6	66kV FEEDER 6
L7	SPARE
L8	SPARE

LOCATION		DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW					
F1			BLANKING PLATE		
F2			BLANKING PLATE WITH THE FOLLOWING COMPONENTS ON REAR:		
	1	MET Z1-R,W,B	ZONE 1 METROSIL (THREE PHASE)	300A/S3/I/SPEC3063	M&I MATERIALS
	2	MET Z2-R,W,B	ZONE 2 METROSIL (THREE PHASE)	300A/S3/I/SPEC3063	M&I MATERIALS
	3	MET CZ-R,W,B	CHECK ZONE METROSIL (THREE PHASE)	300A/S3/I/SPEC3063	M&I MATERIALS
	4	RSTAB Z1-R	VARIABLE STABILISING RESISTORS Z1 = ZONE 1, Z2 = ZONE 2, CZ = CHECK ZONE R = RED PHASE, W = WHITE PHASE, B = BLUE PHASE ORDERING OPTIONS: 0 - 200 OHM, 0 - 800 OHM, 0 - 2000 OHM 200W		KAMA COILS
	5	RSTAB Z1-W			
	6	RSTAB Z1-B			
	7	RSTAB Z2-R			
	8	RSTAB Z2-W			
	9	RSTAB Z2-B			
	10	RSTAB CZ-R			
	11	RSTAB CZ-W			
	12	RSTAB CZ-B			
F3	1	F35	BUSZONE PROTECTION RELAY	F35	GE MULTILIN
F4	1	TR-A-H, X1, X2	HAND & ELEC. RESET TRIP REPEAT RELAYS (BAYS A - H, X1 & X2)	BF4RPT ✱✱0	ARTECHE
F5	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	KRE222 (220Vac/dc)	KIMURA
	2	ZT-I	BUSZONE TRIP INDICATION (RED)	KRE222✱	KIMURA
	3	RST	RESET / LAMP CHECK PUSH BUTTON (BLACK)	MULLER P/BUTTON (2 N/O)	MULLER ELECTRICAL
	4	BZI(1)	BUSZONE ISOLATE SWITCH	CR1825	ROLOP
	5	BFI	BREAKER FAIL ISOLATE SWITCH	CR1821	ROLOP
	6	DCI MCB (DC)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (16A)	EP102UC(C16)	GE
	7	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (2A)	G62(C2)	GE
	8	ESD	ELECTROSTATIC DISCHARGE POINT (BLUE)	RG03	COMMUNICA
	9	PTC	INPUT SURGE SUPPRESSION MODULE (MOUNTED ON REAR OF MCBs)	EPROT-11700 ✱✱	IST
		P1 - 4	POSITIVE TEMPERATURE CO-EFFICIENT RESISTORS (PTCs)		
F6	1	TB-Z1	ZONE 1 RELAY CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	IST
	2	TB-CZ	CHECK ZONE RELAY CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	IST
	3	TB-Z2	ZONE 2 RELAY CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY	IST
F7	1	TB-Z1-A - D	BAY A - D ZONE 1 CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
	2	TB-CZ-A - D	BAY A - D CHECK ZONE CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
	3	TB-Z2-A - D	BAY A - D ZONE 2 CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
F8	1	TB-Z1-E - H	BAY E - H ZONE 1 CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
	2	TB-CZ-E - H	BAY E - H CHECK ZONE CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
	3	TB-Z2-E - H	BAY E - H ZONE 2 CURRENT TRANSFORMER TEST BLOCKS	PK2 4-WAY	IST
F9	1	TB-Z1-X	BUSCOUPLER BAY ZONE 1 TEST BLOCK	PK2 4-WAY	IST
	2	TB-Z2-X	BUSCOUPLER BAY ZONE 2 TEST BLOCK	PK2 4-WAY	IST
TERMINAL BACK PLATE					
R1	1	BWS Z1-X	ZONE 1 CT BUSWIRE SHORTING RELAY	BF4T ✱✱	ARTECHE
	2	BWS Z2-X	ZONE 2 CT BUSWIRE SHORTING RELAY	BF4T ✱✱	ARTECHE
	3	BWS CZ-X	CHECK ZONE CT BUSWIRE SHORTING RELAY	BF4T ✱✱	ARTECHE
	4	DB	DIODE BOARD (4 TRIPPING DIODES)	TRFRENC-40010	IST
X1-X6			TERMINAL RAILS		
			TRUNKING AT TOP OF RAIL (SCHEME SIDE): 25mm x 100mm		
			TRUNKING AT BOTTOM OF RAIL (CABLE SIDE): 40mm x 100mm		
			REFER TO SHTs 16 - 18 FOR TERMINAL BLOCK MAKES AND TYPES		

✱ 220Vac/dc
✱✱ 110Vdc

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
COVER SHEET

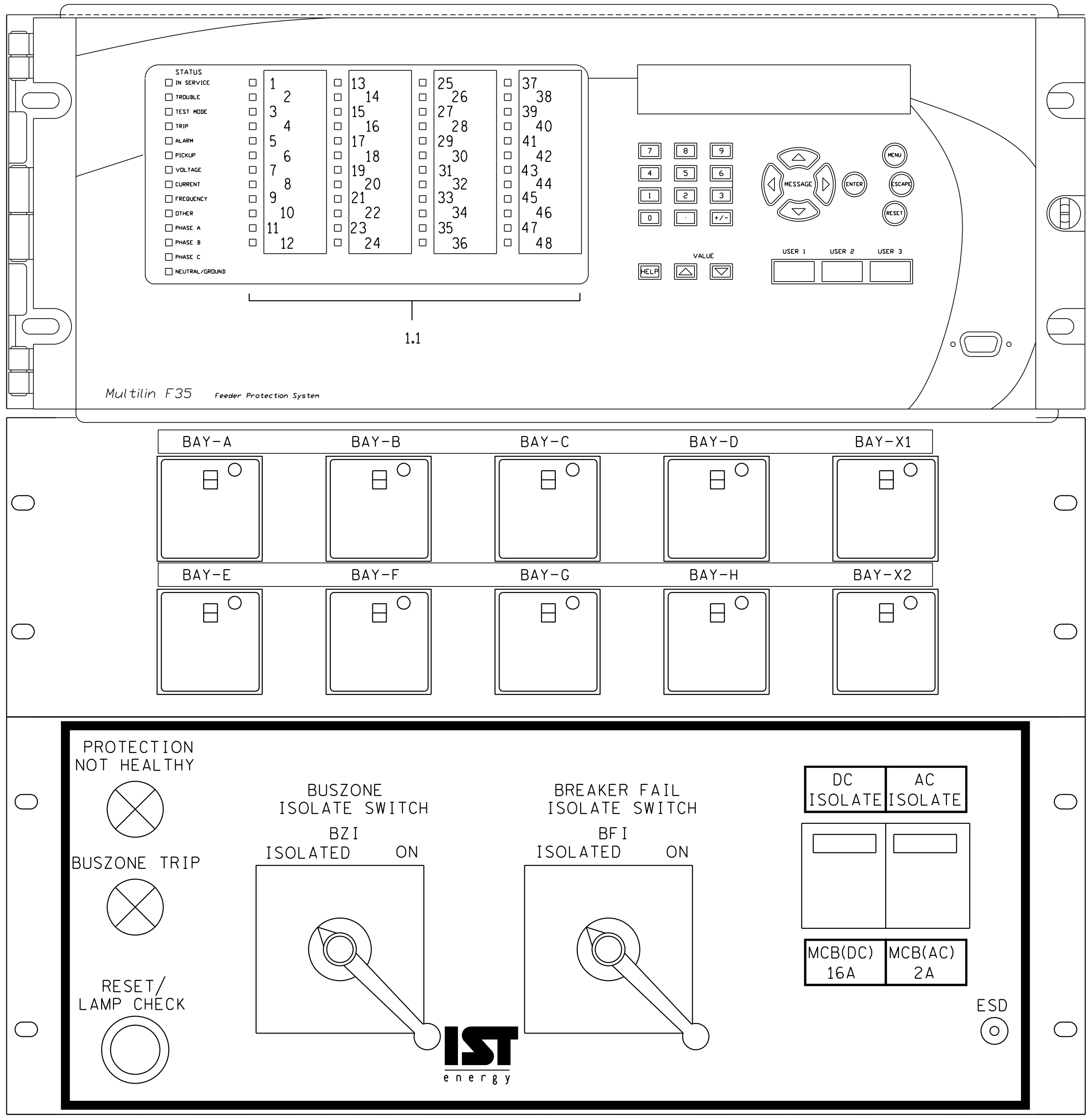
D-WC-8118	SET	SHEET	REVISION
	50	01	00

PANEL TYPE DESIGNATION 4BZ-5700

A1L

LEVELS 1 5 10 17

KEY TO FRONT PANEL LABELING



KEY TO F35 RELAY PROGRAMMABLE LED USAGE

LOCATION		LABEL
FRONT VIEW		
1.1		USER-PROGRAMMABLE LEDs
	COLUMN 1	TRIP INDICATIONS
	1	ZONE 1 TRIP
	2	ZONE 2 TRIP
	3	DIFFERENTIAL TRIP
	4	BREAKER FAIL TRIP
	5	- (NOT USED)
	6	- (NOT USED)
	7	- (NOT USED)
	8	- (NOT USED)
	9	- (NOT USED)
	10	- (NOT USED)
	11	- (NOT USED)
	12	- (NOT USED)
	COLUMN 2	ALARMS
	13	CT SUPERVISION - Z1
	14	CT SUPERVISION - Z2
	15	CT SUPERVISION - CZ
	16	ZONE DISCREPANCY
	17	BUSZONE ISOLATED
	18	BRKR FAIL ISOLATED
	19	BW SHORT RST FAIL
	20	TRIP REPEAT RST FAIL
	21	BZI DISCREPANCY
	22	- (NOT USED)
	23	- (NOT USED)
	24	- (NOT USED)
	COLUMN 3	GENERAL
	25	ZONE 1 DIFF
	26	ZONE 2 DIFF
	27	CHECK ZONE DIFF
	28	ANY TRIP RELAY OP
	29	BUSWIRES SHORTED
	30	OSCILLO RECORD
	31	- (NOT USED)
	32	- (NOT USED)
	33	- (NOT USED)
	34	- (NOT USED)
	35	- (NOT USED)
	36	- (NOT USED)
	COLUMN 4	LEDs 37 - 48 NOT USED

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
CONSULTANT FOR PROJECT:

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
FRONT PANEL LABEL SCHEDULE

D-WC-8118

SET	SHEET	REVISION
50	02	00

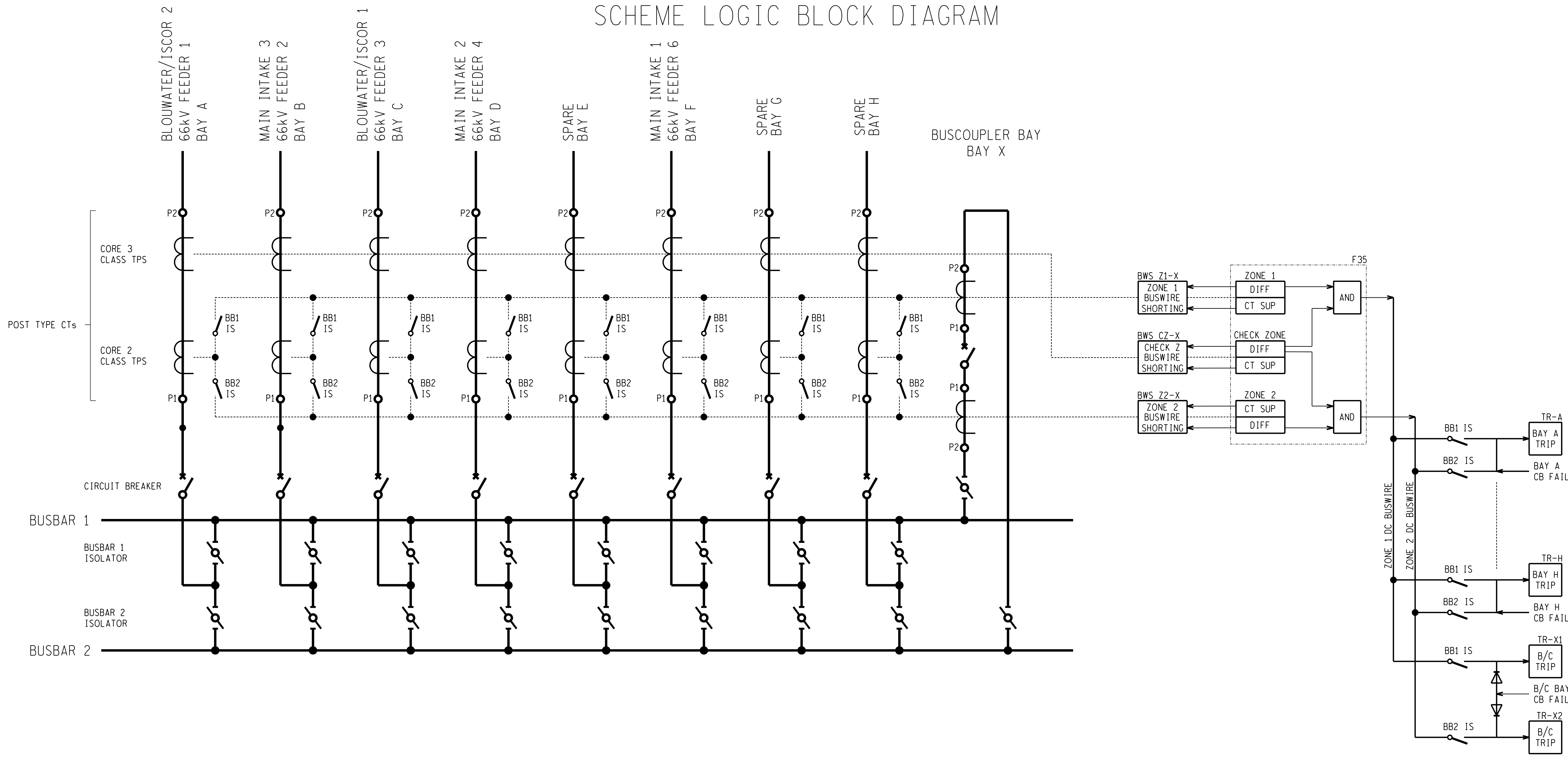
LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 0 OF 23 REVISION 2.1

SCHEME LOGIC BLOCK DIAGRAM



SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET
DRG NO.	REFERENCE DRAWINGS:

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
SCHEME LOGIC DIAGRAM

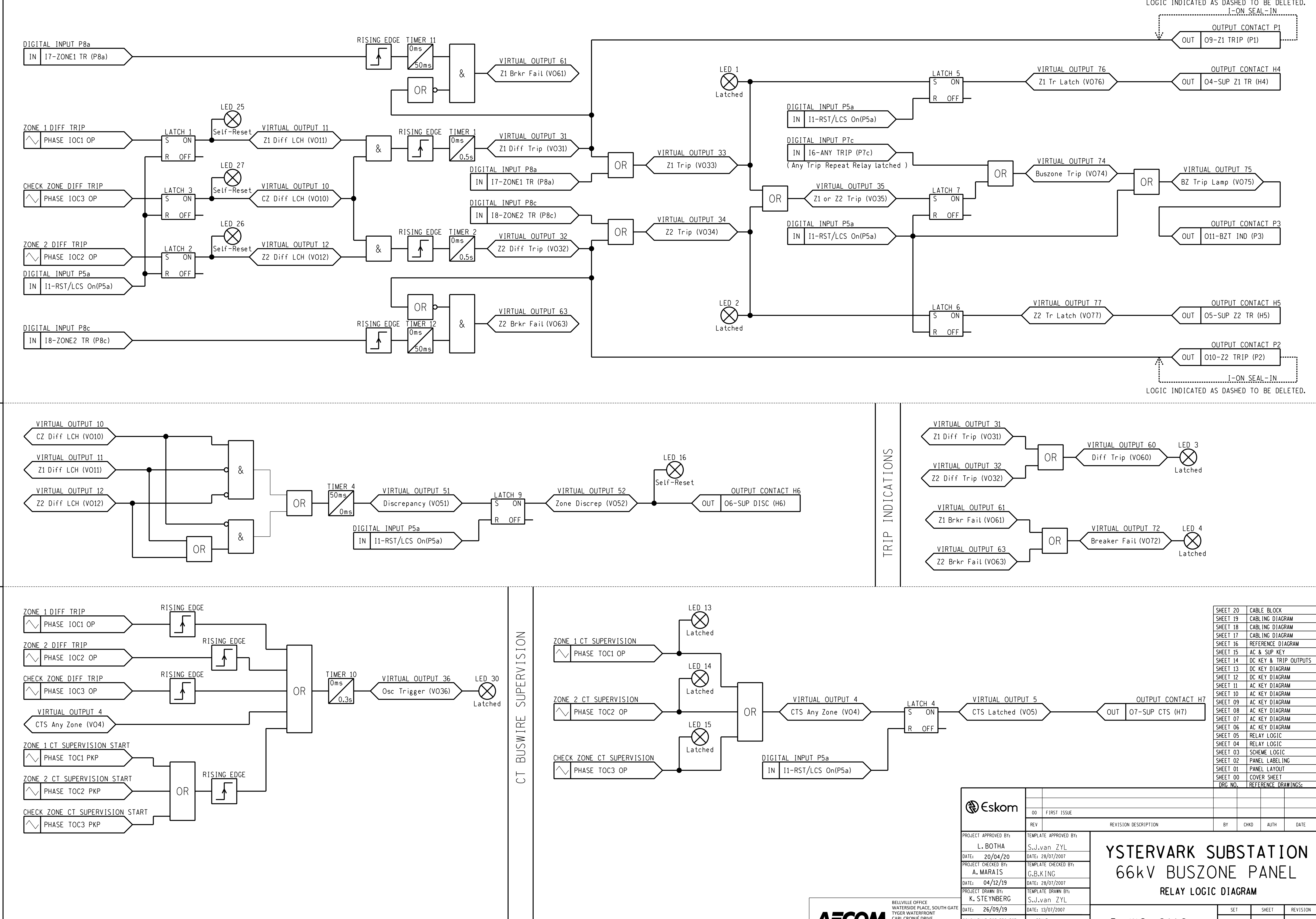
D-WC-8118	SET	SHEET	REVISION
	50	03	00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

GE MULTILIN F35 RELAY - PROGRAMMABLE LOGIC



CONTINUED ON SHEET 05

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
RELAY LOGIC DIAGRAM

D-WC-8118 | SET 50 | SHEET 04 | REVISION 00

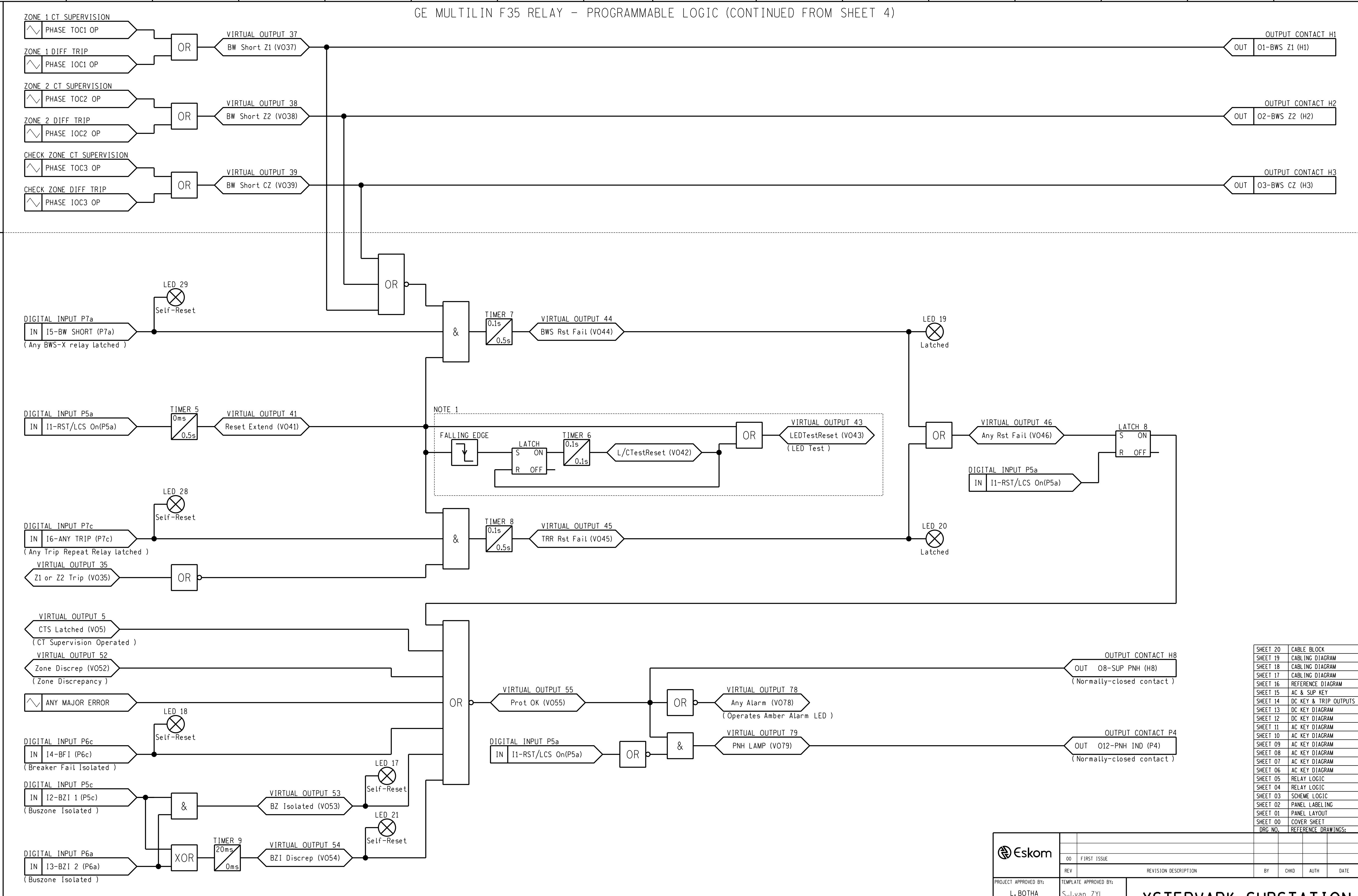
LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 4 OF 23 REVISION 2.1

GE MULTILIN F35 RELAY - PROGRAMMABLE LOGIC (CONTINUED FROM SHEET 4)



NOTE:

1. THE LED TEST LOGIC IN THE F35 CONSISTS OF TWO STAGES. IN THE FIRST STAGE, LASTING AS LONG AS THE RESET PUSH BUTTON ON THE PANEL IS PRESSED, ALL LEDS REMAIN ILLUMINATED . THE SECOND STAGE IS A PROTRACTED SCROLLING TEST OF EACH LED AND STARTS UPON RELEASE OF THE PUSH BUTTON. THE LOGIC INDICATED SERVES TO CREATE A SECOND PULSE ONCE THE RESET PUSH BUTTON IS RELEASED. THIS SERVES TO CANCEL THE SECOND STAGE OF THE LED TEST SEQUENCE.

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007

SCALE :

AECOM

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
SCHEME LOGIC DIAGRAM

D-WC-8118

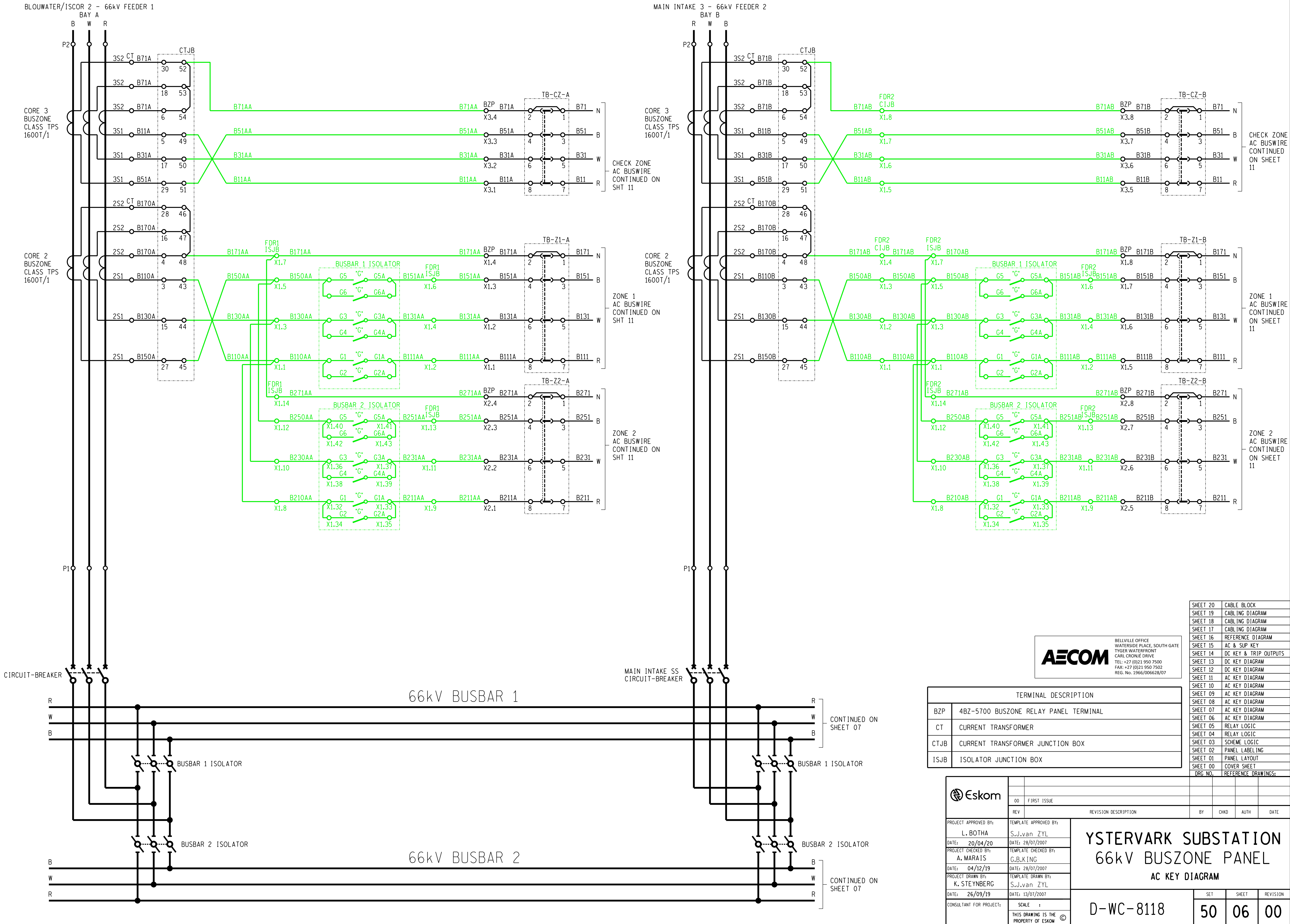
SET	SHEET	REVISION
50	05	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 5 OF 23 REVISION 2.1

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

TERMINAL DESCRIPTION	
BZP	4BZ-5700 BUSZONE RELAY PANEL TERMINAL
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
ISJB	ISOLATOR JUNCTION BOX

Eskom

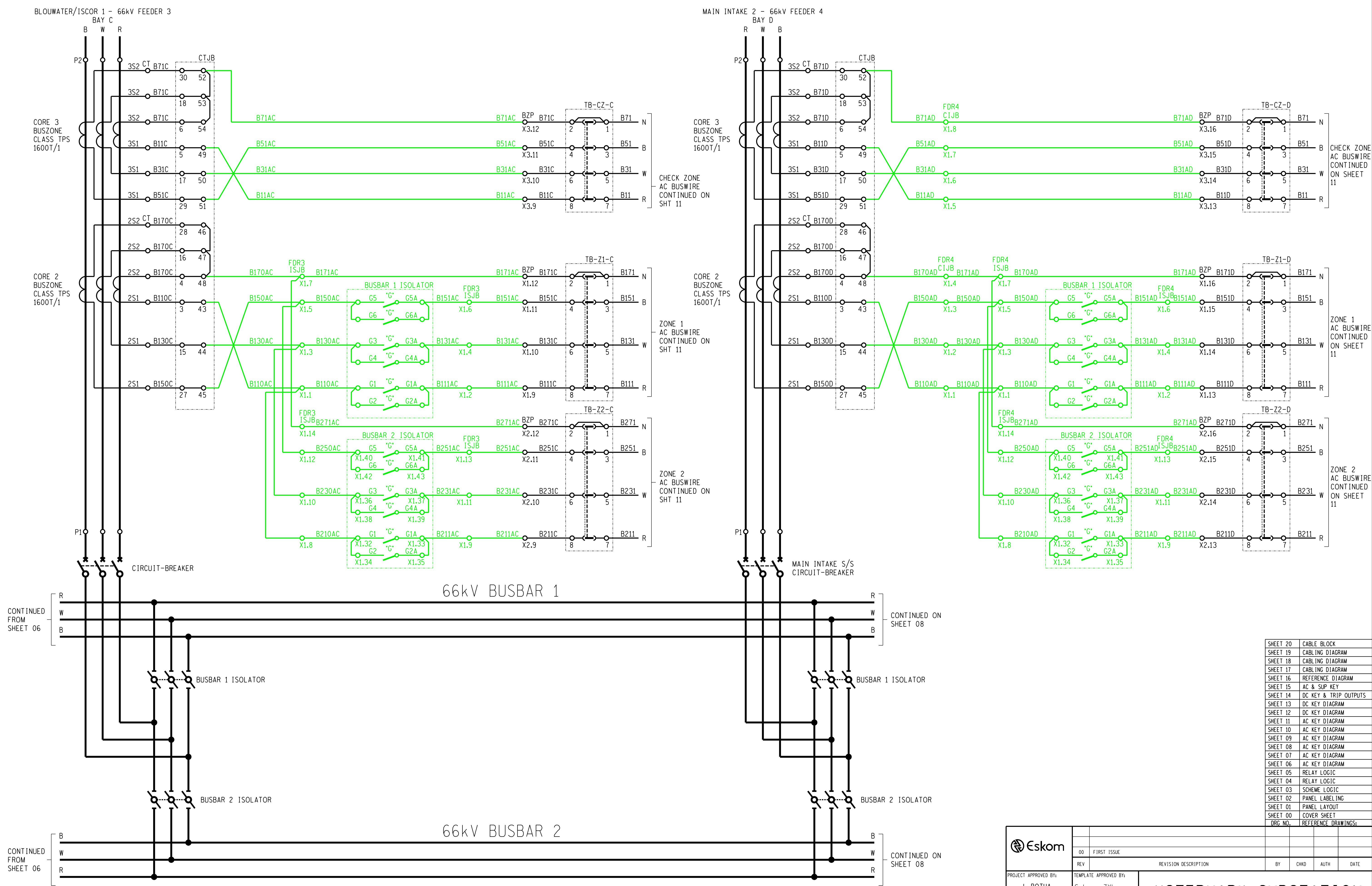
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

D-WC-8118

SET	SHEET	REVISION
50	06	00



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

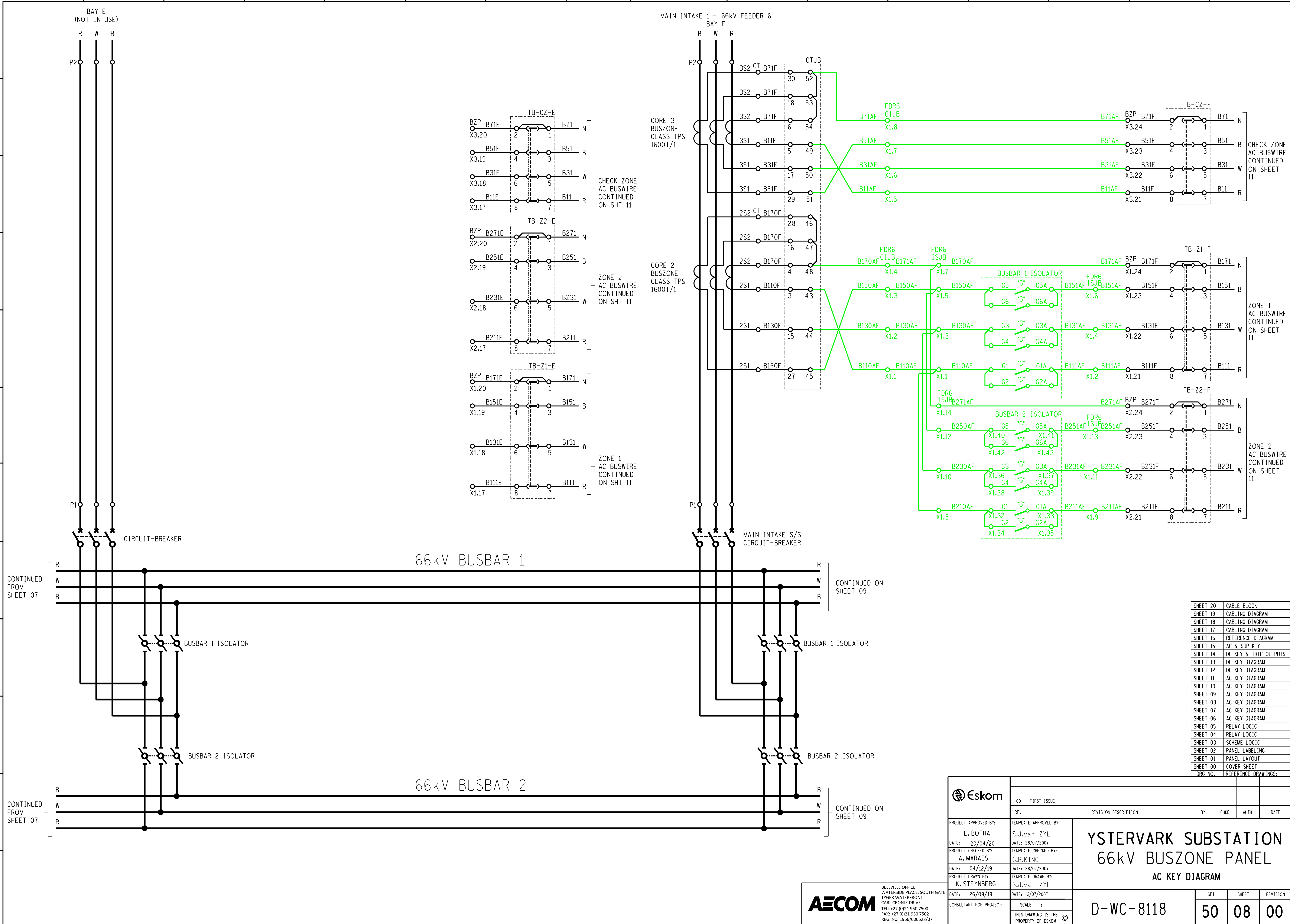
DRG NO.	SET	SHEET	REVISION
D-WC-8118	50	07	00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 7 OF 23 REVISION 2.1



SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET
DRG NO.	REFERENCE DRAWINGS:

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

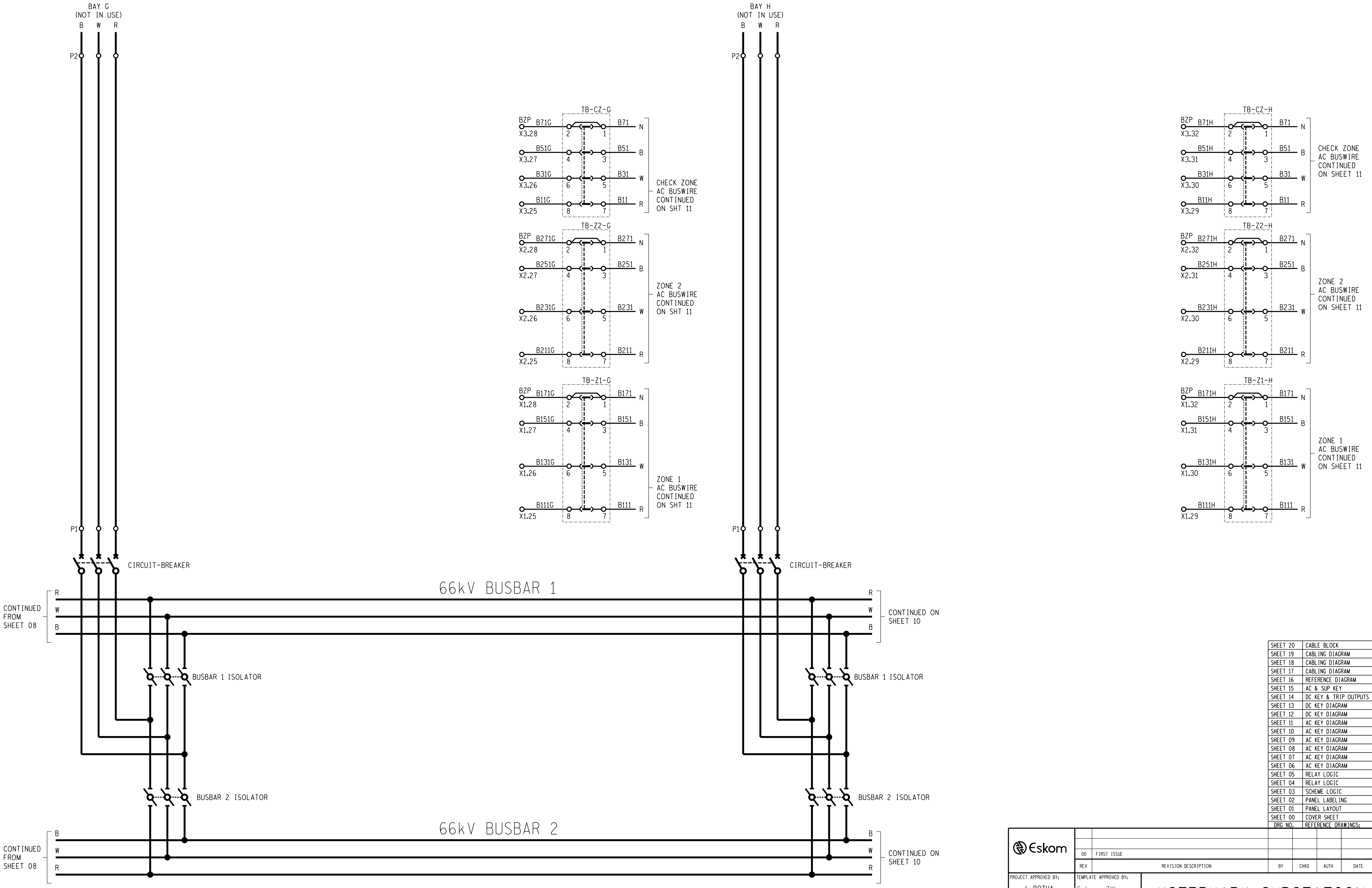
D-WC-8118 SET 50 SHEET 08 REVISION 00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 8 OF 23 REVISION 2.1



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :
	THIS DRAWING IS THE PROPERTY OF ESKOM ©

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

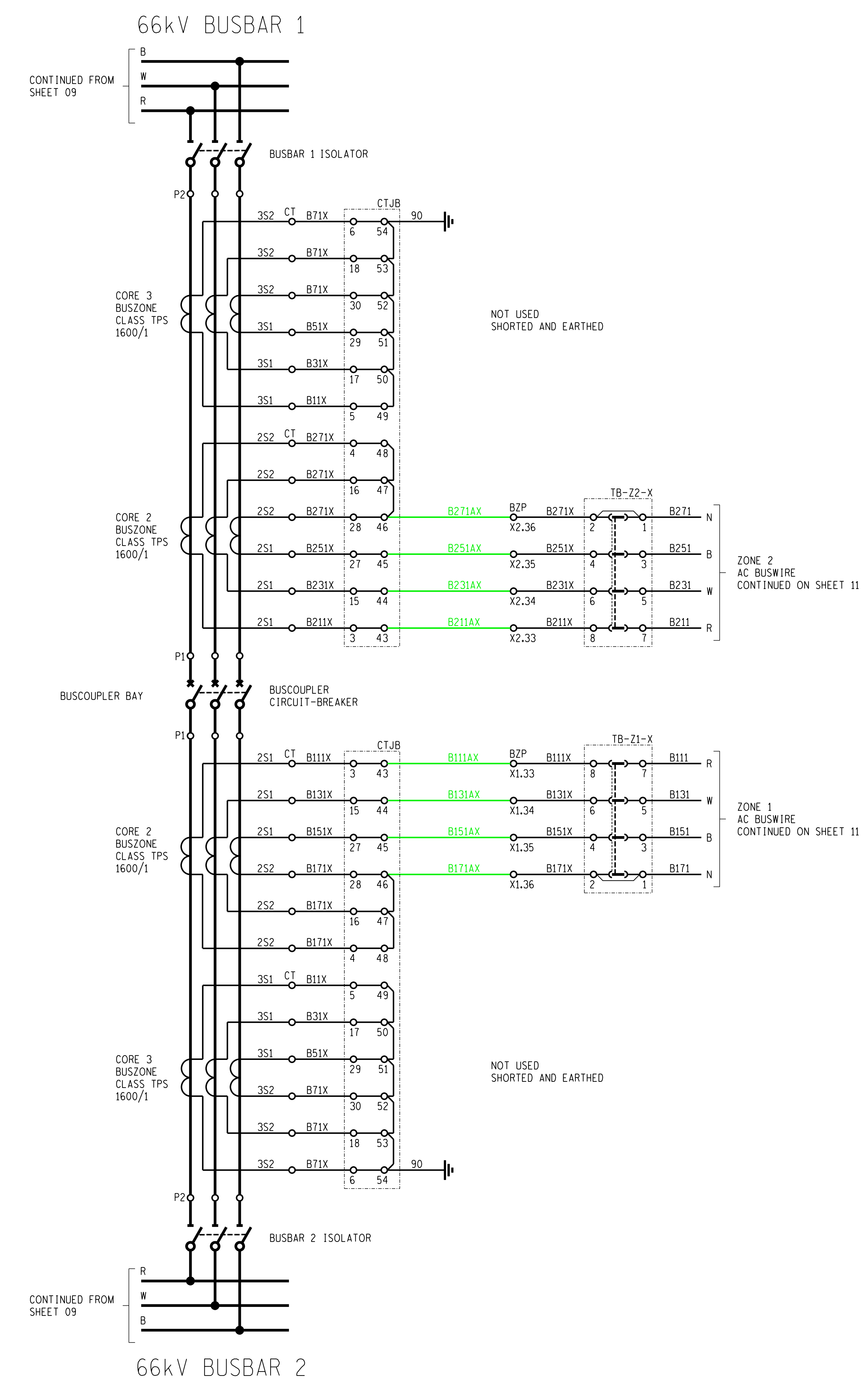
YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	50	09	00

PANEL TYPE DESIGNATION 4BZ-5700

LEVELS 1 5 10

A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :

AECOM

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

D-WC-8118

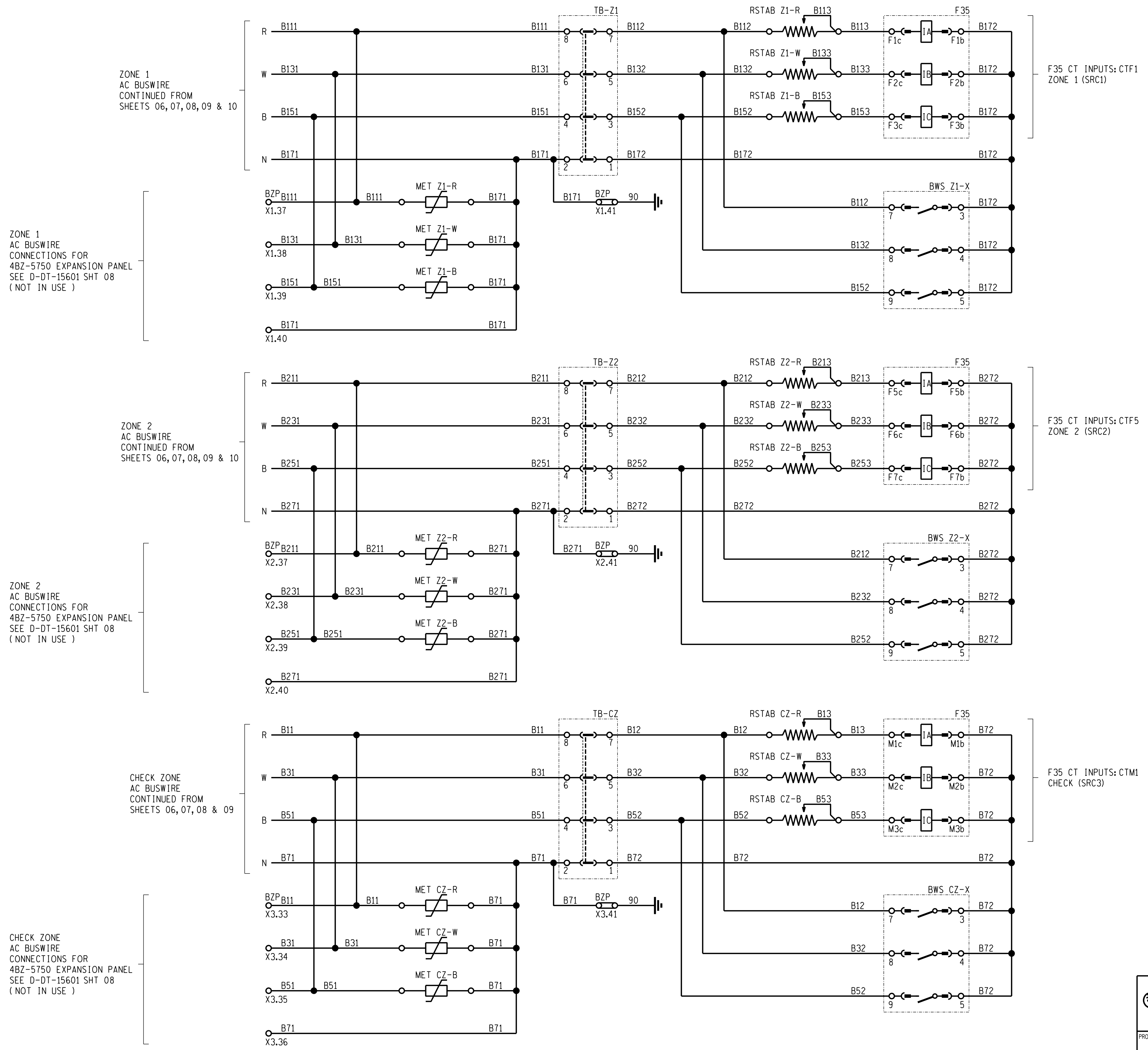
SET	SHEET	REVISION
50	10	00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 10 OF 23 REVISION 2.1



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA — DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS — DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG — DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL — DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING — DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL — DATE: 13/07/2007
SCALE :

AECOM

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC KEY DIAGRAM

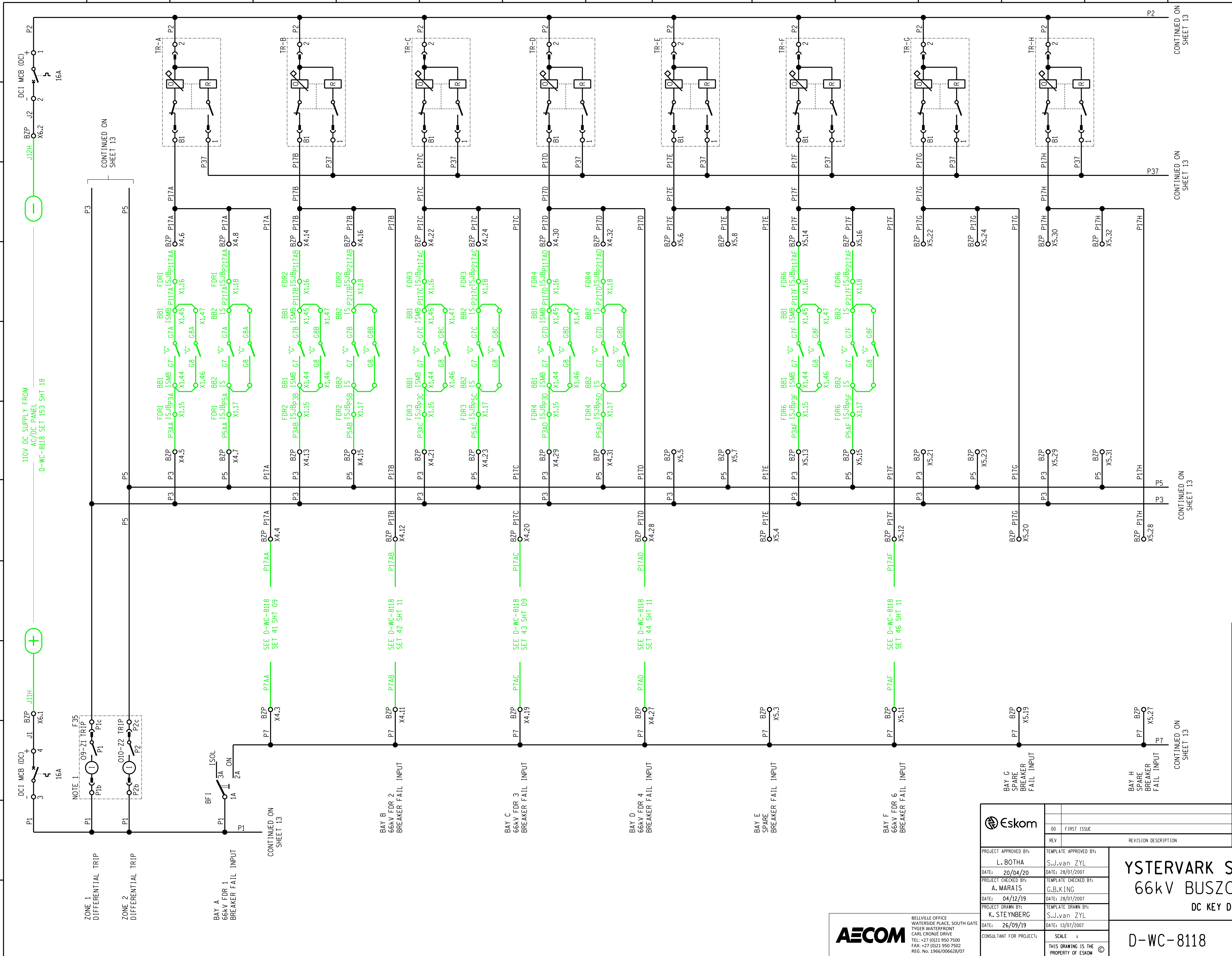
SET	SHEET	REVISION
50	11	00

D-WC-8118

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L



SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET
DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

Eskom

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :
	THIS DRAWING IS THE PROPERTY OF ESKOM ©

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
DC KEY DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	50	12	00

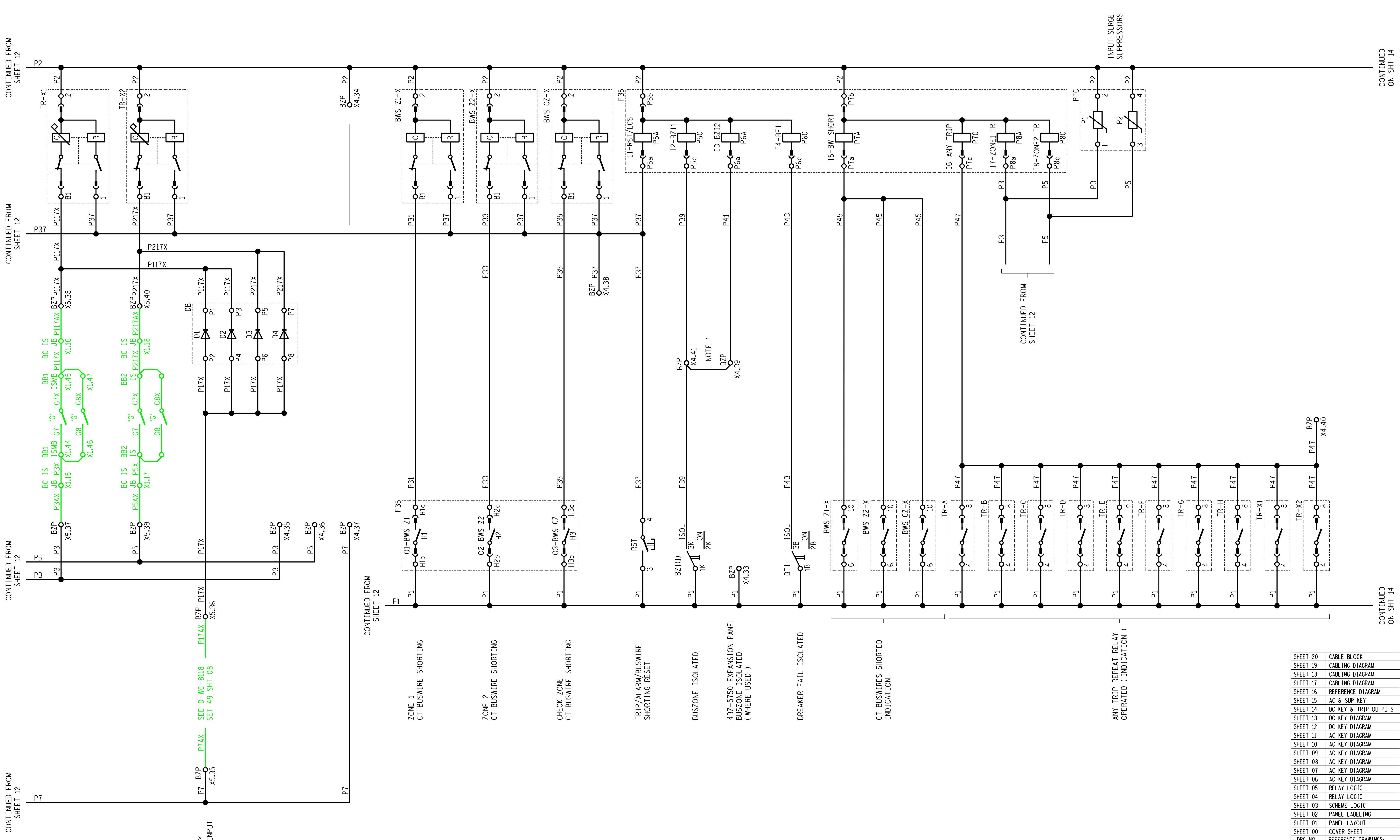
AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 12 OF 23 REVISION 2.1



NOTE:

1. BRIDGE X4.39 AND X4.41 WHEN NOT USING A 4BZ-5750 EXPANSION PANEL.

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

AECOM

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

PROJECT APPROVED BY: L. BOTHA — DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS — DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG — DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL — DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING — DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL — DATE: 13/07/2007
SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM ©

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
DC KEY DIAGRAM

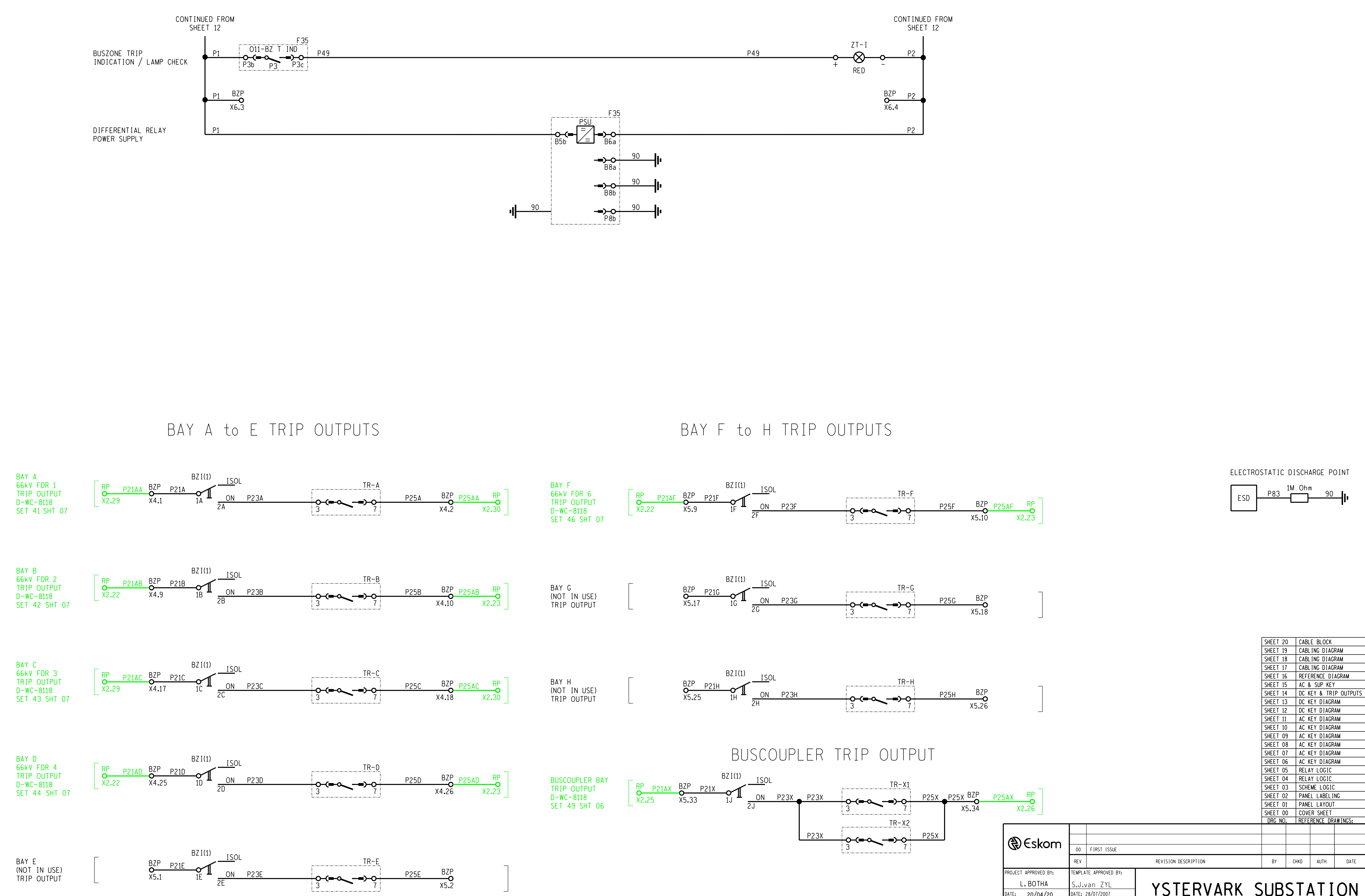
D-WC-8118	SET	SHEET	REVISION
	50	13	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 13 OF 23 REVISION 2.1

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM ©

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
DC KEY & TRIP OUTPUTS DIAGRAM

D-WC-8118

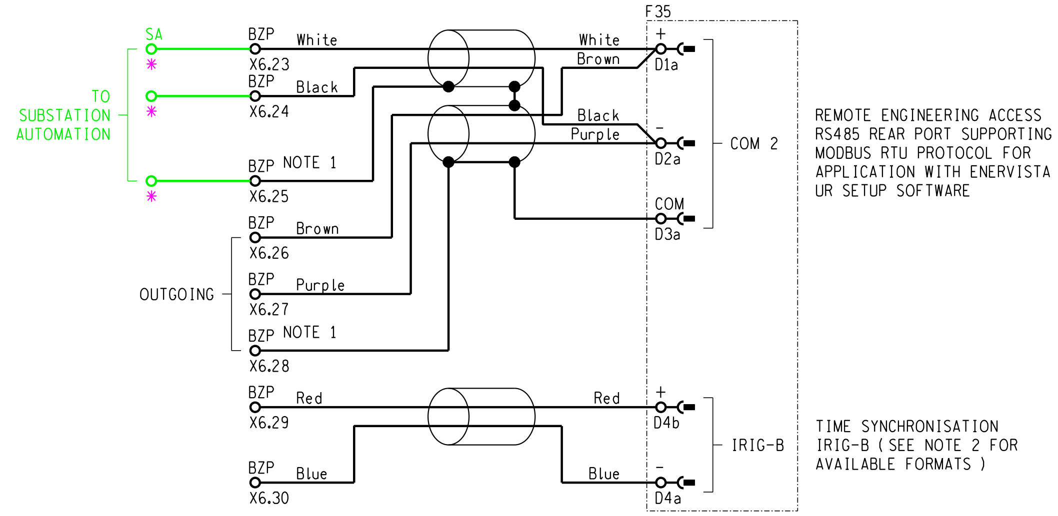
SET	SHEET	REVISION
50	14	00

LEVELS 1 5 10 15

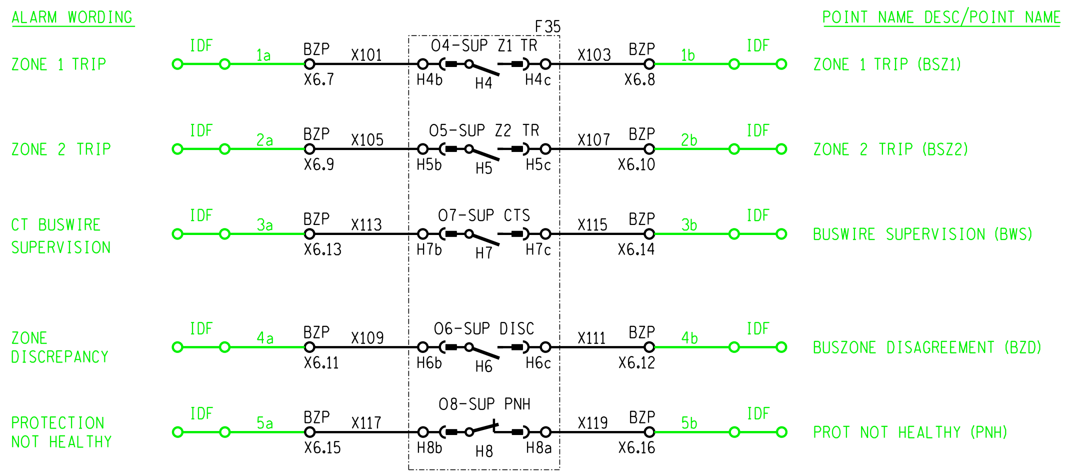
PANEL TYPE DESIGNATION 4BZ-5700

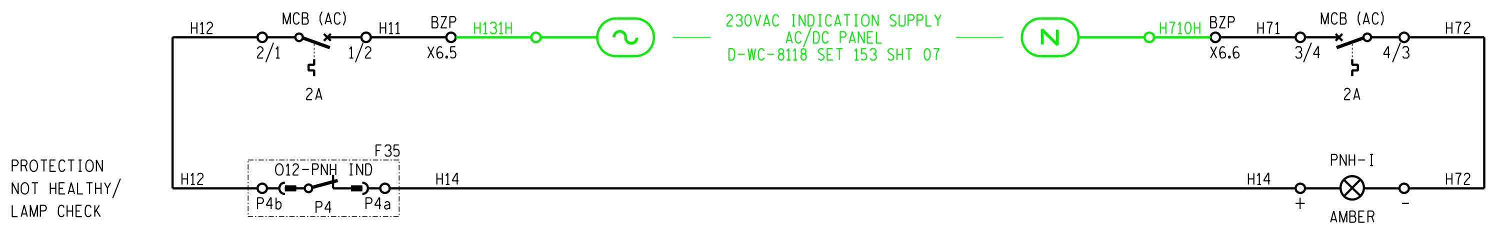
A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 14 OF 23 REVISION 2.1

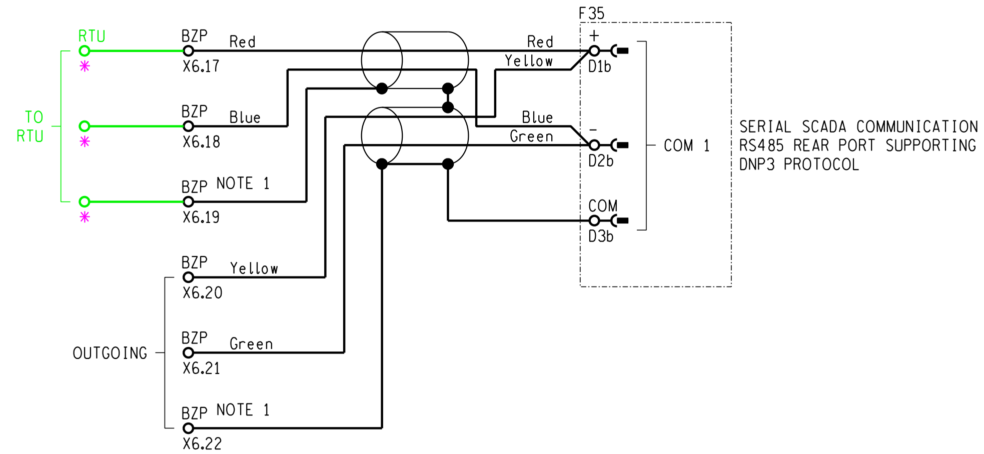


SUPERVISORY ALARMS





SERIAL INTERFACE AND TIME SYNCHRONISATION



NOTE:

1. RS485 COMMUNICATION CIRCUIT SCREENS TO BE CONNECTED TOGETHER AND EARTHED AT THE MASTER UNIT (SINGLE POINT).
2. IRIG-B TIME CODE FORMATS AVAILABLE VIA SETTINGS:

DC SHIFT: B021✱ or B022
AMPLITUDE MODULATED: B121✱ or B122
(✱ CONTROL FUNCTIONS IGNORED)

SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET
DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
AC & SUPERVISORY KEY DIAGRAM

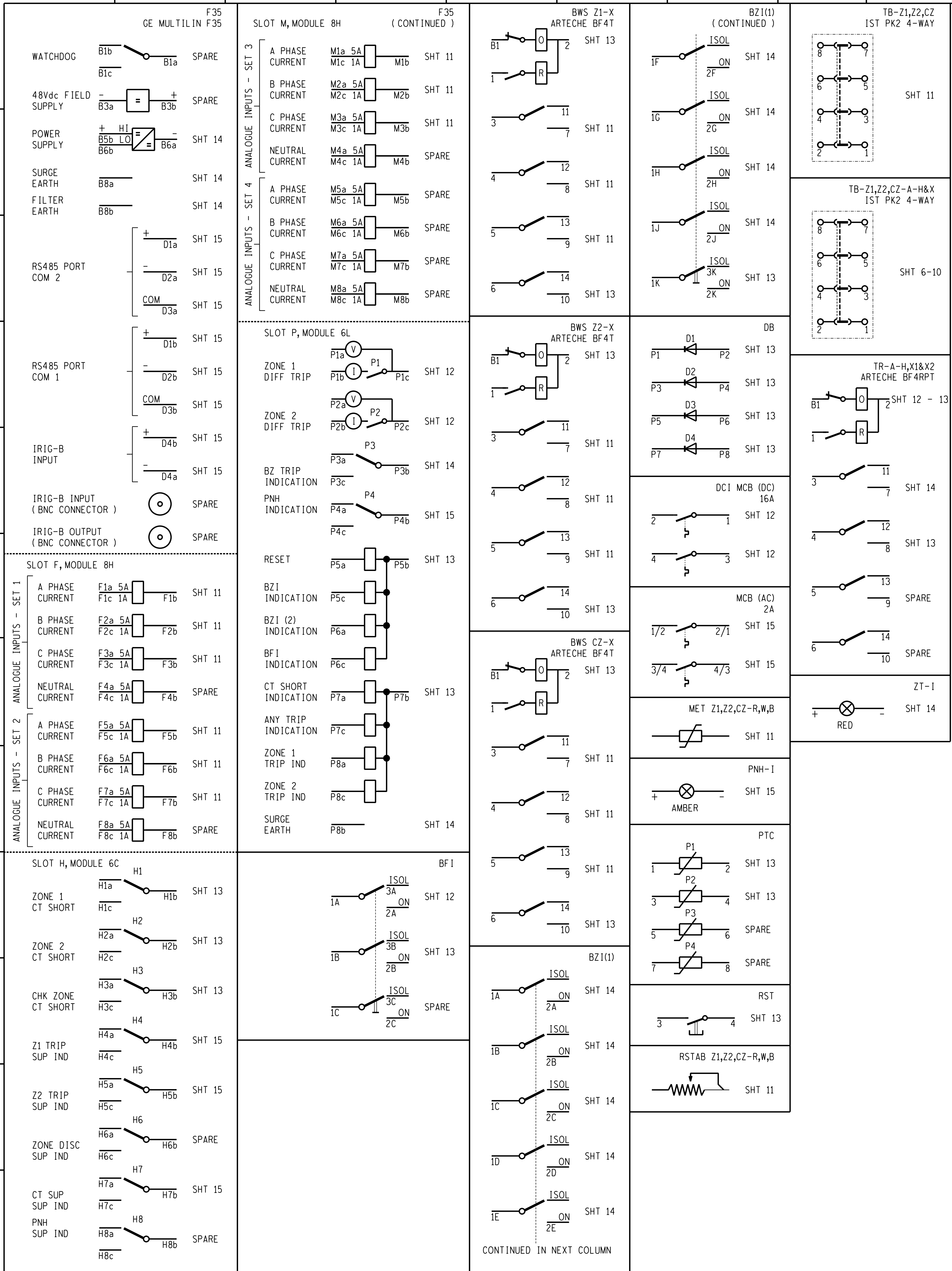
D-WC-8118

SET	SHEET	REVISION
50	15	00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
PROTECTION REFERENCE DIAGRAM

DRG	SET	SHEET	REVISION
D-WC-8118	50	16	00

LEVELS 1 5 10

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 16 OF 23 REVISION 2.1

ZONE 1 CT INPUTS

X1

Group	Lead	Terminal	Core	AA121	AB121	AC121	AD121	AF121	AX121
CT BUSWIRE EXT.	B171	41	90						
	B171	40							
	B151	39							
	B131	38							
	B111	37							
BUS COUPLER BAY	B171X	36	B171AX						46
	B151X	35	B151AX						45
	B131X	34	B131AX						44
	B111X	33	B111AX						43
BAY H	B171H	32							
	B151H	31							
	B131H	30							
	B111H	29							
BAY G	B171G	28							
	B151G	27							
	B131G	26							
	B111G	25							
BAY F	B171F	24	B171AF					X1.7	
	B151F	23	B151AF					X1.6	
	B131F	22	B131AF					X1.4	
	B111F	21	B111AF					X1.2	
BAY E	B171E	20							
	B151E	19							
	B131E	18							
	B111E	17							
BAY D	B171D	16	B171AD				X1.7		
	B151D	15	B151AD				X1.6		
	B131D	14	B131AD				X1.4		
	B111D	13	B111AD				X1.2		
BAY C	B171C	12	B171AC			X1.7			
	B151C	11	B151AC			X1.6			
	B131C	10	B131AC			X1.4			
	B111C	9	B111AC			X1.2			
BAY B	B171B	8	B171AB		X1.7				
	B151B	7	B151AB		X1.6				
	B131B	6	B131AB		X1.4				
	B111B	5	B111AB		X1.2				
BAY A	B171A	4	B171AA	X1.7					
	B151A	3	B151AA	X1.6					
	B131A	2	B131AA	X1.4					
	B111A	1	B111AA	X1.2					

CABLE NUMBER	AA121	AB121	AC121	AD121	AF121	AX121
CABLE SIZE	12	12	12	12	12	4
NUMBER OF SPARES	4	4	4	4	4	-
DESTINATION	66kV FEEDER 1 ISOLATOR JUNCTION BOX	66kV FEEDER 2 ISOLATOR JUNCTION BOX	66kV FEEDER 3 ISOLATOR JUNCTION BOX	66kV FEEDER 4 ISOLATOR JUNCTION BOX	66kV FEEDER 6 ISOLATOR JUNCTION BOX	66kV BUSBAR 2 CT JUNCTION BOX

ZONE 2 CT INPUTS

X2

Group	Lead	Terminal	Core	AA121	AB121	AC121	AD121	AF121	AX122
CT BUSWIRE EXT.	B271	41	90						
	B271	40							
	B251	39							
	B231	38							
	B211	37							
BUS COUPLER BAY	B271X	36	B271AX						46
	B251X	35	B251AX						45
	B231X	34	B231AX						44
	B211X	33	B211AX						43
BAY H	B271H	32							
	B251H	31							
	B231H	30							
	B211H	29							
BAY G	B271G	28							
	B251G	27							
	B231G	26							
	B211G	25							
BAY F	B271F	24	B271AF					X1.14	
	B251F	23	B251AF					X1.13	
	B231F	22	B231AF					X1.11	
	B211F	21	B211AF					X1.9	
BAY E	B271E	20							
	B251E	19							
	B231E	18							
	B211E	17							
BAY D	B271D	16	B271AD				X1.14		
	B251D	15	B251AD				X1.13		
	B231D	14	B231AD				X1.11		
	B211D	13	B211AD				X1.9		
BAY C	B271C	12	B271AC			X1.14			
	B251C	11	B251AC			X1.13			
	B231C	10	B231AC			X1.11			
	B211C	9	B211AC			X1.9			
BAY B	B271B	8	B271AB		X1.14				
	B251B	7	B251AB		X1.13				
	B231B	6	B231AB		X1.11				
	B211B	5	B211AB		X1.9				
BAY A	B271A	4	B271AA	X1.14					
	B251A	3	B251AA	X1.13					
	B231A	2	B231AA	X1.11					
	B211A	1	B211AA	X1.9					

CABLE NUMBER	AA121	AB121	AC121	AD121	AF121	AX122
CABLE SIZE	12	12	12	12	12	4
NUMBER OF SPARES	4	4	4	4	4	-
DESTINATION	66kV FEEDER 1 ISOLATOR JUNCTION BOX	66kV FEEDER 2 ISOLATOR JUNCTION BOX	66kV FEEDER 3 ISOLATOR JUNCTION BOX	66kV FEEDER 4 ISOLATOR JUNCTION BOX	66kV FEEDER 6 ISOLATOR JUNCTION BOX	66kV BUSBAR 1 CT JUNCTION BOX

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 INDICATES NO CHANGE IN LEAD NUMBER.
   P7 P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA — DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS — DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG — DATE: 26/09/19
CONSULTANT FOR PROJECT:

TEMPLATE APPROVED BY: S.J.van ZYL — DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING — DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL — DATE: 13/07/2007
SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
PANEL CABLING DIAGRAM

D-WC-8118 | SET 50 | SHEET 17 | REVISION 00

LEVELS 1 5 10 15

PANEL TYPE DESIGNATION 4BZ-5700

A1L

CHECK ZONE CT INPUTS

Group	Lead	X3	Lead	AA119	AB119	AC119	AD119	AF119
	B71	41	90					
	SPARE	40						
	SPARE	39						
	SPARE	38						
	SPARE	37						
CT BUSWIRE EXT.	B71	36						
	B51	35						
	B31	34						
	B11	33						
BAY H	B71H	32						
	B51H	31						
	B31H	30						
	B11H	29						
BAY G	B71G	28						
	B51G	27						
	B31G	26						
	B11G	25						
BAY F	B71F	24	B71AF					X1.17
	B51F	23	B51AF					X1.18
	B31F	22	B31AF					X1.19
	B11F	21	B11AF					X1.20
BAY E	B71E	20						
	B51E	19						
	B31E	18						
	B11E	17						
BAY D	B71D	16	B71AD				X1.9	
	B51D	15	B51AD				X1.10	
	B31D	14	B31AD				X1.11	
	B11D	13	B11AD				X1.12	
BAY C	B71C	12	B71AC			52		
	B51C	11	B51AC			51		
	B31C	10	B31AC			50		
	B11C	9	B11AC			49		
BAY B	B71B	8	B71AB		X1.8			
	B51B	7	B51AB		X1.7			
	B31B	6	B31AB		X1.6			
	B11B	5	B11AB		X1.5			
BAY A	B71A	4	B71AA	52				
	B51A	3	B51AA	51				
	B31A	2	B31AA	50				
	B11A	1	B11AA	49				
	CABLE NUMBER			AA119	AB119	AC119	AD119	AF119
	CABLE SIZE			4	4	4	4	4
	NUMBER OF SPARES			-	-	-	-	-
	DESTINATION			66kV FEEDER 1 CT JUNCTION BOX	CUSTOMER INTERFACE JUNCTION BOX	66kV FEEDER 3 CT JUNCTION BOX	CUSTOMER INTERFACE JUNCTION BOX	CUSTOMER INTERFACE JUNCTION BOX

TRIP OUTPUTS, BREAKER FAIL INPUTS & ZONE SELECTION - BAYS A to D

Group	Lead	X4	Lead	AA117	AB117	AC117	AD117		AA121	AB121	AC121	AD
	P39	41										
4BZ-5950 DC BUSWIRE	P47	40	NOTE 5									
	P41	39										
	P37	38										
	P7	37										
	P5	36										
	P3	35										
	P2	34										
	P1	33										
BAY D	P17D	32	P217AD									X1.18
	P5	31	P5AD									X1.17
	P17D	30	P117AD									X1.16
	P3	29	P3AD									X1.15
	P17D	28	P17AD				X4.24					
	P7	27	P7AD				X4.23					
	P25D	26	P25AD				X2.23					
	P21D	25	P21AD				X2.22					
BAY C	P17C	24	P217AC								X1.18	
	P5	23	P5AC								X1.17	
	P17C	22	P117AC								X1.16	
	P3	21	P3AC								X1.15	
	P17C	20	P17AC			X4.28						
	P7	19	P7AC			X4.27						
	P25C	18	P25AC			X2.30						
	P21C	17	P21AC			X2.29						
BAY B	P17B	16	P217AB							X1.18		
	P5	15	P5AB							X1.17		
	P17B	14	P117AB							X1.16		
	P3	13	P3AB							X1.15		
	P17B	12	P17AB		X4.24							
	P7	11	P7AB		X4.23							
	P25B	10	P25AB		X2.23							
	P21B	9	P21AB		X2.22							
BAY A	P17A	8	P217AA						X1.18			
	P5	7	P5AA						X1.17			
	P17A	6	P117AA						X1.16			
	P3	5	P3AA						X1.15			
	P17A	4	P17AA	X4.28								
	P7	3	P7AA	X4.27								
	P25A	2	P25AA	X2.30								
	P21A	1	P21AA	X2.29								
	CABLE NUMBER			AA117	AB117	AC117	AD117		AA121	AB121	AC121	AD
	CABLE SIZE			4	4	4	4		12	12	12	12
	NUMBER OF SPARES			-	-	-	-		-	-	-	-
	DESTINATION			66kV FEEDER 1 RELAY PANEL	66kV FEEDER 2 RELAY PANEL	66kV FEEDER 3 RELAY PANEL	66kV FEEDER 4 RELAY PANEL		66kV FEEDER 1 BUSBAR ISOLATOR JUNCTION BOX	66kV FEEDER 2 BUSBAR ISOLATOR JUNCTION BOX	66kV FEEDER 3 BUSBAR ISOLATOR JUNCTION BOX	66kV FEEDER 4 BUSBAR ISOLATOR JUNCTION BOX

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 INDICATES NO CHANGE IN LEAD NUMBER.
   P7 P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

   STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
   D6/8-ST-RS ENTRELEC SLIDING LINK TEST TERMINAL
5. REMOVE BRIDGE BETWEEN X4.39 AND X4.41 WHEN A 4BZ-5750 EXPANSION PANEL IS USED.

SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET
DRG NO.	REFERENCE DRAWINGS:

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
CONSULTANT FOR PROJECT:
SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
PANEL CABLING DIAGRAM

D-WC-8118 SET 50 SHEET 18 REVISION 00

LEVELS 1 5 10 15

PANEL TYPE DESIGNATION 4BZ-5700

A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 18 OF 23 REVISION 2.1

TRIP OUTPUTS, BREAKER FAIL INPUTS & ZONE SELECTION - BAYS E to H & X

		X5						
BAY X	P217X	40	P217AX					X1.18
	P5	39	P5AX					X1.17
	P117X	38	P117AX					X1.16
	P3	37	P3AX					X1.15
	P17X	36	P17AX				X5.36	
	P7	35	P7AX				X5.35	
	P25X	34	P25AX				X2.26	
	P21X	33	P21AX				X2.25	
BAY H	P17H	32						
	P5	31						
	P17H	30						
	P3	29						
	P17H	28						
	P7	27						
	P25H	26						
	P21H	25						
BAY G	P17G	24						
	P5	23						
	P17G	22						
	P3	21						
	P17G	20						
	P7	19						
	P25G	18						
	P21G	17						
BAY F	P17F	16	P217AF			X1.18		
	P5	15	P5AF			X1.17		
	P17F	14	P117AF			X1.16		
	P3	13	P3AF			X1.15		
	P17F	12	P17AF		X4.24			
	P7	11	P7AF		X4.23			
	P25F	10	P25AF		X2.23			
	P21F	9	P21AF		X2.22			
BAY E	P17E	8						
	P5	7						
	P17E	6						
	P3	5						
	P17E	4						
	P7	3						
	P25E	2						
	P21E	1						
	CABLE NUMBER				AF117	AF121	AX117	AX121
	CABLE SIZE				4	12	4	4
	NUMBER OF SPARES				-	-	-	-
	DESTINATION				66kV FEEDER 6 RELAY PANEL	66kV FEEDER 6 BUSBAR ISOLATOR JUNCTION BOX	66kV BUSCOUPLER RELAY PANEL	66kV BUSCOUPLER BUSBAR ISOLATOR JUNCTION BOX

AC & DC SUPPLIES, SUPERVISORY ALARMS, SERIAL COMMUNICATION & IRIG-B

		X6					
HARD-WIRED SUP ALARMS	X223	32	6b				
	X221	31	6a				
IRIG-B	Blue	30					
	Red	29					
RS485 ENGINEERING PORT	SCRN	28					
	Purpl	27					
	Brown	26					
	SCRN	25					
	Black	24					
	White	23					
RS485 SUPERVISORY PORT	SCRN	22					
	Green	21					
	Yell	20					
	SCRN	19					*
	Blue	18					*
	Red	17					*
HARD-WIRED SUPERVISORY ALARMS	X119	16	5b				
	X117	15	5a				
	X115	14	3b				
	X113	13	3a				
	X111	12	4b				
	X109	11	4a				
	X107	10	2b				
	X105	9	2a				
	X103	8	1b				
	X101	7	1a				
AC SUPPLY	H71	6	H710H	X4.N			
	H11	5	H131H	X4.16			
SPARE SUPPLY	P2	4	P2				
	P1	3	P1				
DC SUPPLY	J2	2	J12H	X8.20			
	J1	1	J11H	X8.19			
	CABLE NUMBER			42		56	
	CABLE SIZE			4		10Pr	
	NUMBER OF SPARES			-		4Pr	
	DESTINATION			AC/DC PANEL		INTERMEDIATE DISTRIBUTION FRAME (IDF)	RTU

NOTES:

1. (2) INDICATES TWO LEADS IN PARALLEL.
2. SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
3. LEAD NUMBERS SHOWN THUS
   P7 [ ] INDICATES NO CHANGE IN LEAD NUMBER.
   P7 [ ] P7A INDICATES CHANGE IN LEAD NUMBER.
4. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
● D2.5/5.SN.ADO ENTRELEC INSULATION DISPLACEMENT TERMINAL WITH DISCONNECTOR
⊗ M4/6.RS ENTRELEC SPRING LOADED TERMINAL

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

Eskom

PROJECT APPROVED BY: L. BOTHA DATE: 20/04/20
PROJECT CHECKED BY: A. MARAIS DATE: 04/12/19
PROJECT DRAWN BY: K. STEYNBERG DATE: 26/09/19
CONSULTANT FOR PROJECT:
TEMPLATE APPROVED BY: S.J.van ZYL DATE: 28/07/2007
TEMPLATE CHECKED BY: G.B.KING DATE: 28/07/2007
TEMPLATE DRAWN BY: S.J.van ZYL DATE: 13/07/2007
SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
PANEL CABLING DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	50	19	00

MASTER TRACING FILED UNDER D-WC-8118 SHEET 19 OF 23 REVISION 2.1

LEVELS 1 5 10 15

(NOT USED)

SEE D-WC-8118 SET 159

NOTE:

1. A 12- OR 19-CORE CABLE MAY BE REQUIRED WHERE THE ASSOCIATED FEEDER/TRANSFORMER SCHEME ALSO REQUIRES ISOLATOR STATUS CONTACTS

DRG NO.	REFERENCE DRAWINGS:
SHEET 20	CABLE BLOCK
SHEET 19	CABLING DIAGRAM
SHEET 18	CABLING DIAGRAM
SHEET 17	CABLING DIAGRAM
SHEET 16	REFERENCE DIAGRAM
SHEET 15	AC & SUP KEY
SHEET 14	DC KEY & TRIP OUTPUTS
SHEET 13	DC KEY DIAGRAM
SHEET 12	DC KEY DIAGRAM
SHEET 11	AC KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 09	AC KEY DIAGRAM
SHEET 08	AC KEY DIAGRAM
SHEET 07	AC KEY DIAGRAM
SHEET 06	AC KEY DIAGRAM
SHEET 05	RELAY LOGIC
SHEET 04	RELAY LOGIC
SHEET 03	SCHEME LOGIC
SHEET 02	PANEL LABELING
SHEET 01	PANEL LAYOUT
SHEET 00	COVER SHEET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE
00	FIRST ISSUE				

BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

PROJECT APPROVED BY: L. BOTHA	TEMPLATE APPROVED BY: S.J.van ZYL
DATE: 20/04/20	DATE: 28/07/2007
PROJECT CHECKED BY: A. MARAIS	TEMPLATE CHECKED BY: G.B.KING
DATE: 04/12/19	DATE: 28/07/2007
PROJECT DRAWN BY: K. STEYNBERG	TEMPLATE DRAWN BY: S.J.van ZYL
DATE: 26/09/19	DATE: 13/07/2007
CONSULTANT FOR PROJECT:	SCALE :

YSTERVARK SUBSTATION
66kV BUSZONE PANEL
CABLE BLOCK

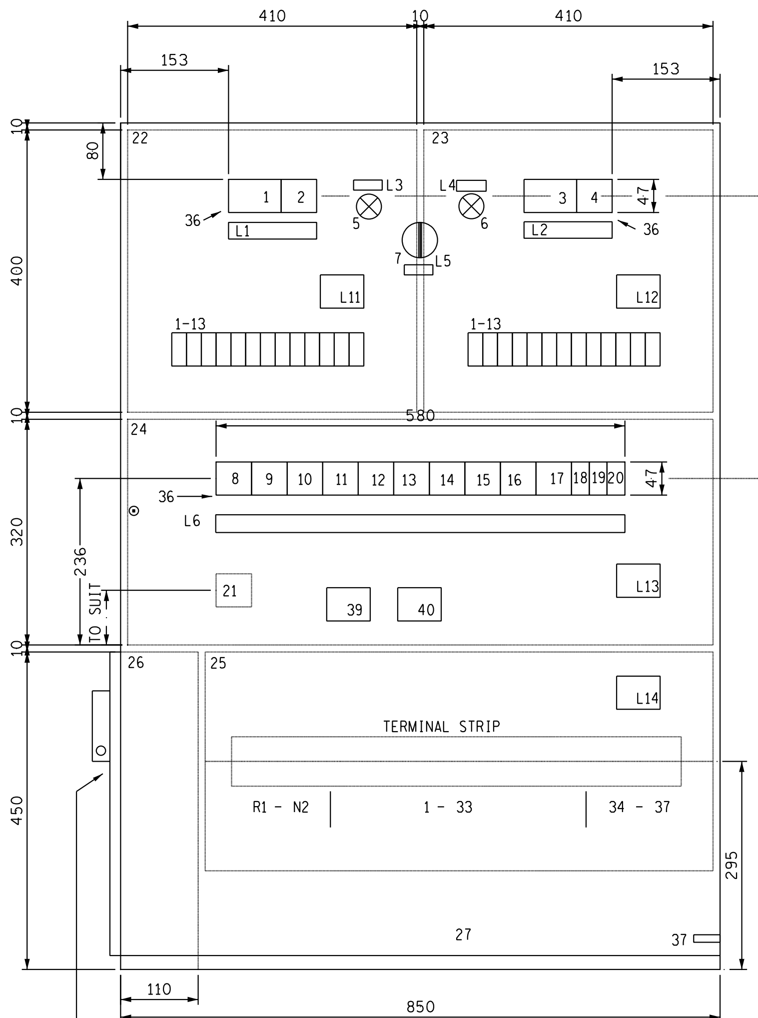
D-WC-8118	SET	SHEET	REVISION
	50	20	00

PANEL TYPE DESIGNATION 4BZ-5700

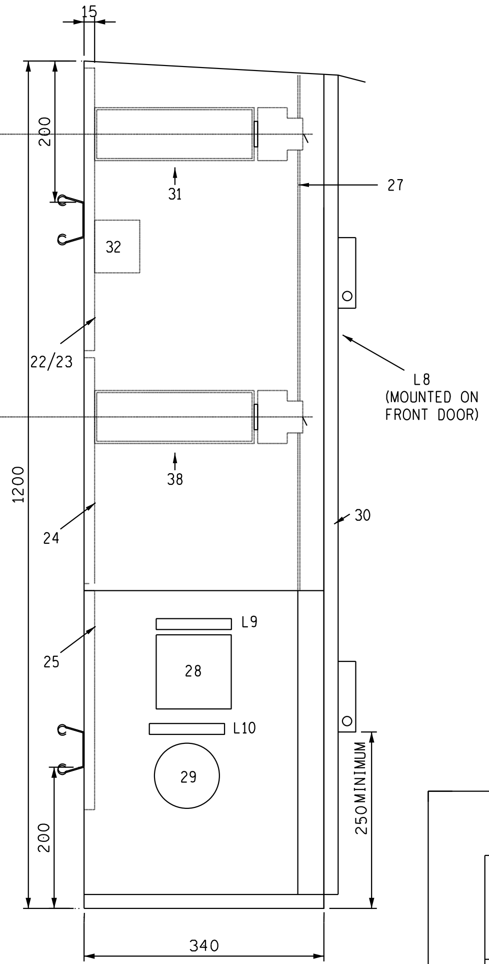
LEVELS 1 5 10

A1L

BVX4EC4



FRONT VIEW (INNER DOOR)
OF ENCLOSURE WITH
OUTER DOOR REMOVED



SIDE VIEW
OF ENCLOSURE

LABEL SCHEDULE			
NUMBER	DESCRIPTION	MINIMUM SIZE	
L1	SEE L/H SIDE	20x125	
L2	SEE L/H SIDE	20x125	
L3	SUPPLY 1	10x50	
L4	SUPPLY 2	10x50	
L5	SELECTOR SWITCH	10x50	
L6	SEE L/H SIDE	20x580	
L7	PLUG BOX	30x250	
L8	YARD AC DISTRIBUTION BOARD	50x450	
L9	ENERGISED BY EL	20x200	RED LABEL
L10	ENERGISED BY MCB(11)	20x200	RED LABEL
L11	X1	25x25	
L12	X2	25x25	
L13	X3	25x25	
L14	X4	25x25	

DESCRIPTION	SAP NO.	D-DT-BUYERS GUIDE
CONTROL MODULE (SINGLE)	0175655	9200 sht 1
CONTROL MODULE (DUAL)	0175656	9200 sht 1
DISTRIBUTION MODULE	0175658	9200 sht 2
TERMINATION MODULE	0175659	9200 sht 2

DESIGNATION	DESCRIPTION		LABEL
1	INCOMING SUPPLY 1 MCB	100 AMPS	ISO
2	CONTROL CIRCUIT MCB	5 AMPS	MCB(C)
3	INCOMING SUPPLY 2 MCB	100 AMPS	ISO
4	CONTROL CIRCUIT MCB	5 AMPS	MCB(C)
5	SUPPLY 1 SELECTED INDICATION LAMP - WHITE		
6	SUPPLY 2 SELECTED INDICATION LAMP - WHITE		
7	PREFERED SUPPLY SELECTOR SWITCH		SSS
8	3 PHASE AC SUPPLY MCB	60 AMPS	MCB-3
9	3 PHASE AC SUPPLY MCB	20 AMPS	MCB-4
10	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-5
11	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-6
12	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-7
13	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-8
14	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-9
15	3 PHASE AC SUPPLY MCB	32 AMPS	MCB-10
16	TEST SOCKET AC SUPPLY MCB	20 AMPS	MCB-11
17	1 PHASE AC OUTLET EARTH LEAKAGE UNIT	20 AMPS	EL
18	1 PHASE AC SUPPLY MCB	10 AMPS	MCB-12
19	1 PHASE AC SUPPLY MCB	10 AMPS	MCB-13
20	1 PHASE AC SUPPLY MCB	20 AMPS	MCB-14
21	CONTACTOR FOR FLOODLIGHT SUPPLIES		FCR
22	CONTROL MODULE 1 BACKPLATE		
23	CONTROL MODULE 2 BACKPLATE		
24	DISTRIBUTION MODULE BACKPLATE		
25	TERMINALS MODULE BACKPLATE		
26	PLUGBOX		
27	INNER DOOR		
28	1 PHASE SOCKET OUTLET		SS
29	3 PHASE SOCKET OUTLET		TS
30	OUTER DOOR		
31	STAND-OFF BRACKET FOR MCBs WITH DIN RAIL		
32	CONTACTOR		COC
33	PHASE FAIL RELAY		ACF
34	TIMER		ACFT
35	PHASE FAIL REPEAT RELAY		ACFR
36	MCB CUT OUTS IN INNER DOOR		
37	EARTH STUD		
38	STAND-OFF BRACKET (HANGER) FOR MCBs WITH DIN RAIL		
39	SURGE PROTECTION		
40	SURGE PROTECTION		

NOTES:

A) ENCLOSURE TO BE MANUFACTURED FROM 2mm 3CR12 STEEL PLATE AND EPOXY COATED IN COMPLIANCE WITH OF SANS 1091 CODE G29. COLOUR: POLE GREY HAMMER STRUCTURE

B) GLAND PLATES TO BE MANUFACTURED FROM 2mm 3CR12 STEEL PLATE AND BOLTED TO THE BOTTOM OF THE ENCLOSURE

C) BACK PLATES AND STAND-OFF BRACKETS TO BE MANUFACTURED FROM 1.6mm GALVANISED MILD STEEL PLATE AND SPRAY PAINTED WHITE

D) ALL WIRING SHALL COMPLY WITH THE "CODE OF PRACTICE FOR THE WIRING OF PREMISES", SANS 10142 AND ANY AMENDMENT THEREOF

E) PROVIDE THE OUTER DOOR WITH LOCKABLE DOOR HANDLES

F) PROVIDE THE INNER DOOR DOOR WITH ONE SQUARE KEY LOCK

G) PROVIDE A SLOT IN THE BOTTOM OF THE PLUG BOX ENABLING THE DOOR TO CLOSE WHEN AN EXTENSION LEAD IS USED

H) ALL OUTER AND INNER DOORS TO BE PROVIDED WITH DUST PROTECTION

I) PROVIDE THE OUTSIDE DOOR WITH A WARNING LABEL INDICATING THE DANGER OF ELECTRICAL SHOCK

J) PROVIDE AN EARTH STUD (ITEM 37) ON THE INSIDE OF THE ENCLOSURE (50mm M10 BRASS NUT)

K) ALL TERMINALS TO BE LABELLED AS INDICATED ON SHEET 4

L) ISOLATOR TERMINALS MUST BE SUITABLE FOR 25mm2 CONDUCTOR

M) ALL MCBs TO BE RATED AT 220V ϕ-N, 380V ϕ-ϕ CONTINUOUSLY

N) ALL MCBs TO COMPLY WITH IEC 947-2; C-CURVE; 5kA

O) MCBs TO PROTRUDE NOT MORE THAN 3mm TROUGH CUT-OUTS

P) SUITABLE LABEL POCKET TO BE PROVIDED INSIDE OF OUTER DOOR FOR DISTRIBUTION LEGEND

Q) WHEN OPTIONAL TERMINAL MODULE (#25) NOT SELECTED (USED): SUPPLY A LEAD TINTED NEUTRAL BUSBAR (35x500x3) IN ACCESSIBLE LOCATION AT BACK OF CUBICLE (BOTTOM). PROVIDE A MINIMUM OF 15 6.5mm ϕ TERMINATION POINTS FITTED WITH 25mm CHROME PLATED BOLTS, WITH FLAT- & SPRING WASHERS PLUS 2 NUTS PER BOLT. FIT A WASHING LINE (10mm ROUND BAR) BELOW MCB TERMINALS FOR EASE OF TERMINATING

R) STANDARD HOLE SIZES FOR ITEMS 5, 6 & 7

S) GROMETS TO BE FITTED IN HOLES OF ITEMS 5, 6 & 7 WHEN THE APPLICATION DOES NOT CALL FOR A CHANGE-OVER SYSTEM

L1/L2

ISO	MCB(C)

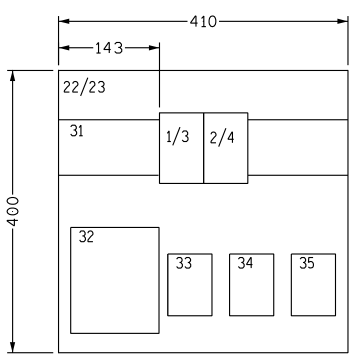
L6

MCB-3	MCB-4	MCB-5	MCB-6	MCB-7	MCB-8	MCB-9	MCB-10	MCB-11	EL	MCB-12	MCB-13	MCB-14

AC YARD DISTRIBUTION LEGEND

CIRCUIT	DESTINATION
MCB-3	AC/DC DISTIBUTION PANEL
MCB-4	YARD FLOODLIGHTS POLE 1
MCB-5	
MCB-6	
MCB-7	
MCB-8	
MCB-9	
MCB-10	YARD PLUG BOXES
MCB-11	3 PHASE TEST SOCKET
EL	1 PHASE SOCKET OUTLETS
MCB-12	FLOODLIGHT CONTROL & DAY/NIGHT SWITCH
MCB-13	
MCB-14	

NOTE: COPY TO BE MADE & PLACED INSIDE DOOR



FRONT VIEW
OF CONTROL MODULE 1 OR 2
EQUIPMENT PLATE

DRG No.	REFERENCE DRAWINGS:
SHT 01	EQUIPMENT LAYOUT
SHT 02	CONTROL MODULE
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 04	CABLING DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

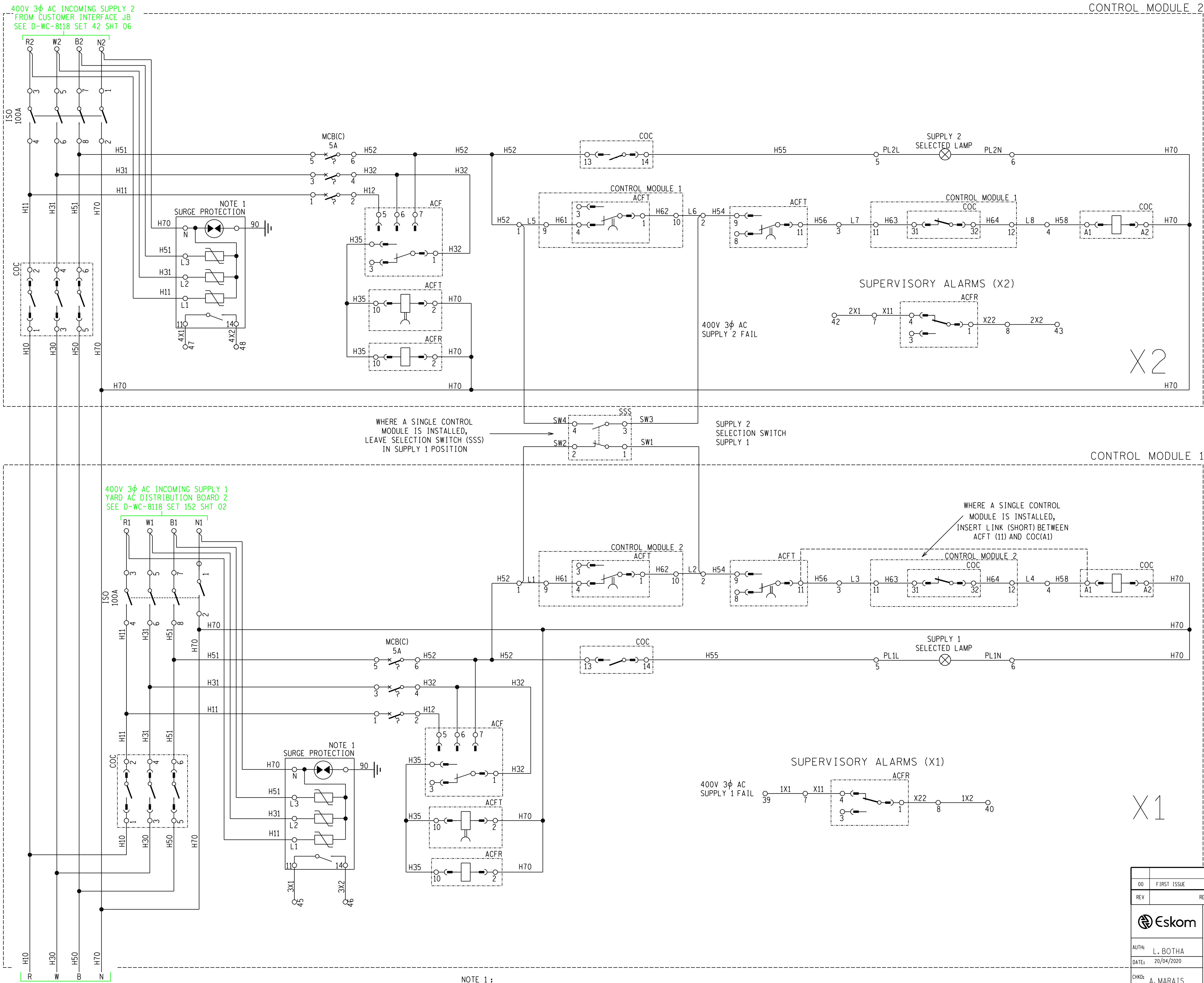
YSTERVARK SUBSTATION

YARD AC DISTRIBUTION BOARD 1
EQUIPMENT LAYOUT

D-WC-8118

SET	SHEET	REVISION
151	01	00

A1L



NOTE 1 :
DEHNGUARD TT 230/400 FM (900550) SURGE PROTECTION
ALARM CONTACTS CONNECTED TO TERMINALS 45 - 46.

ORIGIN	WIRE	X1	WIRE	DESTINATION
MCB(C)-6/ACF-7	H52	1	SW2	SSS-2
X1-1	L1	--	L1	X2-10
ACFT-9	H54	2	SW1	SSS-1
X1-2	L2	--	L2	X2-11
ACFT-11	H56	3	L3	X2-12
COC-A1	H58	4	L4	X2-13
COC-14	H55	5	PL1L	X1-PILOTLIGHT (LIVE)
COC-A2	H70	6	PL1N	X1-PILOTLIGHT (NEUTRAL)
ACFR-4	X11	7	1X1	X4-39
ACFR-1	X22	8	1X2	X4-40
ACFT-4	H61	9	L5	X2-1
ACFT-1	H62	10	L6	X2-2
COC-31	H63	11	L7	X2-3
COC-32	H64	12	L8	X2-4

ORIGIN	WIRE	X2	WIRE	DESTINATION
MCB(C)-6/ACF-7	H52	1	SW4	SSS-4
X2-1	L5	--	L5	X1-10
ACFT-9	H54	2	SW3	SSS-3
X2-2	L6	--	L6	X1-11
ACFT-11	H56	3	L7	X1-12
COC-A1	H58	4	L8	X1-13
COC-14	H55	5	PL2L	X2-PILOTLIGHT (LIVE)
COC-A2	H70	6	PL2N	X2-PILOTLIGHT (NEUTRAL)
ACFR-4	X11	7	2X1	X4-42
ACFR-1	X22	8	2X2	X4-43
ACFT-4	H61	9	L1	X1-1
ACFT-1	H62	10	L2	X1-2
COC-31	H63	11	L3	X1-3
COC-32	H64	12	L4	X1-4

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

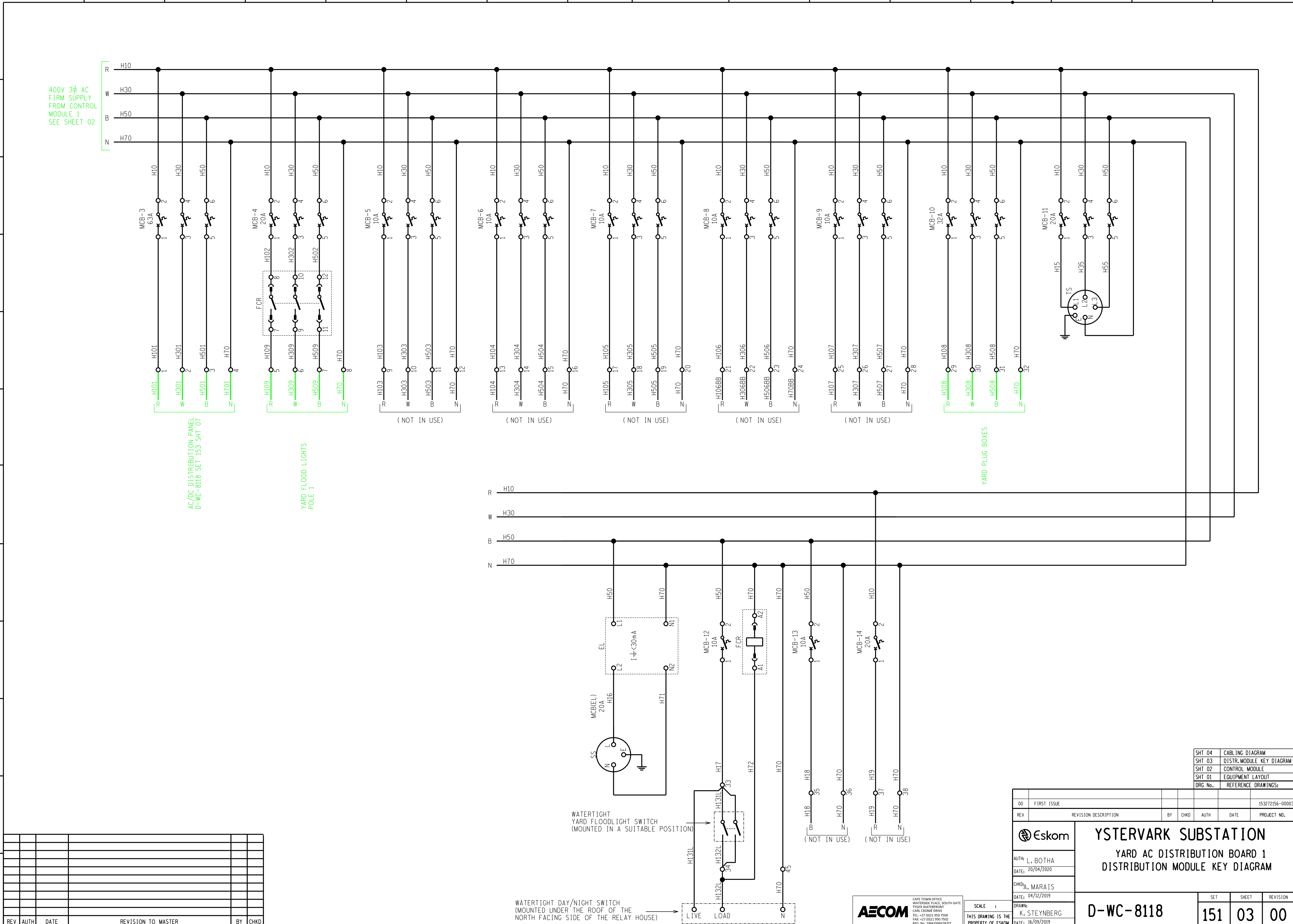
AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

YSTERVARK SUBSTATION
YARD AC DISTRIBUTION BOARD 1
CONTROL MODULE KEY DIAGRAM

D-WC-8118

SET	SHEET	REVISION
151	02	00

A1L



REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

YARD AC DISTRIBUTION BOARD 1
DISTRIBUTION MODULE KEY DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

AECOM

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

	SET	SHEET	REVISION
D-WC-8118	151	03	00

LEVELS 1 5 10 11

PANEL TYPE DESIGNATION

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 OF 04 REVISION 0

TERMINALS MODULE TERMINAL STRIP

						YARD PLUG BOX 1	YARD FLOOD LIGHTS POLE 1	AC/DC DISTRIBUTION PANEL	DESTINATION	Terminal	
								X4.1	H101	1	H101
								X4.2	H301	2	H301
								X4.3	H501	3	H501
								X4.4	H701	4	H70
							*		H109	5	H109
							*		H309	6	H309
							*		H509	7	H509
							*		H70	8	H70
										9	H103
										10	H303
										11	H503
										12	H70
										13	H104
										14	H304
										15	H504
										16	H70
										17	H105
										18	H305
										19	H505
										20	H70
										21	H106
										22	H306
										23	H506
										24	H70
										25	H107
										26	H307
										27	H507
										28	H70
						X1.1			H108	29	H108
						X1.2			H308	30	H308
						X1.3			H508	31	H508
						X1.4			H70	32	H70
										33	H17
										34	H72
										35	H18
										36	H70
										37	H19
										38	H70
										39	1X1
										40	1X2
										41	
										42	2X1
										43	2X2
										44	
										45	3X1
										46	3X2
										47	4X1
										48	4X2
										49	
-	-	-	-	-	-	-	-	-	NUMBER OF SPARES		
-	-	-	-	-	-	4	4	4	NUMBER OF CORES		
-	-	-	-	-	-	7	1	17	CABLE NUMBERS		

TO BE ADDED ON SITE (terminals 45–48)

* INDICATES CONNECTIONS ON FLOODLIGHT CONTROL SWITCH

CUSTOMER INTERFCE JB	YARD AC DISTRIBUTION BOARD 2					
	7	2H11	3	R1	4	1H11
	8	2H31	5	W1	6	1H31
	9	2H51	7	B1	8	1H51
	10	2H71	1	N1	2	H70
X2.8		H72AB	3	R2	4	2H11
X2.7		H52AB	5	W2	6	2H31
X2.6		H32AB	7	B2	8	2H51
X2.5		H12AB	1	N2	2	H70
-	-	NUMBER OF SPARES				
4	4	NUMBER OF CORES				
18	19	CABLE NUMBERS				

CONTROL MODULE 1 MCB(A) (terminals R1–N1)

CONTROL MODULE 2 MCB(B) (terminals R2–N2)

TERMINALS	
NUMBER	TYPE
1 - 4	M16/12
R1 - N1	M35/26EE
R2 - N2	M35/26EE
5-38	M6/8
39-44	M4/6

OR EQUIVALENT

NOTE: 1) ALL SPARE CABLE CORES TO BE EARTHED ON ONE END ONLY

2) 4 CORE 4mm² AC & DC SUPPLY CABLES: CORES TO BE ALLOCATED AS FOLLOWS: RED-LIVE, BLACK-NEUTRAL, YELLOW-110V POS, BLUE-110V NEG

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
YARD AC DISTRIBUTION BOARD 1
TERMINALS MODULE
CABLING DIAGRAM

AUTH: L. BOTHA DATE: 20/04/2020
CHKD: A. MARAIS DATE: 04/12/2019
DRAWN: K. STEYNBERG DATE: 16/09/2019

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

D-WC-8118

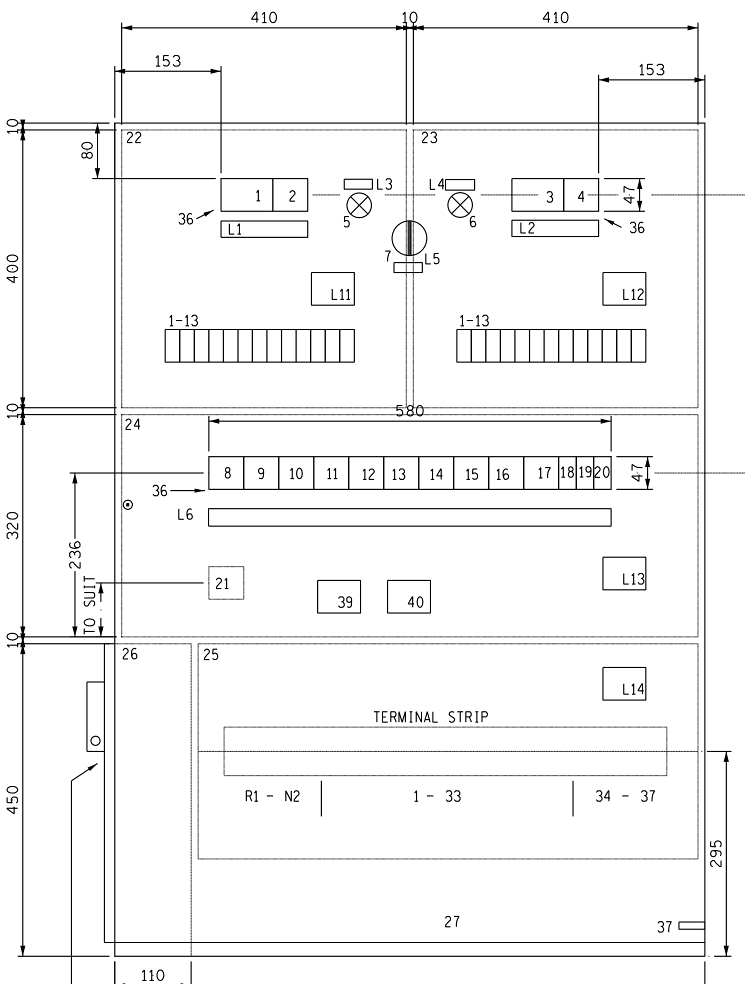
SET	SHEET	REVISION
151	04	00

LEVELS 1 10

PANEL TYPE DESIGNATION ________

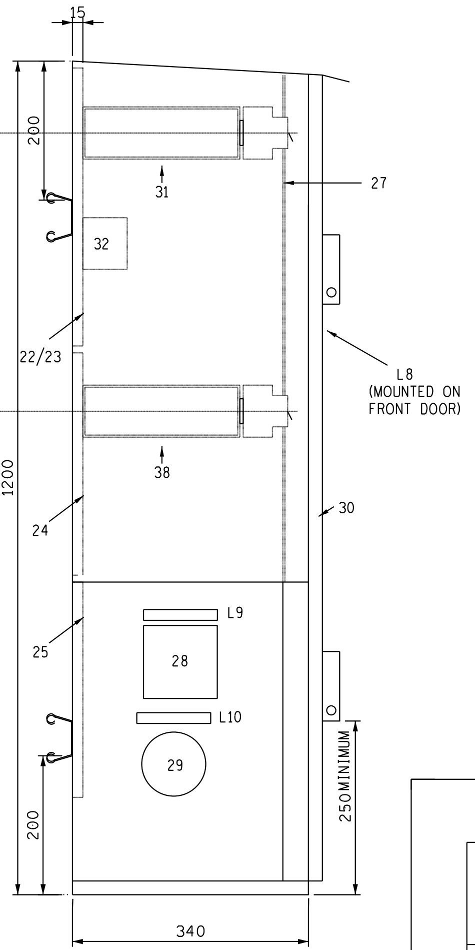
SIZE GROOTTE A2L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 04 OF 04 REVISION 0



SEE LABEL L7
ON SIDE OF DOOR

FRONT VIEW (INNER DOOR)
OF ENCLOSURE WITH
OUTER DOOR REMOVED



SIDE VIEW
OF ENCLOSURE

LABEL SCHEDULE			
NUMBER	DESCRIPTION	MINIMUM SIZE	
L1	SEE L/H SIDE	20x125	
L2	SEE L/H SIDE	20x125	
L3	SUPPLY 1	10x50	
L4	SUPPLY 2	10x50	
L5	SELECTOR SWITCH	10x50	
L6	SEE L/H SIDE	20x580	
L7	PLUG BOX	30x250	
L8	YARD AC DISTRIBUTION BOARD	50x450	
L9	ENERGISED BY EL	20x200	RED LABEL
L10	ENERGISED BY MCB(11)	20x200	RED LABEL
L11	X1	25x25	
L12	X2	25x25	
L13	X3	25x25	
L14	X4	25x25	

DESCRIPTION	SAP NO.	D-DT-BUYERS GUIDE
CONTROL MODULE (SINGLE)	0175655	9200 sht 1
CONTROL MODULE (DUAL)	0175656	9200 sht 1
DISTRIBUTION MODULE	0175658	9200 sht 2
TERMINATION MODULE	0175659	9200 sht 2

DESIGNATION	DESCRIPTION		LABEL
1	INCOMING SUPPLY 1 MCB	100 AMPS	ISO
2	CONTROL CIRCUIT MCB	5 AMPS	MCB(C)
3	INCOMING SUPPLY 2 MCB	100 AMPS	ISO
4	CONTROL CIRCUIT MCB	5 AMPS	MCB(C)
5	SUPPLY 1 SELECTED INDICATION LAMP - WHITE		
6	SUPPLY 2 SELECTED INDICATION LAMP - WHITE		
7	PREFERED SUPPLY SELECTOR SWITCH		SSS
8	3 PHASE AC SUPPLY MCB	60 AMPS	MCB-3
9	3 PHASE AC SUPPLY MCB	20 AMPS	MCB-4
10	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-5
11	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-6
12	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-7
13	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-8
14	3 PHASE AC SUPPLY MCB	10 AMPS	MCB-9
15	3 PHASE AC SUPPLY MCB	32 AMPS	MCB-10
16	TEST SOCKET AC SUPPLY MCB	20 AMPS	MCB-11
17	1 PHASE AC OUTLET EARTH LEAKAGE UNIT	20 AMPS	EL
18	1 PHASE AC SUPPLY MCB	10 AMPS	MCB-12
19	1 PHASE AC SUPPLY MCB	10 AMPS	MCB-13
20	1 PHASE AC SUPPLY MCB	20 AMPS	MCB-14
21	CONTACTOR FOR FLOODLIGHT SUPPLIES		FCR
22	CONTROL MODULE 1 BACKPLATE		
23	CONTROL MODULE 2 BACKPLATE		
24	DISTRIBUTION MODULE BACKPLATE		
25	TERMINALS MODULE BACKPLATE		
26	PLUGBOX		
27	INNER DOOR		
28	1 PHASE SOCKET OUTLET		SS
29	3 PHASE SOCKET OUTLET		TS
30	OUTER DOOR		
31	STAND-OFF BRACKET FOR MCBs WITH DIN RAIL		
32	CONTACTOR		COC
33	PHASE FAIL RELAY		ACF
34	TIMER		ACFT
35	PHASE FAIL REPEAT RELAY		ACFR
36	MCB CUT OUTS IN INNER DOOR		
37	EARTH STUD		
38	STAND-OFF BRACKET (HANGER) FOR MCBs WITH DIN RAIL		
39	SURGE PROTECTION		
40	SURGE PROTECTION		

NOTES:

A) ENCLOSURE TO BE MANUFACTURED FROM 2mm 3CR12 STEEL PLATE AND EPOXY COATED IN COMPLIANCE WITH OF SANS 1091 CODE G29. COLOUR: POLE GREY HAMMER STRUCTURE

B) GLAND PLATES TO BE MANUFACTURED FROM 2mm 3CR12 STEEL PLATE AND BOLTED TO THE BOTTOM OF THE ENCLOSURE

C) BACK PLATES AND STAND-OFF BRACKETS TO BE MANUFACTURED FROM 1.6mm GALVANISED MILD STEEL PLATE AND SPRAY PAINTED WHITE

D) ALL WIRING SHALL COMPLY WITH THE 'CODE OF PRACTICE FOR THE WIRING OF PREMISES', SANS 10142 AND ANY AMENDMENT THEREOF

E) PROVIDE THE OUTER DOOR WITH LOCKABLE DOOR HANDLES

F) PROVIDE THE INNER DOOR DOOR WITH ONE SQUARE KEY LOCK

G) PROVIDE A SLOT IN THE BOTTOM OF THE PLUG BOX ENABLING THE DOOR TO CLOSE WHEN AN EXTENSION LEAD IS USED

H) ALL OUTER AND INNER DOORS TO BE PROVIDED WITH DUST PROTECTION

I) PROVIDE THE OUTSIDE DOOR WITH A WARNING LABEL INDICATING THE DANGER OF ELECTRICAL SHOCK

J) PROVIDE AN EARTH STUD (ITEM 37) ON THE INSIDE OF THE ENCLOSURE (50mm M10 BRASS NUT)

K) ALL TERMINALS TO BE LABELLED AS INDICATED ON SHEET 4

L) ISOLATOR TERMINALS MUST BE SUITABLE FOR 25mm2 CONDUCTOR

M) ALL MCBs TO BE RATED AT 220V ϕ-N, 380V ϕ-ϕ CONTINUOUSLY

N) ALL MCBs TO COMPLY WITH IEC 947-2; C-CURVE; 5kA

O) MCBs TO PROTRUDE NOT MORE THAN 3mm TROUGH CUT-OUTS

P) SUITABLE LABEL POCKET TO BE PROVIDED INSIDE OF OUTER DOOR FOR DISTRIBUTION LEGEND

Q) WHEN OPTIONAL TERMINAL MODULE (#25) NOT SELECTED (USED): SUPPLY A LEAD TINTED NEUTRAL BUSBAR (35x500x3) IN ACCESSIBLE LOCATION AT BACK OF CUBICLE (BOTTOM). PROVIDE A MINIMUM OF 15 6.5mm ϕ TERMINATION POINTS FITTED WITH 25mm CHROME PLATED BOLTS, WITH FLAT- & SPRING WASHERS PLUS 2 NUTS PER BOLT. FIT A WASHING LINE (10mm ROUND BAR) BELOW MCB TERMINALS FOR EASE OF TERMINATING

R) STANDARD HOLE SIZES FOR ITEMS 5, 6 & 7

S) GROMETS TO BE FITTED IN HOLES OF ITEMS 5, 6 & 7 WHEN THE APPLICATION DOES NOT CALL FOR A CHANGE-OVER SYSTEM

L1/L2

ISO	MCB(C)

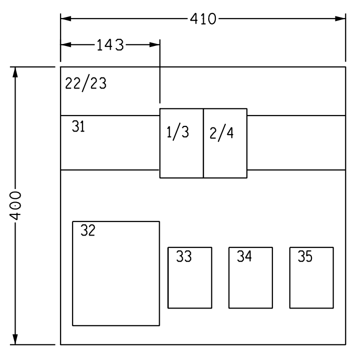
L6

MCB-3	MCB-4	MCB-5	MCB-6	MCB-7	MCB-8	MCB-9	MCB-10	MCB-11	EL	MCB-12	MCB-13	MCB-14

AC YARD DISTRIBUTION LEGEND

CIRCUIT	DESTINATION
MCB-3	YARD AC DISTRIBUTION BOARD 1
MCB-4	
MCB-5	
MCB-6	
MCB-7	
MCB-8	
MCB-9	
MCB-10	
MCB-11	3 PHASE TEST SOCKET
EL	1 PHASE SOCKET OUTLETS
MCB-12	FLOODLIGHT CONTROL & DAY/NIGHT SWITCH
MCB-13	
MCB-14	

NOTE: COPY TO BE MADE & PLACED INSIDE DOOR



FRONT VIEW
OF CONTROL MODULE 1 OR 2
EQUIPMENT PLATE

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

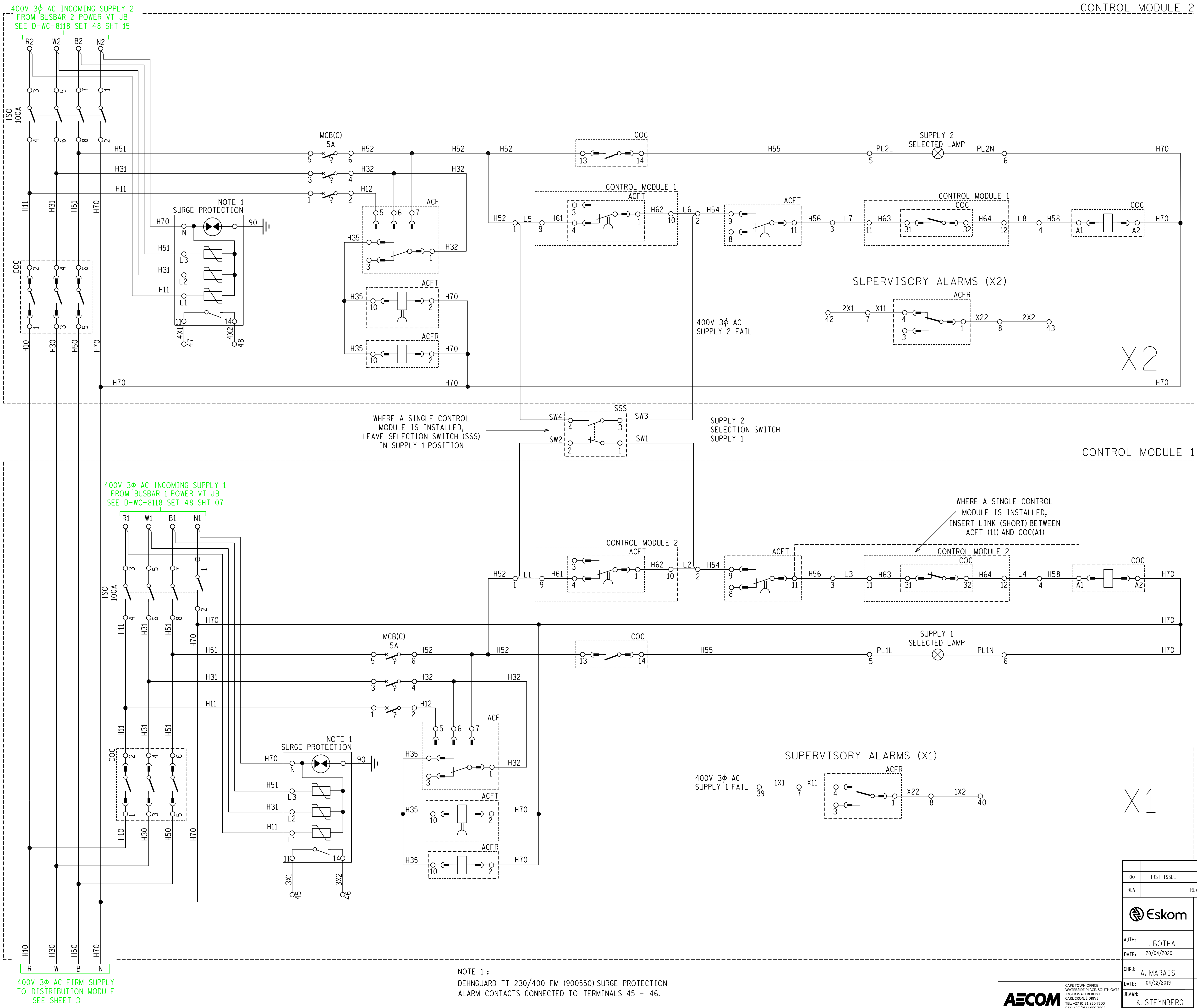
YSTERVARK SUBSTATION

YARD AC DISTRIBUTION BOARD 2
EQUIPMENT LAYOUT

D-WC-8118

SET	SHEET	REVISION
152	01	00

A4L



ORIGIN	WIRE	X1	WIRE	DESTINATION
MCB(C)-6/ACF-7	H52	1	SW2	SSS-2
X1-1	L1	--	L1	X2-10
ACFT-9	H54	2	SW1	SSS-1
X1-2	L2	--	L2	X2-11
ACFT-11	H56	3	L3	X2-12
COC-A1	H58	4	L4	X2-13
COC-14	H55	5	PL1L	X1-PILOTLIGHT (LIVE)
COC-A2	H70	6	PL1N	X1-PILOTLIGHT (NEUTRAL)
ACFR-4	X11	7	1X1	X4-39
ACFR-1	X22	8	1X2	X4-40
ACFT-4	H61	9	L5	X2-1
ACFT-1	H62	10	L6	X2-2
COC-31	H63	11	L7	X2-3
COC-32	H64	12	L8	X2-4

ORIGIN	WIRE	X2	WIRE	DESTINATION
MCB(C)-6/ACF-7	H52	1	SW4	SSS-4
X2-1	L5	--	L5	X1-10
ACFT-9	H54	2	SW3	SSS-3
X2-2	L6	--	L6	X1-11
ACFT-11	H56	3	L7	X1-12
COC-A1	H58	4	L8	X1-13
COC-14	H55	5	PL2L	X2-PILOTLIGHT (LIVE)
COC-A2	H70	6	PL2N	X2-PILOTLIGHT (NEUTRAL)
ACFR-4	X11	7	2X1	X4-42
ACFR-1	X22	8	2X2	X4-43
ACFT-4	H61	9	L1	X1-1
ACFT-1	H62	10	L2	X1-2
COC-31	H63	11	L3	X1-3
COC-32	H64	12	L4	X1-4

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

YSTERVARK SUBSTATION

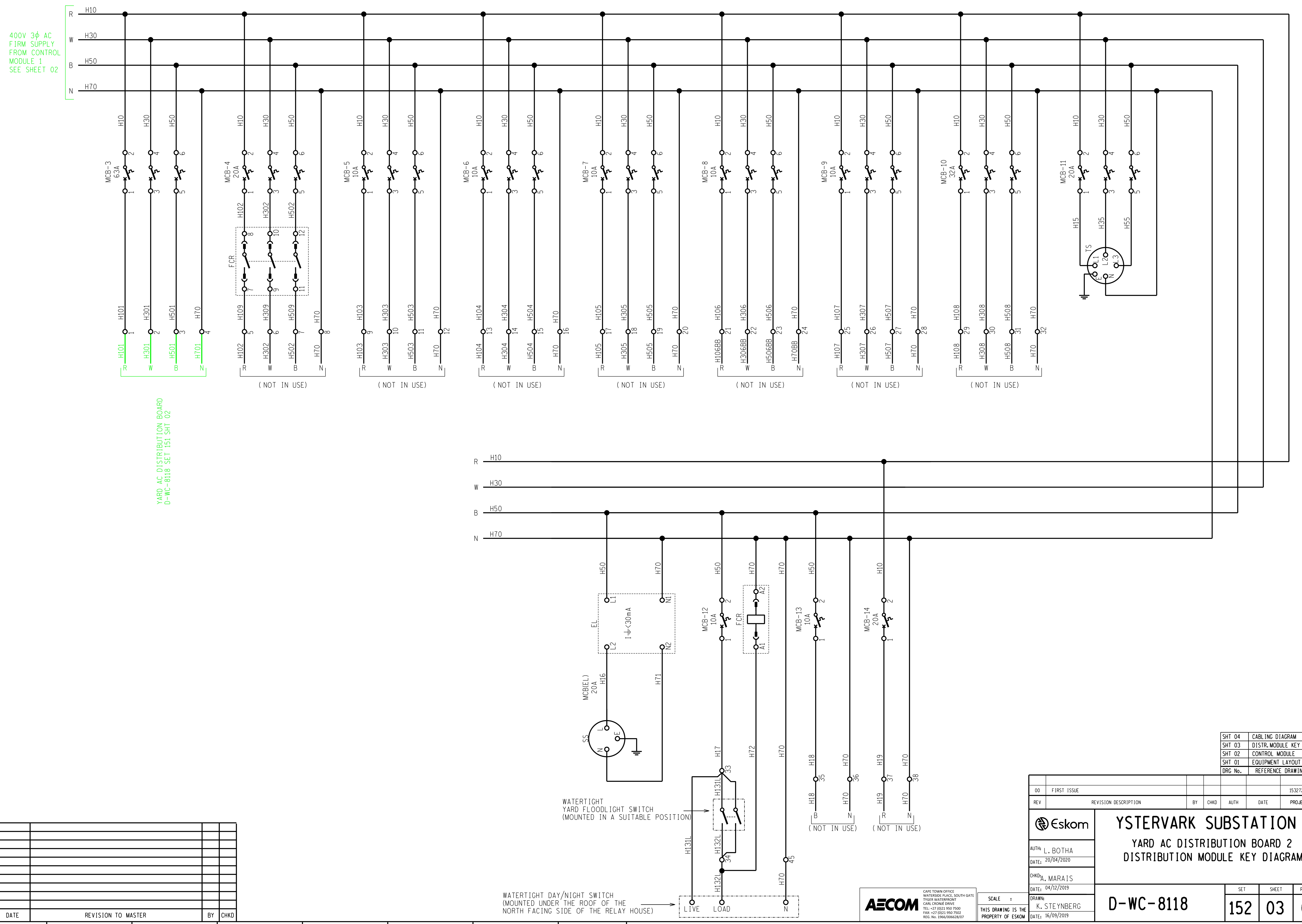
YARD AC DISTRIBUTION BOARD 2
CONTROL MODULE KEY DIAGRAM

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

D-WC-8118

SET	SHEET	REVISION
152	02	00

A1L



SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT
DRG No.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom

YSTERVARK SUBSTATION

YARD AC DISTRIBUTION BOARD 2
DISTRIBUTION MODULE KEY DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

AECOM

SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM

D-WC-8118

SET	SHEET	REVISION
152	03	00

LEVELS 1 5 10 11

PANEL TYPE DESIGNATION

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 03 OF 04 REVISION 0

Core	Wire	Terminal	Designation
1	H101	1	H101
2	H301	2	H301
3	H501	3	H501
4	H701	4	H70
		5	H109
		6	H309
		7	H509
		8	H70
		9	H103
		10	H303
		11	H503
		12	H70
		13	H104
		14	H304
		15	H504
		16	H70
		17	H105
		18	H305
		19	H505
		20	H70
		21	H106
		22	H306
		23	H506
		24	H70
		25	H107
		26	H307
		27	H507
		28	H70
		29	H108
		30	H308
		31	H508
		32	H70
		33	H17
		34	H72
		35	H18
		36	H70
		37	H19
		38	H70
		39	1X1
		40	1X2
		41	
		42	2X1
		43	2X2
		44	
		45	3X1
		46	3X2
		47	4X1
		48	4X2
		49	

TERMINALS MODULE
TERMINAL STRIP

(45–48) TO BE ADDED ON SITE

-	-	-	-	-	-	-	-	-	NUMBER OF SPARES	-	-
-	-	-	-	-	-	-	-	4	NUMBER OF CORES	4	4
-	-	-	-	-	-	-	-	19	CABLE NUMBERS	20	21
								YARD AC DISTRIBUTION BOARD 1	DESTINATION	BUSBAR 1 POWER VTJB	BUSBAR 2 POWER VTJB

CONTROL MODULE 1
MCB(A)

Cable 21 core	Wire	Terminal	MCB	Terminal	Designation
7	2H11	3	R1	4	1H11
8	2H31	5	W1	6	1H31
9	2H51	7	B1	8	1H51
10	2H71	1	N1	2	H70

CONTROL MODULE 2
MCB(B)

Cable 20 core	Wire	Terminal	MCB	Terminal	Designation
10	H72AB	3	R2	4	2H11
9	H52AB	5	W2	6	2H31
8	H32AB	7	B2	8	2H51
7	H12AB	1	N2	2	H70

TERMINALS	
NUMBER	TYPE
1 - 4	M16/12
R1 - N1	M35/26EE
R2 - N2	M35/26EE
5-38	M6/8
39-44	M4/6

OR EQUIVALENT

NOTE: 1) ALL SPARE CABLE CORES TO BE EARTHED ON ONE END ONLY

2) 4 CORE 4mm² AC & DC SUPPLY CABLES: CORES TO BE ALLOCATED AS FOLLOWS: RED-LIVE
BLACK-NEUTRAL
YELLOW-110V POS
BLUE-110V NEG

DRG No.	REFERENCE DRAWINGS:
SHT 04	CABLING DIAGRAM
SHT 03	DISTR. MODULE KEY DIAGRAM
SHT 02	CONTROL MODULE
SHT 01	EQUIPMENT LAYOUT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

* INDICATES CONNECTIONS ON FLOODLIGHT CONTROL SWITCH

Eskom

YSTERVARK SUBSTATION
YARD AC DISTRIBUTION BOARD 2
TERMINALS MODULE
CABLING DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 16/09/2019

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

D-WC-8118

SET	SHEET	REVISION
152	04	00

LEVELS 1 10

PANEL TYPE DESIGNATION ________

SIZE GROOTTE A2L

MASTER TRACING FILED UNDER D-WC-8118 SHEET 04 OF 04 REVISION 0

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGES
0	COVER SHEET	5	06/03/2017	COVER SHEET UPDATED
1	PANEL EQUIPMENT LAYOUT	5	06/03/2017	TERMINALS ADDED, LAYOUTS AND MODULE SIZES UPDATED
2	PANEL LABEL SCHEDULE	6	06/03/2017	LABELS UPDATED
3A	TERMINAL PLATE ARRANGEMENT	5	06/03/2017	TERMINALS ADDED TO X12, X13 CHANGED TO X15
3B	TERMINAL PLATE ARRANGEMENT	5	06/03/2017	TERMINALS ADDED TO X12, X13 CHANGED TO X15
4	MAIN AC INCOMING MODULE EQUIP L/O	5	06/03/2017	LABELS UPDATED
5	MAIN AC INCOMING MODULE KEY DIAG.	5	06/03/2017	DELAY-ON-DROP-OFF TIMER CHANGED TO DELAY-ON-PICK-UP TIMER, X13 CHANGED TO X15
6	400V AC DISTR MODULE EQUIP L/O	5	06/03/2017	LABELS UPDATED, NOTE ADDED
7	400V AC DISTR MODULE KEY DIAG.	4	09/07/2014	AS PER PREVIOUS REVISION
8	230V AC DISTR MODULE 1 EQUIP L/O	5	06/03/2017	LABELS UPDATED, NOTE ADDED
9	230V AC DISTR MODULE 1 KEY DIAG.	4	09/07/2014	AS PER PREVIOUS REVISION
10	230V AC DISTR MODULE 2 EQUIP L/O	5	06/03/2017	LABELS UPDATED, NOTE ADDED
11	230V AC DISTR MODULE 2 KEY DIAG.	4	09/07/2014	AS PER PREVIOUS REVISION
12	AC SUPPLY MODULE EQUIP L/O	6	06/03/2017	LABELS UPDATED
13	AC SUPPLY MODULE KEY DIAG.	5	09/07/2014	AS PER PREVIOUS REVISION
14	INTERFACE MODULE EQUIP L/O	5	06/03/2017	ADDED STANDBY TERMINALS AND AC/DC PANEL 2 MCB, LABELS UPDATED, BACKPLATE CHANGED FROM 4U TO 5U
15	INTERFACE MODULE KEY DIAG.	5	06/03/2017	ADDED STANDBY TERMINALS, AC/DC PANEL 2 MCB & NOTE 1, UPDATED PLUG LAYOUT, CHANGED BATT MCB TO ISOLATOR
16	110V DC DISTR MODULE 1 EQUIP L/O	5	06/03/2017	LABELS UPDATED, NOTE ADDED
17	110V DC DISTR MODULE 1 KEY DIAG.	4	09/07/2014	AS PER PREVIOUS REVISION
18	110V DC DISTR MODULE 2 EQUIP L/O	5	06/03/2017	LABELS UPDATED, NOTE ADDED
19	110V DC DISTR MODULE 2 KEY DIAG.	4	09/07/2014	AS PER PREVIOUS REVISION
20A	AC/DC PANEL CABLING DIAGRAM	5	06/03/2017	TERMINALS ADDED ON X12, X13 CHANGED TO X15
20B	AC/DC PANEL CABLING DIAGRAM	5	06/03/2017	TERMINALS ADDED ON X12, X13 CHANGED TO X15

DRAWING NUMBER	SET NUMBER	SHEET NUMBER	PROJECT SPECIFIC	REVISION	DATE	DESIGN CHANGES
D-WC-8118	153	00	COVER SHEET	0A	19/02/2020	NEW SHEET
D-WC-8118	153	01	PANEL EQUIPMENT LAYOUT	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	02	PANEL LABEL SCHEDULE	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	03	TERMINAL PLATE ARRANGEMENT	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	04	MAIN AC INCOMING MODULE EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	05	MAIN AC INCOMING MODULE KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	06	400V AC DISTR MODULE EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	07	400V AC DISTR MODULE KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	08	230V AC DISTR MODULE 1 EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	09	230V AC DISTR MODULE 1 KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	10	230V AC DISTR MODULE 2 EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	11	230V AC DISTR MODULE 2 KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	12	AC SUPPLY MODULE EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	13	AC SUPPLY MODULE KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218
D-WC-8118	153	14	110V/220V SUBRACK CHARGER BACKPLATE L/O	0B	19/02/2020	ADDED SHT 12 FROM D-DT-11352
D-WC-8118	153	15	110V/220V SUBRACK CHARGER AC & DC INTERCONN.	0B	19/02/2020	ADDED SHT 13 FROM D-DT-11352
D-WC-8118	153	16	110V/220V SUBRACK CHARGER ALARM & SUPERVISORY INTERCONN.	0B	19/02/2020	ADDED SHT 14 FROM D-DT-11352
D-WC-8118	153	17	INTERFACE MODULE EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 14
D-WC-8118	153	18	INTERFACE MODULE KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 15
D-WC-8118	153	19	110V DC DISTR MODULE 1 EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 16
D-WC-8118	153	20	110V DC DISTR MODULE 1 KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 17
D-WC-8118	153	21	110V DC DISTR MODULE 2 EQUIP L/O	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 18
D-WC-8118	153	22	110V DC DISTR MODULE 2 KEY DIAG.	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 19
D-WC-8118	153	23	AC/DC PANEL CABLING DIAGRAM	0B	19/02/2020	UPDATED TO LATEST REVISION OF D-DT-11218 SHT 20B

DRG NO.	REFERENCE DRAWINGS:
SHEET 23	AC/DC PANEL CABLING DIAGRAM
SHEET 22	110V DC DISTR. MODULE 2 KEY DIAGRAM
SHEET 21	110V DC DISTR. MODULE 2 EQUIP. L/O
SHEET 20	110V DC DISTR. MODULE 1 KEY DIAGRAM
SHEET 19	110V DC DISTR. MODULE 1 EQUIP. L/O
SHEET 18	INTERFACE MODULE KEY DIAGRAM
SHEET 17	INTERFACE MODULE EQUIP L/O
SHEET 16	110V/220V SUBRACK CHARGER ALARM & SUPERVISORY INTERCONN.
SHEET 15	110V/220V SUBRACK CHARGER AC & DC INTERCONN.
SHEET 14	110V/220V SUBRACK CHARGER BACKPLATE L/O
SHEET 13	AC SUPPLY MODULE KEY DIAGRAM
SHEET 12	AC SUPPLY MODULE EQUIP L/O
SHEET 11	230V AC DISTR. MODULE 2 KEY DIAGRAM
SHEET 10	230V AC DISTR. MODULE 2 EQUIP. L/O
SHEET 09	230V AC DISTR. MODULE 1 KEY DIAGRAM
SHEET 08	230V AC DISTR. MODULE 1 EQUIP. L/O
SHEET 07	400V AC DISTR. MODULE KEY DIAGRAM
SHEET 06	400V AC DISTR. MODULE EQUIP. L/O
SHEET 05	MAIN AC INCOMING MODULE KEY DIAGRAM
SHEET 04	MAIN AC INCOMING MODULE EQUIP L/O
SHEET 03	TERMINAL PLATE ARRANGEMENT
SHEET 02	PANEL LABEL SCHEDULE
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	COVER SHEET UPDATED	CvS	RV
4	T. JACOBS	09/07/2014	AS PER PREVIOUS REVISION	CvS	RV
3.0	T. JACOBS	11/12/2009	COVER SHEET ADDED	VvZ	T. JACOBS

PROJECT APPROVED L. BOTHA
DATE 20/04/2020
PROJECT CHECKED A. MARAIS
DATE 19/02/2020
DRAWN BY K STEYNBERG
DATE 19/02/2020
SCALE

Eskom
AUTH: T. JACOBS
DATE: /06/2002
CHKD: V. van ZWEEL
DATE: 24/07/2009
DRAWN: V. van ZWEEL
DATE: 24/07/2009

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
COVER SHEET

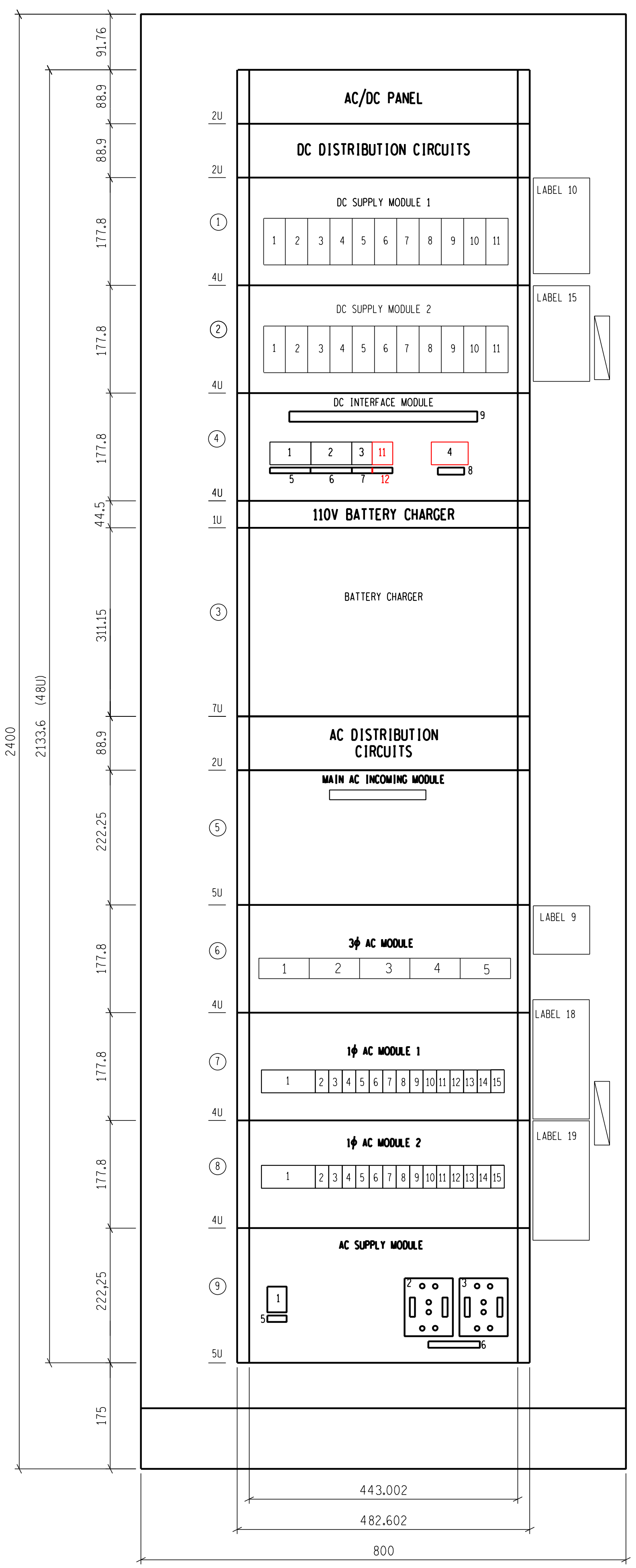
DRAWING	SET	SHEET	REVISION
D-WC-8118	153	00	00

PANEL TYPE DESIGNATION 2AD_303

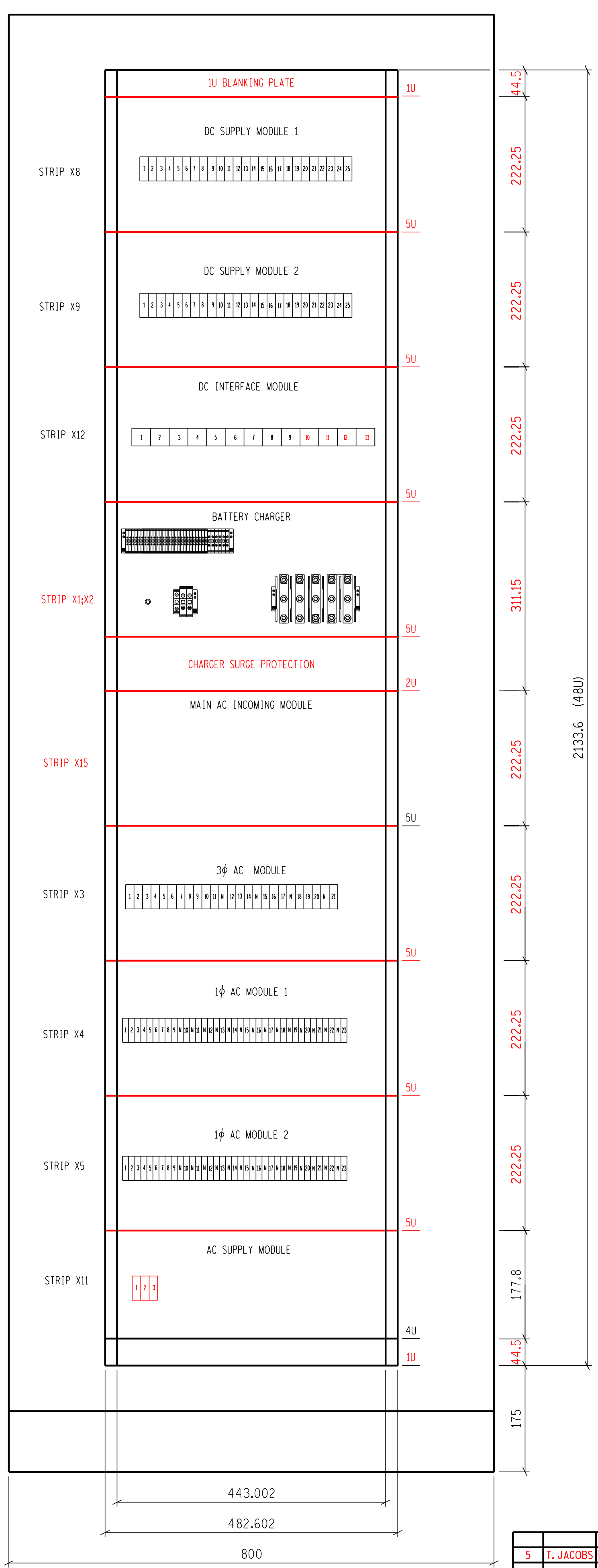
A1L

MASTER TRACING FILED UNDER D-DT-11218 SHEET 00 REVISION 5

PANEL LAYOUT (FRONT VIEW)



TERMINAL STRIP LAYOUT (REAR VIEW)



DESIGNATION	DESCRIPTION	SAP NO.	D-DT-BUYERS GUIDE
1	110V DC SUPPLY MODULE 1	0175668	9203
2	110V DC SUPPLY MODULE 2	0175668	9203
3	BATTERY CHARGER (SEE NOTE 5 & 6)		
4	110V DC INTERFACE MODULE	0185229	9203
5	MAIN AC INCOMING MODULE (NOT INSTALLED)	0186797	9203
6	400V AC 3ϕ DISTRIBUTION MODULE	0175664	9203
7	230V AC 1ϕ DISTRIBUTION MODULE 1	0175665	9203
8	230V AC 1ϕ DISTRIBUTION MODULE 2	0175665	9203
9	AC SUPPLY MODULE	0175669	9203
	CABINET SWING FRAME	0011357	9141
	1U BLANKING PLATE	0006327	9141
	2U BLANKING PLATE	0006328	9141
	4U BLANKING PLATE	0006492	9141

NOTES:

1. KEEP STANDARD LAYOUT INSERT BLANKING PLATE IF MODULE NOT USED.
2. SHOULD EXTRA INDICATION OUTPUTS BE REQUIRED, ADD AN EXTRA CP STRIP TERMINAL & LOOP FROM EXISTING CP STRIP TERMINAL.
3. 1U = 44.5mm.
4. MAIN AC INCOMING MODULE NOT USED WHEN YARD AC DB IS USED.
5. REFER TO LATEST REVISION OF THE RELEVANT CHARGER AS PER THE DESIGN.
6. REFER TO D-DT-11352 (CORDEX BATTERY CHARGER).
7. THIS DRAWING TO BE READ IN CONJUNCTION WITH DISTRIBUTION SPECIFICATION, 240-75658628, DISTRIBUTION GROUP'S SPECIFIC REQUIREMENTS FOR AC/DC DISTRIBUTION UNITS.

DRG NO.	REFERENCE DRAWINGS:
SHEET 23	AC/DC PANEL CABLING DIAGRAM
SHEET 22	110V DC DISTR. MODULE 2 KEY DIAGRAM
SHEET 21	110V DC DISTR. MODULE 2 EQUIP. L/O
SHEET 20	110V DC DISTR. MODULE 1 KEY DIAGRAM
SHEET 19	110V DC DISTR. MODULE 1 EQUIP. L/O
SHEET 18	INTERFACE MODULE KEY DIAGRAM
SHEET 17	INTERFACE MODULE EQUIP L/O
SHEET 16	110V/220V SUBRACK CHARGER ALARM & SUPERVISORY INTERCONN.
SHEET 15	110V/220V SUBRACK CHARGER AC & DC INTERCONN.
SHEET 14	110V/220V SUBRACK CHARGER BACKPLATE L/O
SHEET 13	AC SUPPLY MODULE KEY DIAGRAM
SHEET 12	AC SUPPLY MODULE EQUIP L/O
SHEET 11	230V AC DISTR. MODULE 2 KEY DIAGRAM
SHEET 10	230V AC DISTR. MODULE 2 EQUIP. L/O
SHEET 09	230V AC DISTR. MODULE 1 KEY DIAGRAM
SHEET 08	230V AC DISTR. MODULE 1 EQUIP. L/O
SHEET 07	400V AC DISTR. MODULE KEY DIAGRAM
SHEET 06	400V AC DISTR. MODULE EQUIP. L/O
SHEET 05	MAIN AC INCOMING MODULE KEY DIAGRAM
SHEET 04	MAIN AC INCOMING MODULE EQUIP L/O
SHEET 03	TERMINAL PLATE ARRANGEMENT
SHEET 02	PANEL LABEL SCHEDULE
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	TERMINALS ADDED, LAYOUTS & MODULE SIZES UPDATED	CvS	RV
4	T. JACOBS	09/07/2014	UPDATED SUPPLY MODULE EQUIPMENT LAYOUT, HANDLES AND LEGENDS REPOSITIONED	CvS	RV
3.0	T. JACOBS	11/12/2009	NOTE 7 ADDED. INTERLOCKING SWITCH ADDED TO AC SUPPLY MODULE FACE PLATE OF MAIN AC & AC SUPPLY MODULES WERE CHANGED TO 5U.	AB	T. JACOBS
2	T. JACOBS	26/01/2006	INSERTED NOTE 6	VvZ	T. JACOBS

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 19/02/2020
DRAWN BY K STEYNBERG DATE 19/02/2020
SCALE

Eskom
AUTH: T. JACOBS DATE: /06/2002
CHKD: V. van ZWEEL DATE: 06/06/2002
DRAWN: T. ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
PANEL EQUIPMENT LAYOUT

D-WC-8118 | SET 153 | SHEET 01 | REVISION 00

PANEL TYPE DESIGNATION 2AD_303

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 01 REVISION 5

A1L

AC SUPPLY MODULE

SEE SHEET 12

LABEL 4: AC SUPPLY MODULE (252 × 12)

LABEL 5: SWITCHED SOCKETS (36)

LABEL 6: SWITCHED (SS1) SOCKETS (SS2) (54 × 12)

LABEL 7: X11 AC SUPPLY MODULE (85 × 18)

NOTE :
ALL TEXT IS (BLACK TEXT ON WHITE BACKGROUND) = BTWB

MAIN AC INCOMING MODULE

SEE SHEET 4

LABEL 6: MAIN AC INCOMING MODULE (252 × 12)

LABEL 7: MAIN ISOLATOR (72 × 12)

LABEL 8: CONTROL CIRCUITS (54 × 12)

LABEL 9: X15 MAIN AC INCOMING MOD (85 × 18)

NOTE :
ALL TEXT IS (BLACK TEXT ON WHITE BACK GROUND) = BTWB

DC INTERFACE MODULE

SEE SHEET 14

LABEL 9: DC INTERFACE MODULE (252 × 12)

LABEL 5: MAIN DC SUPPLY ISOLATOR (72)

LABEL 6: STANDBY DC SUPPLY ISOLATOR (72)

LABEL 7: ISO (BATT) (36)

LABEL 8: STANDBY CHGR SOCKET (54 × 12)

LABEL 10: X12 DC INTERFACE MODULE (85 × 18)

LABEL 12: MCB AC/DC PNL2 (36)

NOTE :
ALL TEXT IS (RED TEXT ON WHITE BACKGROUND) = RTWB

Panel labels

SEE SHEET 01: A.C. DISTRIBUTION CIRCUITS (252 × 24)

SEE SHEET 01: D.C. DISTRIBUTION CIRCUITS (252 × 24)

SEE SHEET 01: AC/DC PANEL (252 × 50)

230V 1 PHASE AC DISTRIBUTION MODULE 1

(MODULE 1) TO BE STUCK ON BY TECHNICIAN

SEE SHEET 8

LABEL 18: X4 230V 1ϕ AC MODULE 1 (85 × 18)

LABEL 18: 230V 1-PHASE AC DISTRIBUTION CIRCUITS (MODULE 1) (25 + 68; 15, 13, 182, 197)

MCB (1A)	66kV FEEDER 1
MCB (1B)	66kV FEEDER 2
MCB (1C)	66kV FEEDER 3
MCB (1D)	66kV FEEDER 4
MCB (1E)	
MCB (1F)	66kV FEEDER 6
MCB (1G)	
MCB (1H)	66kV BUSZONE
MCB (1J)	66kV BUS COUPLER
MCB (1K)	STATISTICAL METERING
MCB (1L)	TARIFF METERING
MCB (1M)	
MCB (1N)	
MCB (1P)	

NOTE :
ALL TEXT IS (BLACK TEXT ON WHITE BACK GROUND) = BTWB

LABEL 16: 230V 1-PHASE AC DISTRIBUTION (MODULE 1) (252 × 12)

LABEL 17: ISOL (AC) (72) | MCB (1A) (18) | MCB (1B) | MCB (1C) | MCB (1D) | MCB (1E) | MCB (1F) | MCB (1G) | MCB (1H) | MCB (1J) | MCB (1K) | MCB (1L) | MCB (1M) | MCB (1N) | MCB (1P) (12)

230V 1 PHASE AC DISTRIBUTION MODULE 2

(MODULE 2) TO BE STUCK ON BY TECHNICIAN

SEE SHEET 10

LABEL 18: X5 230V 1ϕ AC MODULE 2 (85 × 18)

LABEL 19: 230V 1-PHASE AC DISTRIBUTION CIRCUITS (MODULE 2) (25 + 68; 15, 13, 182, 197)

MCB (1A), MCB (1B), MCB (1C), MCB (1D), MCB (1E), MCB (1F), MCB (1G), MCB (1H), MCB (1J), MCB (1K), MCB (1L), MCB (1M), MCB (1N), MCB (1P)

NOTE :
ALL TEXT IS (BLACK TEXT ON WHITE BACKGROUND) = BTWB

LABEL 16: 230V 1-PHASE AC DISTRIBUTION (MODULE 2) (252 × 12)

LABEL 17: ISOL (AC) (72) | MCB (1A) (18) | MCB (1B) | MCB (1C) | MCB (1D) | MCB (1E) | MCB (1F) | MCB (1G) | MCB (1H) | MCB (1J) | MCB (1K) | MCB (1L) | MCB (1M) | MCB (1N) | MCB (1P) (12)

110V DC DISTRIBUTION MODULE 1

(MODULE 1) TO BE STUCK ON BY TECHNICIAN

SEE SHEET 16

LABEL 10: 110V D.C. DISTRIBUTION CIRCUITS (MODULE 1) (25 + 68; 15, 13, 143)

ISOL (DC)	DC ISOLATOR
MCB (2A)	66kV FEEDER 1
MCB (2B)	66kV FEEDER 2
MCB (2C)	66kV FEEDER 3
MCB (2D)	66kV FEEDER 4
MCB (2E)	
MCB (2F)	66kV FEEDER 6
MCB (2G)	
MCB (2H)	66kV BUSZONE
MCB (2J)	66kV BUS COUPLER
MCB (2K)	EMERGENCY LIGHTS

NOTE :
ALL TEXT IS (RED TEXT ON WHITE BACKGROUND) = RTWB

LABEL 14: X8 110V DC DIST MODULE 1 (85 × 18)

LABEL 12: 110V DC DISTRIBUTION (MODULE 1) (252 × 12)

LABEL 13: ISOL (DC) | MCB (2A) | MCB (2B) | MCB (2C) | MCB (2D) | MCB (2E) | MCB (2F) | MCB (2G) | MCB (2H) | MCB (2J) | MCB (2K) (396 × 12; 36)

110V DC DISTRIBUTION MODULE 2

SEE SHEET 18

(MODULE 2) TO BE STUCK ON BY TECHNICIAN

LABEL 15: 110V D.C. DISTRIBUTION CIRCUITS (MODULE 2) (25 + 68; 15, 13, 143)

ISOL (DC)	DC ISOLATOR
MCB (2A)	SUBSTATION AUTOMATION
MCB (2B)	RTU
MCB (2C)	
MCB (2D)	
MCB (2E)	
MCB (2F)	
MCB (2G)	
MCB (2H)	
MCB (2J)	
MCB (2K)	

NOTE :
ALL TEXT IS (RED TEXT ON WHITE BACKGROUND) = RTWB

LABEL 14: X9 110V DC DIST MODULE 2 (85 × 18)

LABEL 12: 110V DC DISTRIBUTION (MODULE 2) (252 × 12)

LABEL 13: ISOL (DC) | MCB (2A) | MCB (2B) | MCB (2C) | MCB (2D) | MCB (2E) | MCB (2F) | MCB (2G) | MCB (2H) | MCB (2J) | MCB (2K) (396 × 12; 36)

400V 3 PHASE AC DISTRIBUTION MODULE

SEE SHEET 06

LABEL 8: X3 400V 3ϕ AC DIST MOD (85 × 18)

LABEL 9: 400V 3-PHASE AC DISTRIBUTION CIRCUITS (25 + 68; 15, 13, 80)

ISOL (AC)	AC ISOLATOR
MCB (3A)	BUILDING DB
MCB (3B)	BATTERY ROOM FAN
MCB (3C)	
MCB (3D)	

LABEL 6: 400V 3-PHASE AC DISTRIBUTION (252 × 12)

LABEL 7: ISOL (AC) (72) | MCB (3A) | MCB (3B) | MCB (3C) | MCB (3D) (54) (288 × 12)

NOTE :
ALL TEXT IS (BLACK TEXT ON WHITE BACKGROUND) = BTWB

NOTE
"MODULE --" DESIGNATION TO BE DONE DURING INSTALLATION/COMMISSIONING

DRG NO.	REFERENCE DRAWINGS:
SHEET 23	AC/DC PANEL CABLING DIAGRAM
SHEET 22	110V DC DISTR. MODULE 2 KEY DIAGRAM
SHEET 21	110V DC DISTR. MODULE 2 EQUIP. L/O
SHEET 20	110V DC DISTR. MODULE 1 KEY DIAGRAM
SHEET 19	110V DC DISTR. MODULE 1 EQUIP. L/O
SHEET 18	INTERFACE MODULE KEY DIAGRAM
SHEET 17	INTERFACE MODULE EQUIP L/O
SHEET 16	110V/220V SUBRACK CHARGER ALARM & SUPERVISORY INTERCONN.
SHEET 15	110V/220V SUBRACK CHARGER AC & DC INTERCONN.
SHEET 14	110V/220V SUBRACK CHARGER BACKPLATE L/O
SHEET 13	AC SUPPLY MODULE KEY DIAGRAM
SHEET 12	AC SUPPLY MODULE EQUIP L/O
SHEET 11	230V AC DISTR. MODULE 2 KEY DIAGRAM
SHEET 10	230V AC DISTR. MODULE 2 EQUIP. L/O
SHEET 09	230V AC DISTR. MODULE 1 KEY DIAGRAM
SHEET 08	230V AC DISTR. MODULE 1 EQUIP. L/O
SHEET 07	400V AC DISTR. MODULE KEY DIAGRAM
SHEET 06	400V AC DISTR. MODULE EQUIP. L/O
SHEET 05	MAIN AC INCOMING MODULE KEY DIAGRAM
SHEET 04	MAIN AC INCOMING MODULE EQUIP L/O
SHEET 03	TERMINAL PLATE ARRANGEMENT
SHEET 02	PANEL LABEL SCHEDULE
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
6	T. JACOBS	06/03/2017	LABELS UPDATED	CvS	RV
5	T. JACOBS	09/07/2014	LABELS UPDATED	CvS	RV
4	T. JACOBS	27/03/2013	LABELS UPDATED	RV	RV
3.0	T. JACOBS	11/12/2009	AC SUPPLY, 230V 1ϕ AC DISTR MODULES 1 & 2 LABELLING REVISED.	AB	T. JACOBS
2	T. JACOBS	26/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 19/02/2020
DRAWN BY K STEYNBERG DATE 19/02/2020
SCALE

Eskom
AUTH: T JACOBS DATE: /06/2002
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
LABEL SCHEDULE

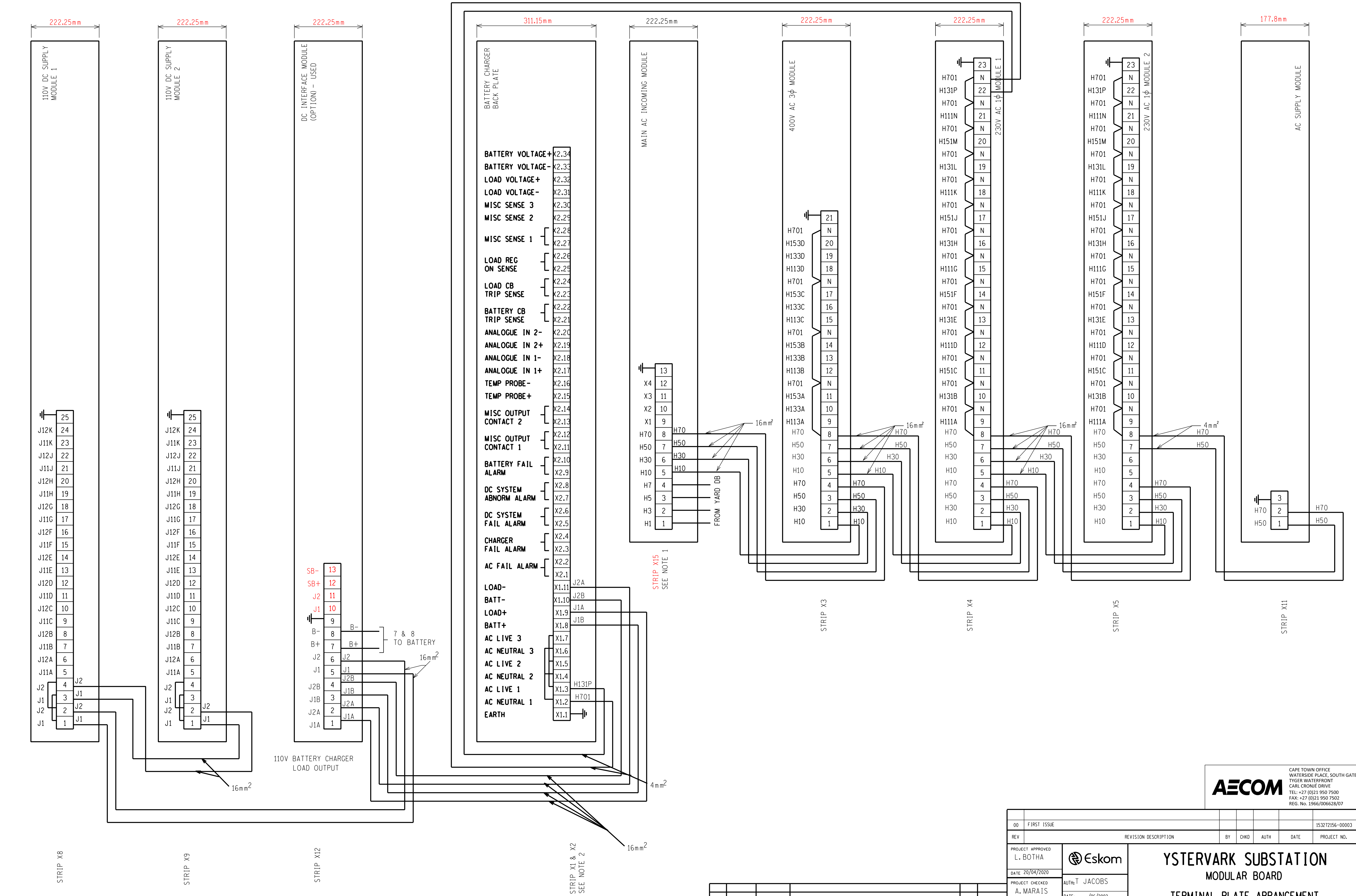
D-WC-8118 | SET 153 | SHEET 02 | REVISION 00

LEVELS 1 … 10

PANEL TYPE DESIGNATION 2AD_303

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 02 REVISION 6

AOL



NOTE

1. MAIN AC INCOMING MODULE NOT USED WHEN YARD AC DB IS USED.
2. REFER TO D-DT-11352. (CORDEX BATTERY CHARGER)

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	TERMINALS ADDED TO X12; X13 CHANGED TO X15	CvS	RV
4	T. JACOBS	09/07/2014	CORE NUMBERS UPDATED. AC SUPPLY MODULE TERMINALS UPDATED.	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	26/01/2006	SHT 3B ADDED	VvZ	T. JACOBS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJE DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 19/02/2020
DRAWN BY K STEYNBERG DATE 19/02/2020
SCALE

Eskom
AUTH: T JACOBS DATE: /06/2002
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
MODULAR BOARD
TERMINAL PLATE ARRANGEMENT

D-WC-8118

SET	SHEET	REVISION
153	03	00

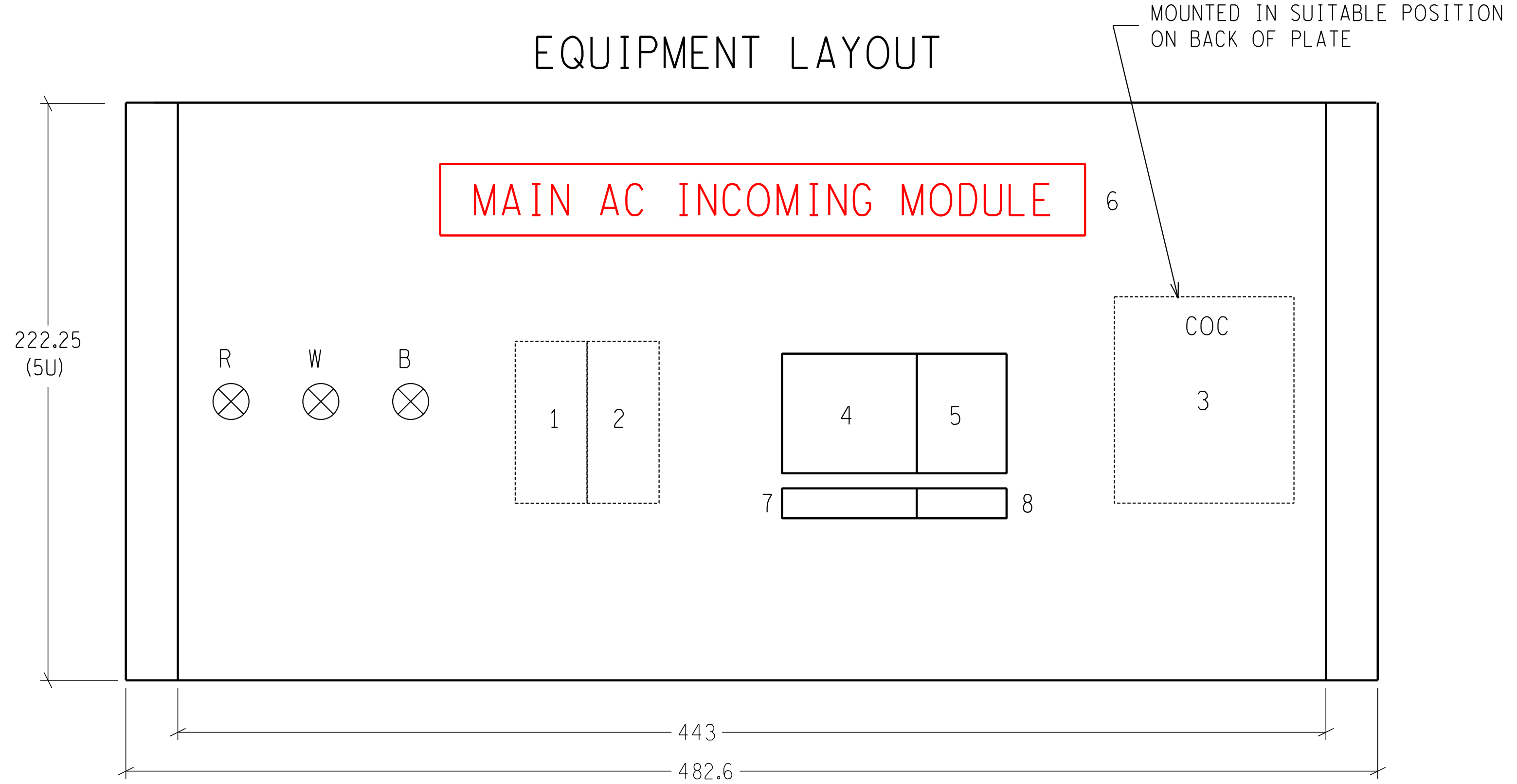
LEVELS 1 10

PANEL TYPE DESIGNATION 2AD_303

SIZE GROOTTE A1L

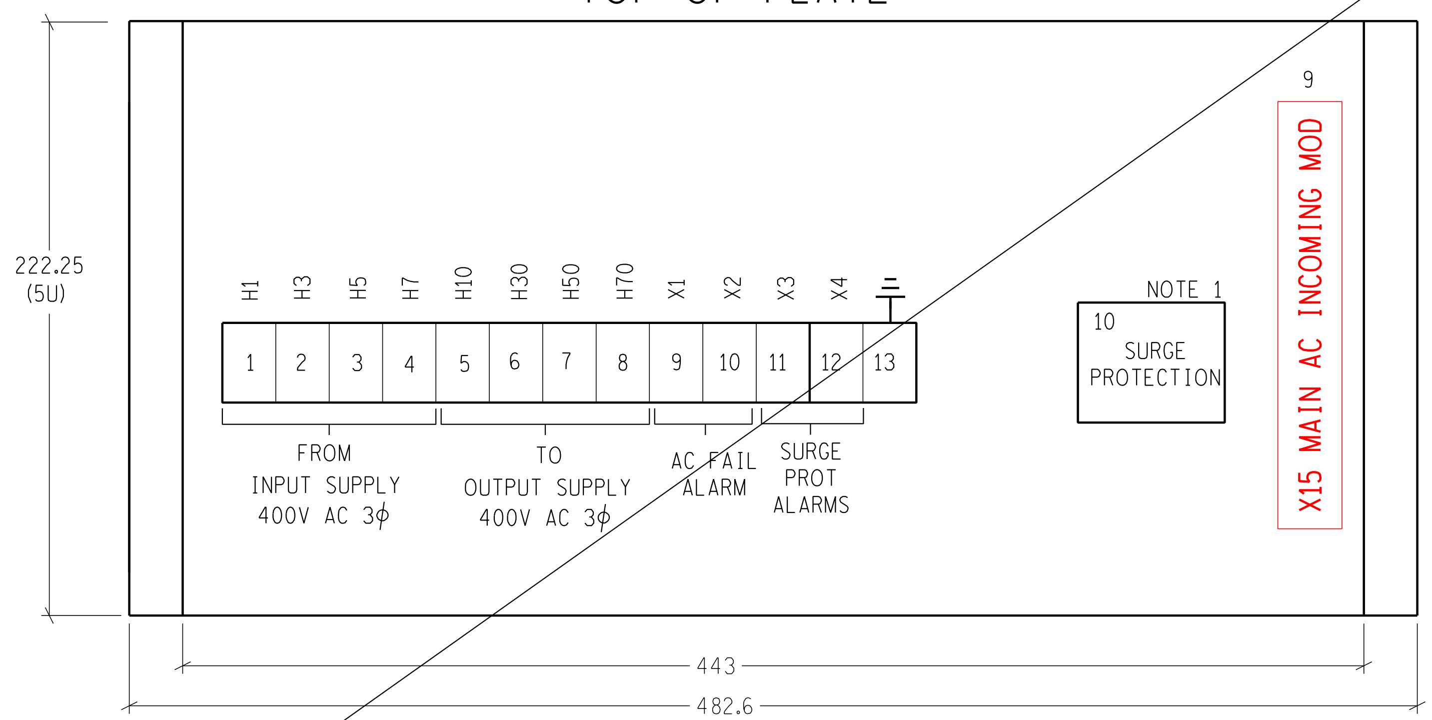
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 03B REVISION 5

EQUIPMENT LAYOUT



NOTE:
ITEMS 1, 2 & 3 AT BACK OF PLATE.

TERMINAL PLATE TOP OF PLATE



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	AC FAIL TIMER - DELAY-ON-PICK-UP (0-60sec)	ACF-T	230V AC			
2	AC FAIL RELAY	ACF	400V AC			
3	CONTACTOR	COC	400V AC	100		
4	INCOMING BREAKER/ISOLATOR (4-POLE)	BRK/ISOL (AC)	400V AC	100	5kA	
5	CONTROL CIRCUIT MCB (3-POLE)	MCB (C)	230V AC	6A	5kA	C
6	LABEL	MAIN AC INCOMING MODULE				
7	LABEL	MAIN ISOLATOR				
8	LABEL	CONTROL CIRCUITS				
9	LABEL	X15 MAIN AC INCOMING MOD				
10	SURGE PROTECTION	SURGE PROTECTION				

NOTE :
1. DEHNGUARD TT 230/400 FM (900 550) OR SIMILAR APPROVED BY ESKOM

TERMINALS	
NUMBER	TYPE
1-4	M35/26EE - STUD TYPE
5-8	M35/16 - STUD TYPE
9-12	M4/6 - SPRING LOADED
13	EARTH

OR EQUIVALENT

NOTE: ALL STUD TERMINALS TO HAVE COVERS.

NOT USED

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	LABELS UPDATED	CvS	RV
4	T. JACOBS	09/07/2014	PART NUMBERS AND TERMINAL SPECIFICATIONS UPDATED	CvS	RV
3.0	T. JACOBS	11/12/2009	FACE PLATE SIZE CHANGED TO 5U	AB	T. JACOBS
2	T. JACOBS	26/01/2006	SURGE PROTECTION ADDED	VvZ	T. JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: 06/06/2006
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: 20/05/2002

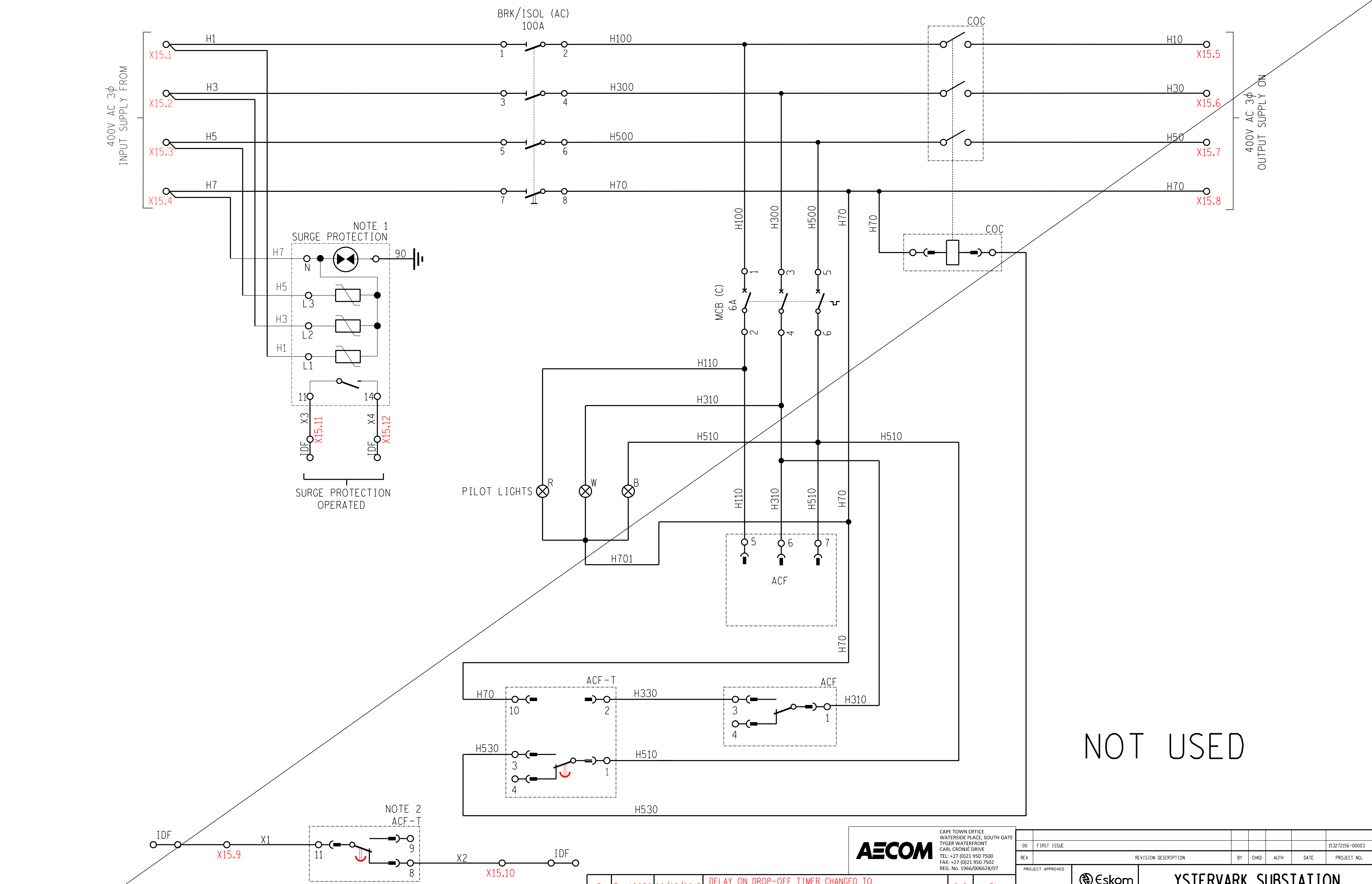
YSTERVARK SUBSTATION
MAIN AC INCOMING MODULE
EQUIPMENT LAYOUT

D-WC-8118

SET	SHEET	REVISION
153	04	00

PANEL TYPE DESIGNATION 2AC_303 A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 04 REVISION 5



NOTE:

1. SURGE PROTECTION ALARM CONTACTS CONNECTED TO TERMINALS X15.11 - X15.12.

2. X15.9 & X15.10 ARE AC FAIL ALARM TERMINALS

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	DELAY ON DROP-OFF TIMER CHANGED TO DELAY ON PIC-UP TIMER. X13 CHANGED TO X15.	CvS	RV
4	T. JACOBS	09/07/2014	CHANGED ISOL TO BRK/ISOL. CORRECTED MCB SYMBOLS.	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	26/01/2006	SURGE PROTECTION ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DELAY ON PICK-UP TIMER CHANGED TO DELAY ON DROP-OFF TIMER	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS
DATE: 06/06/2006
CHKD: V van ZWEEL
DATE: 06/06/2002
DRAWN: T ERASMUS
DATE: 20/05/2002

YSTERVARK SUBSTATION
MAIN AC INCOMING MODULE
AC KEY DIAGRAM

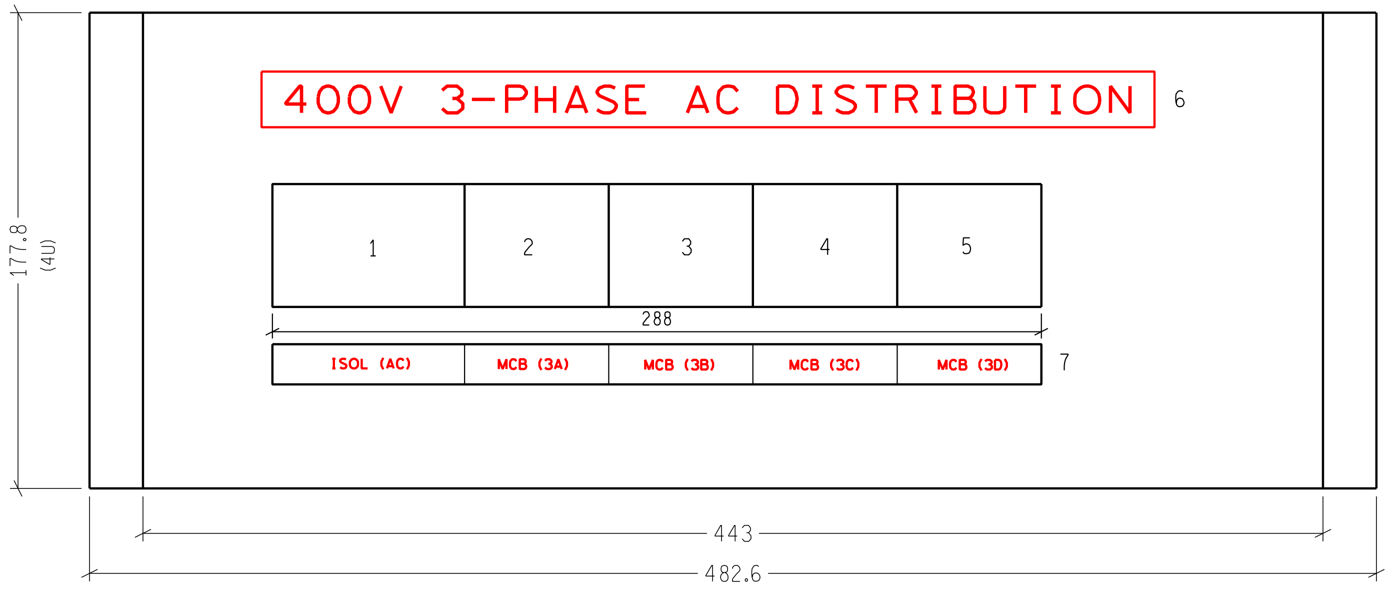
D-WC-8118

SET	SHEET	REVISION
153	05	00

PANEL TYPE DESIGNATION 2AC_303 A2L

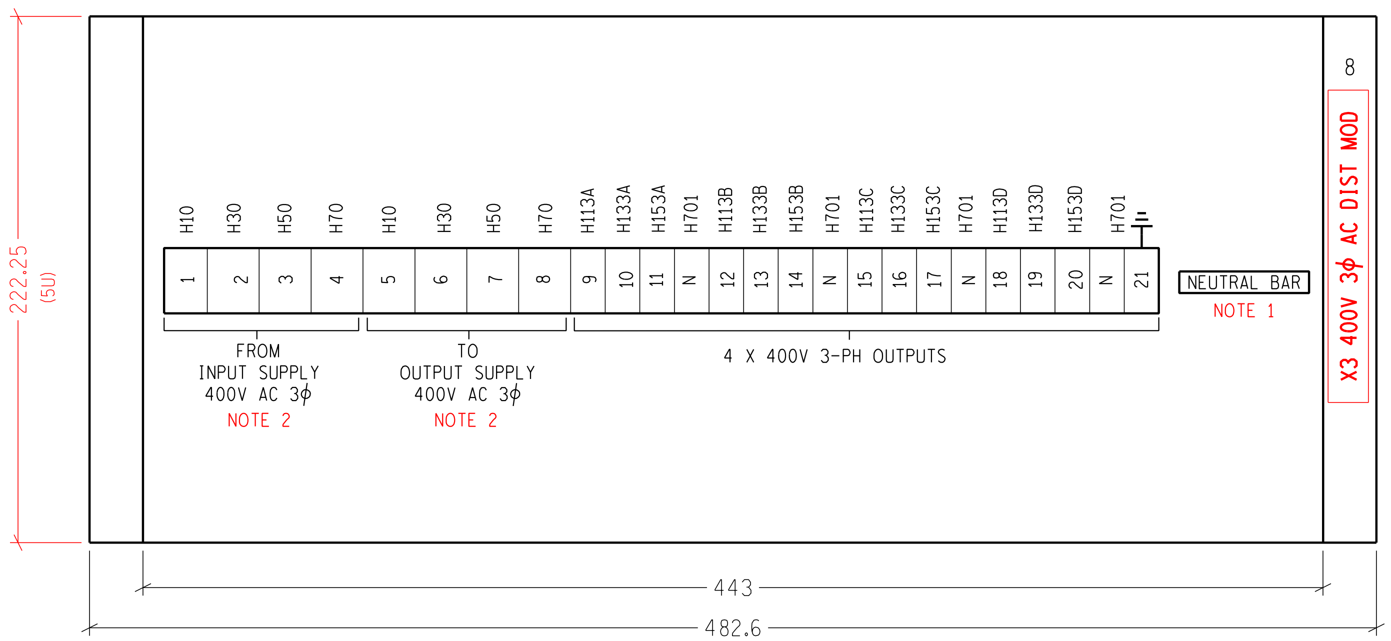
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 05 REVISION 5

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	4 POLE ISOLATOR	ISOL (AC)	400V AC	63A	5kA	
2	MCB-CIRCUIT (A) (3-POLE)	MCB (3A)	400V AC	32A	5kA	C
3	MCB-CIRCUIT (B) (3-POLE)	MCB (3B)	400V AC	32A	5kA	C
4	MCB-CIRCUIT (C) (3-POLE)	MCB (3C)	400V AC	16A	5kA	C
5	MCB-CIRCUIT (D) (3-POLE)	MCB (3D)	400V AC	16A	5kA	C
6	LABEL	400V 3-PHASE AC DISTRIBUTION				
7	LABEL	SEE EQUIPMENT LAYOUT				
8	LABEL	X3 400V 3ϕ AC DIST MOD				

TERMINAL PLATE
TOP OF PLATE



NOTE:

1. NEUTRAL BAR ONLY TO BE INSERTED IF REQUIRED FOR WIRING PURPOSES.
2. STUD TYPE TERMINAL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T.JACOBS	06/03/2017	LABELS UPDATED. NOTE ADDED	CvS	RV
4	T.JACOBS	09/07/2014	CHANGED ISOLATOR RATING	CvS	RV
3.0	T.JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T.JACOBS
2	T.JACOBS	07/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

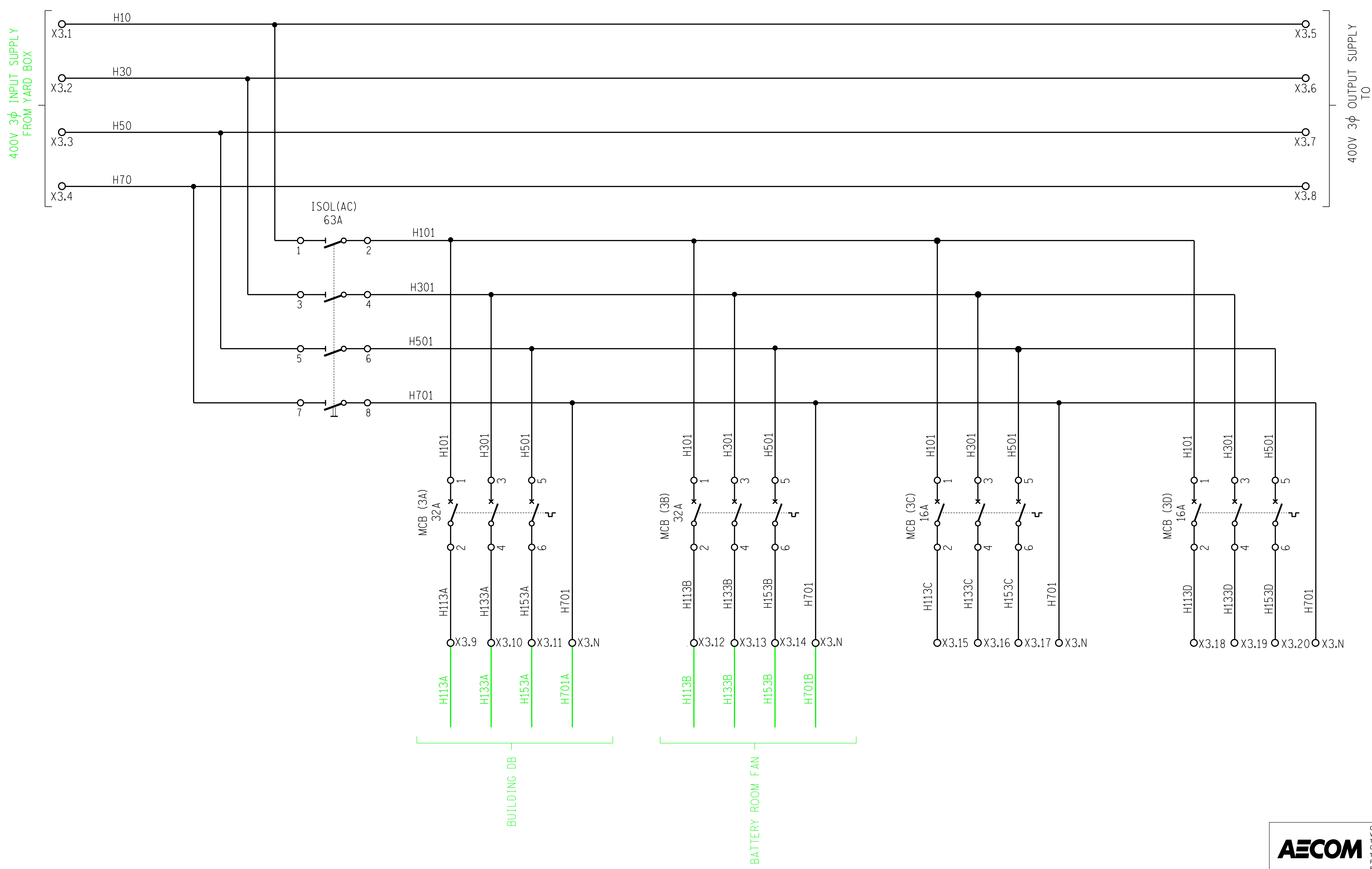
YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
400V 3ϕ AC DISTRIBUTION MODULE
PANEL EQUIPMENT LAYOUT

D-WC-8118 | SET 153 | SHEET 06 | REVISION 00

PANEL TYPE DESIGNATION 2AC_403

A2L

MASTER TRACING FILED UNDER D-DT-1218 SET 23 SHEET 06 REVISION 5



NOTE:

NEUTRAL TERMINALS SHALL BE PROVIDED FOR EACH CIRCUIT WITH FERRULE NUMBER 'H701' AND TERMINAL NUMBER 'N'.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
4	T. JACOBS	09/07/2014	CHANGED ISOL POSITION & RATING. CORRECTED MCB SYMBOLS.	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
400V 3ϕ DISTRIBUTION MODULE AC KEY DIAGRAM

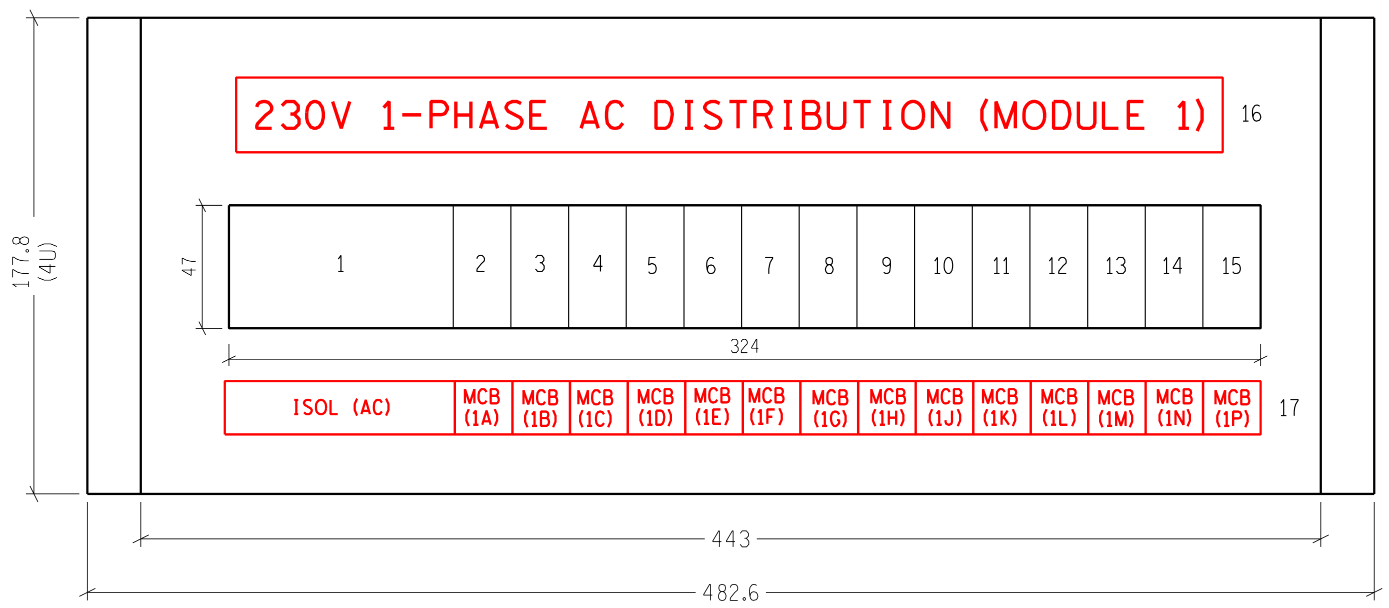
D-WC-8118

SET	SHEET	REVISION
153	07	00

PANEL TYPE DESIGNATION 2AC_403 A2L

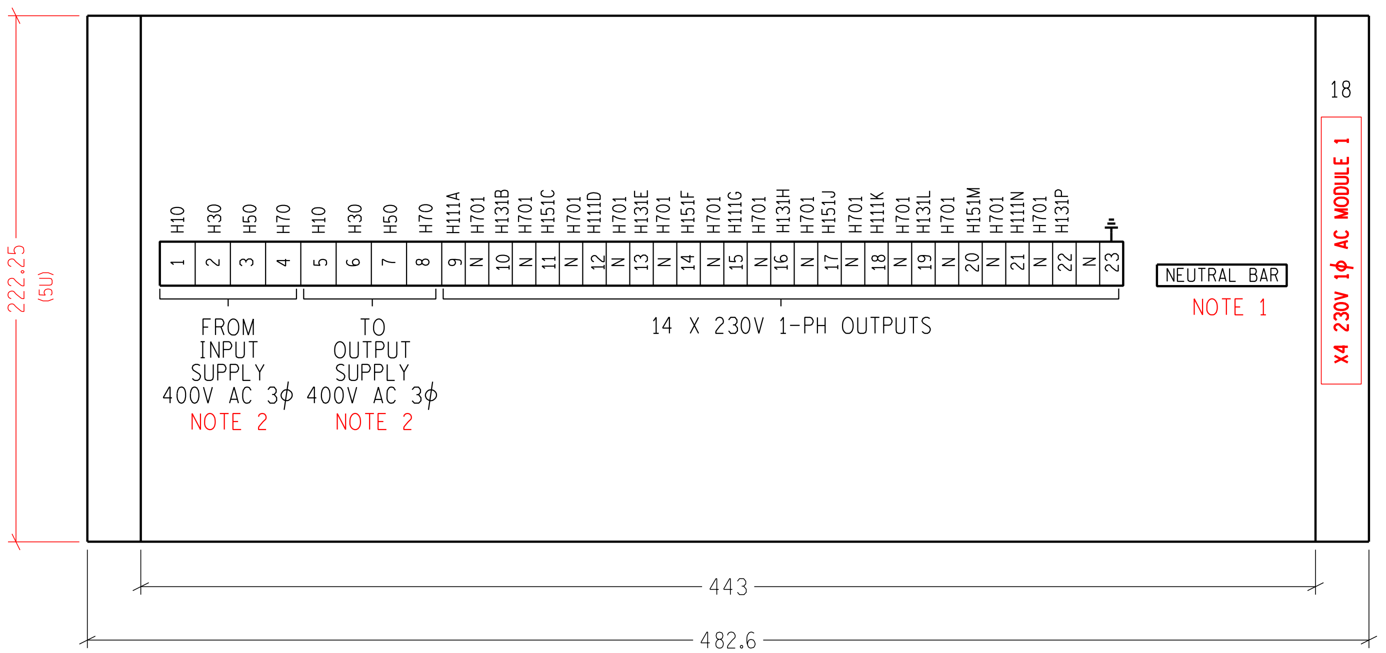
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 07 REVISION 4

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	4-POLE ISOLATOR	ISOL (AC)	400V AC	63A	5kA	
2	MCB CIRCUIT A (1-Pole)	MCB (1A)	230V AC	20A	5kA	C
3	MCB CIRCUIT B (1-Pole)	MCB (1B)	230V AC	20A	5kA	C
4	MCB CIRCUIT C (1-Pole)	MCB (1C)	230V AC	20A	5kA	C
5	MCB CIRCUIT D (1-Pole)	MCB (1D)	230V AC	20A	5kA	C
6	MCB CIRCUIT E (1-Pole)	MCB (1E)	230V AC	20A	5kA	C
7	MCB CIRCUIT F (1-Pole)	MCB (1F)	230V AC	20A	5kA	C
8	MCB CIRCUIT G (1-Pole)	MCB (1G)	230V AC	20A	5kA	C
9	MCB CIRCUIT H (1-Pole)	MCB (1H)	230V AC	20A	5kA	C
10	MCB CIRCUIT J (1-Pole)	MCB (1J)	230V AC	20A	5kA	C
11	MCB CIRCUIT K (1-Pole)	MCB (1K)	230V AC	20A	5kA	C
12	MCB CIRCUIT L (1-Pole)	MCB (1L)	230V AC	20A	5kA	C
13	MCB CIRCUIT M (1-Pole)	MCB (1M)	230V AC	20A	5kA	C
14	MCB CIRCUIT N (1-Pole)	MCB (1N)	230V AC	20A	5kA	C
15	MCB CIRCUIT P (1-Pole)	MCB (1P)	230V AC	20A	5kA	C
16	LABEL	230V 1-PHASE AC DISTRIBUTION (MODULE 1)				
17	LABEL	SEE EQUIPMENT LAYOUT				
18	LABEL	X4 230V 1ϕ AC MODULE 1				

TERMINAL PLATE
TOP OF PLATE



NOTE:

1. NEUTRAL BAR ONLY TO BE INSERTED IF REQUIRED FOR WIRING PURPOSES.
2. STUD TYPE TERMINAL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T.JACOBS	06/03/2017	LABELS UPDATED. NOTE ADDED	CvS	RV
4	T.JACOBS	09/07/2014	CORRECTED ISOLATOR RATING AND CORE NUMBERS	CvS	RV
3.0	T.JACOBS	11/12/2009	40A 4-POLE AC ISLOATOR ADDED	AB	T.JACOBS
2	T.JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

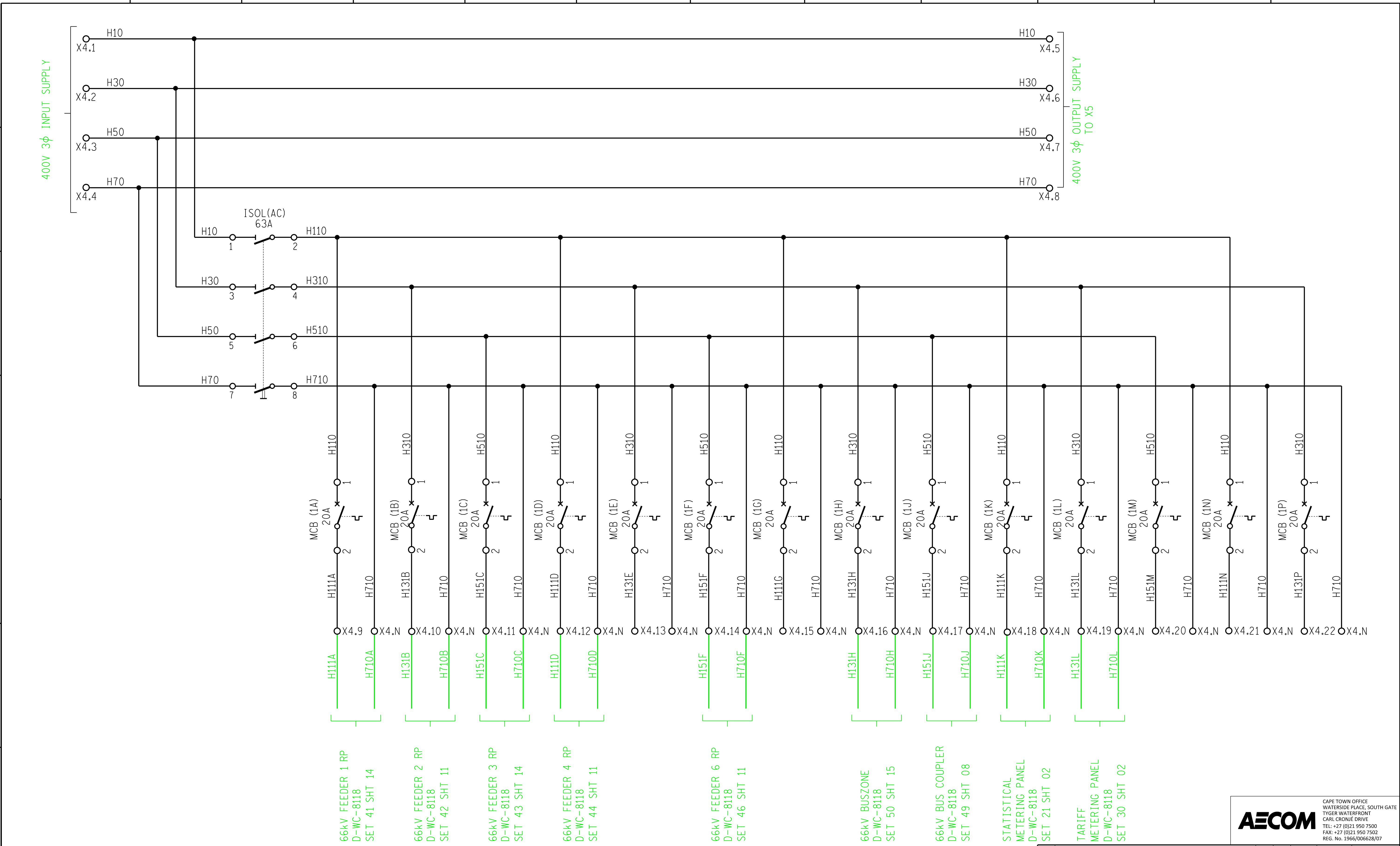
YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
230V 1ϕ AC DISTRIBUTION MODULE 1
EQUIPMENT LAYOUT

D-WC-8118 | SET 153 | SHEET 08 | REVISION 00

PANEL TYPE DESIGNATION 2AC_503

A2L

MASTER TRACING FILED UNDER D-DT-1218 SET 23 SHEET 08 REVISION 5



NOTE:

NEUTRAL TERMINALS SHALL BE PROVIDED FOR EACH CIRCUIT WITH FERRULE NUMBER 'H710' AND TERMINAL NUMBER 'N'.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
4	T. JACOBS	09/07/2014	CHANGED ISOL RATING. CORRECTED MCB SYMBOLS. CORE NUMBERS CORRECTED.	CvS	RV
3.0	T. JACOBS	11/12/2009	40A 4-POLE AC ISOLATOR ADDED	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002
SCALE

Eskom

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
230V 1ϕ AC DISTRIBUTION MODULE 1
KEY DIAGRAM

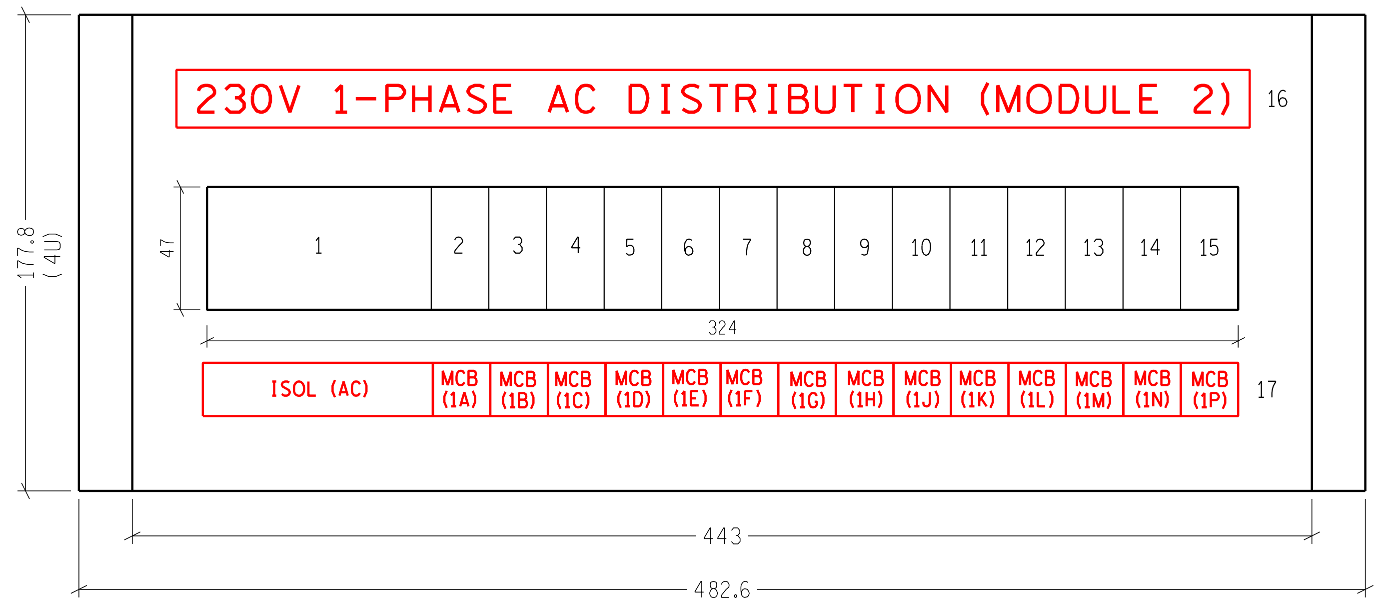
D-WC-8118	SET	SHEET	REVISION
	153	09	00

PANEL TYPE DESIGNATION 2AC_503

A2L

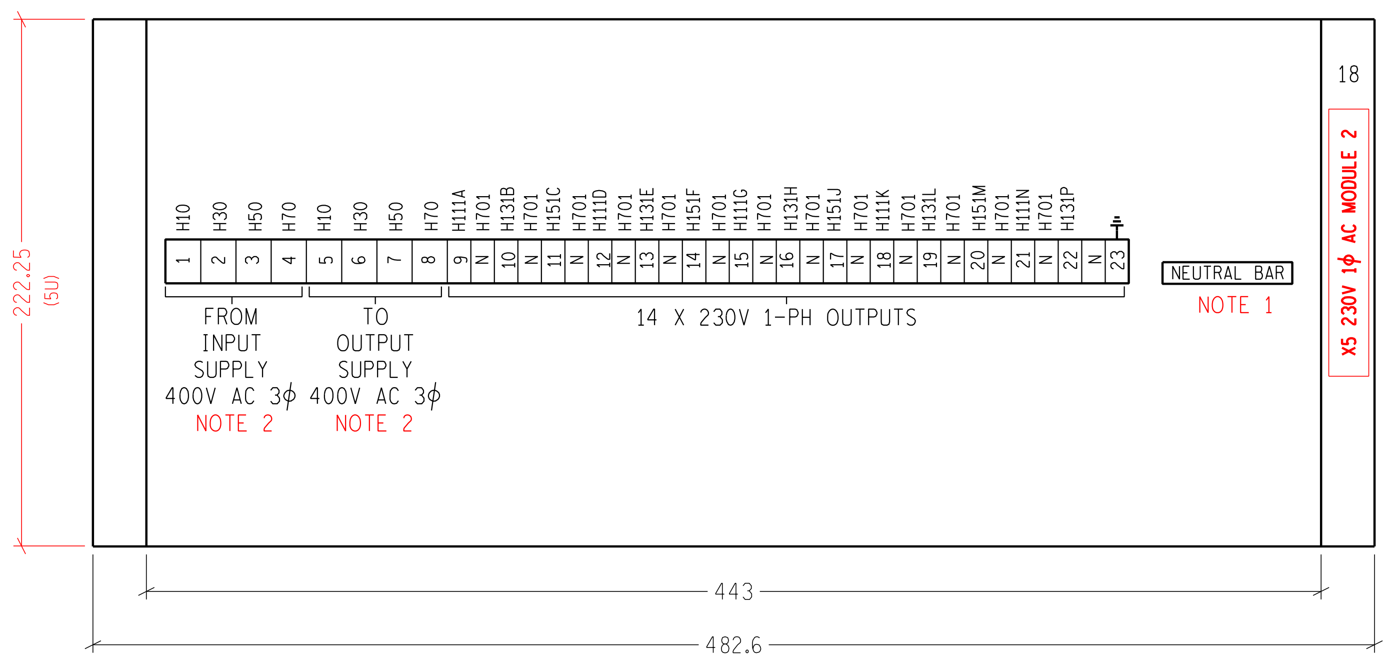
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 09 REVISION 4

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	4-POLE ISOLATOR	ISOL (AC)	400V AC	63A	5kA	
2	MCB CIRCUIT A (1-Pole)	MCB (1A)	230V AC	20A	5kA	C
3	MCB CIRCUIT B (1-Pole)	MCB (1B)	230V AC	20A	5kA	C
4	MCB CIRCUIT C (1-Pole)	MCB (1C)	230V AC	20A	5kA	C
5	MCB CIRCUIT D (1-Pole)	MCB (1D)	230V AC	20A	5kA	C
6	MCB CIRCUIT E (1-Pole)	MCB (1E)	230V AC	20A	5kA	C
7	MCB CIRCUIT F (1-Pole)	MCB (1F)	230V AC	20A	5kA	C
8	MCB CIRCUIT G (1-Pole)	MCB (1G)	230V AC	20A	5kA	C
9	MCB CIRCUIT H (1-Pole)	MCB (1H)	230V AC	20A	5kA	C
10	MCB CIRCUIT J (1-Pole)	MCB (1J)	230V AC	20A	5kA	C
11	MCB CIRCUIT K (1-Pole)	MCB (1K)	230V AC	20A	5kA	C
12	MCB CIRCUIT L (1-Pole)	MCB (1L)	230V AC	20A	5kA	C
13	MCB CIRCUIT M (1-Pole)	MCB (1M)	230V AC	20A	5kA	C
14	MCB CIRCUIT N (1-Pole)	MCB (1N)	230V AC	20A	5kA	C
15	MCB CIRCUIT P (1-Pole)	MCB (1P)	230V AC	20A	5kA	C
16	LABEL	230V 1-PHASE AC DISTRIBUTION (MODULE 2)				
17	LABEL	SEE EQUIPMENT LAYOUT				
18	LABEL	X5 230V 1ϕ AC MODULE 2				

TERMINAL PLATE
TOP OF PLATE



NOTE:

1. NEUTRAL BAR ONLY TO BE INSERTED IF REQUIRED FOR WIRING PURPOSES.
2. STUD TYPE TERMINAL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T.JACOBS	06/03/2017	LABELS UPDATED. NOTE ADDED	CvS	RV
4	T.JACOBS	09/07/2014	CORRECTED ISOLATOR RATING AND CORE NUMBERS	CvS	RV
3.0	T.JACOBS	11/12/2009	40A 4-POLE AC ISLOATOR ADDED	AB	T.JACOBS
2	T.JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA — DATE 20/04/2020
PROJECT CHECKED: A. MARAIS — DATE 04/12/2019
DRAWN BY: K STEYNBERG — DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS — DATE: /06/2002
CHKD: V van ZWEEL — DATE: 06/06/2002
DRAWN: T ERASMUS — DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
230V 1ϕ AC DISTRIBUTION MODULE 2
EQUIPMENT LAYOUT

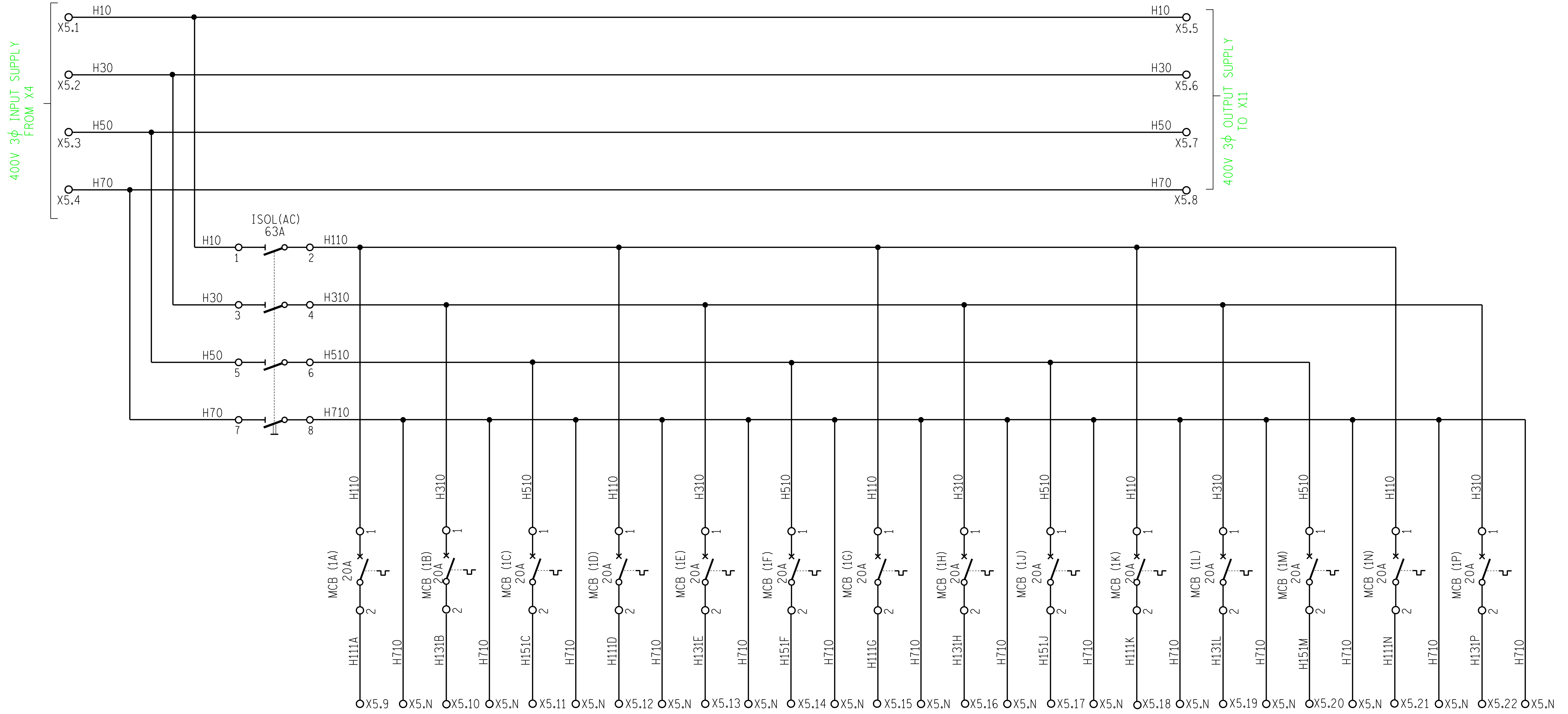
D-WC-8118

SET	SHEET	REVISION
153	10	00

PANEL TYPE DESIGNATION 2AC_503

A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 10 REVISION 5



NOTE

NEUTRAL TERMINALS SHALL BE PROVIDED
FOR EACH CIRCUIT WITH FERRULE NUMBER
'H710' AND TERMINAL NUMBER 'N'.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
4	T. JACOBS	09/07/2014	CHANGED ISOL RATING. CORRECTED MCB SYMBOLS. CORE NUMBERS CORRECTED.	CvS	RV
3.0	T. JACOBS	29/05/2009	40A 4-POLE AC ISOLATOR ADDED	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
230V 1φ AC DISTRIBUTION MODULE 2
AC KEY DIAGRAM

D-WC-8118

SET	SHEET	REVISION
153	11	00

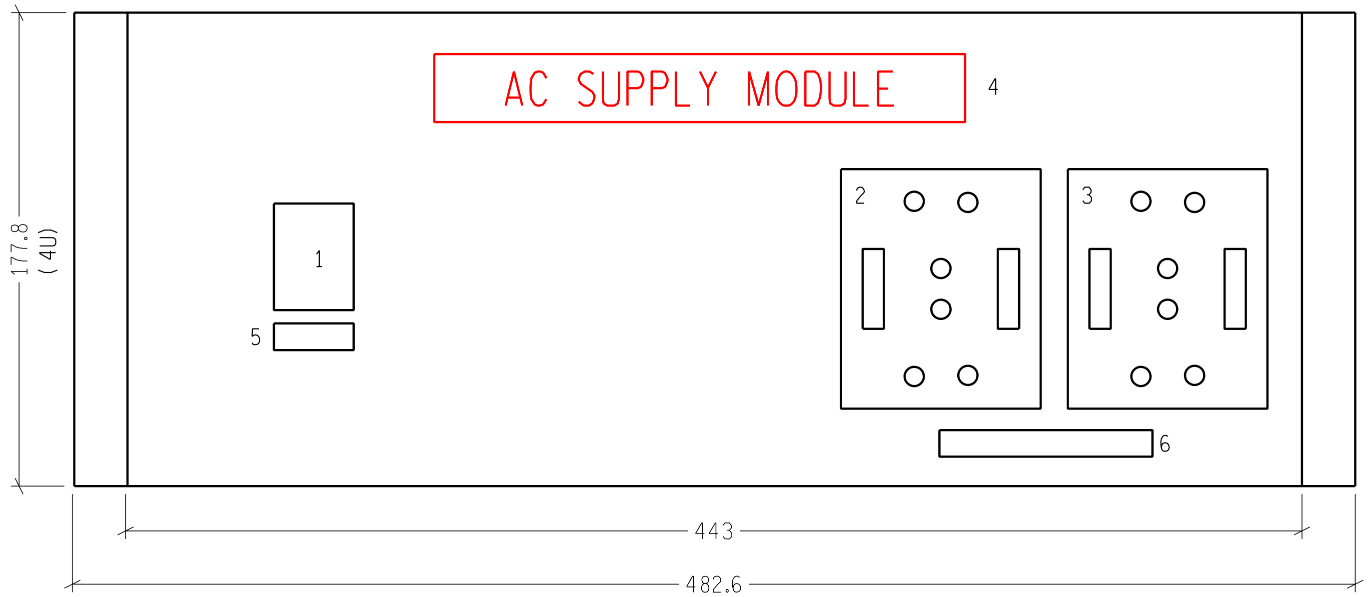
SCALE

PANEL TYPE DESIGNATION 2AC_503

A2L

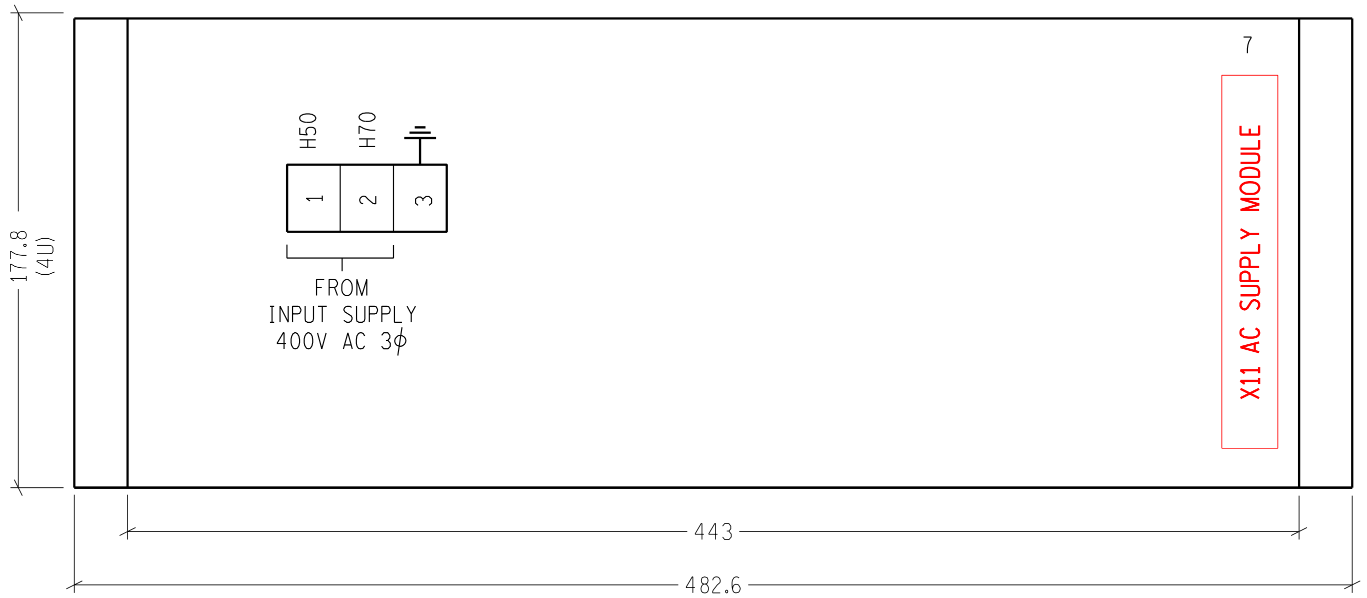
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 11 REVISION 4

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	EARTH LEAKAGE UNIT (30mA)	EL	230V AC	20A	5kA	C
2	1ϕ DOUBLE SWITCHED SOCKET OUTLET 1	SS1	230V AC	16A		
3	1ϕ DOUBLE SWITCHED SOCKET OUTLET 2	SS2	230V AC	16A		
4	LABEL	AC SUPPLY MODULE				
5	LABEL	SWITCHED SOCKETS				
6	LABEL	SWITCHED SOCKETS (SS1) (SS2)				
7	LABEL	X11 AC SUPPLY MODULE				

TERMINAL PLATE
TOP OF PLATE



REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
6	T. JACOBS	06/03/2017	LABELS UPDATED	CvS	RV
5	T. JACOBS	09/07/2014	CORE NUMBERS UPDATED. TERMINALS REMOVED.	CvS	RV
4	T. JACOBS	/ /2012	REMOVE 3ϕ SOCKET & 3ϕ E/L, ADD DOUBLE PLUGS & 1ϕ E/L	RV	RV
3.0	T. JACOBS	29/05/2009	FACEPLATE SIZE CHANGED TO 5U. ITEMS 1, 4 & 5 REVISED. ITEM 3 ADDED.	AB	T. JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: 06/06/2006
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: 20/05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
AC SUPPLY MODULE
EQUIPMENT LAYOUT

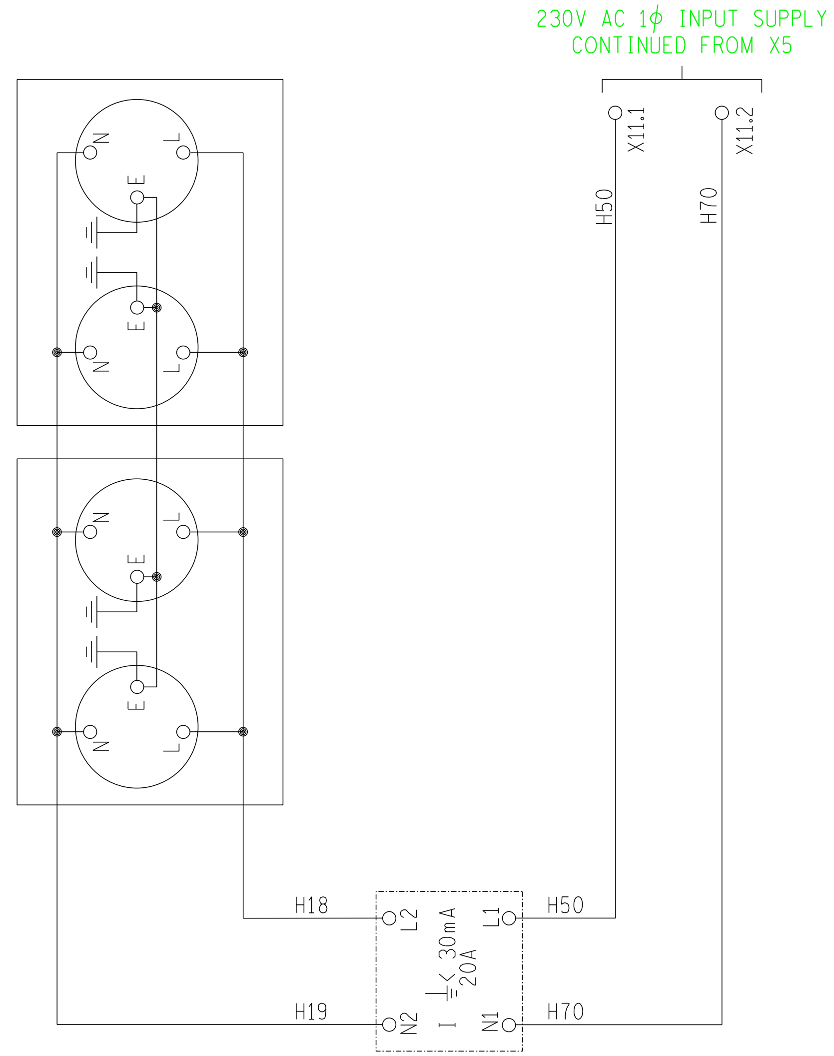
D-WC-8118

SET	SHEET	REVISION
153	12	00

PANEL TYPE DESIGNATION 2AC_603

12 A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 12 REVISION 6



5	T. JACOBS	09/07/2014	CORE NUMBERS UPDATED. TERMINALS REMOVED.	CvS	RV
4	T. JACOBS	27/03/2013	REMOVE 3ϕ SOCKET & 3ϕ E/L, ADD DOUBLE PLUGS & 1ϕ E/L	RV	RV
3.0	T. JACOBS	11/12/2009	4-POLE EARTH LEAKAGE UNIT AND MCB (SS) ADDED	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
AC SUPPLY MODULE KEY DIAGRAM

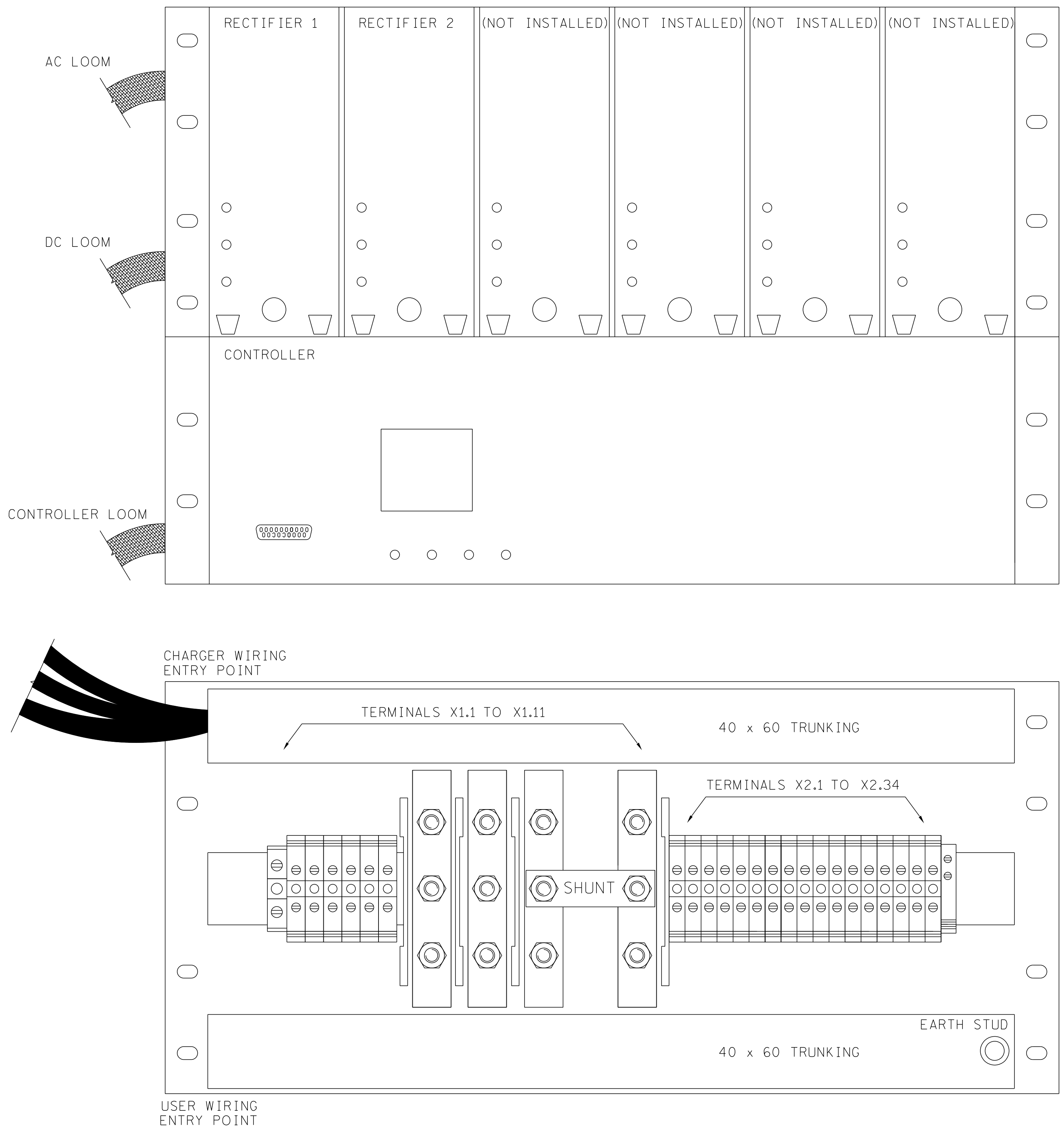
D-WC-8118

SET	SHEET	REVISION
153	13	00

PANEL TYPE DESIGNATION 2AC_603

A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 13 REVISION 5



TERMINALS	ALLOCATION
X1.1	EARTH
X1.2	AC NEUTRAL 1
X1.3	AC LIVE 1
X1.4	AC NEUTRAL 2
X1.5	AC LIVE 2
X1.6	AC NEUTRAL 3
X1.7	AC LIVE 3
X1.8	BATT+
X1.9	LOAD+
X1.10	BATT-
SHUNT	LOAD CURRENT SHUNT
X1.11	LOAD-
X2.1-X2.2	AC FAILALARM CONTACT
X2.3-X2.4	CHARGER FAILALARM CONTACT
X2.5-X2.6	DC SYSTEM FAILALARM CONTACT
X2.7-X2.8	DC SYSTEM ABNORMAL ALARM CONTACT
X2.9-X2.10	BATTERY FAILALARM CONTACT
X2.11-X2.12	MISCELLANEOUS OUTPUT CONTACT 1
X2.13-X2.14	MISCELLANEOUS OUTPUT CONTACT 2
X2.15	TEMPERATURE PROBE+
X2.16	TEMPERATURE PROBE-
X2.17	ANALOGUE IN 1+
X2.18	ANALOGUE IN 1-
X2.19	ANALOGUE IN 2+
X2.20	ANALOGUE IN 2-
X2.21-X2.22	BATTERY CIRCUIT BREAKER TRIP SENSE
X2.23-X2.24	LOAD CIRCUIT BREAKER TRIP SENSE
X2.25-X2.26	LOAD REGULATOR ON SENSE
X2.27-X2.28	MISCELLANEOUS SENSE 1
X2.29	MISCELLANEOUS SENSE 2
X2.30	MISCELLANEOUS SENSE 3
X2.31	LOAD VOLTAGE-
X2.32	LOAD VOLTAGE+
X2.33	BATTERY VOLTAGE-
X2.34	BATTERY VOLTAGE+

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 19/02/2020
DRAWN BY K STEYNBERG DATE 19/02/2020

Eskom
AUTH: T JACOBS DATE: /06/2006
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V/220V SUBRACK CHARGER BACKPLATE LAYOUT

D-WC-8118

SET	SHEET	REVISION
153	14	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

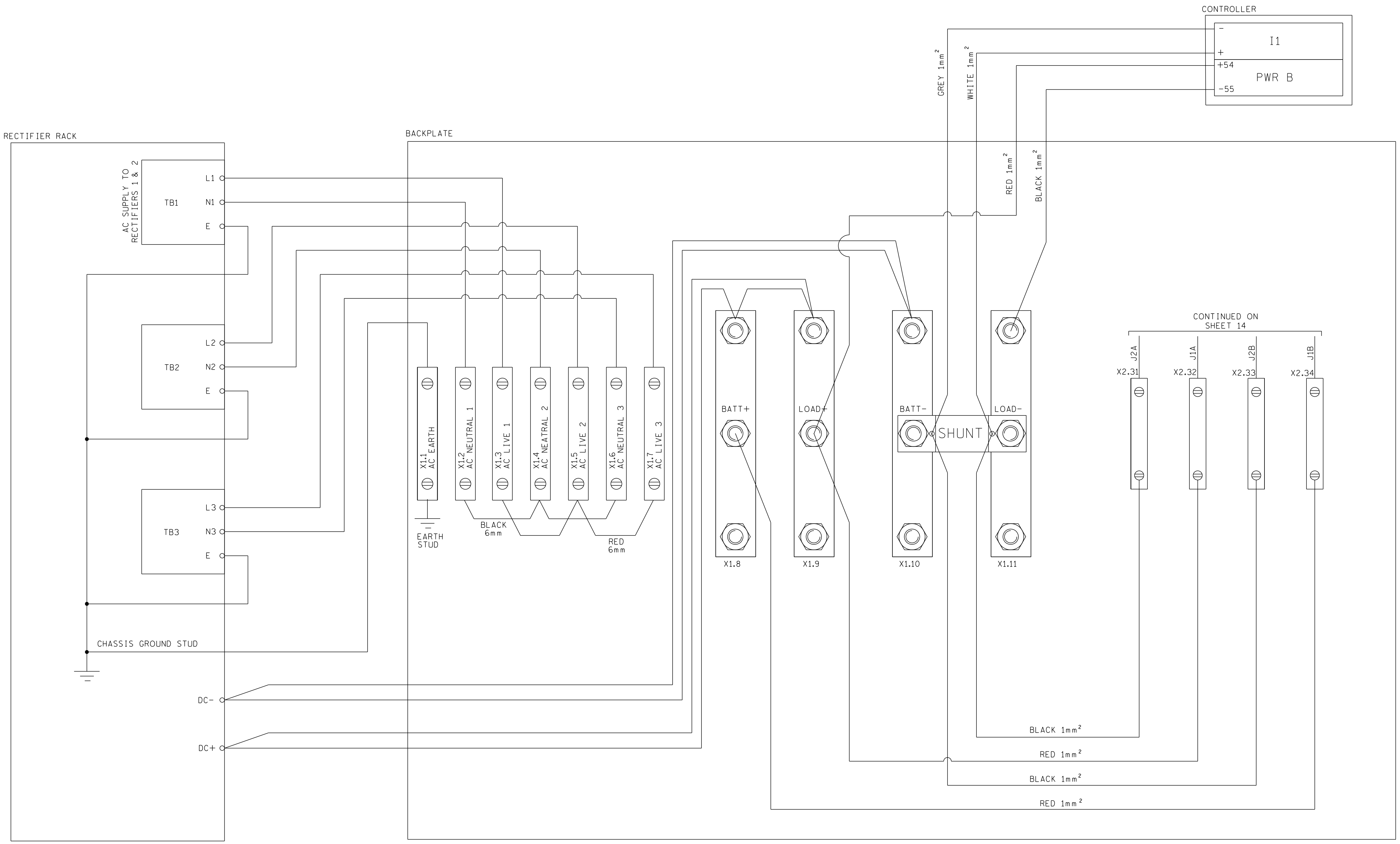
SCALE

LEVELS 1 10

PANEL TYPE DESIGNATION

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-11352 SHEET 12 OF 23 REVISION 0



NOTES:
THESE NOTES ARE APPLICABLE UNLESS OTHERWISE STATED
1. AC AND DC WIRING TO BE IN SEPERATE LOOMS
2. ALL EARTH WIRING IS 4mm GREEN/YELLOW
3. ALL AC NEUTRAL WIRING IS 4mm BLACK
4. ALL AC LIVE 1 WIRING IS 4mm RED
5. ALL AC LIVE 2 WIRING IS 4mm WHITE
6. ALL AC LIVE 3 WIRING IS 4mm BLUE
7. ALL DC+ WIRING IS 16mm RED FOR 110V SYSTEMS
8. ALL DC+ WIRING IS 10mm RED FOR 220V SYSTEMS
9. ALL DC- WIRING IS 16mm BLACK FOR 110V SYSTEMS
10. ALL DC- WIRING IS 10mm BLACK FOR 220V SYSTEMS
11. TERMINALS X1.1 TO X1.7 ARE ENTRELEC M10/10.RS
12. TERMINALS X1.8 TO X1.11 ARE ENTRELEC M35/26.EE
13. TERMINALS X2.31 TO X2.34 ARE ENTRELEC M4/6

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 19/02/2020
DRAWN BY K STEYNBERG DATE 19/02/2020
SCALE

Eskom
AUTH: T JACOBS DATE: /06/2006
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V/220V SUBRACK CHARGER
AC & DC INTERCONNECTIONS

D-WC-8118

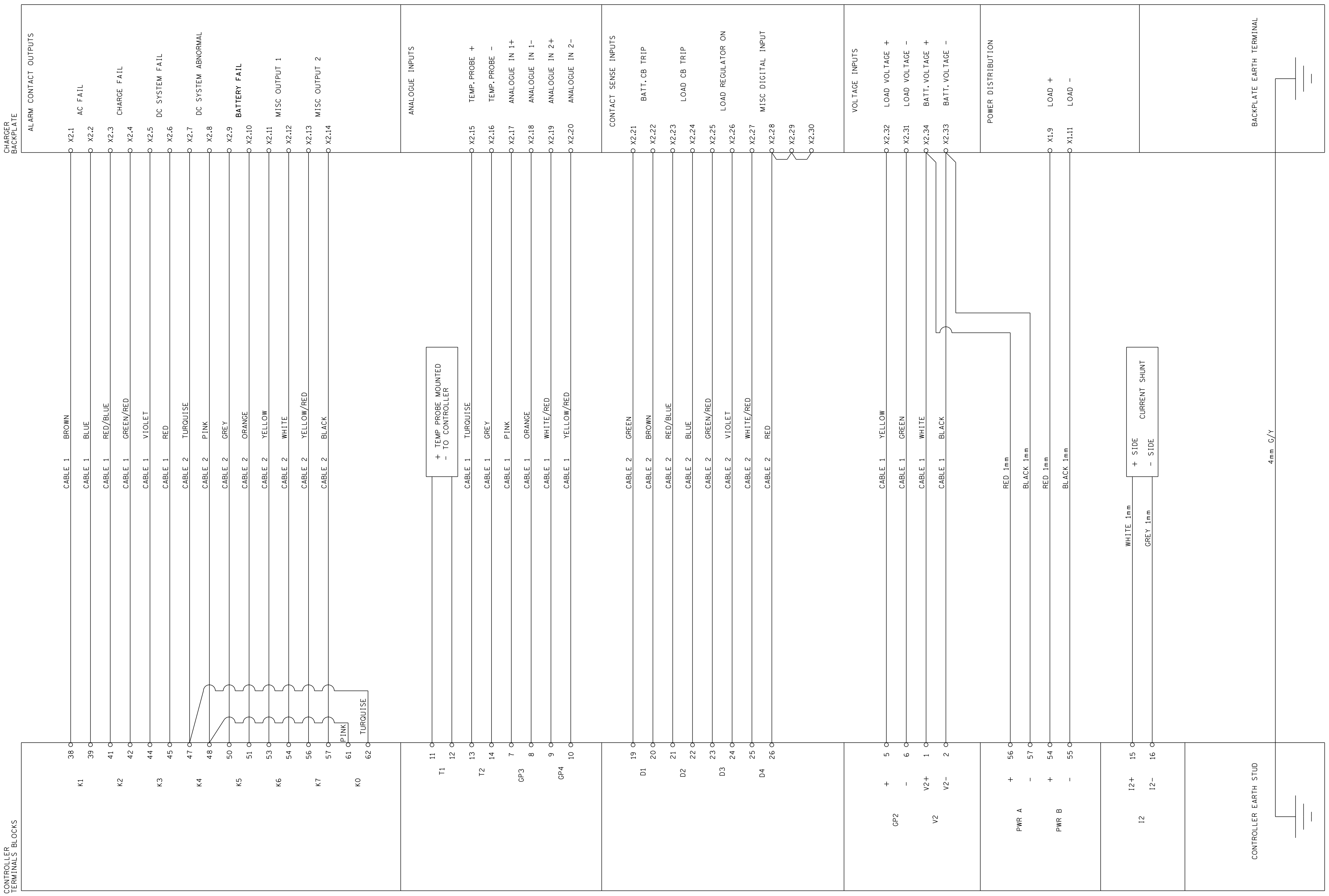
SET	SHEET	REVISION
153	15	00

LEVELS 1 10

PANEL TYPE DESIGNATION

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-11352 SHEET 13 OF 23 REVISION 0



NOTES:
1. TERMINALS X2.1 TO X2.30 ARE ENTRELEC D2.5/5.ADO
2. TERMINALS X2.31 TO X2.34 ARE ENTRELEC M4/6
3. CABLE 1 AND 2 ARE 8PAIR OAM SCREENED CABLE 7x0.2mm TCW

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED L. BOTHA
DATE 20/04/2020
PROJECT CHECKED A. MARAIS
DATE 19/02/2020
DRAWN BY K STEYNBERG
DATE 19/02/2020

Eskom

AUTH: T JACOBS
DATE: /06/2006
CHKD: V van ZWEEL
DATE: 06/06/2002
DRAWN: T ERASMUS
DATE: /05/2002

SCALE

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V/220V SUBRACK CHARGER
ALARM & SUPERVISORY INTER CON

D-WC-8118

SET	SHEET	REVISION
153	16	00

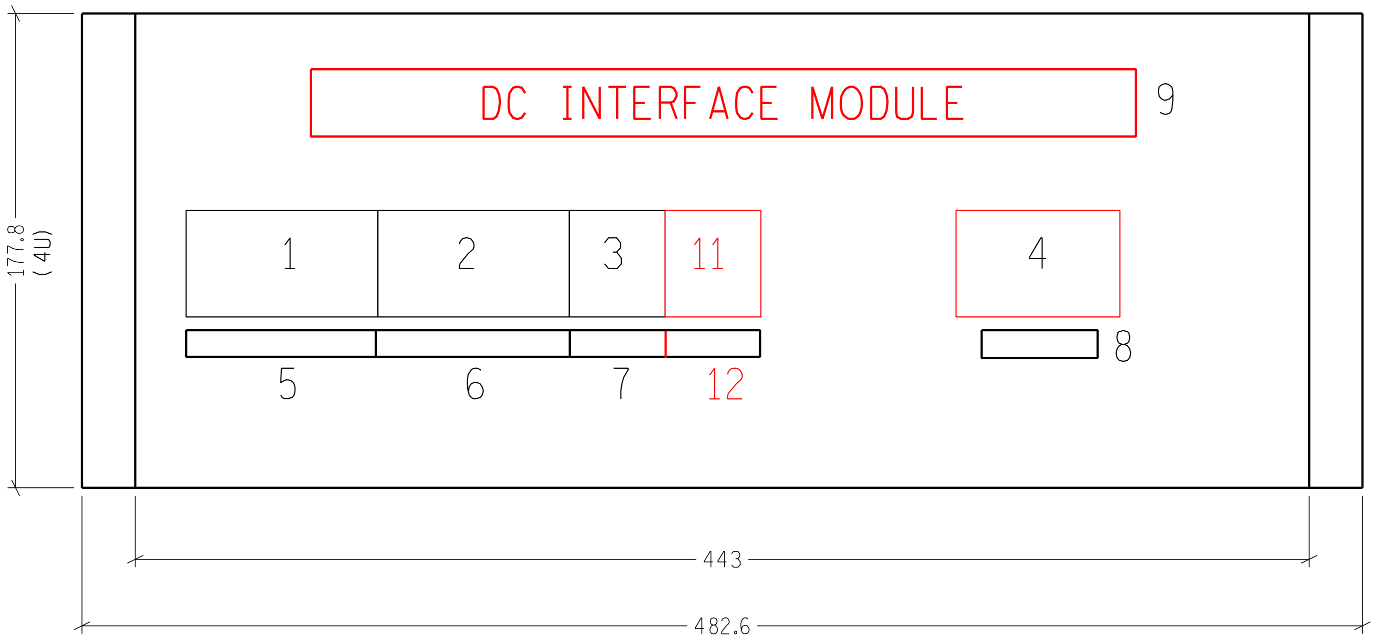
LEVELS 1 10

PANEL TYPE DESIGNATION

SIZE GROOTTE A1L

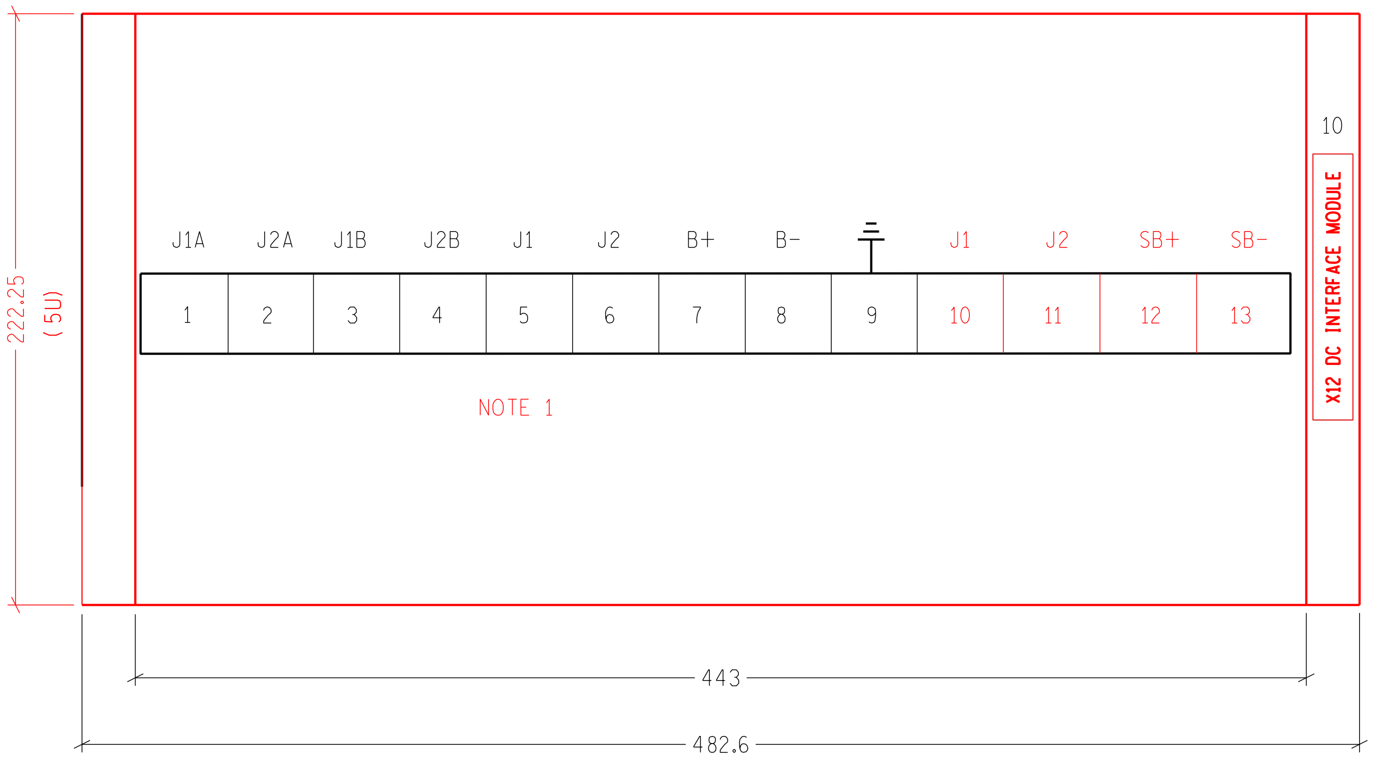
MASTER TRACING FILED UNDER D-DT-11352 SHEET 14 OF 23 REVISION 0

EQUIPMENT LAYOUT



ITEM	DESCRIPTION	LABEL	V	A	kA
1	MAIN DC SUPPLY ISOLATOR	ISO (CHGR)	140V DC	63A	5kA
2	STANDBY DC SUPPLY ISOLATOR	STANDBY DC ISOLATOR	140V DC	63A	5kA
3	BATTERY ISOLATOR	ISO (BATT)	140V DC	63A	5kA
4	STANDBY DC SUPPLY FLAT PLATE ANDERSON PLUG	STANDBY CHGR SOCKET	140V DC	50A	
5	LABEL	MAIN DC SUPPLY ISOLATOR			
6	LABEL	STANDBY DC SUPPLY ISOLATOR			
7	LABEL	ISO (BATT)			
8	LABEL	STANDBY CHGR SOCKET			
9	LABEL	DC INTERFACE MODULE			
10	LABEL	X12 DC INTERFACE MODULE			
11	BATTERY MCB, C-CURVE	MCB (AC/DC PANEL 2)	140V DC	63A	5kA
12	LABEL	MCB AC/DC PNL2			

TERMINAL PLATE
TOP OF PLATE



NOTE:
1. STUD TYPE TERMINAL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	ADDED STANDBY TERMINALS AND AC/DC PANEL 2 MCB. LABELS UPDATED. BACKPLATE CHANGED FROM 4U TO 5U.	CvS	RV
4	T. JACOBS	09/07/2014	UPDATED ISOL & MCB SPECIFICATIONS	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS — DATE: /06/2002
CHKD: V van ZWEEL — DATE: 06/06/2002
DRAWN: T ERASMUS — DATE: /05/2002

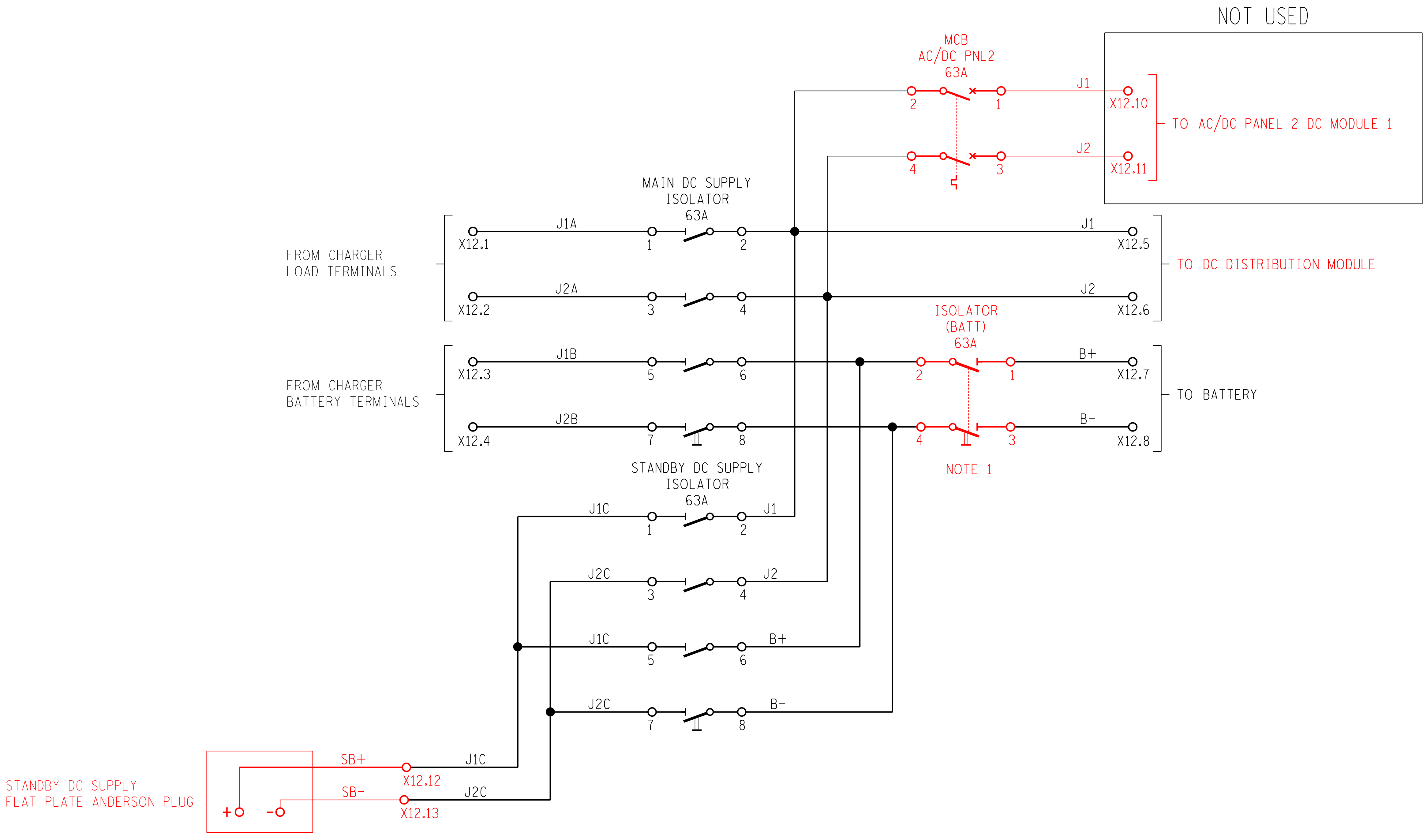
YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
DC INTERFACE MODULE EQUIPMENT LAYOUT

D-WC-8118 | SET 153 | SHEET 17 | REVISION 00

PANEL TYPE DESIGNATION 2DC_203

A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 14 REVISION 5



NOTE:
1. THE SHORT CIRCUIT CURRENT FOR THE MCB MUST BE FOR THE MAXIMUM SHORT CIRCUIT CURRENT OF THE BATTERY.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	/03/2017	ADDED STANDBY TERMINALS, AC/DC PANEL 2 MCB & NOTE 1, UPDATED PLUG LAYOUT, CHANGED BATT MCB TO ISOLATOR.	CvS	RV
4	T. JACOBS	09/07/2014	UPDATED ISOL & MCB SYMBOLS AND ADDED RATINGS	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
DC INTERFACE MODULE KEY DIAGRAM

D-WC-8118

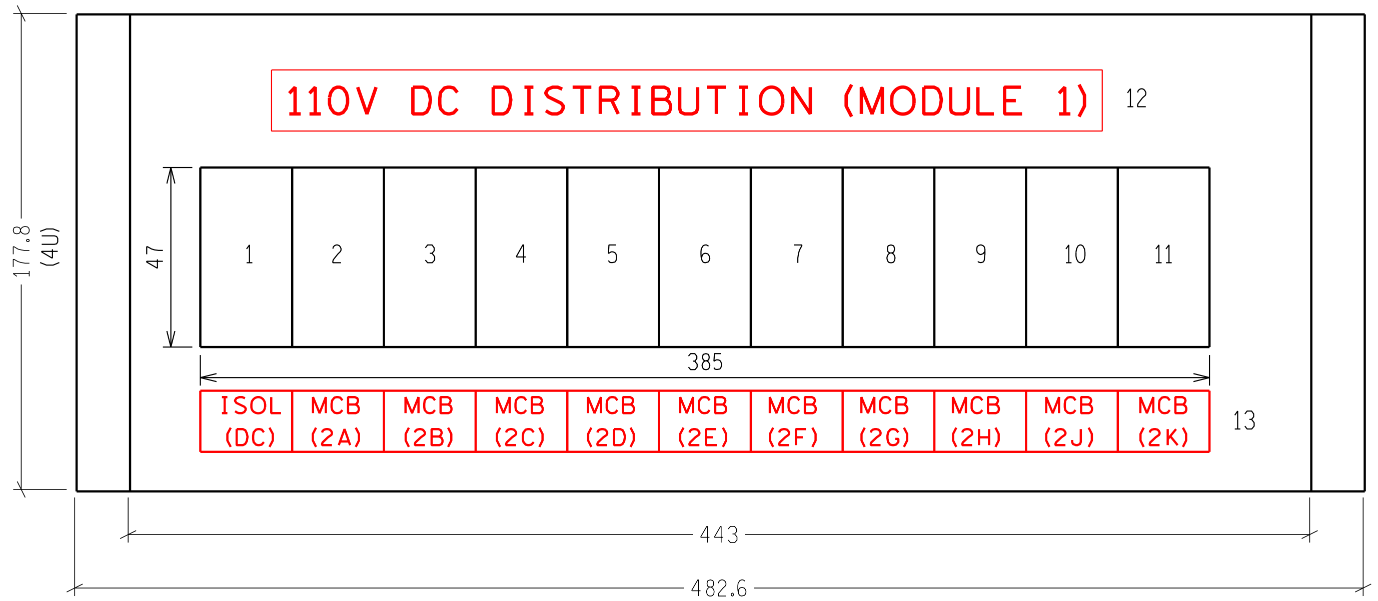
SET	SHEET	REVISION
153	18	00

PANEL TYPE DESIGNATION 2DC_203

A2L

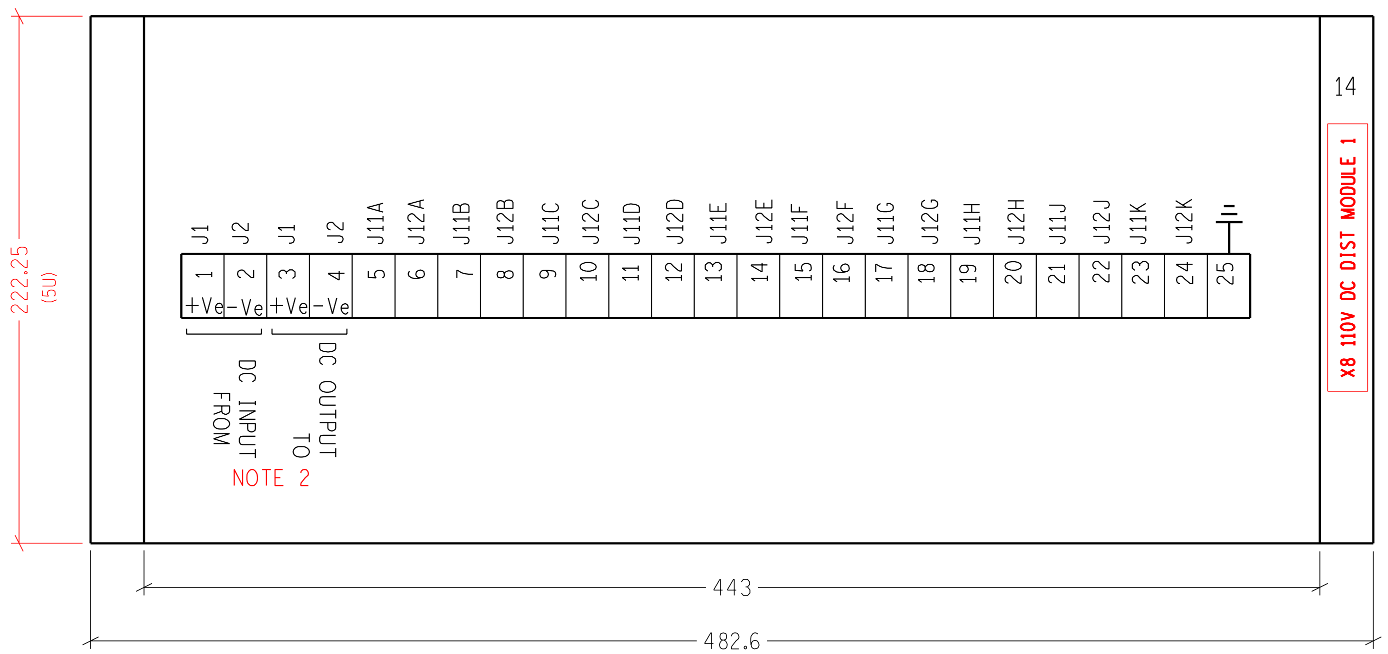
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 15 REVISION 5

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	DC SUPPLY ISOLATOR	ISOL (DC)	140V DC	63A	5kA	
2	DC SUPPLY MCB CIRCUIT (A)(2-Pole)	MCB (2A)	140V DC	32A	5kA	C
3	DC SUPPLY MCB CIRCUIT (B)(2-Pole)	MCB (2B)	140V DC	32A	5kA	C
4	DC SUPPLY MCB CIRCUIT (C)(2-Pole)	MCB (2C)	140V DC	32A	5kA	C
5	DC SUPPLY MCB CIRCUIT (D)(2-Pole)	MCB (2D)	140V DC	32A	5kA	C
6	DC SUPPLY MCB CIRCUIT (E)(2-Pole)	MCB (2E)	140V DC	32A	5kA	C
7	DC SUPPLY MCB CIRCUIT (F)(2-Pole)	MCB (2F)	140V DC	32A	5kA	C
8	DC SUPPLY MCB CIRCUIT (G)(2-Pole)	MCB (2G)	140V DC	32A	5kA	C
9	DC SUPPLY MCB CIRCUIT (H)(2-Pole)	MCB (2H)	140V DC	32A	5kA	C
10	DC SUPPLY MCB CIRCUIT (J)(2-Pole)	MCB (2J)	140V DC	32A	5kA	C
11	DC SUPPLY MCB CIRCUIT (K)(2-Pole)	MCB (2K)	140V DC	32A	5kA	C
12	LABEL	110V DC DISTRIBUTION (MODULE 1)				
13	LABEL	SEE EQUIPMENT LAYOUT				
14	LABEL	X8 110V DC DIST MODULE 1				

TERMINAL PLATE
TOP OF PLATE



NOTE:

1. 1U=44.45mm
2. STUD TYPE TERMINAL.

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T.JACOBS	06/03/2017	LABELS UPDATED. NOTE ADDED.	CvS	RV
4	T.JACOBS	09/07/2014	MCB AND ISOL RATINGS UPDATED	CvS	RV
3.0	T.JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T.JACOBS
2	T.JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V DC DISTRIBUTION MODULE 1
EQUIPMENT LAYOUT

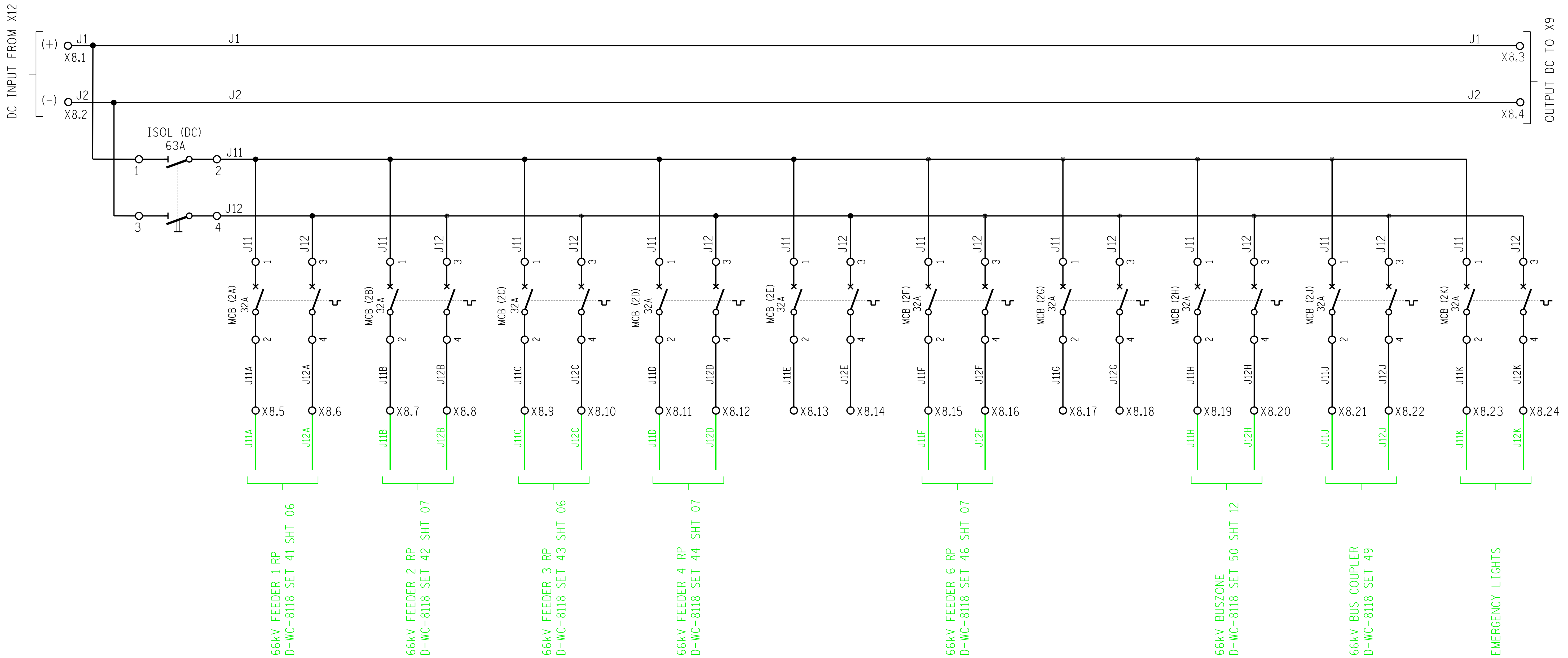
D-WC-8118

SET	SHEET	REVISION
153	19	00

PANEL TYPE DESIGNATION 2DC_103

A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 16 REVISION 5



REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
4	T. JACOBS	09/07/2014	UPDATED MCB AND ISOL SYMBOLS. UPDATED ISOL RATING.	CvS	RV
3.0	T. JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T. JACOBS
2	T. JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T. JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS — DATE: /06/2002
CHKD: V van ZWEEL — DATE: 06/06/2002
DRAWN: T ERASMUS — DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V DC DISTRIBUTION MODULE 1 KEY DIAGRAM

D-WC-8118

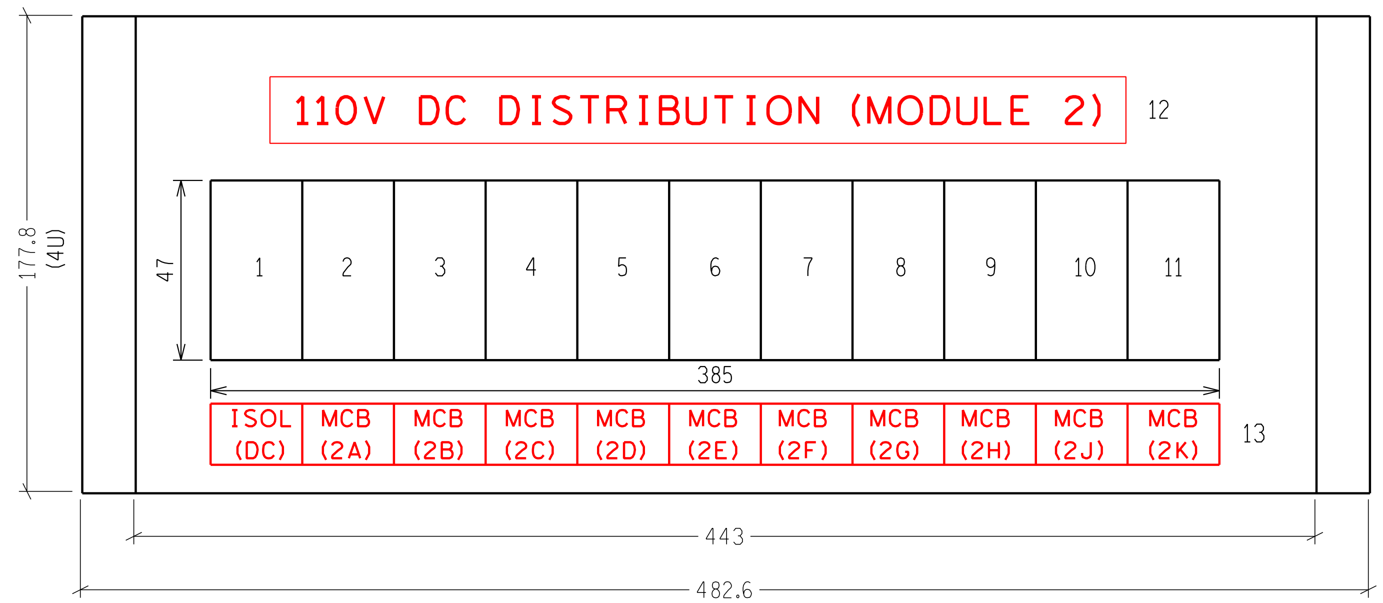
SET	SHEET	REVISION
153	20	00

PANEL TYPE DESIGNATION 2DC_103

A2L

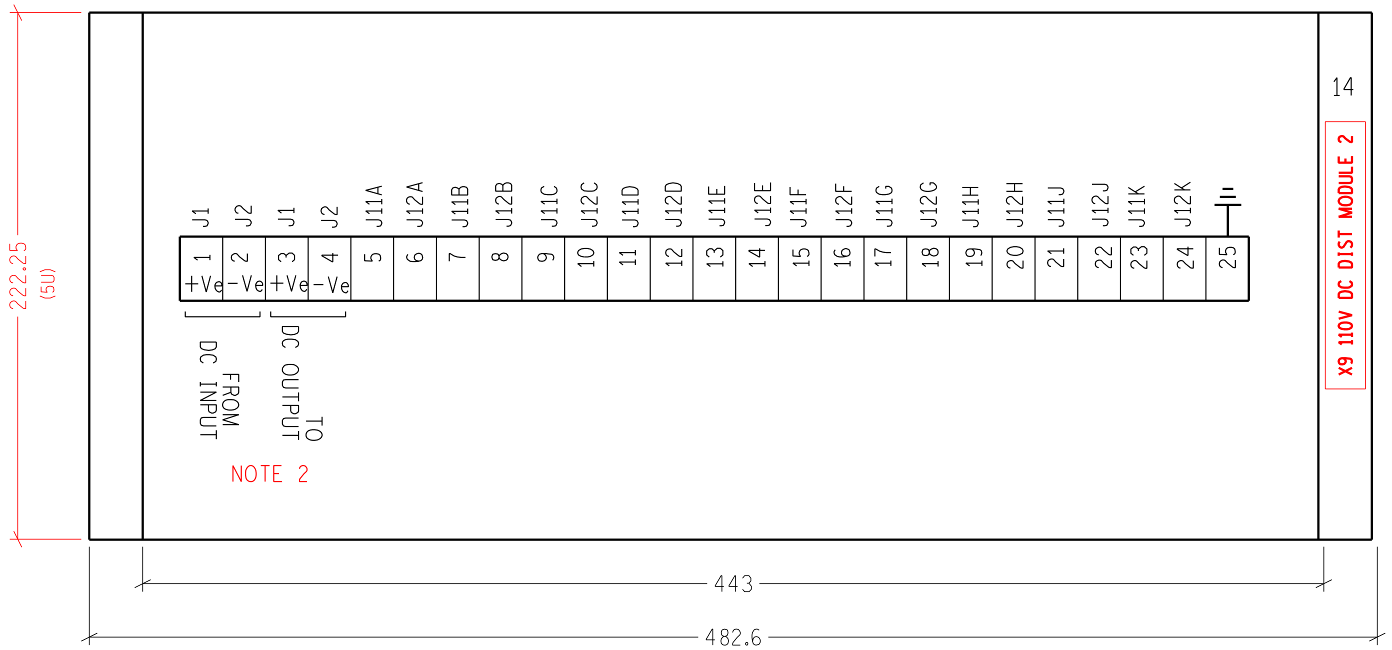
MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 17 REVISION 4

EQUIPMENT LAYOUT



	DESCRIPTION	LABEL	V	A	kA	TRIP CURVE
1	DC SUPPLY ISOLATOR	ISOL (DC)	140V DC	63A	5kA	
2	DC SUPPLY MCB CIRCUIT (A)(2-Pole)	MCB (2A)	140V DC	32A	5kA	C
3	DC SUPPLY MCB CIRCUIT (B)(2-Pole)	MCB (2B)	140V DC	32A	5kA	C
4	DC SUPPLY MCB CIRCUIT (C)(2-Pole)	MCB (2C)	140V DC	32A	5kA	C
5	DC SUPPLY MCB CIRCUIT (D)(2-Pole)	MCB (2D)	140V DC	32A	5kA	C
6	DC SUPPLY MCB CIRCUIT (E)(2-Pole)	MCB (2E)	140V DC	32A	5kA	C
7	DC SUPPLY MCB CIRCUIT (F)(2-Pole)	MCB (2F)	140V DC	32A	5kA	C
8	DC SUPPLY MCB CIRCUIT (G)(2-Pole)	MCB (2G)	140V DC	32A	5kA	C
9	DC SUPPLY MCB CIRCUIT (H)(2-Pole)	MCB (2H)	140V DC	32A	5kA	C
10	DC SUPPLY MCB CIRCUIT (J)(2-Pole)	MCB (2J)	140V DC	32A	5kA	C
11	DC SUPPLY MCB CIRCUIT (K)(2-Pole)	MCB (2K)	140V DC	32A	5kA	C
12	LABEL	110V DC DISTRIBUTION (MODULE 2)				
13	LABEL	SEE EQUIPMENT LAYOUT				
14	LABEL	X9 110V DC DIST MODULE 2				

TERMINAL PLATE TOP OF PLATE



NOTE:

1. 1U=44.45mm
2. STUD TYPE TERMINAL.

5	T.JACOBS	06/03/2017	LABELS UPDATED. NOTE ADDED.	CvS	RV
4	T.JACOBS	09/07/2014	MCB AND ISOL RATINGS UPDATED	CvS	RV
3.0	T.JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T.JACOBS
2	T.JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2019
DRAWN BY: K STEYNBERG, DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS, DATE: /06/2002
CHKD: V van ZWEEL, DATE: 06/06/2002
DRAWN: T ERASMUS, DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V DC DISTRIBUTION MODULE 2 EQUIPMENT LAYOUT

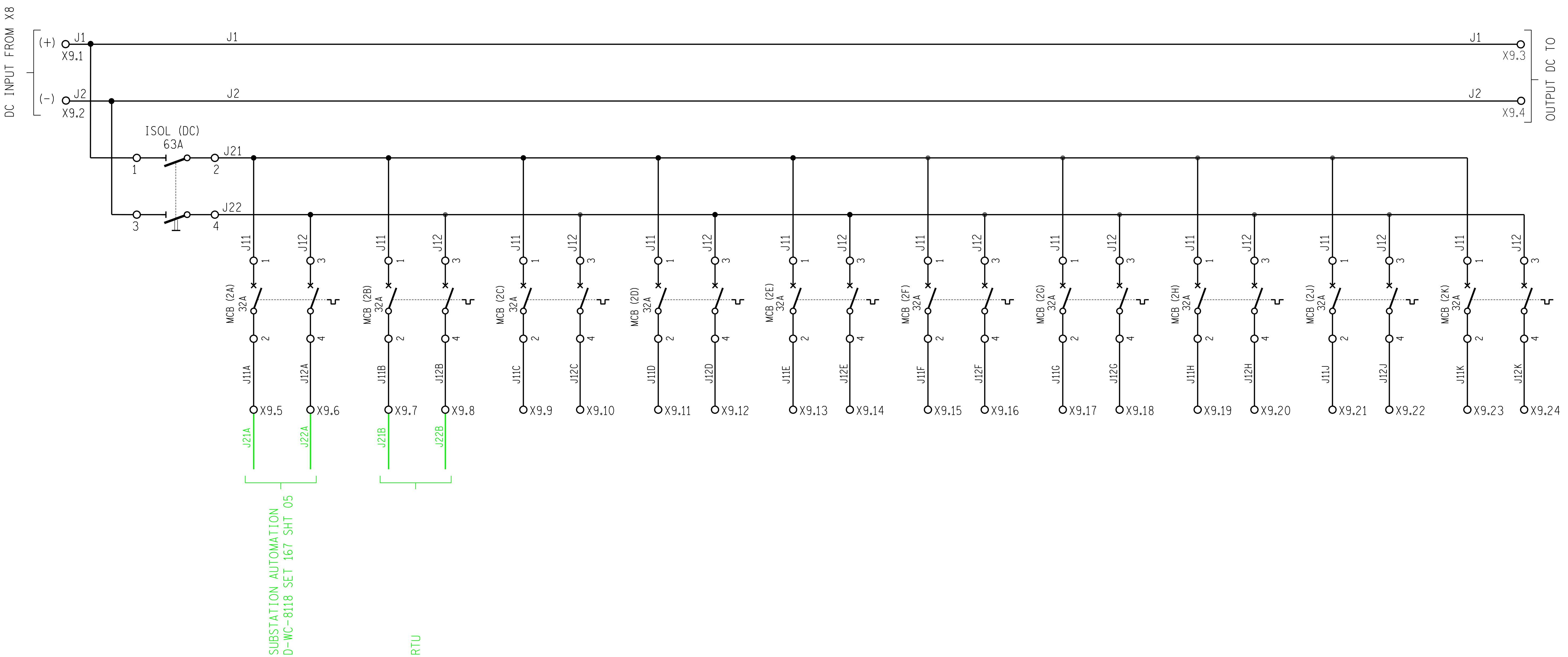
D-WC-8118

SET	SHEET	REVISION
153	21	00

PANEL TYPE DESIGNATION 2DC_103

A2L

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 18 REVISION 5



REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
4	T.JACOBS	09/07/2014	UPDATED MCB AND ISOL SYMBOLS. UPDATED ISOL RATING.	CvS	RV
3.0	T.JACOBS	11/12/2009	AS PER PREVIOUS REVISION	AB	T.JACOBS
2	T.JACOBS	27/01/2006	SHTS 3A, 3B, 20A & 20B ADDED	VvZ	T.JACOBS
1	TDJ	17/02/2005	DRAWING NO. CHANGED FROM D-DT-5600	VvZ	

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED L.BOTHA DATE 20/04/2020
PROJECT CHECKED A.MARAIS DATE 04/12/2019
DRAWN BY K STEYNBERG DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS DATE: /06/2002
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
110V DC DISTRIBUTION MODULE 2 KEY DIAGRAM

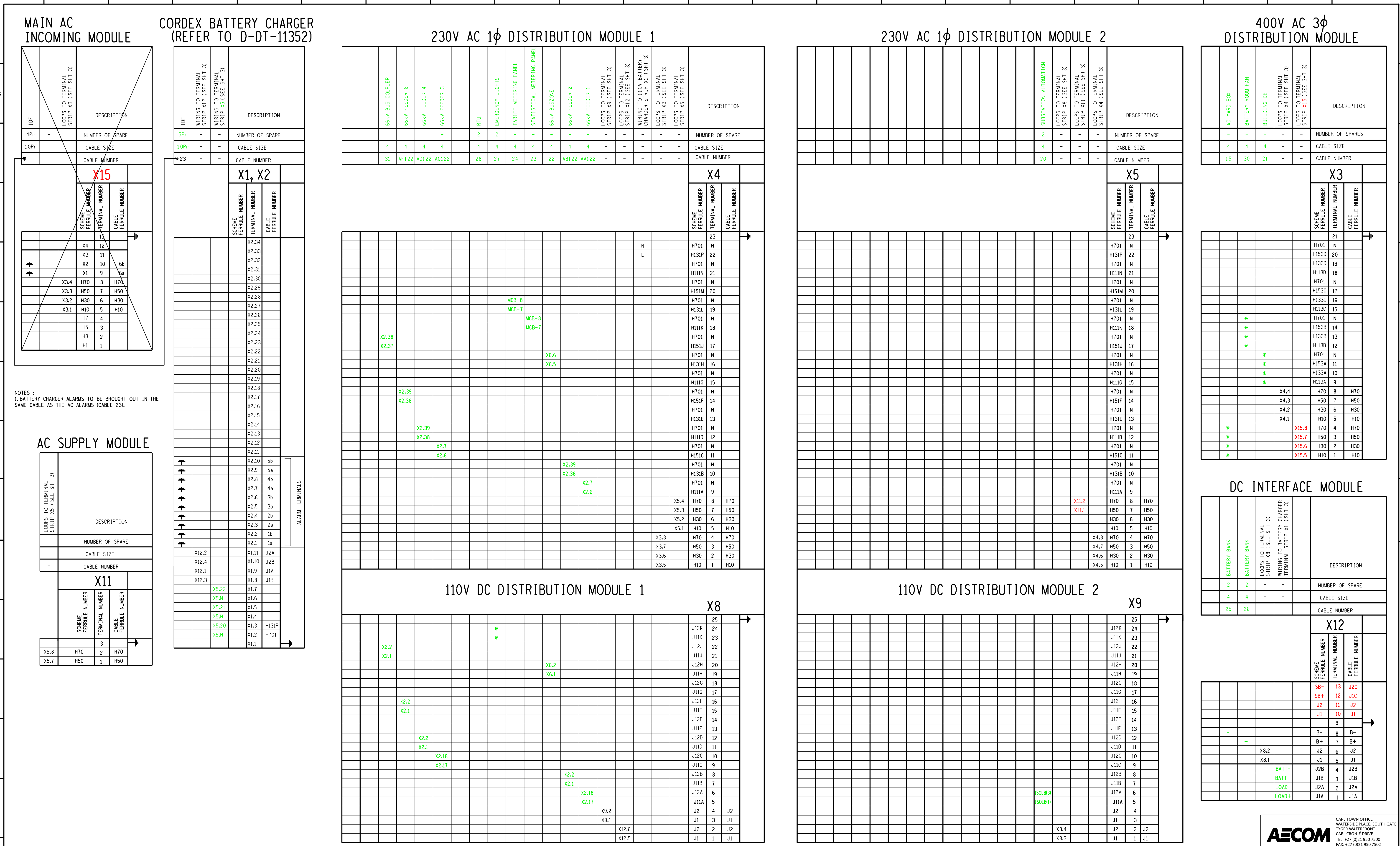
D-WC-8118

SET	SHEET	REVISION
153	22	00

PANEL TYPE DESIGNATION 2DC_103

A2L

MASTER TRACING FILED UNDER D-DT-1218 SET 23 SHEET 19 REVISION 4



NOTES :
1. BATTERY CHARGER ALARMS TO BE BROUGHT OUT IN THE SAME CABLE AS THE AC ALARMS (CABLE 23).

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
5	T. JACOBS	06/03/2017	TERMINALS ADDED ON X12. X13 CHANGED TO X15.	CvS	RV
4	T. JACOBS	09/07/2014	CORE NUMBERS UPDATED. LAYOUT REVISED.	CvS	T. JACOBS
3.0	T. JACOBS	29/05/2009	ALARM FERRULE NO'S CHANGED ON BATTERY CHARGER AND MAIN AC INCOMING MODULE.	AB	T. JACOBS
2	T. JACOBS	26/01/2006	SURGE PROTECTION TERMINALS ADDED	VvZ	T. JACOBS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

PROJECT APPROVED: L. BOTHA DATE 20/04/2020
PROJECT CHECKED: A. MARAIS DATE 04/12/2019
DRAWN BY: K STEYNBERG DATE 16/09/2019
SCALE

Eskom
AUTH: T JACOBS DATE: /06/2002
CHKD: V van ZWEEL DATE: 06/06/2002
DRAWN: T ERASMUS DATE: /05/2002

YSTERVARK SUBSTATION
28/20 WAY AC/DC PANEL
PANEL CABLING DIAGRAM

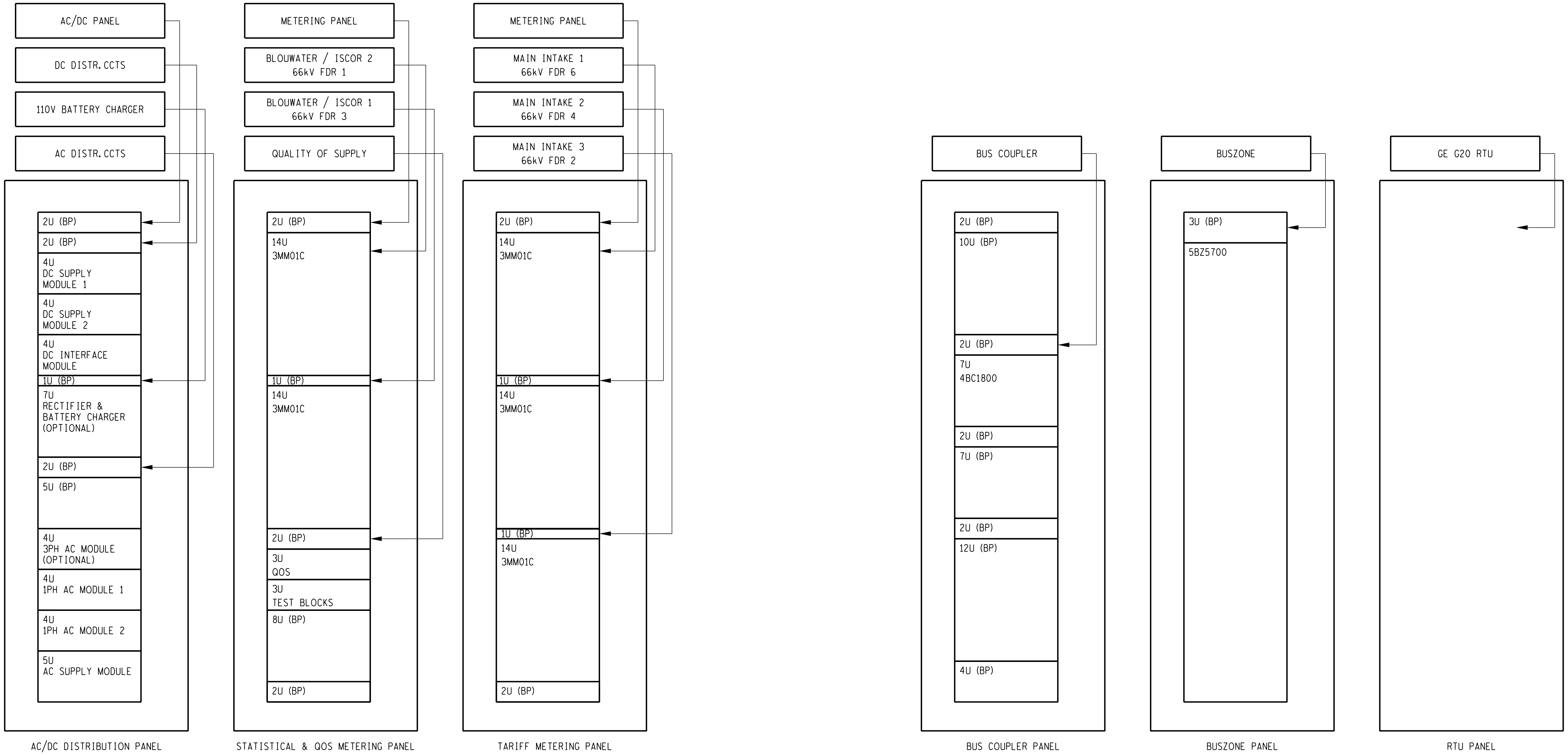
D-WC-8118

SET	SHEET	REVISION
153	23	00

PANEL TYPE DESIGNATION 2AD_303

MASTER TRACING FILED UNDER D-DT-11218 SET 23 SHEET 20B REVISION 5

AOL



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE	KS				153272156-00003

Eskom

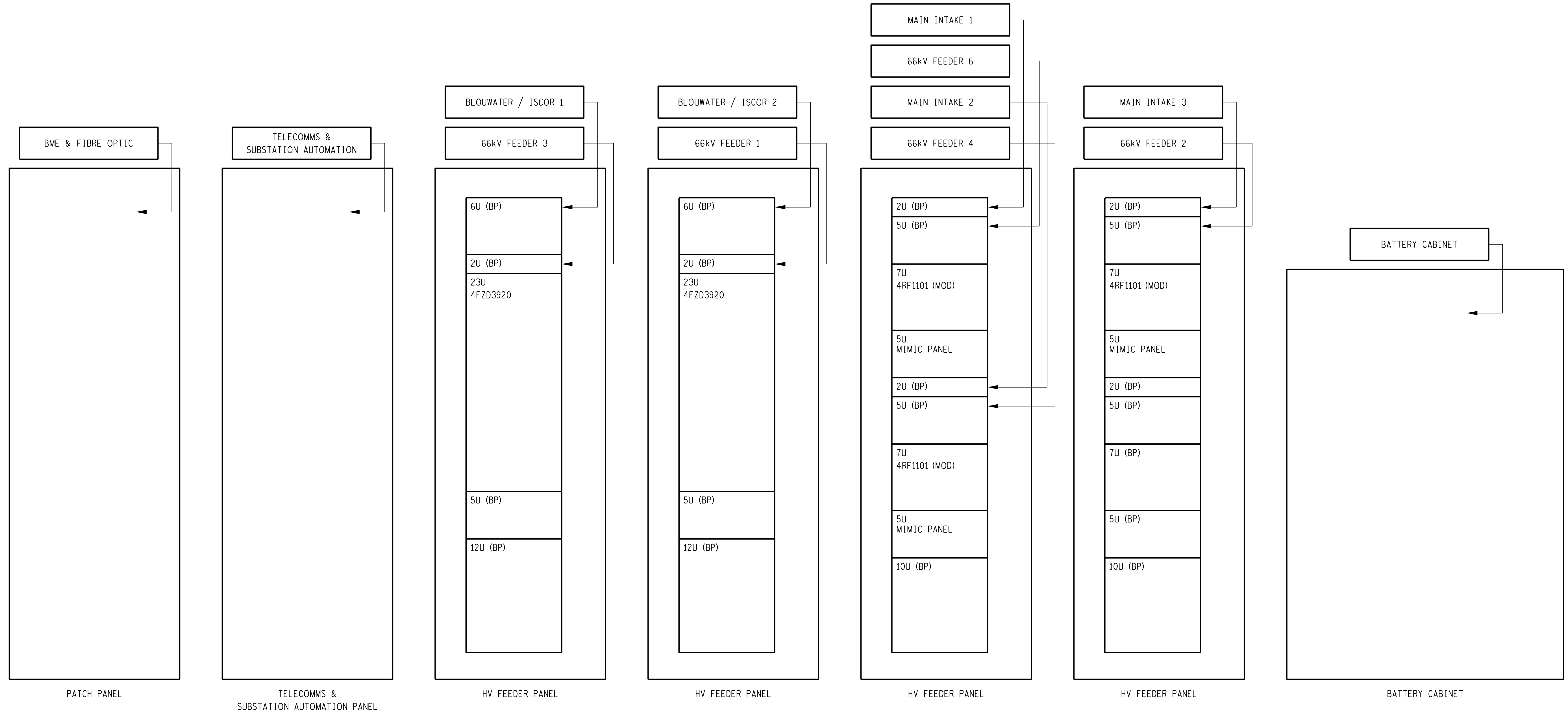
YSTERVARK SUBSTATION
PANEL LAYOUT & MAIN LABEL ENGRAVING

AUTH: L. BOTHA — DATE: 20/04/2020 — ACC: — DATE: / /
CHKD: A. MARAIS — DATE: 04/12/2019 — CHKD: — DATE: / /
DRAWN: K. STEYNBERG — DATE: 18/09/2019 — DRAWN: — DATE: / /

AECOM

DRAWING	SET	SHEET	REVISION
D-WC-8118	156	01	00

A1L



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

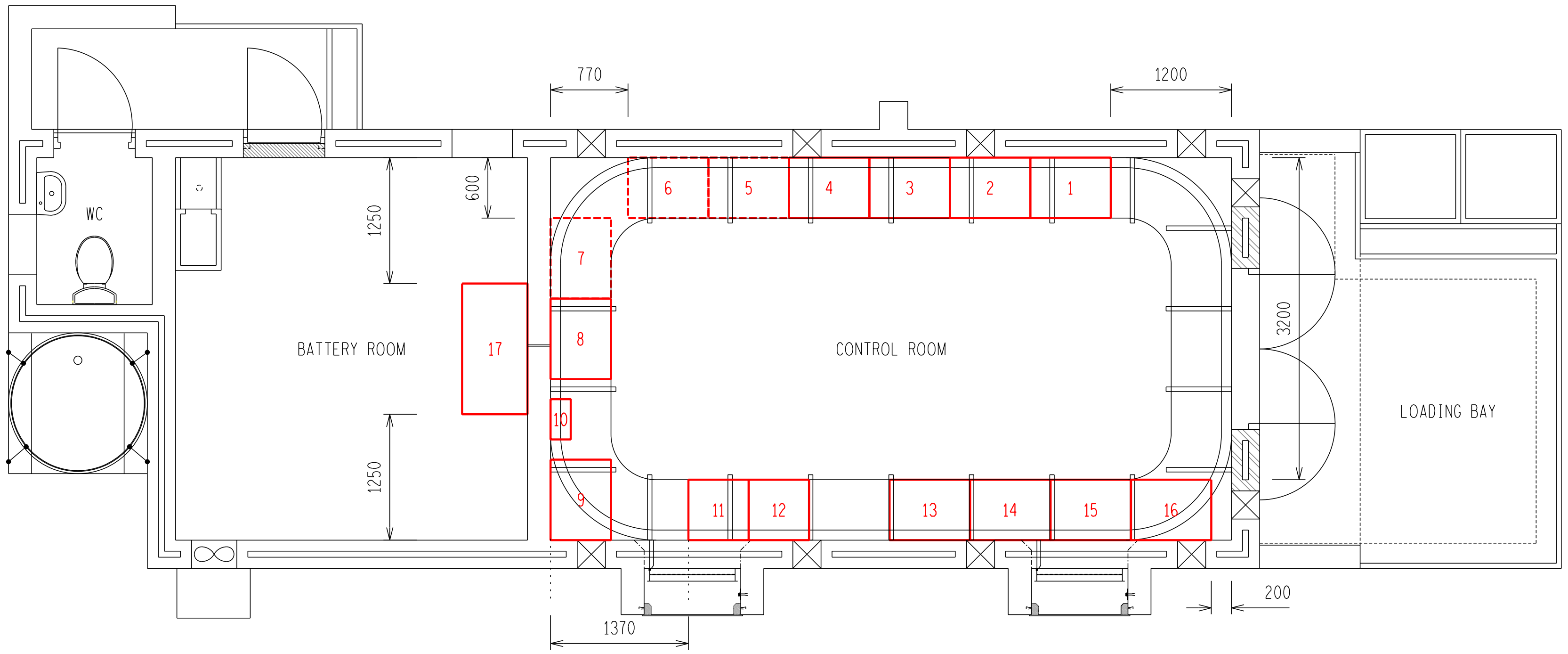
YSTERVARK SUBSTATION
PANEL LAYOUT & MAIN LABEL ENGRAVING

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

AUTH: L. BOTHA	ACC:
DATE: 20/04/2020	DATE: / /
CHKD: A. MARAIS	CHKD:
DATE: 04/12/2019	DATE: / /
DRAWN: K. STEYNBERG	DRAWN:
DATE: 18/09/2019	DATE: / /

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	156	02	00

A1L



PANEL NUMBER	PANEL NAME
1	66kV BUSZONE
2	66kV BUS COUPLER
3	66kV FEEDER 1
4	66kV FEEDER 3
5	FUTURE
6	FUTURE
7	FUTURE
8	AC/DC PANEL
9	RTU
10	IDF
11	TELECOMMS
12	PATCH PANEL & SUBSTATION AUTOMATION
13	66kV FEEDER 2
14	66kV FEEDER 4 & 6
15	STATISTICAL & QOS METERING
16	TARIFF METERING
17	BATTERY CABINET

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

AUTH: L. BOTHA	AUTH:
DATE: 20/04/2020	DATE: / /
CHKD: A. MARAIS	CHKD:
DATE: 04/12/2019	DATE: / /
DRAWN: K STEYNBERG	DRAWN:
DATE: 18/09/2019	DATE: / /

Eskom

YSTERVARK SUBSTATION

PANEL ARRANGEMENT

D-WC-8118

SET	SHEET	REVISION
157	01	00

PANEL TYPE DESIGNATION 2AC_403

A2L

MASTER TRACING FILED UNDER D-DT-1218 SET 22 SHEET 06 REVISION 3.0

DRAWING REFERENCE NUMBERS			
	FEEDER 1	FEEDER 3	
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
WIRING			
KEY			
CABLING			
ARRANGEMENT			
KEY			
CABLING			
ARRANGEMENT			
WIRING			
KEY			
CABLING			
ARRANGEMENT			
WIRING			
KEY			
CABLING			

66kV B/B 2 ISOLATOR MB

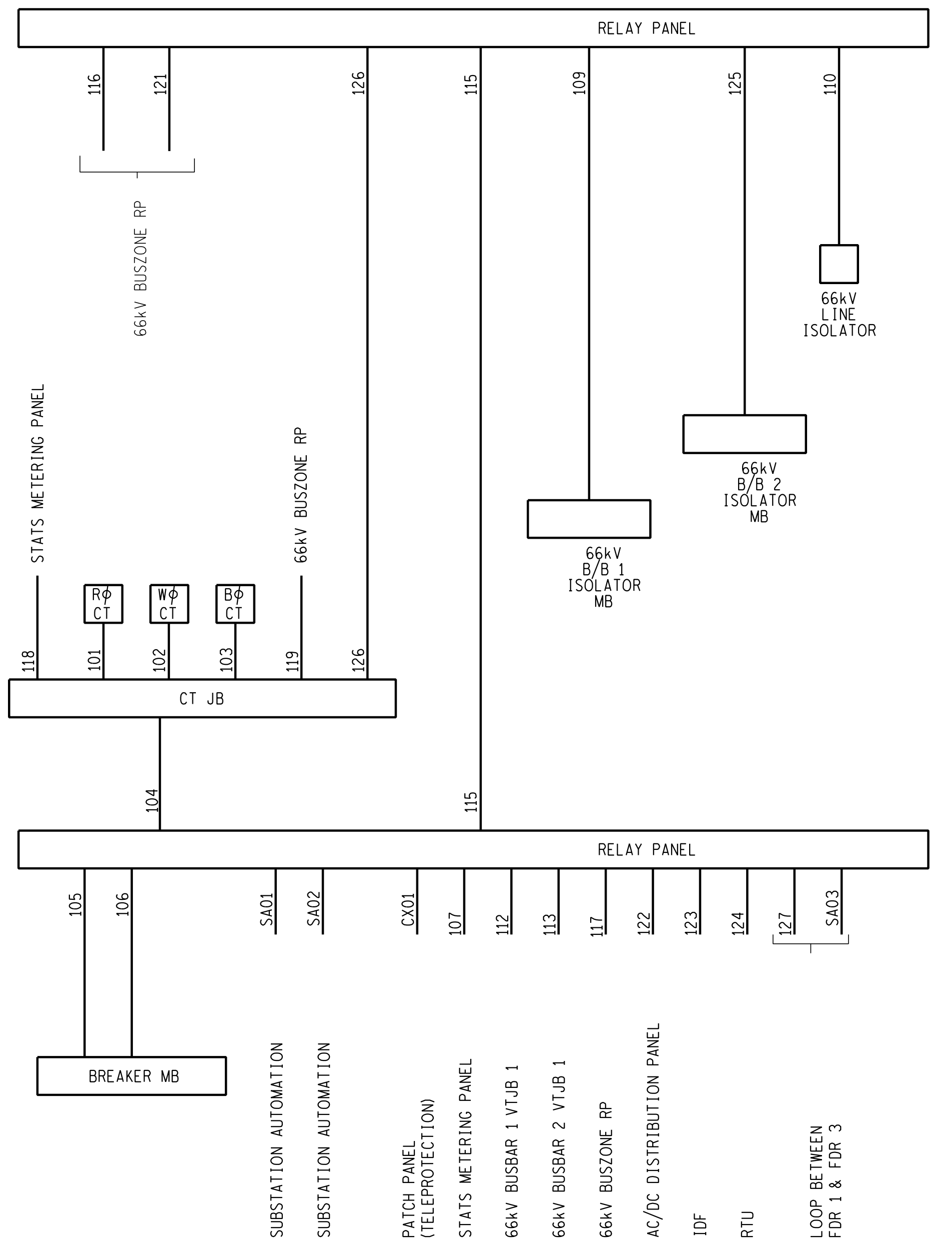
66kV B/B 1 ISOLATOR MB

66kV CTs

CT JB

RELAY PANEL

BREAKER MB



CABLE DESIGNATION		FDR 1		FDR 3
No.	PREFIX / TYPE	AA		AC
101	BVX12DCV	*		*
102	BVX12DCV	*		*
103	BVX12DCV	*		*
104	BVX12DCV	*		*
105	BVX19DCV	*		*
106	BVX12DCV	*		*
107	BVX4DCV	*		*
108	BVX19DCV			
109	BVX19DCV	*		*
110	BVX19DCV	*		*
111	BVX4ECV			
112	BVX12DCV	*		*
113	BVX12DCV	*		*
114	BVX4ECV			
115	BVX19DCV	*		*
116	BVX4DCV	*		*
117	BVX4DCV	*		*
118	BVX4DCV	*		*
119	BVX4DCV	*		*
120	BVX12DCV			
121	BVX12DCV	*		*
122	BVX4DCV	*		*
123	TPH10AV	*		*
124	CAT5E FTP4S	*		
125	BVX4DCV	*		*
126	BVX19DCV	*		*
127	CAT5E FTP4S	*		
128	BVX12DCV			
129	BVX12DCV			
130	BVX4DCV			
131	BVX4DCV			
132	BVX4DCV			
133	BVX4DCV			
134	CAT5E FTP4S			
129	CAT5E FTP4S			
SA01	MM F/O	*		
SA02	MM F/O			*
SA03	MM F/O	*		

NOTE :
1. * DENOTES CABLES USED.

DRG No.	REFERENCE DRAWINGS:
SHT 03	AUXILIARIES CABLE BLOCK DIAGRAM
SHT 02	66kV FEEDER 2, 4 & 6 CABLE BLOCK DIAGRAM
SHT 01	66kV FEEDER 1 & 3 CABLE BLOCK DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

66kV FEEDER 1 & 3

CABLE BLOCK DIAGRAM

AUTH: L.BOTHA
DATE: 20/04/2020
CHKD: A.MARAIS
DATE: 04/12/2019
DRAWN: K.STEYNBERG
DATE: 09/10/2019

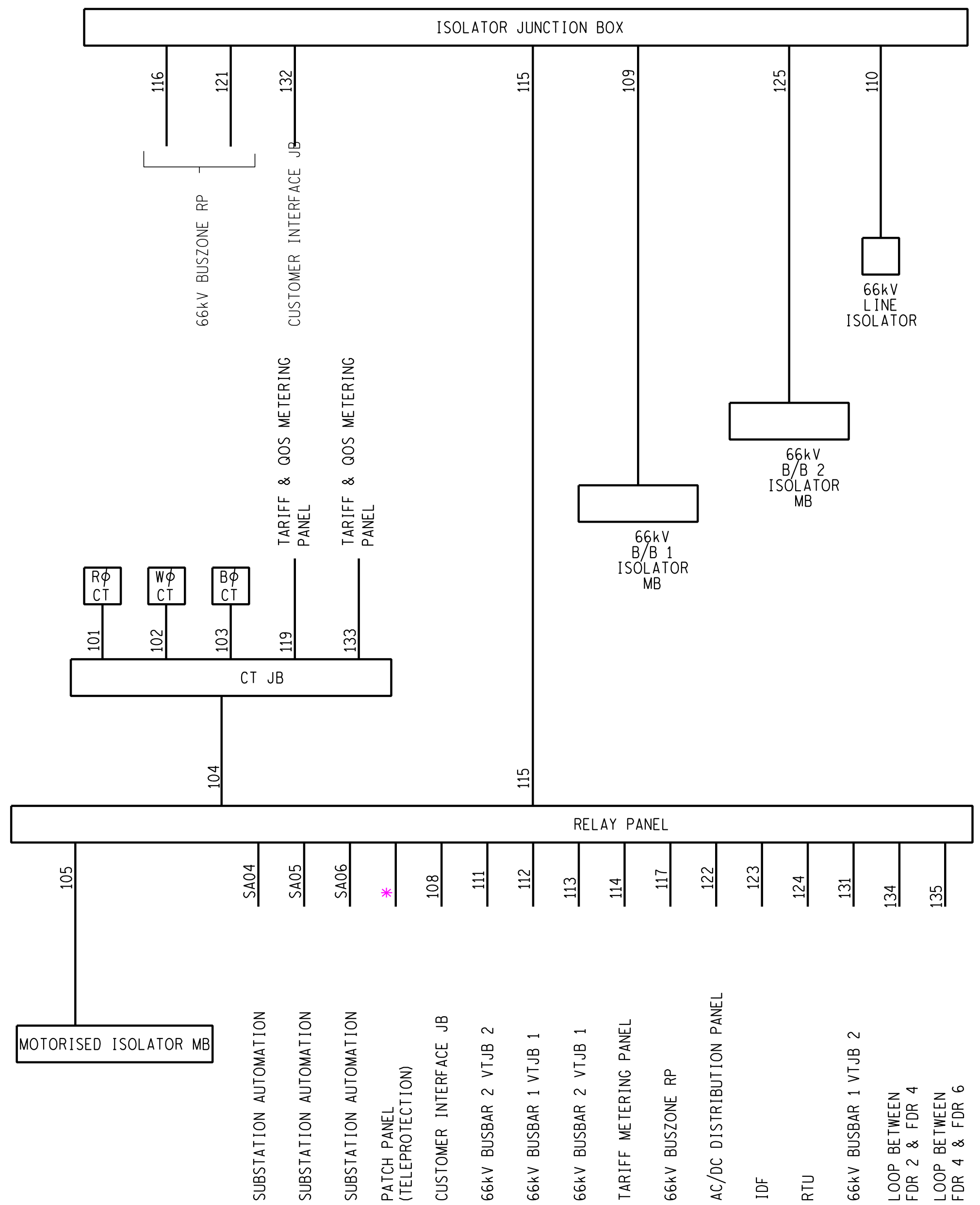
SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

	SET	SHEET	REVISION
D-WC-8118	159	01	00

A1L

DRAWING REFERENCE NUMBERS				
	FEEDER 2	FEEDER 4	FEEDER 6	
WIRING				
KEY				
CABLING				
WIRING				
KEY				
CABLING				
WIRING				
KEY				
CABLING				
WIRING				
KEY				
CABLING				
WIRING				
KEY				
CABLING				
WIRING				
KEY				
CABLING				
WIRING				
KEY				66kV B/B 1 & 2 ISOLATOR MB
CABLING				
WIRING				
KEY				66kV CTs
CABLING				
WIRING				
KEY				CT JB
CABLING				
WIRING				
KEY				
CABLING				
ARRANGEMENT				
KEY				RELAY PANEL
CABLING				
ARRANGEMENT				
WIRING				
KEY				
CABLING				
ARRANGEMENT				
WIRING				66kV MOTORISED ISOLATOR MB
KEY				
CABLING				



CABLE DESIGNATION		FDR 2	FDR 4	FDR 6
No.	PREFIX / TYPE	AB	AD	AF
101	BVX12DCV	*	*	*
102	BVX12DCV	*	*	*
103	BVX12DCV	*	*	*
104	BVX12DCV	*	*	*
105	BVX19DCV	*	*	*
106	BVX12DCV			
107	BVX4DCV	*	*	*
108	BVX19DCV	*	*	*
109	BVX19DCV	*	*	*
110	BVX19DCV			
111	BVX4ECV	*	*	*
112	BVX12DCV	*	*	*
113	BVX12DCV	*	*	*
114	BVX4ECV	*	*	*
115	BVX19DCV			
116	BVX4DCV			
117	BVX4DCV	*	*	*
118	BVX4DCV	*	*	*
119	BVX4DCV	*	*	*
120	BVX12DCV	*	*	*
121	BVX12DCV			
122	BVX4DCV	*	*	*
123	TPH10AV	*	*	*
124	CAT5E FTP4S	*	*	*
125	BVX4DCV	*	*	*
126	BVX19DCV	*		
127	CAT5E FTP4S		*	
128	BVX12DCV			*
129	BVX12DCV			
130	BVX4DCV	*	*	*
131	BVX4DCV			*
132	BVX4DCV	*	*	*
133	BVX4DCV	*		
134	CAT5E FTP4S	*		
129	CAT5E FTP4S		*	
SA01	MM F/O			
SA02	MM F/O			
SA03	MM F/O			

NOTE :
1. * DENOTES CABLES USED.

DRG No.	REFERENCE DRAWINGS:
SHT 03	AUXILIARIES CABLE BLOCK DIAGRAM
SHT 02	66kV FEEDER 2, 4 & 6 CABLE BLOCK DIAGRAM
SHT 01	66kV FEEDER 1 & 3 CABLE BLOCK DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION
66kV FEEDER 2, 4 & 6
CABLE BLOCK DIAGRAM

AUTH: L. BOTHA DATE: 20/04/2020
CHKD: A. MARAIS DATE: 04/12/2019
DRAWN: K. STEYNBERG DATE: 09/10/2019

SCALE :

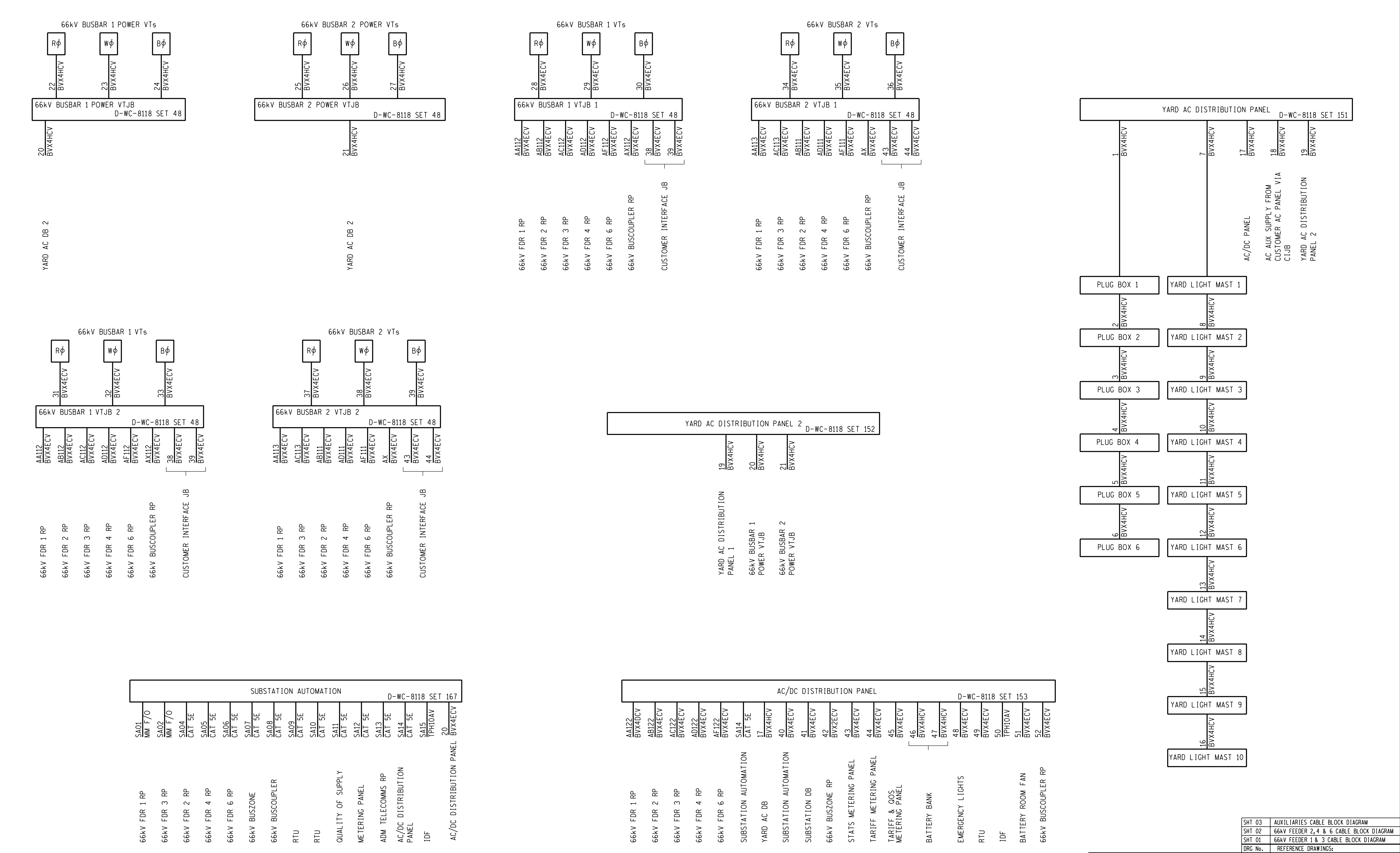
THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

D-WC-8118

SET	SHEET	REVISION
159	02	00

A1L



DRG No.	REFERENCE DRAWINGS:
SHT 03	AUXILIARIES CABLE BLOCK DIAGRAM
SHT 02	66kV FEEDER 2,4 & 6 CABLE BLOCK DIAGRAM
SHT 01	66kV FEEDER 1 & 3 CABLE BLOCK DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

Eskom

YSTERVARK SUBSTATION

AUXILIARIES

CABLE BLOCK DIAGRAM

AUTH: L. BOTHA
DATE: 20/04/2020
CHKD: A. MARAIS
DATE: 04/12/2019
DRAWN: K. STEYNBERG
DATE: 09/10/2019

SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

DRAWING	SET	SHEET	REVISION
D-WC-8118	159	03	00

A1L

NOTE:
1. * INDICATES TO BE CONFIRMED.
2. HIGHEST CABLE NUMBER USED 58

DRG No.	REFERENCE DRAWINGS:
SHT 03	AUXILIARIES CABLE BLOCK DIAGRAM
SHT 02	66kV FEEDER 2,4 & 6 CABLE BLOCK DIAGRAM
SHT 01	66kV FEEDER 1 & 3 CABLE BLOCK DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

AECOM
BELLVILLE OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

SCALE :

Eskom

YSTERVARK SUBSTATION
AUXILIARIES
CABLE BLOCK DIAGRAM

AUTH: L. BOTHA DATE: 20/04/2020
CHKD: A. MARAIS DATE: 04/12/2019
DRAWN: K. STEYNBERG DATE: 09/10/2019

D-WC-8118

SET	SHEET	REVISION
159	04	00

A1L

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
00	COVER SHEET	REV 3	02/06/2016	SINGLE MODE FIBRE DRIVER ADDED, REVISED SHEETS 1,2
01	PANEL EQUIPMENT LAYOUT	REV 3	02/06/2016	ADDED MEDIA CONVERTOR & OPTIMISED PANEL LAYOUT
02	DC CONVERTER DC KEY DIAGRAM	REV 3	02/06/2016	ADDED DC CONVERTOR WIRING & ALARM DETAIL. ADDED ETHERNET MEDIA CONVERTOR
03	DC DISTRIBUTION MODULE LAYOUT	REV 3	02/06/2016	AS PREVIOUS REVISION
04	DC KEY DIAGRAM	REV 3	02/06/2016	AS PREVIOUS REVISION
05	CABLING DIAGRAM	REV 3	02/06/2016	AS PREVIOUS REVISION
06	CABLE BLOCK DIAGRAM	REV 3	02/06/2016	MEDIA CONVERTOR ADDED
07	PANEL CABLE ENTRY LAYOUT	REV 3	02/06/2016	ADDED NOTE 6
08				
09				
10				

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1	STANDARD DESIGN DRAWING	16	
2	SMP 16SG DATA CONCENTRATOR OPTION	17	
3	RS416 PORT SERVER OPTION	18	
4		19	
5	MULTENET MODEM OPTION	20	
6		21	
7	110V DC - 12V DC CONVERTER	22	
8	LIGHT LINK MEDIA CONVERTER	23	
9	110-50VDC CONVERTOR AND 50VDC DISTRIBUTION MODULE	24	
10	STANDARD DESIGN DRAWING	25	
11	TELECOMMS ADM	26	
12	TELECOMMS 2 x FIBRE PATCH PANEL	27	
13	OPTIONAL THIRD FIBRE PATCH PANEL	28	
14	110VDC DISTRIBUTION MODULE	29	
15	SINGLE MODE FIBRE DRIVER (ETHERNET)	30	

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 04/12/2020
DRAWN BY K STEYNBERG DATE 19/09/2019
SCALE :
SCALE
THIS DRAWING IS THE PROPERTY OF ESKOM

Eskom
AUTH: T. HYMAN DATE: 05/09/2014
CHKD: M. VALA DATE: 05/09/2014
DRAWN: N. NGUBANE DATE: 06/08/2014

YSTERVARK SUBSTATION

TELECOMMS & SUBSTATION AUTOMATION COVER SHEET

D-WC-8118

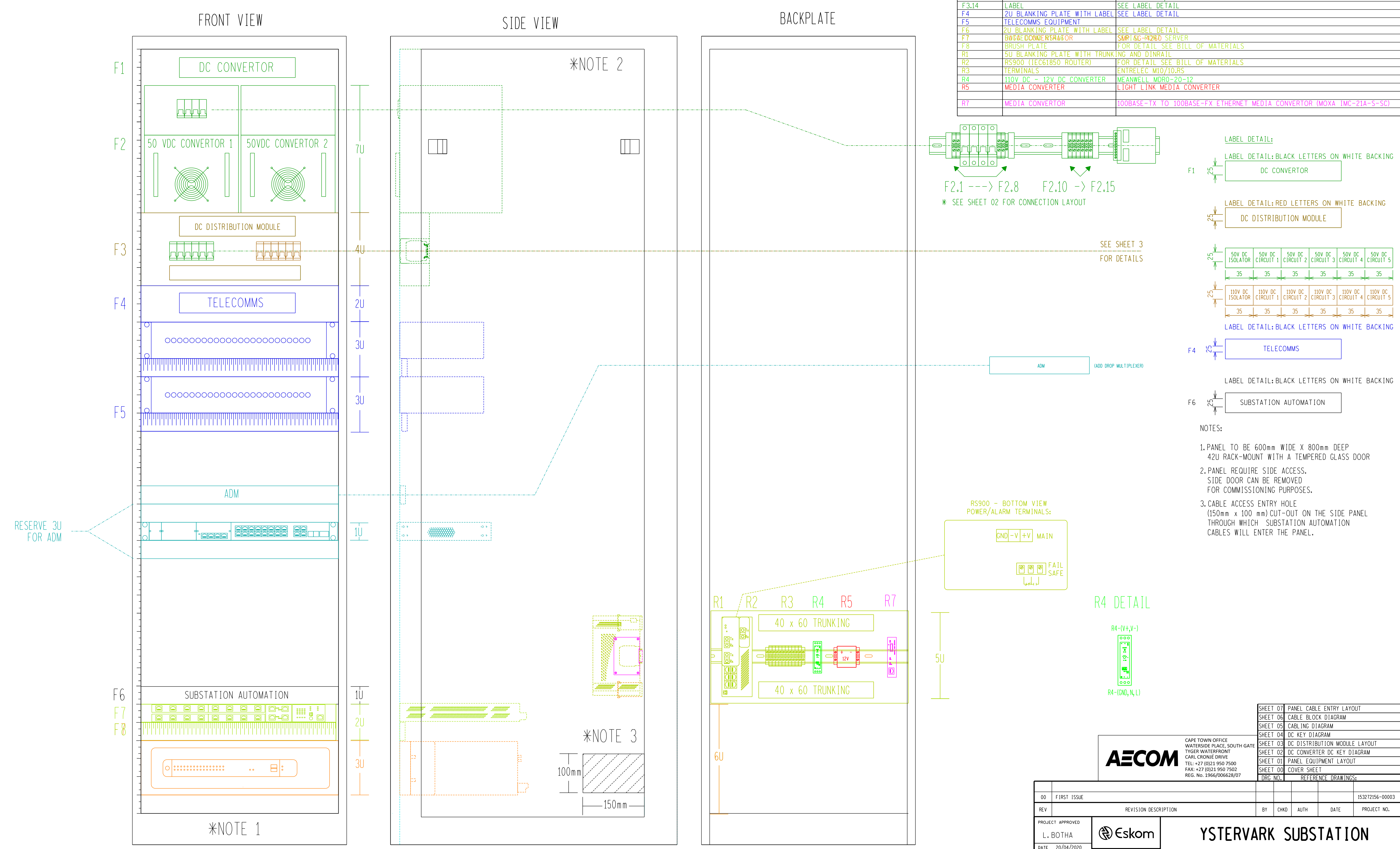
SET	SHEET	REVISION
167	00	00

LEVELS 1 2 3 5 7 8 9 10 11 12 13 14 15

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-00.03 REVISION 3

LOCATION	DESIGNATION	DESCRIPTION
F1	2U BLANKING PLATE WITH LABEL	SEE LABEL DETAIL
F2	110-50VDC CONVERTOR	S.O.S. INDUSTRIAL ELECTRONICS - MODEL S017CE110V
F3	DC DISTRIBUTION MODULE	REMOVABLE 4U PLATE EXPOSES 110V DC CIRCUIT BREAKERS AND TERMINALS
F3.1/F3.2	50V DC ISLOLATOR	32A DOUBLE CIRCUIT DC CIRCUIT BREAKER (ABB S282-UC B32 OR EQUIVALENT)
F3.3-F3.12	50V DC CIRCUITS 1 TO 5	5x 10A DOUBLE CIRCUIT DC CIRCUIT BREAKER (ABB S282-UC B10 OR EQUIVALENT)
F3.13/F3.14	110V DC ISLOLATOR	32A DOUBLE CIRCUIT DC CIRCUIT BREAKER (ABB S282-UC B32 OR EQUIVALENT)
F3.15-F3.24	110V DC CIRCUIT 1 TO 5	5x 10A DOUBLE CIRCUIT DC CIRCUIT BREAKER (ABB S282-UC B10 OR EQUIVALENT)
F3.13	TERMINALS X1.1 TO X1.26	ENTRELEC M10/10.RS
F3.14	LABEL	SEE LABEL DETAIL
F4	2U BLANKING PLATE WITH LABEL	SEE LABEL DETAIL
F5	TELECOMMS EQUIPMENT	
F6	2U BLANKING PLATE WITH LABEL	SEE LABEL DETAIL
F7	DATA CONCENTRATOR	SMP SG-4260 SERIAL PORT SERVER
F8	BRUSH PLATE	FOR DETAIL SEE BILL OF MATERIALS
R1	5U BLANKING PLATE WITH TRUNKING AND DINRAIL	
R2	RS900 (IEC61850 ROUTER)	FOR DETAIL SEE BILL OF MATERIALS
R3	TERMINALS	ENTRELEC M10/10.RS
R4	110V DC - 12V DC CONVERTER	MEANWELL MDR0-20-12
R5	MEDIA CONVERTER	LIGHT LINK MEDIA CONVERTER
R7	MEDIA CONVERTOR	100BASE-TX TO 100BASE-FX ETHERNET MEDIA CONVERTOR (MOXA IMC-21A-S-SC)



NOTES:

1. PANEL TO BE 600mm WIDE X 800mm DEEP 42U RACK-MOUNT WITH A TEMPERED GLASS DOOR
2. PANEL REQUIRE SIDE ACCESS. SIDE DOOR CAN BE REMOVED FOR COMMISSIONING PURPOSES.
3. CABLE ACCESS ENTRY HOLE (150mm x 100 mm) CUT-OUT ON THE SIDE PANEL THROUGH WHICH SUBSTATION AUTOMATION CABLES WILL ENTER THE PANEL.

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	ADDED MEDIA CONVERTOR & OPTIMISED PANEL LAYOUT		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2014	CHANGED DC DISTR. MODULE, ADDED A 12V DC CONVERTER & ADDED SHEETS 4,5,6 & 7 ADDED		

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

LEVELS 1 2 3 7 8 9 10 11 12 14 15

PROJECT APPROVED L. BOTHA DATE 20/04/2020

PROJECT CHECKED A. MARAIS DATE 04/12/2020

DRAWN BY K STEYNBERG DATE 19/09/2019

SCALE

Eskom

AUTH: T. HYMAN DATE: 28/08/2014

CHKD: M. VALA DATE: 22/08/2014

DRAWN: N. NGUBANE DATE: 11/08/2014

YSTERVARK SUBSTATION

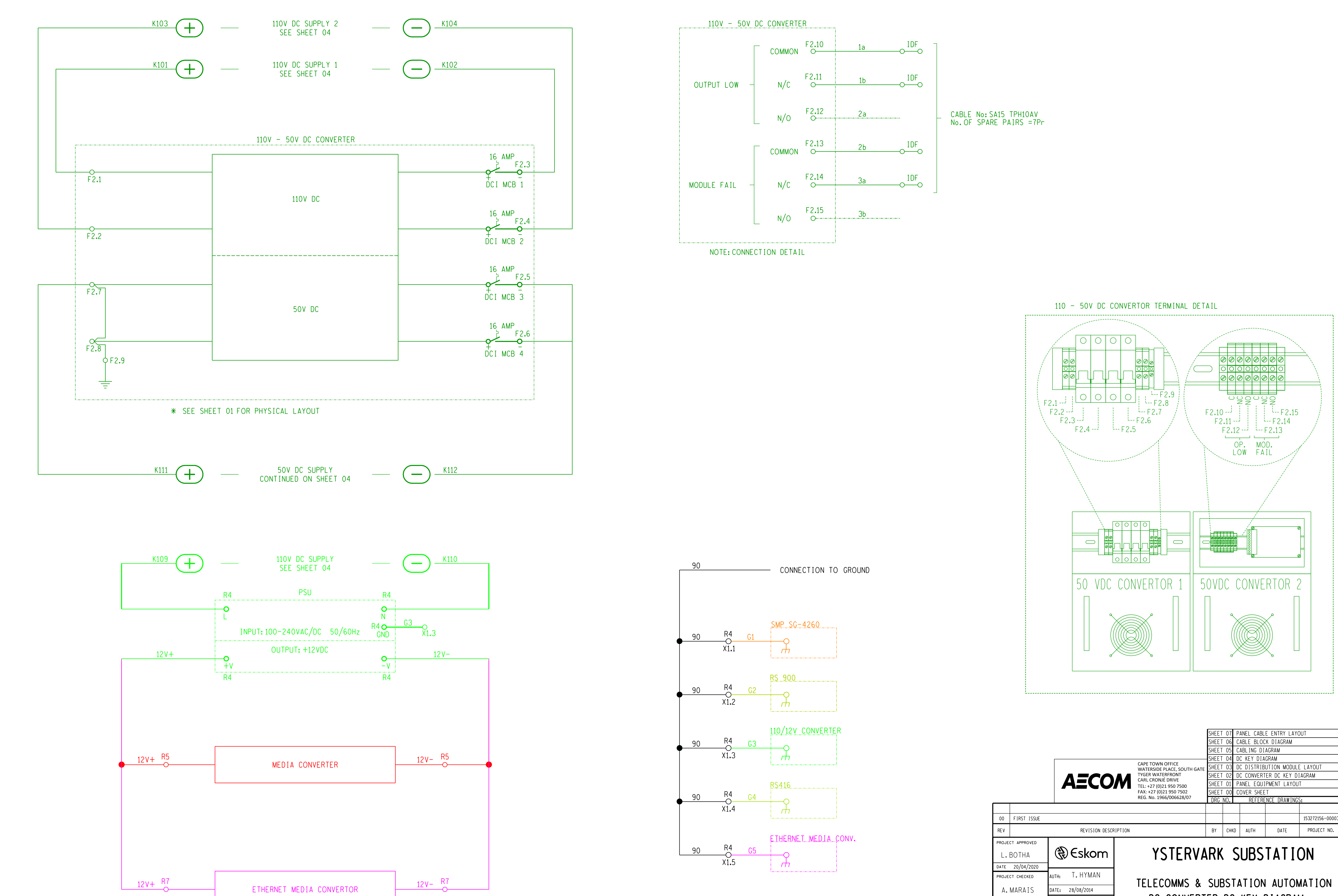
TELECOMMS & SUBSTATION AUTOMATION PANEL EQUIPMENT LAYOUT

D-WC-8118

SET	SHEET	REVISION
167	01	00

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-01_03 REVISION 3

SIZE GROOTTE A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM

CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	ADDED DC CONVERTOR WIRING & ALARM DETAIL. ADDED ETHERNET MEDIA CONVERTOR		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2014	COMPLETE REWORK OF DC KEYS		

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 04/12/2020
DRAWN BY K STEYNBERG DATE 19/09/2019

Eskom
AUTH: T. HYMAN DATE: 28/08/2014
CHKD: M. VALA DATE: 22/08/2014
DRAWN: N. NGUBANE DATE: 11/08/2014

SCALE :

SCALE

YSTERVARK SUBSTATION

TELECOMMS & SUBSTATION AUTOMATION DC CONVERTER DC KEY DIAGRAM

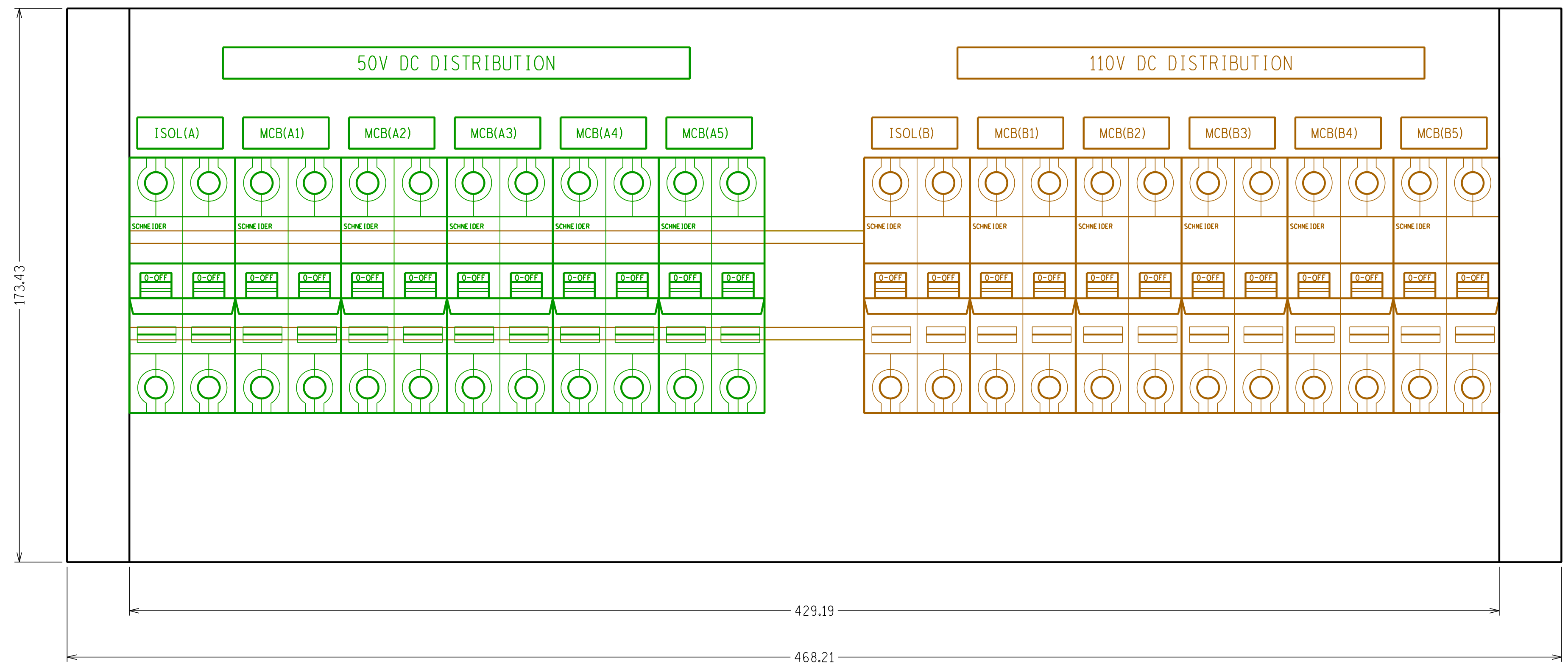
	SET	SHEET	REVISION
D-WC-8118	167	02	00

LEVELS 1 2 3 6 7 8 9 10 11 12 14 15

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-00.03 REVISION 3

FRONT VIEW



LEGEND			
DESIGNATION	SYMBOL	DESCRIPTION	QUANTITY
TRUNKING		25X60mm GREY PVC WITH 4mm WIRE SLOTS	1m
DIN rail		35x7.5mm ALUMINIUM, PRE-PUNCHED	0,5m
RIVET		4.8x8mm ALUMINIUM RIVET, LARGE FLANGE	10
MCB		SCHNEIDER, 15kA, 10A D-CURVE, 2 POLE, PART No.: A9F85210	10
ISOLATOR		SCHENIDER, 15kA, 63A, PART No.: A9560263	2

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03		02/06/2016	AS PREVIOUS REVISION		
02		02/06/2016	AS PREVIOUS REVISION		
01		06/08/2014	SHEET 3 CHANGED TO SHEET 6 & SHEETS 4,5,6 & 7 ADDED		

SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 04/12/2020
DRAWN BY K STEYNBERG DATE 19/09/2019
SCALE

Eskom
AUTH: T. HYMAN DATE: 28/08/2014
CHKD: M. VALA DATE: 22/08/2014
DRAWN: N. NGUBANE DATE: 14/08/2014

YSTERVARK SUBSTATION

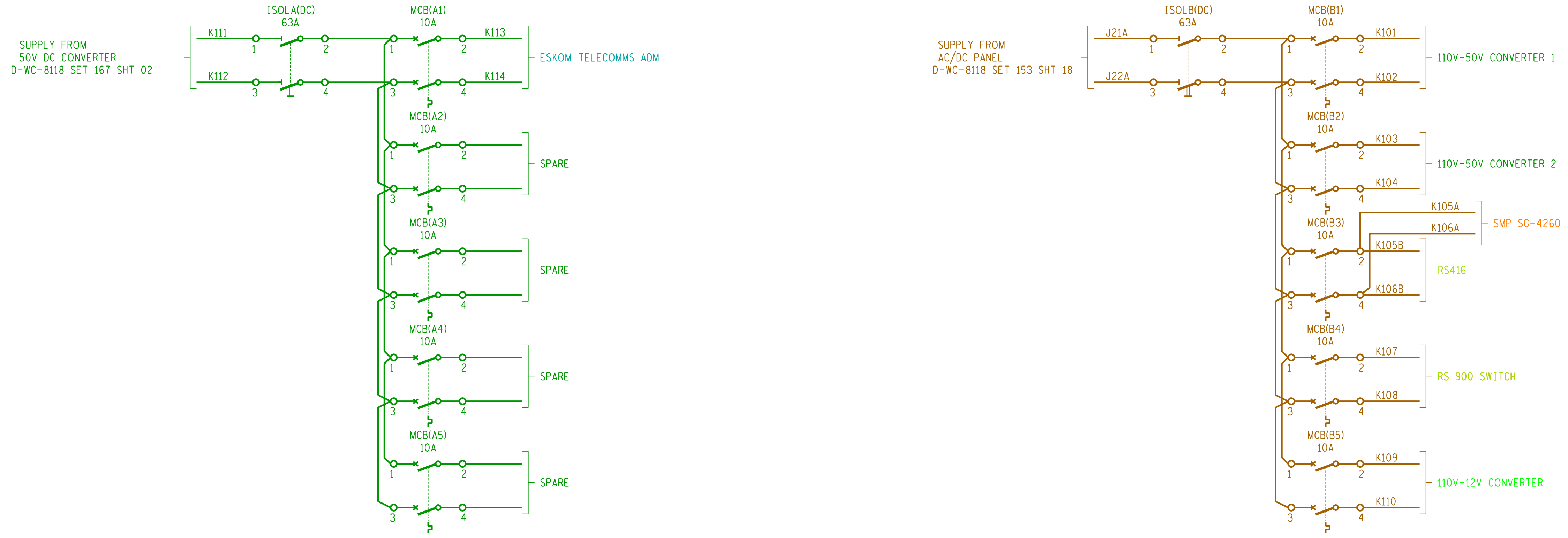
TELECOMMS & SUBSTATION AUTOMATION DC DISTRIBUTION MODULE LAYOUT

DRAWING NO.	SET	SHEET	REVISION
D-WC-8118	167	03	00

LEVELS 3 7 8 9 10 11 12 14 15

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-03.03 REVISION 3

SIZE GROOTTE A1L



DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	AS PREVIOUS REVISION		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2014	AS PREVIOUS REVISION		

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 04/12/2020
DRAWN BY K STEYNBERG DATE 19/09/2019
SCALE

Eskom
AUTH: T. HYMAN DATE: 05/09/2014
CHKD: M. VALA DATE: 05/09/2014
DRAWN: N. NGUBANE DATE: 11/08/2014

YSTERVARK SUBSTATION

TELECOMMS & SUBSTATION AUTOMATION DC KEY DIAGRAM

D-WC-8118	SET	SHEET	REVISION
	167	04	00

LEVELS 1 2 3 7 8 9 10 11 12 14 15

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-04_03 REVISION 3

-													K110	MCB(B5)
+													K109	
	-												K108	MCB(B4)
	+												K107	
		-	-										K106A/K106B	MCB(B3)
		+	+										K105A/K105B	
				F2.4									K104	MCB(B2)
				F2.2									K103	
					F2.3								K102	MCB(B1)
					F2.1								K101	
						X9.6							J22A	ISOLB
						X9.5							J21A	
														MCB(A5)
														MCB(A4)
														MCB(A3)
														MCB(A2)
							-						K114	MCB(A1)
							+						K113	
								F2.5/F2.6					K112	ISOLA
								F2.7/F2.8					K111	
						20							CABLE NUMBER	
-	-	-	-	-	-	4	-	-					CABLE SIZE	
-	-	-	-	-	-	2	-	-					NUMBER OF SPARES	
110V-12V DC CONVERTER LOOP TO R4	RS5900 SWITCH LOOP TO R2	RS416 LOOP TO F7	SMP SG-4260 LOOP TO F7	110V-50V CONVERTER 2 LOOP TO F2	110V-50V CONVERTER 1 LOOP TO F2	AC/DC PANEL D-WC-8118 SET 153 SHEET 18	ESKOM TELECOMMS ADM LOOPED	110V-50V CONVERTER 1 & 2 50V OUTPUT LOOP FROM F2					DESTINATION	

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	AS PREVIOUS REVISION		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2014	AS PREVIOUS REVISION		

LEVELS 1 2 7 9 10 11 12 13 14 15

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED L. BOTHA DATE 20/04/2020
PROJECT CHECKED A. MARAIS DATE 04/12/2020
DRAWN BY K STEYNBERG DATE 19/09/2019
SCALE

Eskom
AUTH: T. HYMAN DATE: 28/08/2014
CHKD: M. VALA DATE: 22/08/2014
DRAWN: N. NGUBANE DATE: 11/08/2014

YSTERVARK SUBSTATION

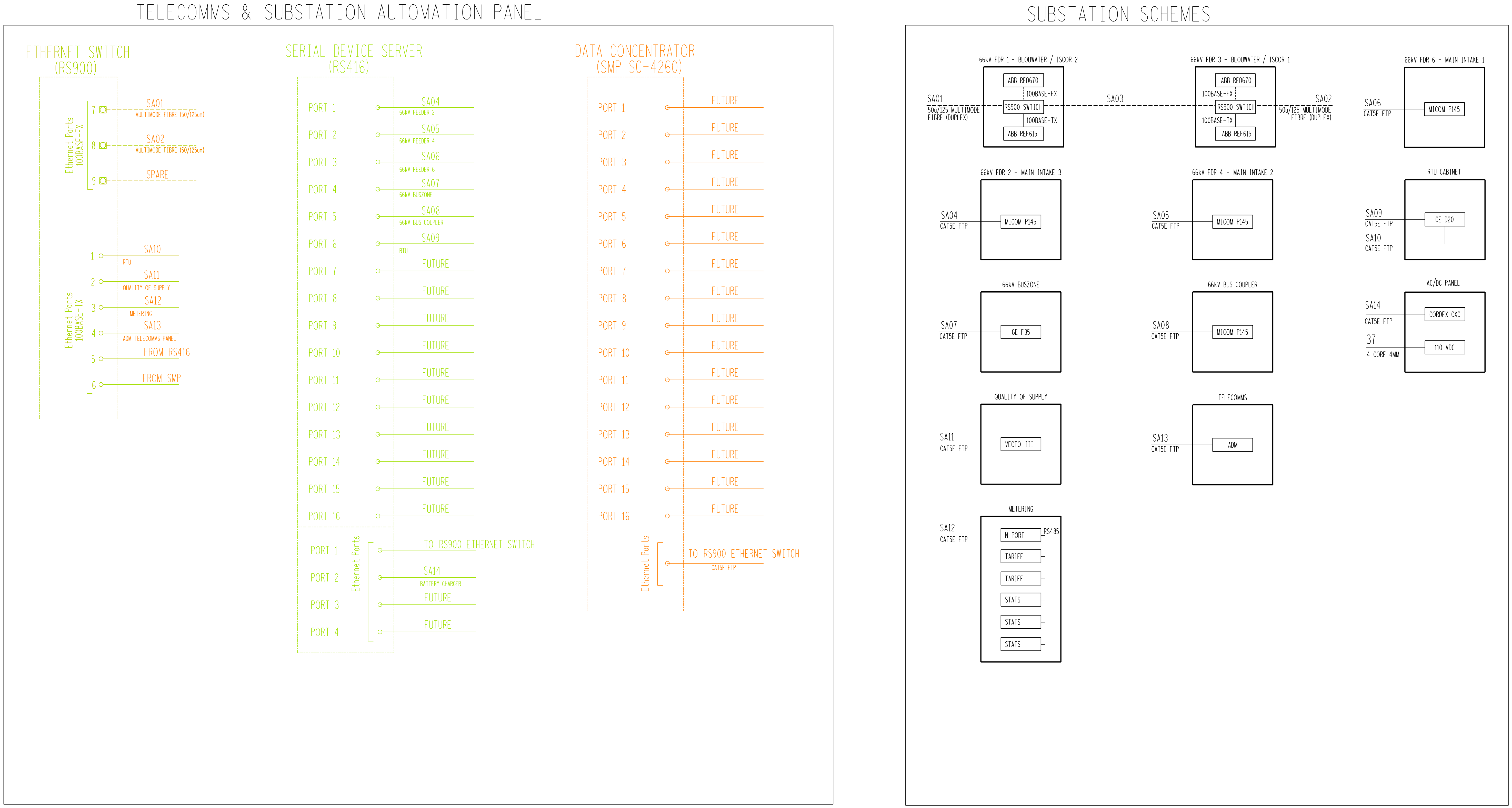
TELECOMMS & SUBSTATION AUTOMATION CABLING DIAGRAM

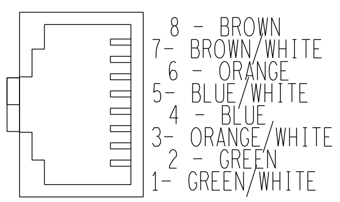
D-WC-8118

SET	SHEET	REVISION
167	05	00

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-05_03 REVISION 3





T568A

NOTES:

1. ALL CAT5E CABLES TO BE TERMINATED TO T568A STANDARD
2. ALL CAT5E AND FIBRE CABLES & PATCH-LEADS TO BE TESTED END-TO-END AND COMMISSIONING CHECKSHEET COMPLETED FOR EACH

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	ADDED MEDIA CONVERTOR		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2016	AS PREVIOUS REVISION		

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

SCALE :

THIS DRAWING IS THE PROPERTY OF ESKOM

SCALE

LEVELS 1 3 7 8 9 10 11 12 14 15 2

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

PROJECT APPROVED: L. BOTHA, DATE 20/04/2020
PROJECT CHECKED: A. MARAIS, DATE 04/12/2020
DRAWN BY: K STEYNBERG, DATE 19/09/2019
AUTH: T. HYMAN, DATE: 28/08/2014
CHKD: M. VALA, DATE: 22/08/2014
DRAWN: N. NGUBANE, DATE: 19/08/2014

Eskom

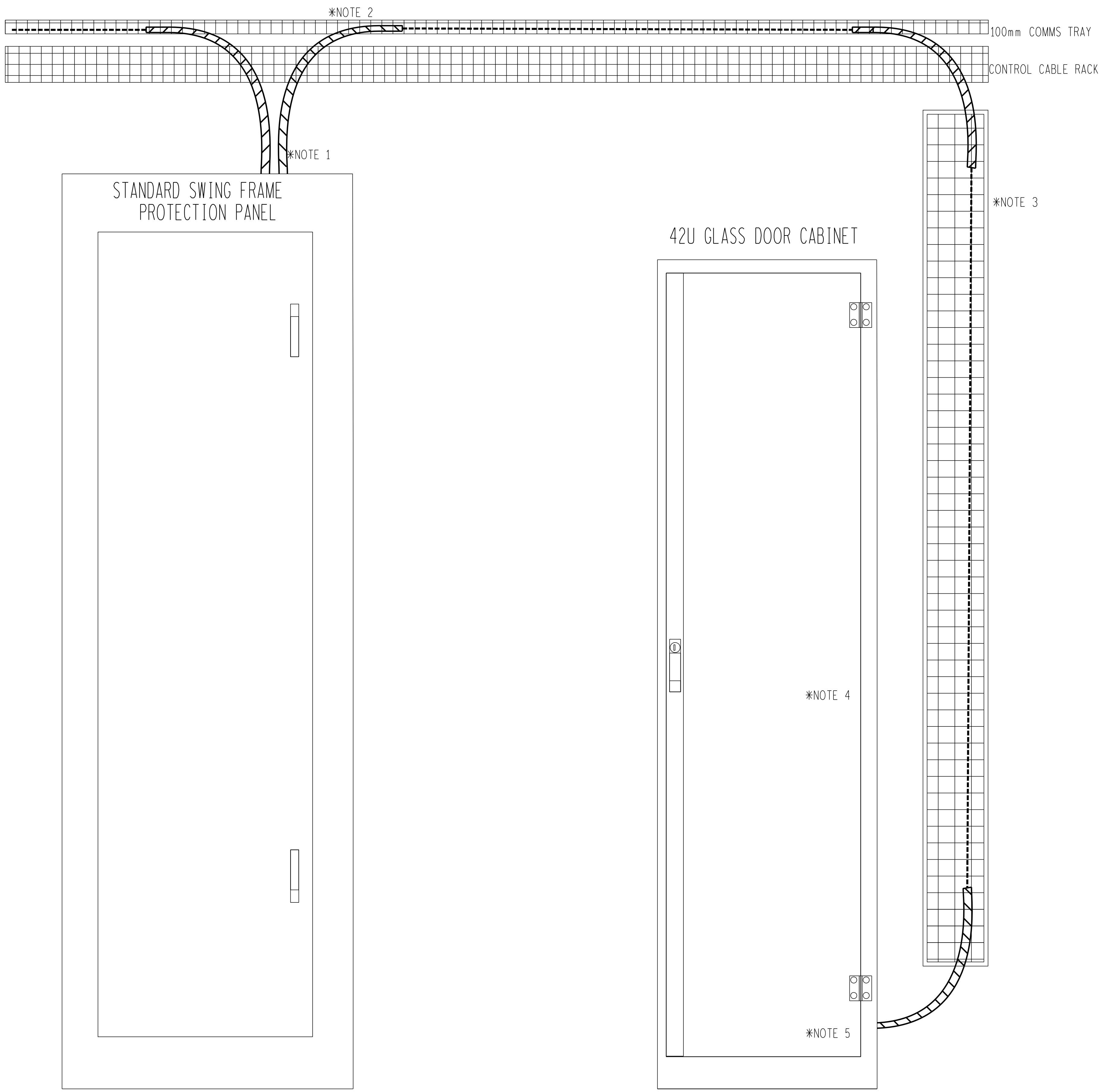
YSTERVARK SUBSTATION

TELECOMMS & SUBSTATION AUTOMATION CABLE BLOCK DIAGRAM

	SET	SHEET	REVISION
D-WC-8118	167	06	00

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-00.03 REVISION 3



SPRAGG TUBING

FIBRE PATCH LEAD

NOTES:

1. FIBRE CABLES TO EXIT SCHEMES IN SPRAGG TUBING.
2. FIBRE CABLE TO ENTER THE 100mm COMMS TRAY WITHIN SPRAGG TUBING. ALLOW FOR 300mm ADDITINAL SPRAGG INTO THE COMMS TRAY.
3. MOUNT A 100mm x 50mm CABLE TRAY ON THE WALL NEXT TO THE PANEL TO ALLOW FOR CABLE MANAGEMENT FROM THE 100mm COMMS TRAY TO THE BOTTOM CABLE ACCESS HOLE ON THE PANEL.
4. PANEL REQUIRE SIDE ACCESS.
5. CABLE ACCESS ENTRY HOLE (150mm x 100mm) CUT-OUT ON THE SIDE PANEL THROUGH WHICH SUBSTATION AUTOMATION CABLES WILL ENTER THE PANEL.
6. ALL CAT5E CABLES TO BE INSTALLED WITH 500mm SLACK AT THE BOTTOM OF THE PANELS (BOTH END OF CABLE).
   SUBSTATION AUTOMATION SIDE TO BE TERMINATED WITH SHIELDED RJ45 PLUGS, RELAY END TERMINATED WITH NON-SHIELDED RJ45 PLUGS.

DRG NO.	REFERENCE DRAWINGS:
SHEET 07	PANEL CABLE ENTRY LAYOUT
SHEET 06	CABLE BLOCK DIAGRAM
SHEET 05	CABLING DIAGRAM
SHEET 04	DC KEY DIAGRAM
SHEET 03	DC DISTRIBUTION MODULE LAYOUT
SHEET 02	DC CONVERTER DC KEY DIAGRAM
SHEET 01	PANEL EQUIPMENT LAYOUT
SHEET 00	COVER SHEET

AECOM
CAPE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
TYGER WATERFRONT
CARL CRONJÉ DRIVE
TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
00	FIRST ISSUE					153272156-00003

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
03	TH	02/06/2016	ADDED NOTE 6		
02	TH	02/06/2016	AS PREVIOUS REVISION		
01		06/08/2016	AS PREVIOUS REVISION		

PROJECT APPROVED: L. BOTHA — DATE 20/04/2020
PROJECT CHECKED: A. MARAIS — DATE 04/12/2020
DRAWN BY: K STEYNBERG — DATE 19/09/2019
SCALE :
THIS DRAWING IS THE PROPERTY OF ESKOM
SCALE

Eskom
AUTH: T. HYMAN — DATE: 28/08/2014
CHKD: M. VALA — DATE: 22/08/2014
DRAWN: N. NGUBANE — DATE: 11/08/2014

YSTERVARK SUBSTATION

TELECOMMS & SUBSTATION AUTOMATION PANEL CABLE ENTRY LAYOUT

DRAWING	SET	SHEET	REVISION
D-WC-8118	167	07	00

LEVELS 1 2 3 7 8 9 10 11 12 14 15

SIZE GROOTTE A1L

SUBSTATION AUTOMATION REVISION CONTROL - DWC0000-167-07.03 REVISION 3

10.7 Non-Standard Material Specifications

10.7.1 Junction Boxes

Table 28: Technical Schedule for Non-Standard Junction Boxes

Description	Interface JB	Power VT JB	VT JB	CT JB	Isolator JB	Plug Box
Eskom SAP Number(s)	Buy out	0186950	0186950	0186961	0185255	Buy out
PDE Drawing(s) Applicable	N/A	D-DT-9101 D-DT-5402	D-DT-9101 D-DT-5405	D-DT-9101 D-DT-5404	D-DT-9101 D-DT-5403	D-DT-11226
Material (Eskom Standard)	3CR12 or 304 SS	3CR12 or 304 SS	3CR12 or 304 SS	3CR12 or 304 SS	3CR12 or 304 SS	3CR12 or 304 SS
Material (Specified)	316L SS	316L SS	316L SS	316L SS	316L SS	316L SS
Fixing Materials	316L SS	316L SS	316L SS	316L SS	316L SS	316L SS
Colour (Eskom Standard)	'G29' - SANS 1091	'G29' - SANS 1091	'G29' - SANS 1091	'G29' - SANS 1091	'G29' - SANS 1091	'G29' - SANS 1091
Comment	The interface junction box is for signalling between the two substations' protection on each bay. It includes space for the isolating point for the alternative supply from Transnet. The junction box shall be fitted with all circuit breakers and isolators, as applicable, on either side of the box, in order for control by both Transnet & Eskom respectively and independently.					

11 Execution Plan and Temporary Arrangements

11.1 Constructability Plan

The proposed constructability plan below for the Ystervark Substation covers the major tasks to be performed and is divided between pre-outage and outage works.

Pre - Outage Works:

1.) Platform

- Mark the setting out lines on the site (by a surveyor).
- Establish the site in preparation for the civil works.
- Construct the platform for the new Substation to the civil bulk earthworks design.

2.) Earth grid

- Take soil resistivity measurements and verify earth grid design once platform has been completed.
- Install the Substation earth grid and reinstate the platform.

3.) Drainage

- Install the storm water drainage pipes and channels.
- Construct the headwalls/berms and soak-away trench(es).

4.) Roads

- Construct the compacted external G5 / G7 gravel Substation access roads.
- Construct the compacted internal G5 / G7 gravel with covered interlocking paving, Substation road.

5.) Foundations and trenches

- Excavate and cast foundations, plinths and equipotential gateway slabs.
- Connect all foundation earth tails to the earth grid.
- Form / construct control cable trenches.

6.) Fences

- Construct the Substation perimeter and internal fences.
- Construct the manual gates.

7.) Equipment installations

- Erect all equipment steelwork and supports.
- Install yard lighting.
- Install post insulators, busbars, isolators, surge arrestors, CT’s, VT’s, power VT’s and circuit breakers.
- Install the Customer Interface JB (CIJB) enclosure with access from Eskom and Transnet side.
- Install all junction boxes (JBs) and plug boxes (PBs).
- Install all jumpers including clamps and connectors to connect the power plant.

8.) Relay house

- Construct the Substation relay house brick building.
- Install and connect all sewage and waste water drainage systems to the conservancy tank and oil dam as applicable.
- Install small power and lighting.
- Install all cable racking inside the building.

9.) Yard finishing

- Lay yard stone over the respective Substation areas, including a 1,2m wide strip around the perimeter.

10.) Control plant

- Install the control panels, with associated systems, in the Substation relay house.
- Earth all panels and associated infrastructure.
- Install, lug and loom all control cables.

11.) Commissioning

- Test and cold commission all equipment and protection schemes.

12.) Site clearing

- Remove all construction equipment and materials from the site.

Outage Works:

1.) Testing and hot commissioning

- Prove OPGW communications between Iscor, Blouwater and Ystervark Substations.
- Energise the Ystervark Substation in accordance with procedures.
- Energise Transnet 66 kV feeders in accordance with procedures.
- Prove protection schemes and interlocking. ***Note: Eskom should allow for additional handover time, as the buszone commissioning could happen at a later stage due to the buszone CT not being ready at the Transnet side.***

The final execution / constructability plan shall be agreed to on-site between the Contractor, Transnet and Eskom, once the Contractor's work programme has been received.

11.2 Temporary Arrangements

At present there are no planned temporary arrangements. Given the dynamics of this project, and its criticality on the overall Transnet Tippler 3 project, it is foreseen that possible adhoc temporary arrangements will come to fruition during the construction phase. Should this occur, Transnet will engage with Eskom accordingly.

11.3 Specification

Not Applicable

11.4 Bill of Materials

Not Applicable

11.5 Bill of Quantities

Not Applicable

11.6 Detailed Drawings

Not Applicable

11.7 Non-Standard Material Specifications

Not Applicable

12 HV Lines

Not Applicable

13 MV Lines

Not Applicable

AECOM

www.aecom.com

To enhance and
sustain the world’s
built, natural and
social environments