Project Name	:	Transnet Saldanha NMD Upgrade - New Ystervark S/S
Project ID	:	153272156
Job Name	:	Blouwater S/S - Ystervark FDR Control Plant
Job ID	:	153272156-00002

Final Design Package: Book 1

Prepared for
TRANSNET GROUP CAPITAL

Prepared by
Brian Homann

In association with
Lize-Mari Botha & Amanda Marais

2020-04-24

AECOM AGILITY
CLIENTS
EMPLOYEES
EXCELLENCE
INNOVATION
INTEGRITY
PROFITABLE GROWTH
SAFETY

Quality Information

Document	Final Design Package: Blouwater S/S - Ystervark FDR Control Plant - Book 1		
Ref	Eskom Job Number: 153272156-00002	Date	2020-04-24
Prepared by	Brian Homann	Reviewed by	Colin Pym
Document Number	1924701-2-300-E-RPT-0005		

ISSUED FOR USE

Revision History

Authorized Practice Line Lead, Electrical, Africa
29 April 2020

Revision	Revision Date	Details	Name/Position	Signature	Date
Rev 02	2020-04-24	Issued for Use	Colin Pym		

Additional Signatories for Transnet SOC Ltd

Authorized

Richard Shandu  22/04/2020

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

Authorized 

22/04/2020

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

Authorized 

22/04/2020

Revision	Revision Date	Details	Name/Position	Signature	Date
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
AC	Alternating Current
ADSS	All-dielectric Self-supporting
Al	Aluminium
AMSL	Above Mean Sea Level
B/B	Busbar
BIL	Basic Insulation Level
BKR	Breaker
BoM	Bill of Materials
BoQ	Bill of Quantities
BTU	Battery Terminal Unit
CD	Compact Disc
CPU	Central Processing Unit
CT	Current Transformers
Cu	Copper
dB	Decibel
DB	Distribution Board
DC	Direct Current
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

Abbreviation	Meaning Given to the Abbreviation
ENC	Eskom National Contract
GPS	Global Positioning System
HIRA	Hazard Identification & Risk Assessment
Hz	Hertz
HMI	Human-machine Interface
HV	High Voltage
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
ISOL	Isolator
JB	Junction Box
kA	Kilo Ampere
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
LSC	Loss of Service Continuity

Abbreviation	Meaning Given to the Abbreviation
LV	Low Voltage
mm	Millimetre
ms	Milliseconds
MS	Microsoft
MTTR	Mean Time To Repair
MV	Medium Voltage
MVA	Mega Volt Ampere
MW	Mega Watt
Native	Original electronic file format of documentation
NC	Normally Closed
NEC	Neutral Electro-Magnetic Coupler
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
ºC	Degree Celsius
PC	Personal Computer
PCS	Process Control System
PFC	Power Factor Correction
PPS	Pulse Per Second
PTP	Precision Timing Protocol
p.u.	Per Unit
QA	Quality Assurance
QoS	Quality of Supply

Abbreviation	Meaning Given to the Abbreviation
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
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Tests
SCADA	Supervisory Control and Data Acquisition
SED	Station Electric Diagram
SEF	Sensitive Earth Fault
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
TEF	Technical Evaluation Forum
TTL	Transistor-Transistor Logic
USB	Universal Serial Bus
UV	Ultra-violet
V	Volt
VA	Volt Ampere
VLF	Very Low Frequency
VT	Voltage Transformer
W	Watt
kWhr	Kilowatt Hours

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 (Area Plant Engineer if not Initiator)	
Project Engineering:	Masturah Barodien	
Land Development:	Owen Peters Justine Wyngaardt	
MEW	Marlyn Hendriks	
Network Operations:	Nwabisa Mjoli Elsje Basson	
Network Planning:	Ahilan Kailasanathan	
Constructability:	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
Electrical Engineer:	Lize-Mari Botha	021 950 7500
Document Controls Lead:	Dino O'Brien	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
Document Controls Lead:	Adrian Ford	022 703 2460
Document Controller:	Rolivhuwa Nemakonde	022 703 2460

4. Assumptions, Agreements, Acceptances and Additional Notes

The scope of works defined in this document was not included in the environmental study conducted for the Transnet bulk power upgrade project (the project includes all Eskom self-build related works), due to the fact that the study was conducted prior to TEF approval for these works.

However, Transnet Group Capital's environmental manager has advised that the current bulk power upgrade project's environmental authorisation sufficiently covers the activities at Blouwater Substation, and no amendment to the aforementioned will be required.

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 modifications needed at Blouwater Substation, in order to facilitate the required integration of the new Ystervark 66 - 132 kV Substation into the existing Eskom Blouwater-Iscor 66 kV network.

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

The Fig overleaf depicts the location of the existing Blouwater Substation.

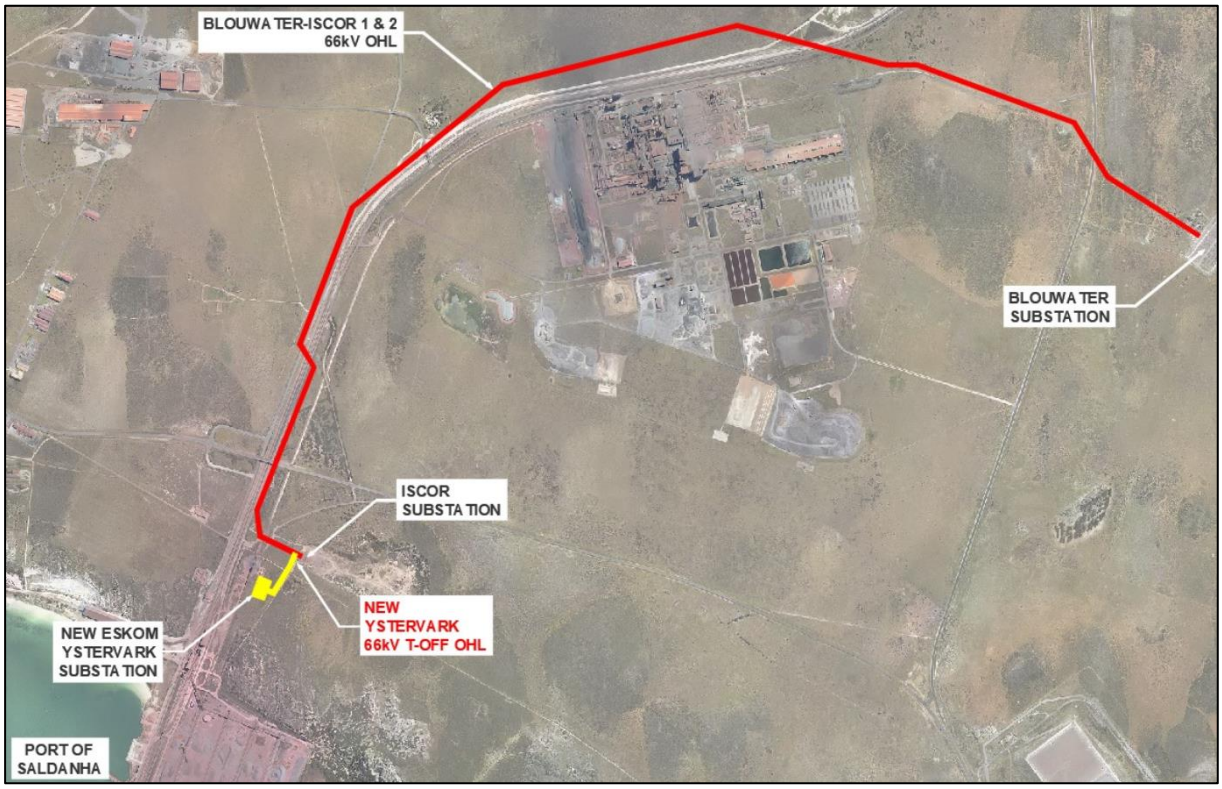


Figure 1: Blouwater Substation Location

5.2. Scope of Works

Both of the existing Blouwater-Iscor 66 kV feeder lines have 4FZD3920 protection schemes installed. The line differential protection function within the ABB RED 670 protection relays, installed in the schemes, is used as unit protection for the lines.

As the Ystervark 66 - 132 kV Substation will be integrated onto the existing Blouwater-Iscor 66 kV overhead lines via a tee-off branch line immediately before Iscor Substation, three-terminal differential protection will be required to cater for the aforementioned.

As a result, an additional fibre communication card for each feeder protection panel's ABB RED 670 relay must be installed. ABB have indicated that these additional cards have to be supplied, installed and initialised on site by them.

Further to the above, label changes will also be undertaken on the protection panels and respective outdoor HV equipment of the 2 x 66 kV feeders, to ensure the current naming convention of 'Iscor' is changed to Iscor/Ystervark TEE.

5.3. Site/Environmental Conditions

Given the nature of the works at Blouwater Substation, and the site being an existing ‘live’ operational Substation, it is not foreseen that the environmental conditions such as the weather will be of significant influence.

Furthermore it is also not foreseen the works should negatively affect any flora, fauna and the like, as no heavy construction (e.g. use of machinery, excavations etc.) will be applicable.

However the contractor must still take the above into account as part of the project’s SHEQ, Eskom and statutory regulations requirements, and may not ignore the abovementioned.

It should be noted that the site condition (although not the only one), which will influence the works the most, will be the ‘live’ electrical installations of the Substation.

Reference to be made to Section 4 of this document as well.

5.4. Credit Bill of Material

5.5. Existing Network Configuration

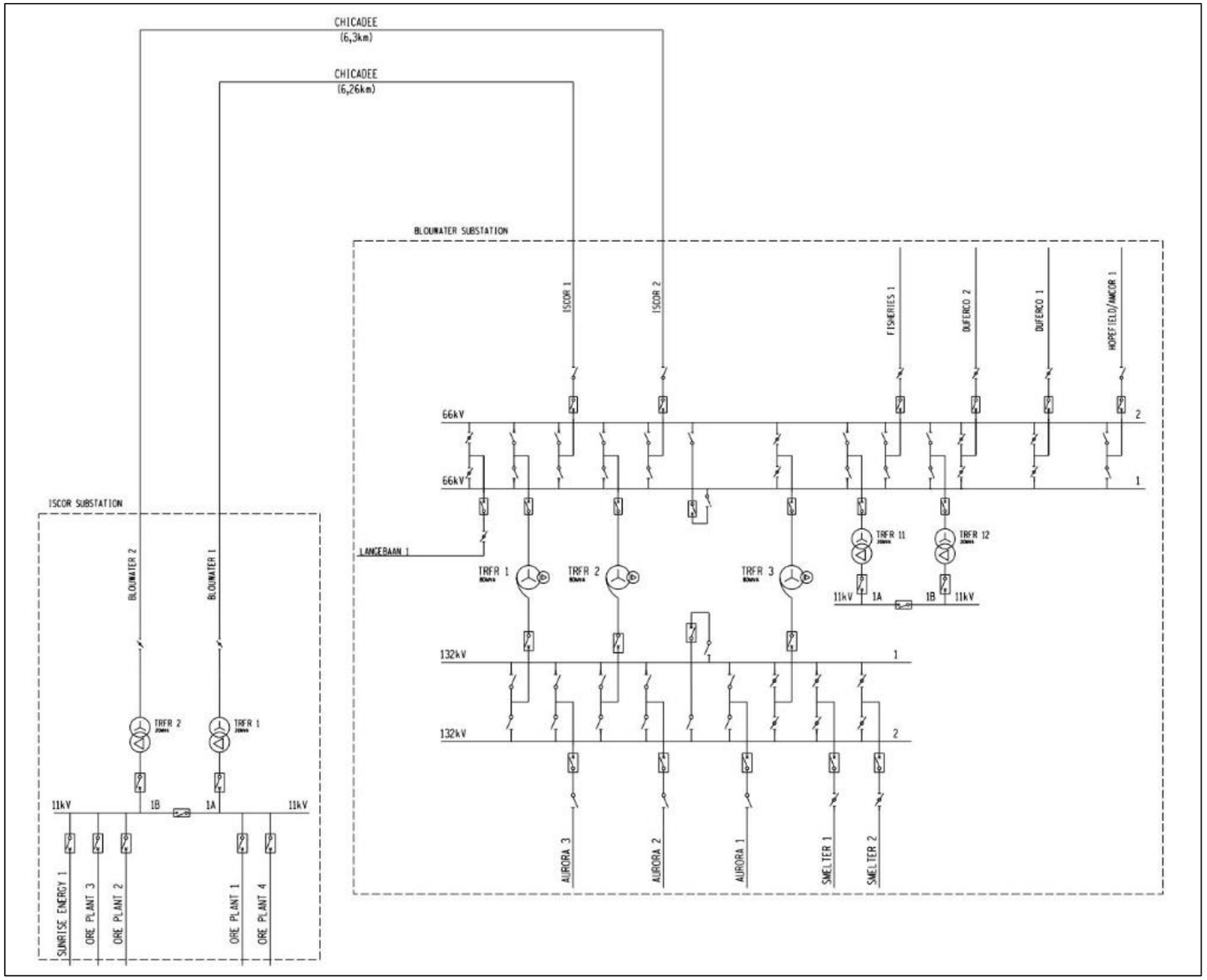


Figure 2: Existing Electrical Network Configuration - Blouwater to Iscor Substation

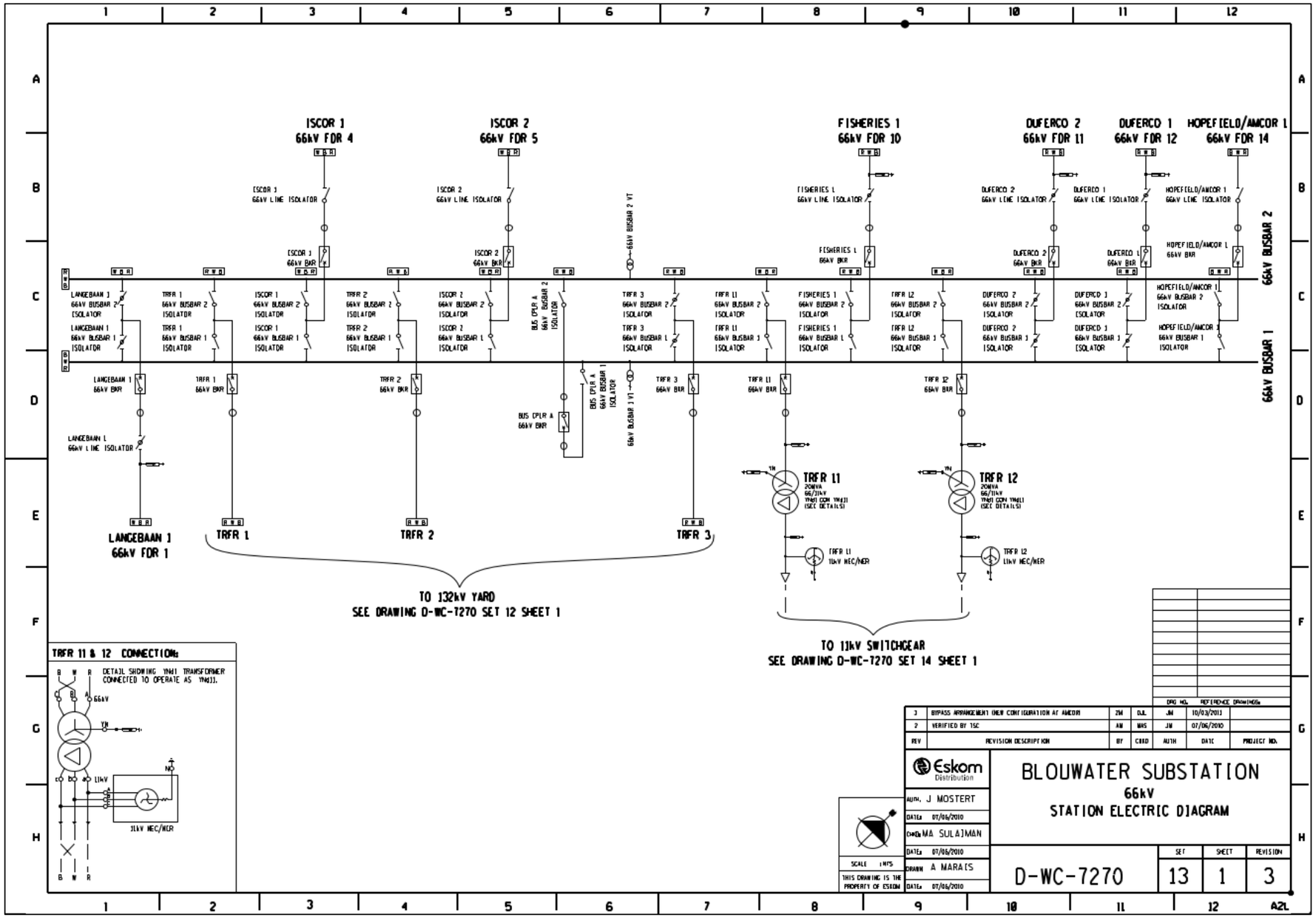


Figure 3: SED - Blouwater Substation (Existing)

5.6. Proposed Network Configuration

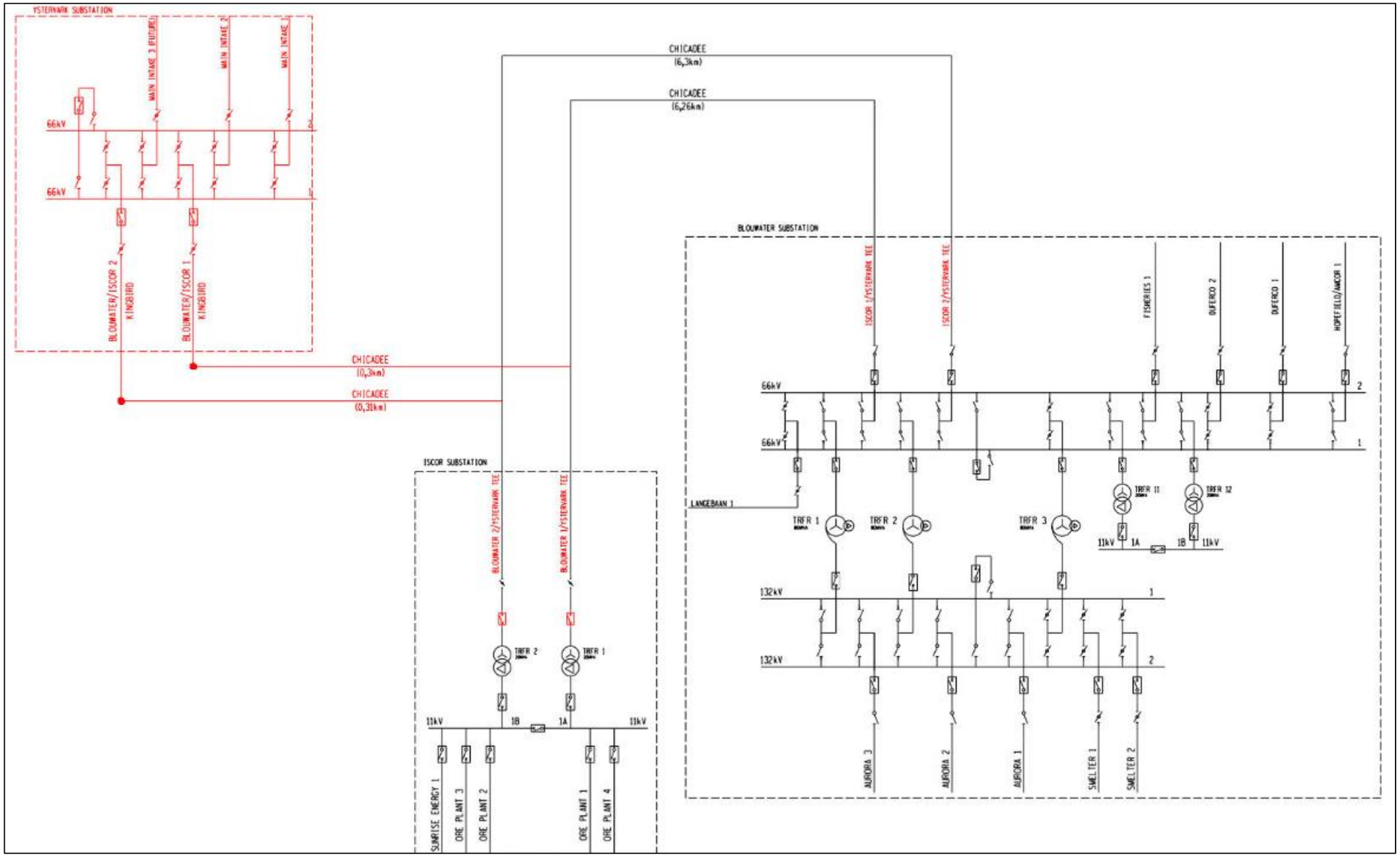


Figure 4: Proposed New Electrical Network Configuration - Blouwater to Iscor/Ystervark Substations

6. Civil

7. Structural

8. Architectural

9. Power Plant

9.1. Overview

Currently, Iscor Substation is fed via two 66 kV overhead lines from Blouwater Substation. The new Ystervark 66 - 132 kV Substation will be constructed approximately 350 m from the existing Iscor Substation, and will tie into both of the Blouwater-Iscor 66 kV lines.

The connection of Ystervark Substation instigates the need for label changes at Blouwater Substation's respective outdoor HV equipment of the 2 x 66 kV feeders, to ensure the current naming convention of 'Iscor' is changed to Iscor/Ystervark TEE.

9.2. Specification

9.2.1. Substation HV Equipment Labels

The existing Iscor 1 & 2 feeder bay equipment labels will be renamed and shall be labelled with new fibre glass equipment labels in accordance to the following standards and specifications:

- 240-75660336 - Substation and network equipment label specification.
- 240-120804300 - Standard for the labelling of electrical equipment within Eskom wired network.

9.2.2. Existing Iscor 1 66 kV Feeder

The following HV yard equipment labels will be changed as follows:

Table 1: Yard Equipment Label Changes Required for Addition of Ystervark Substation - Feeder 1

Existing	New
ISCOR 1 66 kV BKR	ISCOR 1/YSTERVARK TEE 66 kV BKR
ISCOR 1 66 kV LINE ISOLATOR	ISCOR 1/YSTERVARK TEE 66 kV LINE ISOLATOR
ISCOR 1 66 kV CT	ISCOR 1/YSTERVARK TEE 66 kV CT
ISCOR 1 66 kV BUSBAR 1 ISOLATOR	ISCOR 1/YSTERVARK TEE 66 kV BUSBAR 1 ISOLATOR

Existing	New
ISCOR 1 66 kV BUSBAR 2 ISOLATOR	ISCOR 1/YSTERVARK TEE 66 kV BUSBAR 2 ISOLATOR

9.2.3. Existing Iscor 2 66 kV Feeder

The following HV yard equipment labels will be changed as follows:

Table 2: Yard Equipment Label Changes Required for Addition of Ystervark Substation - Feeder 2

Existing	New
ISCOR 2 66 kV BKR	ISCOR 2/YSTERVARK TEE 66 kV BKR
ISCOR 2 66 kV LINE ISOLATOR	ISCOR 2/YSTERVARK TEE 66 kV LINE ISOLATOR
ISCOR 2 66 kV CT	ISCOR 2/YSTERVARK TEE 66 kV CT
ISCOR 2 66 kV BUSBAR 1 ISOLATOR	ISCOR 2/YSTERVARK TEE 66 kV BUSBAR 1 ISOLATOR
ISCOR 2 66 kV BUSBAR 2 ISOLATOR	ISCOR 2/YSTERVARK TEE 66 kV BUSBAR 2 ISOLATOR

9.3. Long Lead Time Bill of Materials

9.4. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM							
POWER PLANT							
JOB NAME	Blouwater S/S – Ystervark Fdr Control Plant			WCOU_BOM-14-08	REV :	0	
JOB NUMBER:	153272156-00002						
BOM TYPE:	FINAL BOM & BOQ						
PREPARED BY :	L. Botha (AECOM)						
Tel No	+27(0)21 950 7500						
DATE PREP. :	23 January 2019						
MISCELLANEOUS							
QTY	SAP	REFERENCE	Rev	DESCRIPTION			PRICE
	MISCELLLANEOUS						
	Signage						
10	Buy Out	D-DT-5047	0	Equipment/Bay Labels		Label	

9.5. Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM											WCOU_BOM-14-08
JOB NAME	Blouwater S/S – Ystervark Fdr Control Plant					LASTEST REV :	0				
JOB NUMBER:	153272156-00002										
BOM TYPE:	FINAL BOM & BOQ										
PREPARED BY :	D. Agenbag (AECOM)										
Tel No	+27(0)21 950 7500										
DATE PREP. :	23 January 2019										
BILL OF QUANTITIES				BASED ON MEW SUBSTATION BOQ		rev. 11					
					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										
	Labeling	each	10		12.35		0.04	0.16	1.60		0.40
	SUBTOTAL (SP ACTIVITIES)										0.40
	TOTALS:										

9.6. Label Schedule

WCOU NED - HV SUBSTATION LABEL SCHEDULE

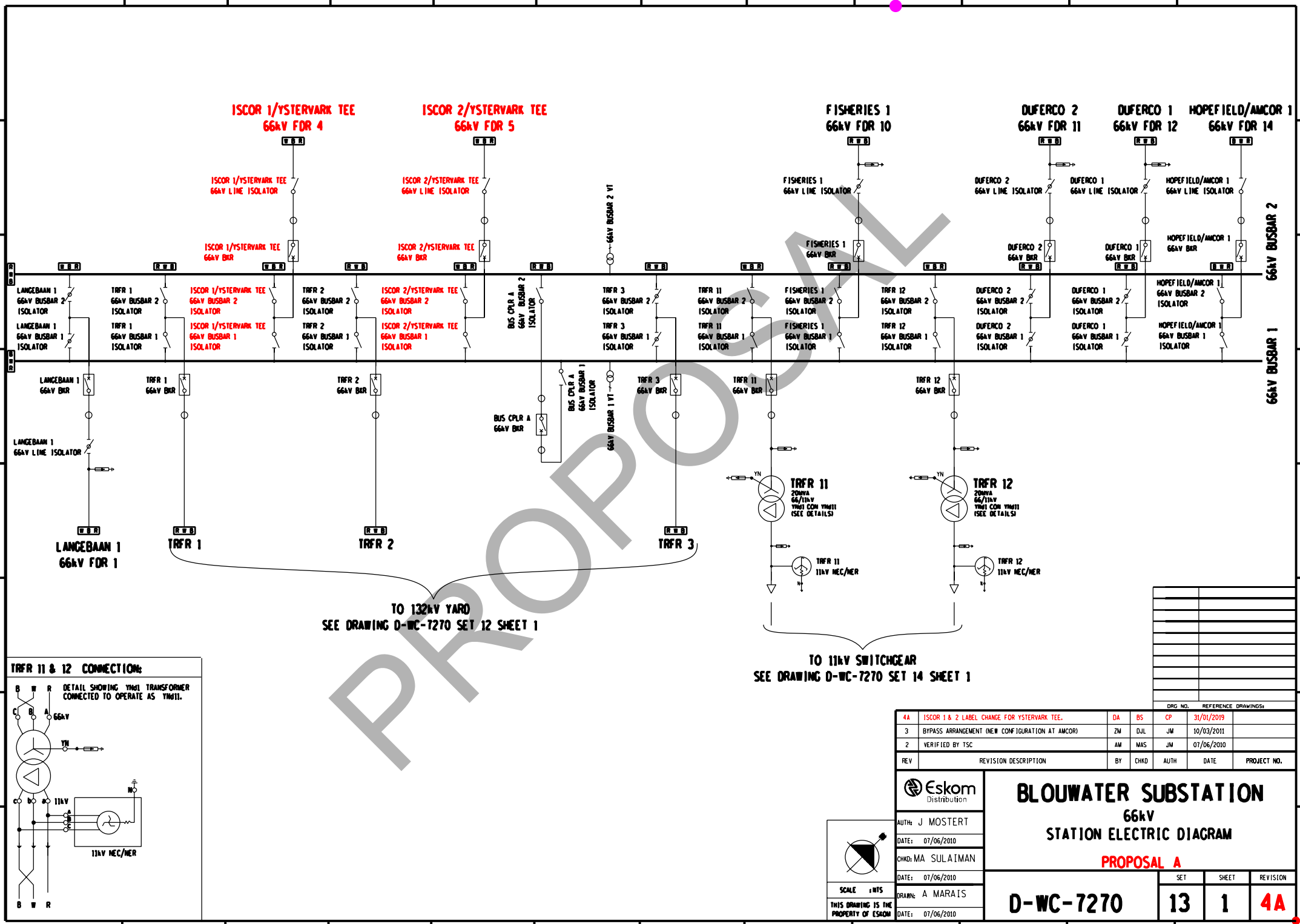
JOB NAME	Blouwater S/S - Ystervark FDR Control Plant	LASTEST REV :	0
JOB NUMBER:	153272156-00002		
BOM TYPE:	FINAL		
PREPARED BY :	DIRK AGENBAG		
Tel No	021 950 7500		
DATE PREP. :	21 January 2019		

Label Schedule

QTY	MATERIAL	REFERENCE	RevNo		LABEL NO
	ISOLATORS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 1/YSTERVARK TEE 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 1/YSTERVARK TEE 66 kV BUSBAR 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 1/YSTERVARK TEE 66 kV BUSBAR 2 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 2/YSTERVARK TEE 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 2/YSTERVARK TEE 66 kV BUSBAR 1 ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 2/YSTERVARK TEE 66 kV BUSBAR 2 ISOLATOR	2
	CURRENT TRANSFORMERS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 1/YSTERVARK TEE 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 2/YSTERVARK TEE 66 kV CT	2
	CIRCUIT BREAKERS				
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 1/YSTERVARK TEE 66 kV BKR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	ISCOR 2/YSTERVARK TEE 66 kV BKR	2

9.7. Detailed Drawings

Drawing No.	Drawing Title	Rev
D-WC-7270-13-01	66kV - Station Electric Diagram	4A



DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
4A	ISCOR 1 & 2 LABEL CHANGE FOR YSTERVARK TEE.	DA	BS	CP	31/01/2019	
3	BYPASS ARRANGEMENT (NEW CONFIGURATION AT AMCOR)	ZM	DJL	JM	10/03/2011	
2	VERIFIED BY TSC	AM	MAS	JM	07/06/2010	

Eskom Distribution

BLOUWATER SUBSTATION
66kV
STATION ELECTRIC DIAGRAM
PROPOSAL A

AUTH: J MOSTERT
DATE: 07/06/2010
CHKD: MA SULAIMAN
DATE: 07/06/2010
DRAWN: A MARAIS
DATE: 07/06/2010

SCALE : NTS

THIS DRAWING IS THE PROPERTY OF ESKOM

D-WC-7270 | SET 13 | SHEET 1 | REVISION 4A

A2L

9.8. Non Standard Material Specifications

10. Control Plant

10.1. Overview

Both of the existing Blouwater-Iscor 66 kV feeder lines have 4FZD3920 protection schemes installed. The lines are protected using the line differential protection function of the ABB RED 670 line differential and impedance protection relay within each respective protection scheme. Ystervark Substation will be connected to the Blouwater-Iscor 66 kV lines via two tee-in lines of approximately 300 m in length, immediately before Iscor Substation.

The existing line differential protection scheme will not operate correctly with the introduction of the tee-off lines. To correct this, the existing differential protection schemes at Blouwater and Iscor Substations respectively will be retrofitted with the addition of a second teleprotection card and the three-terminal differential protection functionality selected for each of the existing respective ABB RED 670 relays at each Substation.

Further to the above, label changes will be undertaken on the respective feeder protection panels to ensure the current naming convention of 'Iscor' is changed to Iscor/Ystervark TEE.

Note: The fibre link for the differential protection between Blouwater and Ystervark Substations will be patched via Iscor Substation. No direct fibre optic circuit links will be in-place between Blouwater and Ystervark Substation.

10.2. Specification

10.2.1. Existing Iscor 1 66 kV Feeder - 4FZD3920 Protection Scheme

The current protection scheme for the Iscor 1 66 kV feeder is the 4FZD3920 type. It is equipped with a single fibre teleprotection card to facilitate line differential protection for the Blouwater-Iscor 1 line.

A second fibre teleprotection card must be provided to the scheme in order to allow for three-terminal line differential protection to be enabled on the RED 670 relay. Installation, initialising of the card and updating the masking will be undertaken by ABB on site, and witnessed by the Eskom team.

The following equipment will be installed in the existing scheme:

- Long-range fibre teleprotection and communication card.
- SC/APC - FC single-mode fibre optic patch lead between relay panel and patch panel.

Reference to be made to Eskom drawing D-DT-9051 Sheet 14 (Sap Material No. 0248587).

10.2.2. Existing Iscor 2 66 kV Feeder - 4FZD3920 Protection Scheme

The current protection scheme for the Iscor 2 66 kV feeder is the 4FZD3920 type. It is equipped with a single fibre teleprotection card to facilitate line differential protection for the Blouwater-Iscor 2 line.

A second fibre teleprotection card must be provided to the scheme in order to allow for three-terminal line differential protection to be enabled on the RED 670 relay. Installation, initialising of the card and updating the masking will be undertaken by ABB on site, and witnessed by the Eskom team.

The following equipment will be installed in the existing scheme:

- Long-range fibre teleprotection and communication card.
- SC/APC - FC single-mode fibre optic patch lead between relay panel and patch panel.

Reference to be made to Eskom drawing D-DT-9051 Sheet 14 (Sap Material No. 0248587).

10.2.3. Labelling

New labels will be manufactured for installation on the relay panels for Iscor 1 & 2 66 kV feeders. The label changes will be as follows:

Table 3: Required Relay Panel Label Changes

Existing	New
ISCOR 1	ISCOR 1/YSTERVARK TEE
ISCOR 2	ISCOR 2/YSTERVARK TEE

10.2.4. Metering

No changes are required.

10.2.5. AC/DC Panel

No changes are required.

10.2.6. Substation Automation

No changes are required.

10.2.7. Telecontrol

No changes are required.

10.2.8. Telecommunication

Fibre optic patch leads will be installed between the retrofitted fibre teleprotection cards respectively for both Iscor/Ystervark 1 & 2 66 kV feeders and associated patch panels, to allow for the differential protection communication.

Two additional fibre circuits (4 x fibre cores) are required between Blouwater and Ystervark Substations. Eskom's Telecommunication Department must indicate which fibre cores in the patch panels to terminate the patch leads to.

Refer to final design as received from Eskom Telecommunication in Section 10.7 for a detailed scope of work and bill of materials and quantities. The Contractor Scope is detailed under section 4.6 in the abovementioned design document. It should be noted that there is a requirement for duct fibre and the associated materials between the Telecomms panel and the new patch panels that is not included in any of the bills of quantities and should be measured on site based on final panel position and ceiling heights.

The following, but necessarily limited to, Eskom standards shall apply as well:

- 240-132190480 - Telecommunications Equipment Installation Standard.
- 240-67907017 - Fibre Optic Core Allocation Standard.

10.3. Long Lead Time Bill of Materials

10.4. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

CONTROL PLANT

JOB NAME	Blouwater S/S – Ystervark Fdr Control Plant	WCOU_BOM-14-08	REV :	0
JOB NUMBER:	153272156-00002			
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	L. Botha (AECOM)			
Tel No	+27(0)21 950 7500			
DATE PREP. :	23 January 2019			

This document is the property of Eskom

HIGH VOLTAGE FEEDER PROTECTION

QTY	SAP	REFERENCE	Rev	DESCRIPTION	PRICE
	HV FEEDER SCHEME				
2	0248587	D-DT-9051	0	Three Terminal Diff Option	

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

CONTROL PLANT

JOB NAME	Blouwater S/S – Ystervark Fdr Control Plant	WCOU_BOM-14-08	REV :	0
JOB NUMBER:	153272156-00002			
BOM TYPE:	LLT BOM [FINAL]			
PREPARED BY :	FINAL BOM & BOQ			
Tel No	+27(0)21 950 7500			
DATE PREP. :	23 January 2019			

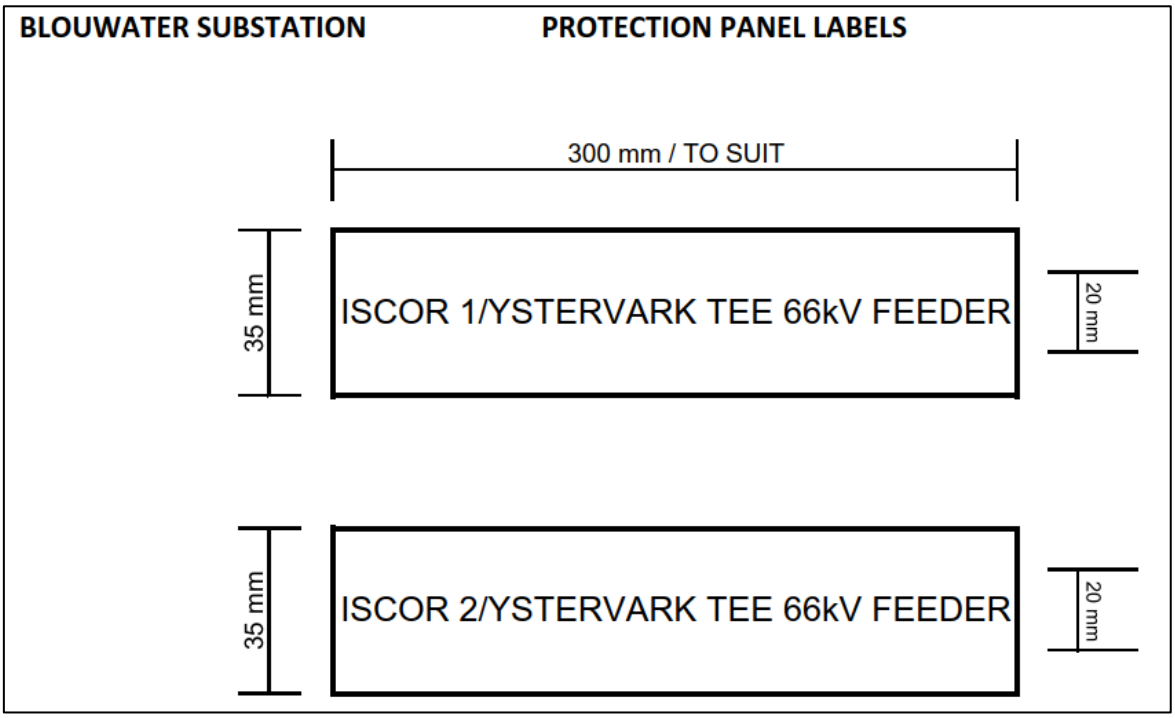
This document is the property of Eskom

MISCELLANEOUS

QTY	SAP	DT reference	Rev	DESCRIPTION	PRICE
	WRCP007	-	-	Fibre Optic Cabinet	
	WRCP008	-	-	KabelFlex Underground Cable	
2	BUY-OUT	-	-	SC/APC - FC single Mode Patch Leads Ruggedised	

10.5. Final Bill of Quantities

10.6. Label Schedule



10.7. Eskom Telecommunication Design and Bill of Materials

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **1** of **26**

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

Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **2** of **26**

Table of Contents

Planning for: Ystervark SS Comms

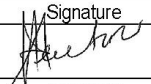
Unique Identifier: **ETFM 1846**
Revision: **1**

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

		☑☒ NA
1	**Financial**	
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**

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	Ystervark 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 021 980 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

Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**

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)

Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**

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.**

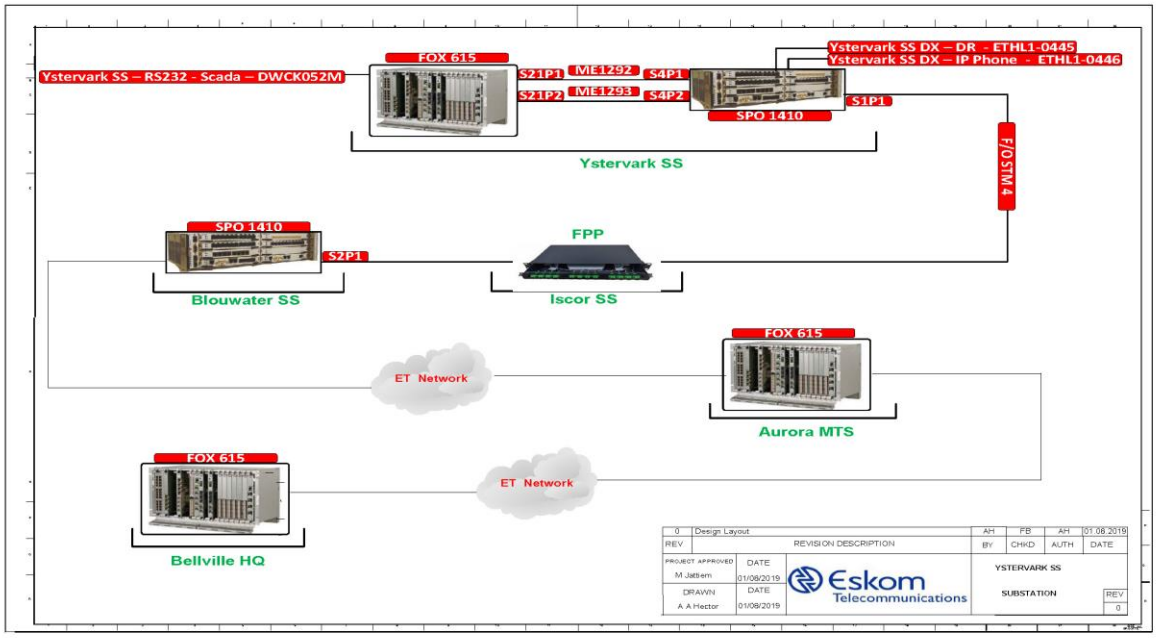
3.1.1 – Fibre Optic Link Budget: Ystervark SS to Blouwater SS (Via Iscor SS).

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

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **9** of **26**

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/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

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**

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-E1B **(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	568429	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	prn		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 UU 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	prn		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																	

Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**

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

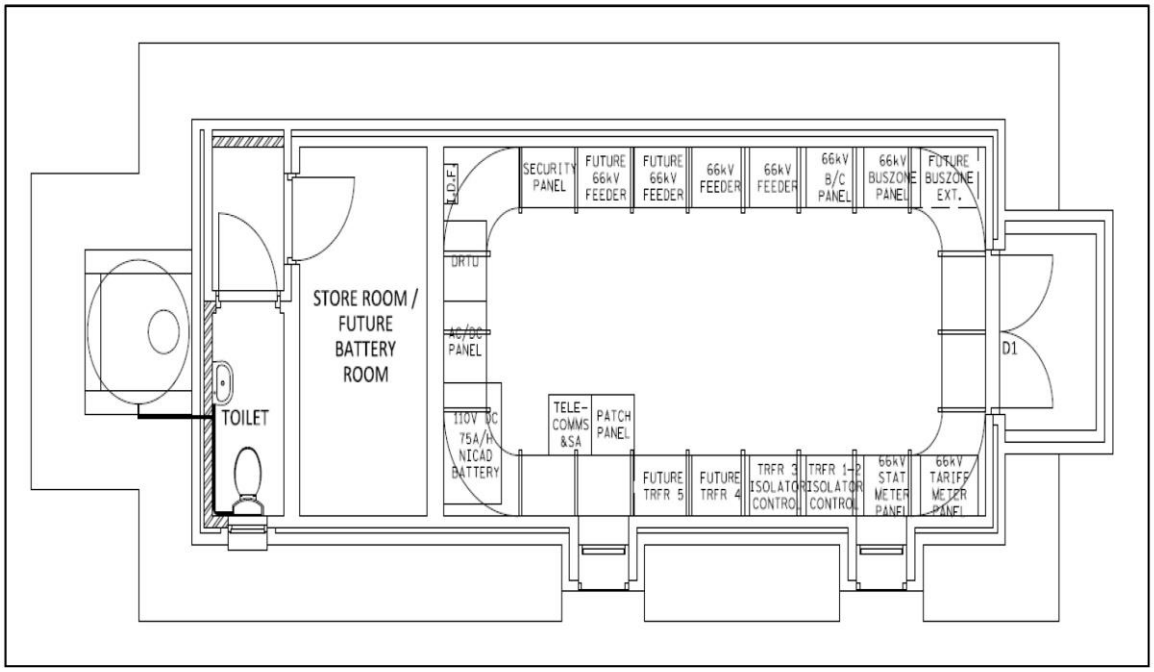
8.1 – Miscellaneous Materials

1. Contractor to supply everything needed to do installation.

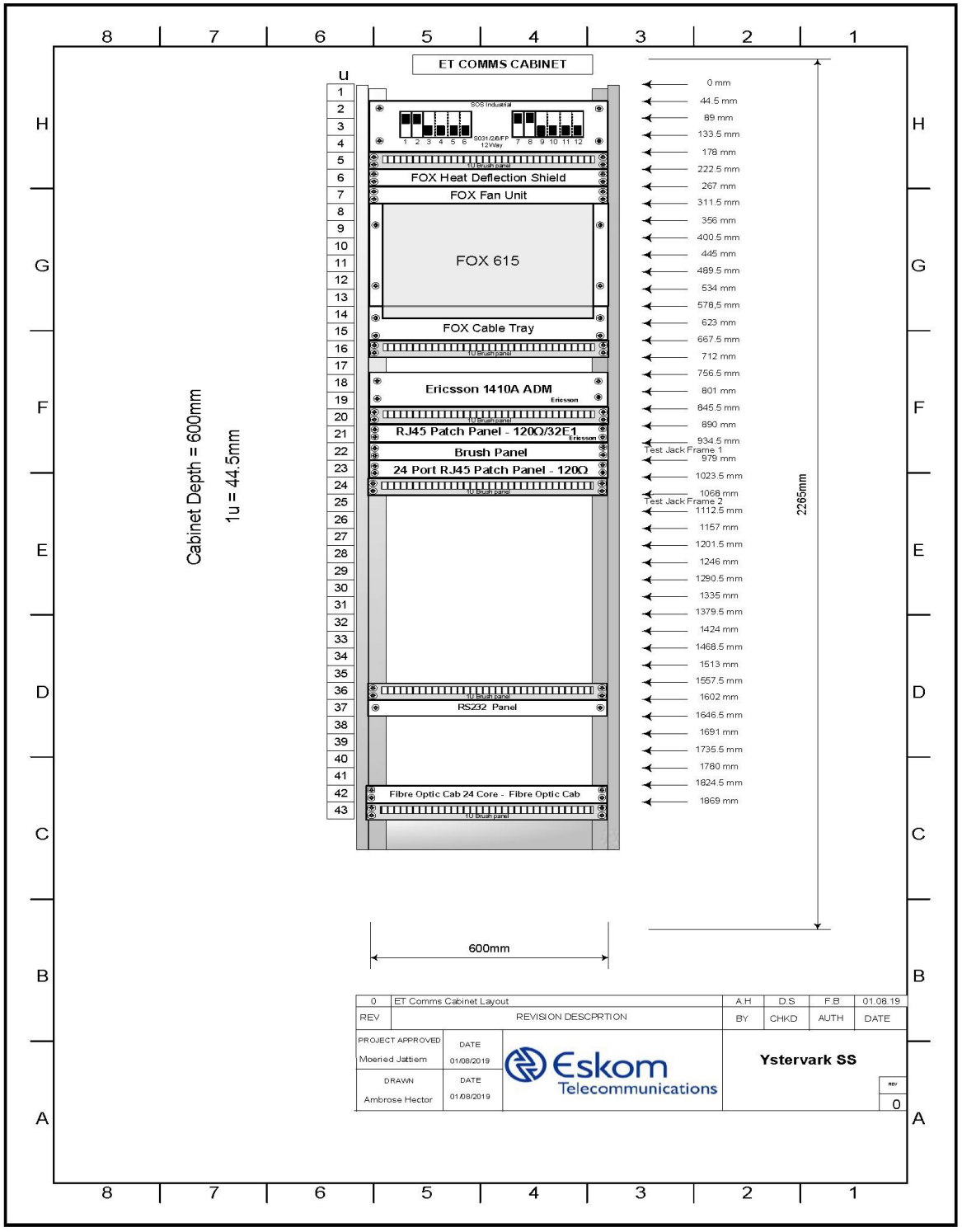
SECTION 9: SITE DRAWINGS

Unique Identifier: **ETFM 1846**
Revision: **1**
Page **20** of **26**

9.1 – Ystervark 132 kV SS Control Room Layout (ET Cabinet 600mmx800mm)



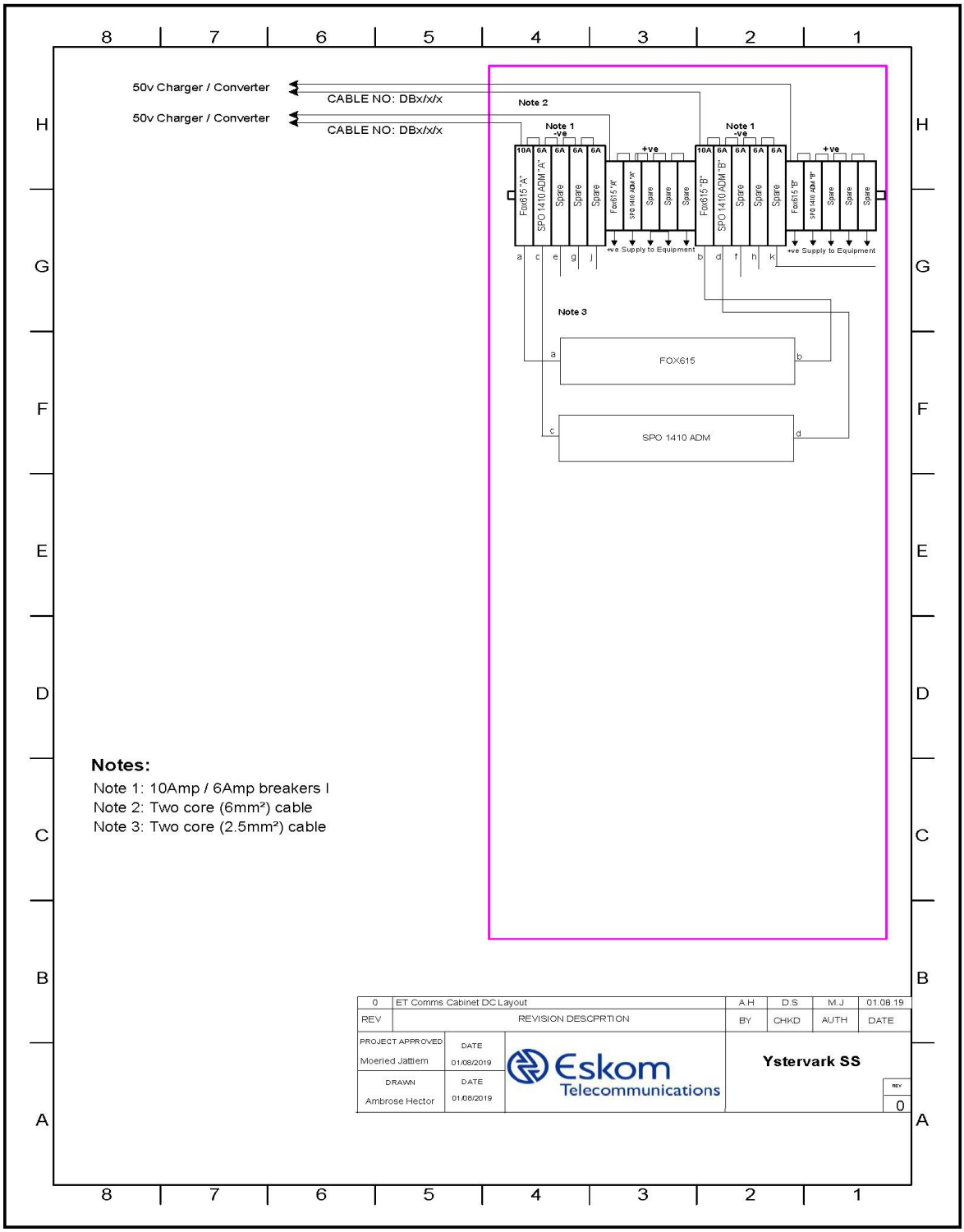
9.2 – Ystervark 132kV SS ET Comms Cabinet



Planning for: Ystervark SS Comms

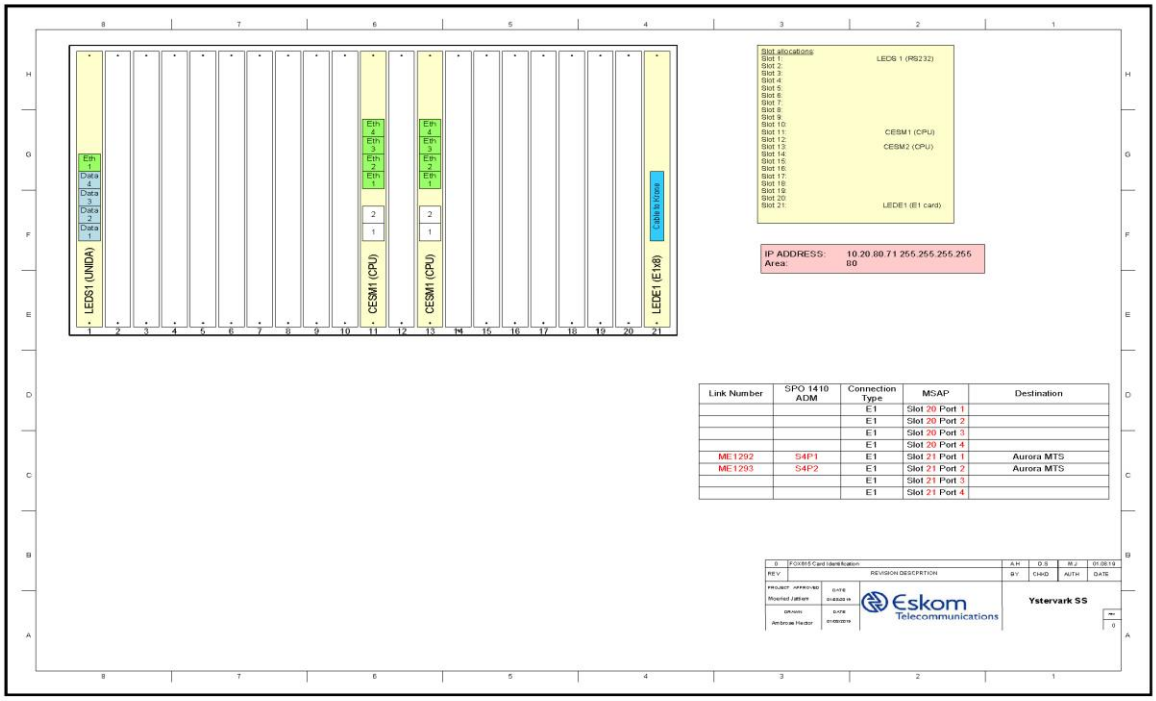
Unique Identifier: **ETFM 1846**
Revision: **1**

9.3 – Ystervark 132kV SS ET Comms Cabinet DC Cabling



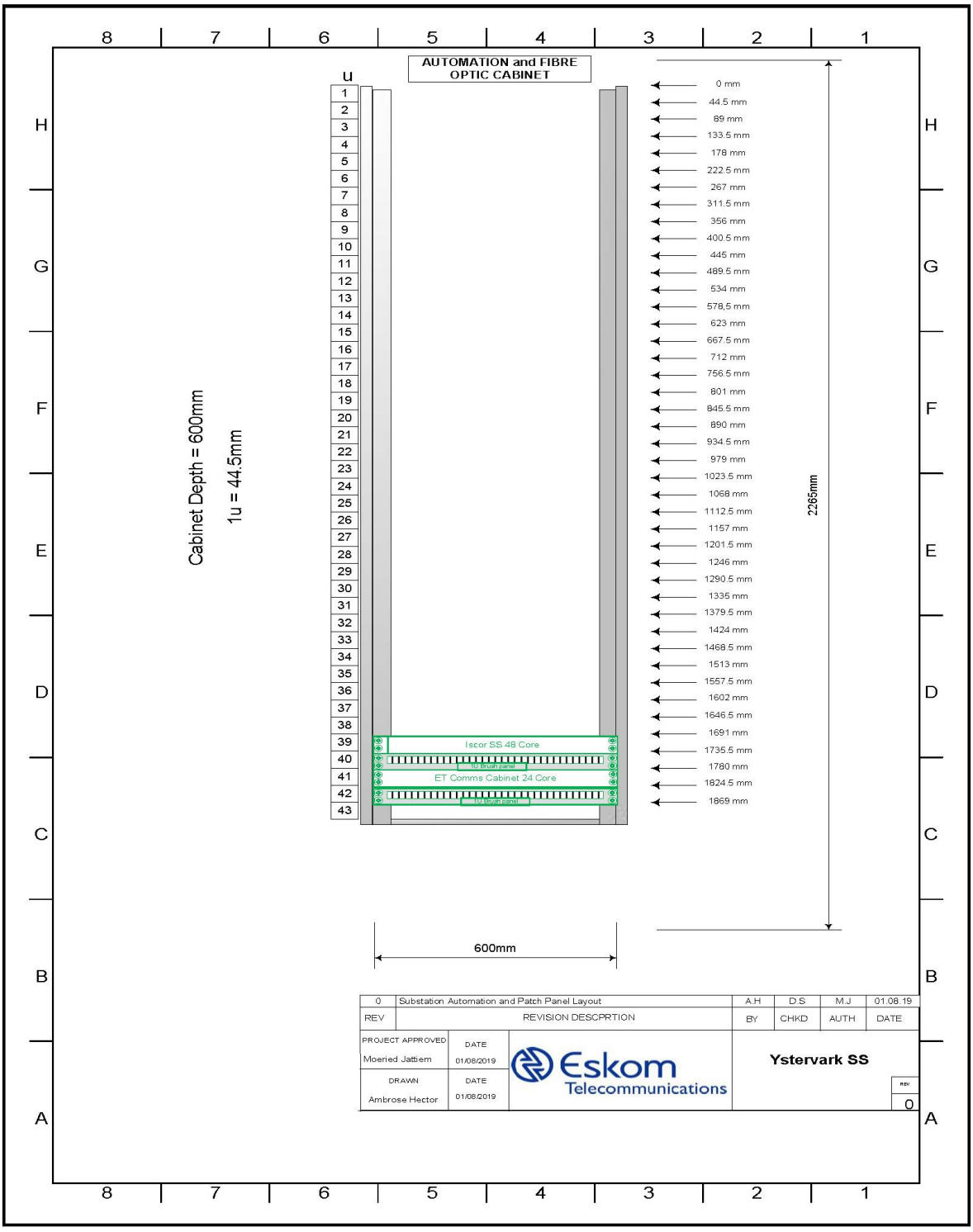
Unique Identifier: **ETFM 1846**
Revision: **1**
Page **23** of **26**

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	

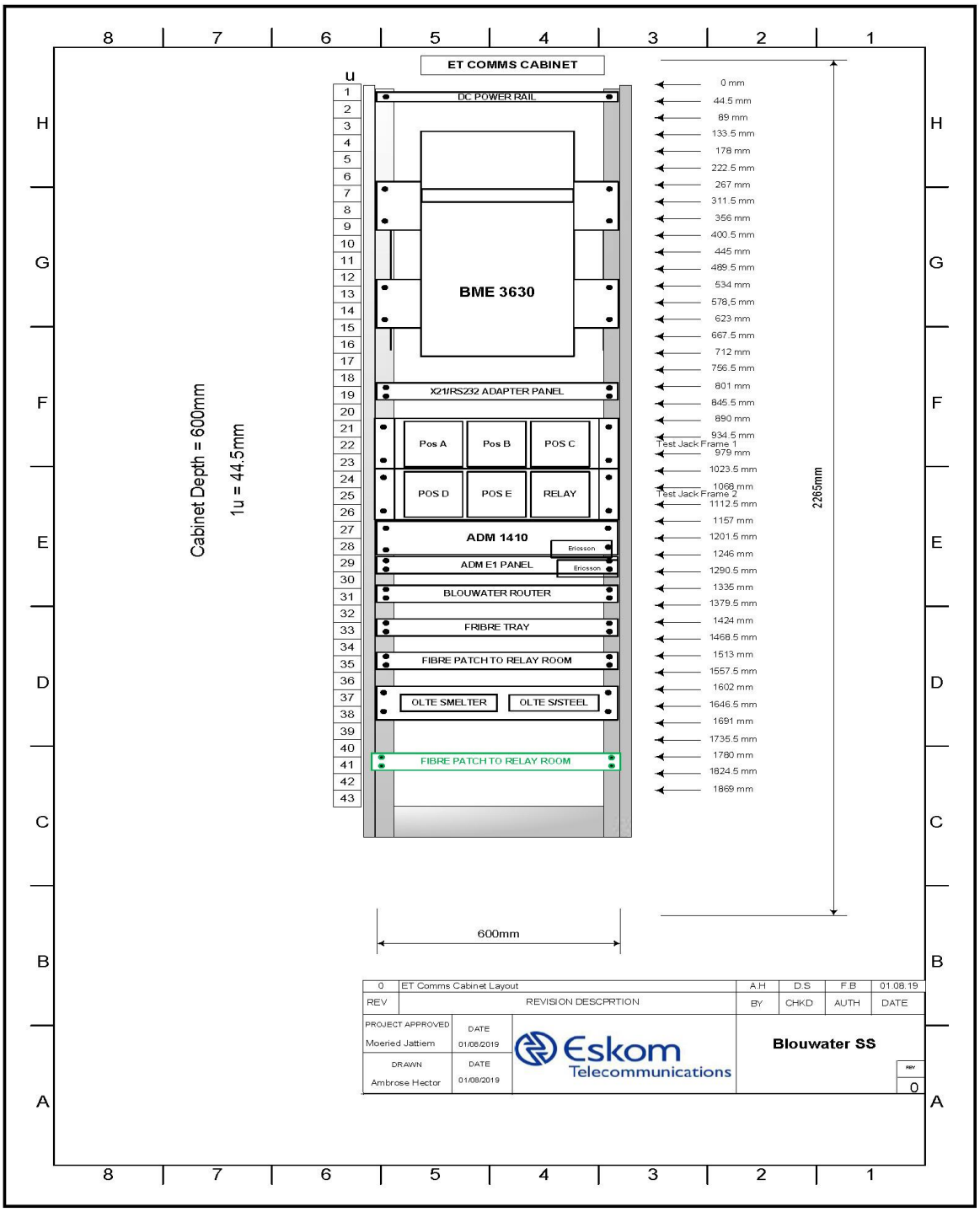
9.5 – Ystervark Fibre Comms Cabinet



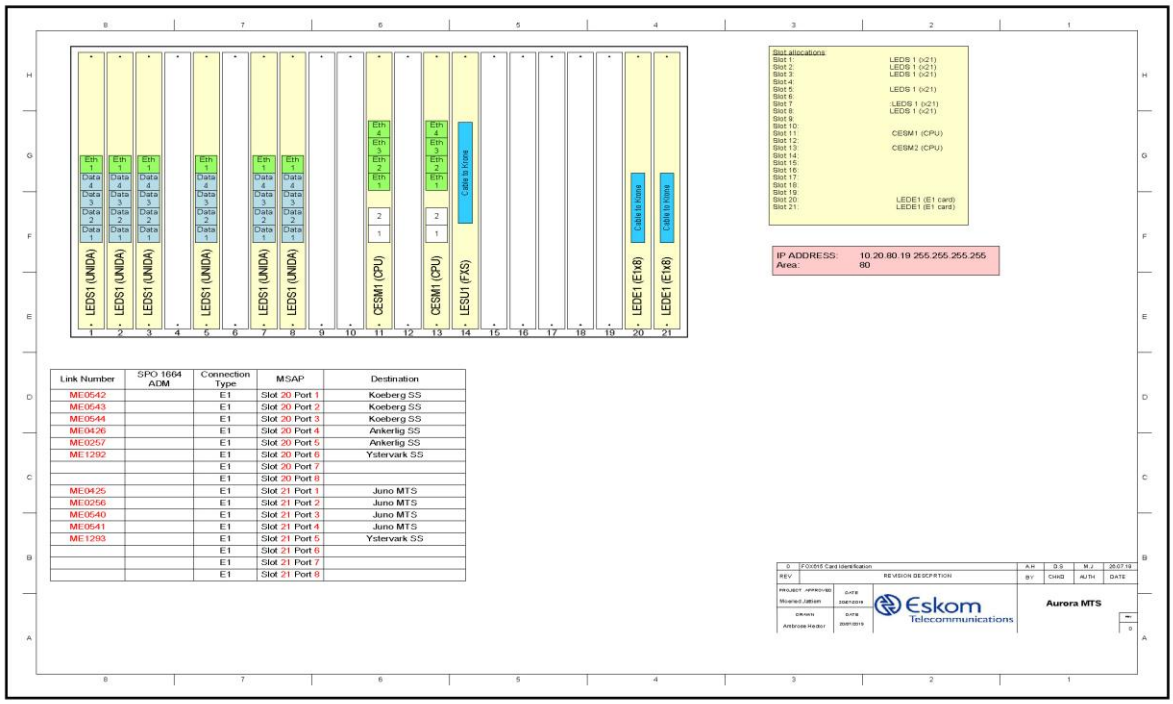
Planning for: Ystervark SS Comms

Unique Identifier: **ETFM 1846**
Revision: **1**

9.6 – Blouwater SS Comms Cabinet



9.7 – Aurora MTS Fox 615 Face Layout



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	

10.8. Detailed Drawings

Drawing No	Drawing Title	Rev
D-WC-7270-64-00	66 kV Feeder 4 - Cover Sheet	00
D-WC-7270-64-01	66 kV Feeder 4 - Panel Equipment Layout	01
D-WC-7270-64-02	66 kV Feeder 4 - Logic Diagram	00
D-WC-7270-64-03	66 kV Feeder 4 - Single Line Diagram	01
D-WC-7270-64-04	66 kV Feeder 4 - AC Key Diagram	00
D-WC-7270-64-05	66 kV Feeder 4 - VT Supply Key Diagram	00
D-WC-7270-64-06	66 kV Feeder 4 - Main DC Key Diagram	01
D-WC-7270-64-07	66 kV Feeder 4 - Main DC Key Diagram	01
D-WC-7270-64-08	66 kV Feeder 4 - Teleprotection DC Key Diagram	01
D-WC-7270-64-09	66 kV Feeder 4 - Back-Up DC Key Diagram	01
D-WC-7270-64-10	66 kV Feeder 4 - Back-Up DC Key Diagram	01
D-WC-7270-64-11	66 kV Feeder 4 - Back-Up DC Key Diagram	01
D-WC-7270-64-12	66 kV Feeder 4 - Close DC Key Diagram	01
D-WC-7270-64-13	66 kV Feeder 4 - Indication DC Key Diagram	00
D-WC-7270-64-14	66 kV Feeder 4 - Spring Rewind and AC Key Diagram	01
D-WC-7270-64-15	66 kV Feeder 4 - REA and Measurements Key Diag	00
D-WC-7270-64-16	66 kV Feeder 4 - Supervis. Status & Control Key	00
D-WC-7270-64-17	66 kV Feeder 4 - Supervisory Alarms Key Diagram	00
D-WC-7270-64-18	66 kV Feeder 4 - Disturbance Recorder Key Diagram	00
D-WC-7270-64-19	66 kV Feeder 4 - Protection Reference Diagram	00
D-WC-7270-64-20	66 kV Feeder 4 - Protection Reference Diagram	00
D-WC-7270-64-21	66 kV Feeder 4 - Protection Reference Diagram	00

D-WC-7270-64-22	66 kV Feeder 4 - Panel Cabling Diagram	01
D-WC-7270-64-23	66 kV Feeder 4 - Panel Cabling Diagram	01
D-WC-7270-64-24	66 kV Feeder 4 - Panel Cabling Diagram	00
D-WC-7270-64-25	66 kV Feeder 4 - Junction Box Cabling Diagram	01
D-WC-7270-64-26	66 kV Feeder 4 - Breaker Reference Diagram	01
D-WC-7270-65-00	66 kV Feeder 5 - Cover Sheet	00
D-WC-7270-65-01	66 kV Feeder 5 - Panel Equipment Layout	01
D-WC-7270-65-02	66 kV Feeder 5 - Logic Diagram	00
D-WC-7270-65-03	66 kV Feeder 5 - Single Line Diagram	02
D-WC-7270-65-04	66 kV Feeder 5 - AC Key Diagram	02
D-WC-7270-65-05	66 kV Feeder 5 - VT Supply Key Diagram	00
D-WC-7270-65-06	66 kV Feeder 5 - Main DC Key Diagram	01
D-WC-7270-65-07	66 kV Feeder 5 - Main DC Key Diagram	01
D-WC-7270-65-08	66 kV Feeder 5 - Teleprotection DC Key Diagram	01
D-WC-7270-65-09	66 kV Feeder 5 - Back-Up DC Key Diagram	01
D-WC-7270-65-10	66 kV Feeder 5 - Back-Up DC Key Diagram	01
D-WC-7270-65-11	66 kV Feeder 5 - Back-Up DC Key Diagram	01
D-WC-7270-65-12	66 kV Feeder 5 - Close DC Key Diagram	01
D-WC-7270-65-13	66 kV Feeder 5 - Indication DC Key Diagram	00
D-WC-7270-65-14	66 kV Feeder 5 - Spring Rewind and AC Key Diagram	01
D-WC-7270-65-15	66 kV Feeder 5 - REA and Measurements Key Diag	00
D-WC-7270-65-16	66 kV Feeder 5 - Supervis. Status & Control Key	01
D-WC-7270-65-17	66 kV Feeder 5 - Supervisory Alarms Key Diagram	00
D-WC-7270-65-18	66 kV Feeder 5 - Disturbance Recorder Key Diagram	00

D-WC-7270-65-19	66 kV Feeder 5 - Protection Reference Diagram	00
D-WC-7270-65-20	66 kV Feeder 5 - Protection Reference Diagram	00
D-WC-7270-65-21	66 kV Feeder 5 - Protection Reference Diagram	00
D-WC-7270-65-22	66 kV Feeder 5 - Panel Cabling Diagram	01
D-WC-7270-65-23	66 kV Feeder 5 - Panel Cabling Diagram	01
D-WC-7270-65-24	66 kV Feeder 5 - Panel Cabling Diagram	00
D-WC-7270-65-25	66 kV Feeder 5 - Junction Box Cabling Diagram	02
D-WC-7270-65-26	66 kV Feeder 5 - Breaker Reference Diagram	00

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	0	13/12/2010	
1	PANEL EQUIPMENT LAYOUT	0	13/12/2010	
2	LOGIC DIAGRAM	0	13/12/2010	
3	SINGLE LINE DIAGRAM	0	13/12/2010	
4	AC KEY DIAGRAM	0	13/12/2010	
5	VT SUPPLY KEY DIAGRAM	0	13/12/2010	
6	MAIN DC KEY DIAGRAM	0	13/12/2010	
7	MAIN DC KEY DIAGRAM	0	13/12/2010	
8	TELEPROTECTION DC KEY DIAGRAM	0	13/12/2010	
9	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
10	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
11	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
12	CLOSE DC KEY DIAGRAM	0	13/12/2010	
13	INDICATION DC KEY DIAGRAM	0	13/12/2010	
14	SPRING REWIND AND AC KEY DIAGRAM	0	13/12/2010	
15	REA AND MEASUREMENTS KEY DIAGRAM	0	13/12/2010	
16	SUPERVISORY STATUS & CONTROL KEY DIAGRAM	0	13/12/2010	
17	SUPERVISORY ALARMS KEY DIAGRAM	0	13/12/2010	
18	DISTURBANCE RECORDER KEY DIAGRAM	0	13/12/2010	
19	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
20	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
21	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
22	PANEL CABLING DIAGRAM	0	13/12/2010	
23	PANEL CABLING DIAGRAM	0	13/12/2010	
24	PANEL CABLING DIAGRAM	0	13/12/2010	
~~25~~	~~ISOLATOR JUNCTION BOX~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
~~26~~	~~LINE VTJB LAYOUT & KEY DIAGRAM~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
~~27~~	~~CABLE BLOCK DIAGRAM~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
25	JUNCTION BOX CABLING	REV 0	18/02/2011	SHEET ADDED FOR (SITE SPECIFIC) APPLICATION
26	BREAKER REFERENCE DIAGRAM	REV 0	18/02/2011	SHEET ADDED FOR (SITE SPECIFIC) APPLICATION

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2	4FZD3920 DISTANCE/ DIFFERENTIAL SCHEME	17	
3		18	
4		19	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - ACTOM AREVA i5MT FREE ISSUED)
5		20	
6		21	
7		22	
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	
12		27	
13	STANDARD OUTDOOR HV ABB CIRCUIT-BREAKER 36-72.5kV (AS PER ABB DRAWINGS 1HYB902173-100 REV D)	28	IEC-61850/ETHERNET COMMS (ORDERING OPTION)
14	VOLTAGE SELECTOR RELAY (VSR) DOUBLE BUSBAR (ORDERING OPTION)	29	
15		30	

θ MUTUALLY EXCLUSIVE LEVELS/SHEETS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.
x MUTUALLY INCLUSIVE LEVELS/SHEETS.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
COVER SHEET

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	00	00

PANEL TYPE DESIGNATION 4FZD-3920

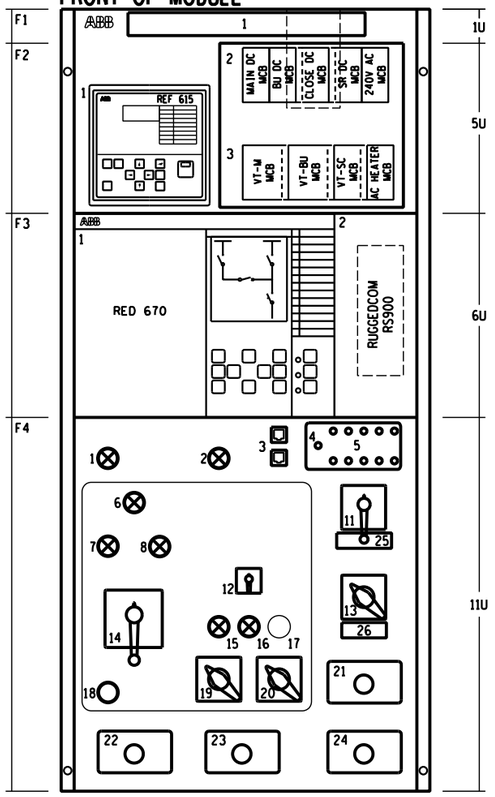
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 0 OF 27 REVISION 0

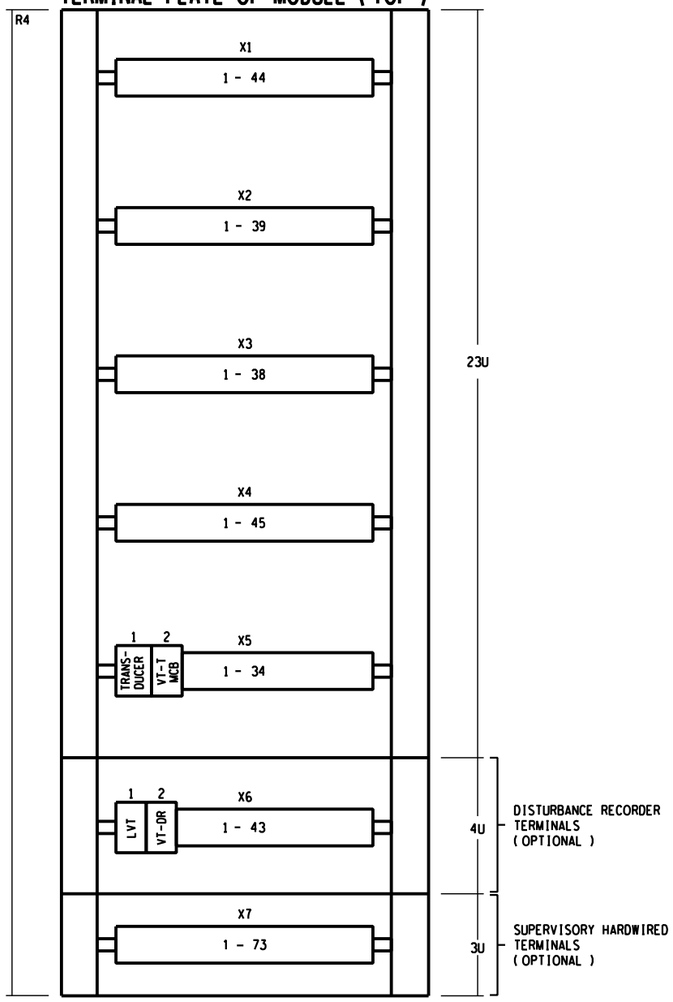
PLEASE NOTE!!!!!!!!!!

WHEN USING THIS SCHEME PLEASE MAKE SURE THAT REFERENCE FILE title4TM7100r1 IS ATTACHED ON ALL THE SHEETS AT ALL TIMES.

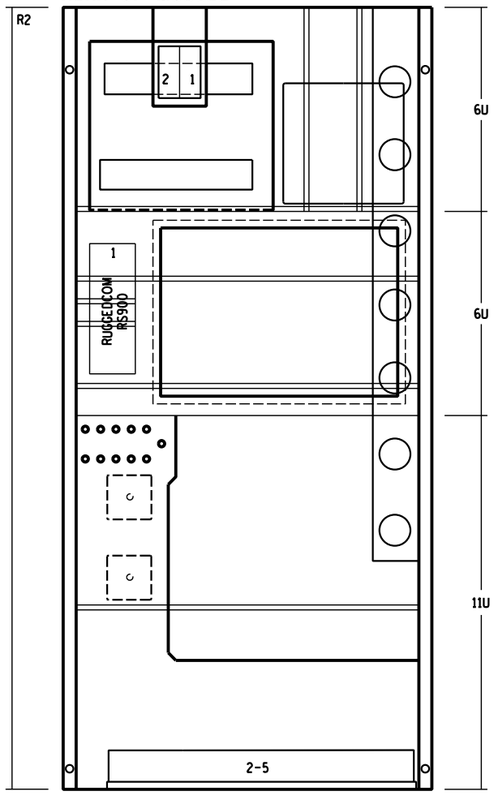
FRONT OF MODULE



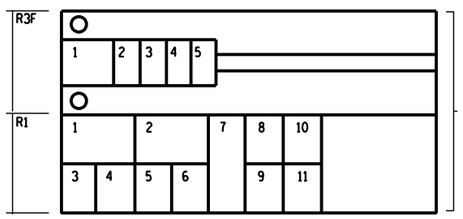
TERMINAL PLATE OF MODULE (TOP)



REAR OF MODULE

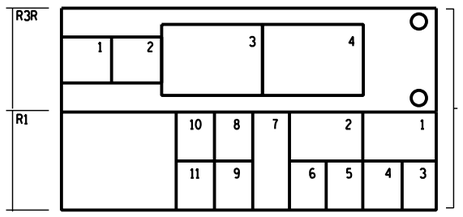


INTERNAL TO MODULE



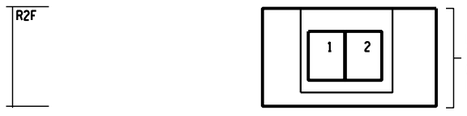
LAYOUT FOR 110V AND 220V DC SCHEME (FRONT VIEW)

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				
INTERNAL TO MODULE								
R1	1		VSR-1	ISOLATOR 1 REPEAT RELAY	(* AN=110V DC, AS=220V DC)	(NOT USED)	RK251205AN	ABB
	2		VSR-2	ISOLATOR 2 REPEAT RELAY	(* AN=110V DC, AS=220V DC)	(NOT USED)	RK251205AN	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	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)		RXMB 1 AN	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-U048DC3L	ABB
	3		CBCS-X1	CIRCUIT BREAKER CLOSE SUPERVISORY AUXILIARY 1 RELAY	(48V DC)	(OPTIONAL)	CR-U048DC3L	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
						(3 PHASE)	SINEAX CAM/;STAT;5MT	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		(NOT USED) (1 AMP)	S202-C 1	ABB
	X6.2		MCB (VT-DR)	DISTURBANCE RECORDER VT SUPPLY MCB	(3 POLE)	(NOT USED) (1 AMP)	S203-C 1	ABB

BAY NAME "ISCOR 1/YSTERVARK TEE" 66 kV FEEDER 4

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	FEEDER NAME CHANGED	JF	BBH	LMB	21/01/2019	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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
			SCALE		

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 4
PANEL EQUIPMENT LAYOUT

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	01

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 1 OF 27 REVISION 0

LEVELS 1 2 10 11 13 14 19 23 24 25 28

RED670 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 6FZD3100 AND 6FZD3300 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) NOT USED

GT-05) NOT USED

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) RESERVED

GT-10) NOT USED

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-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 MANUALY 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):

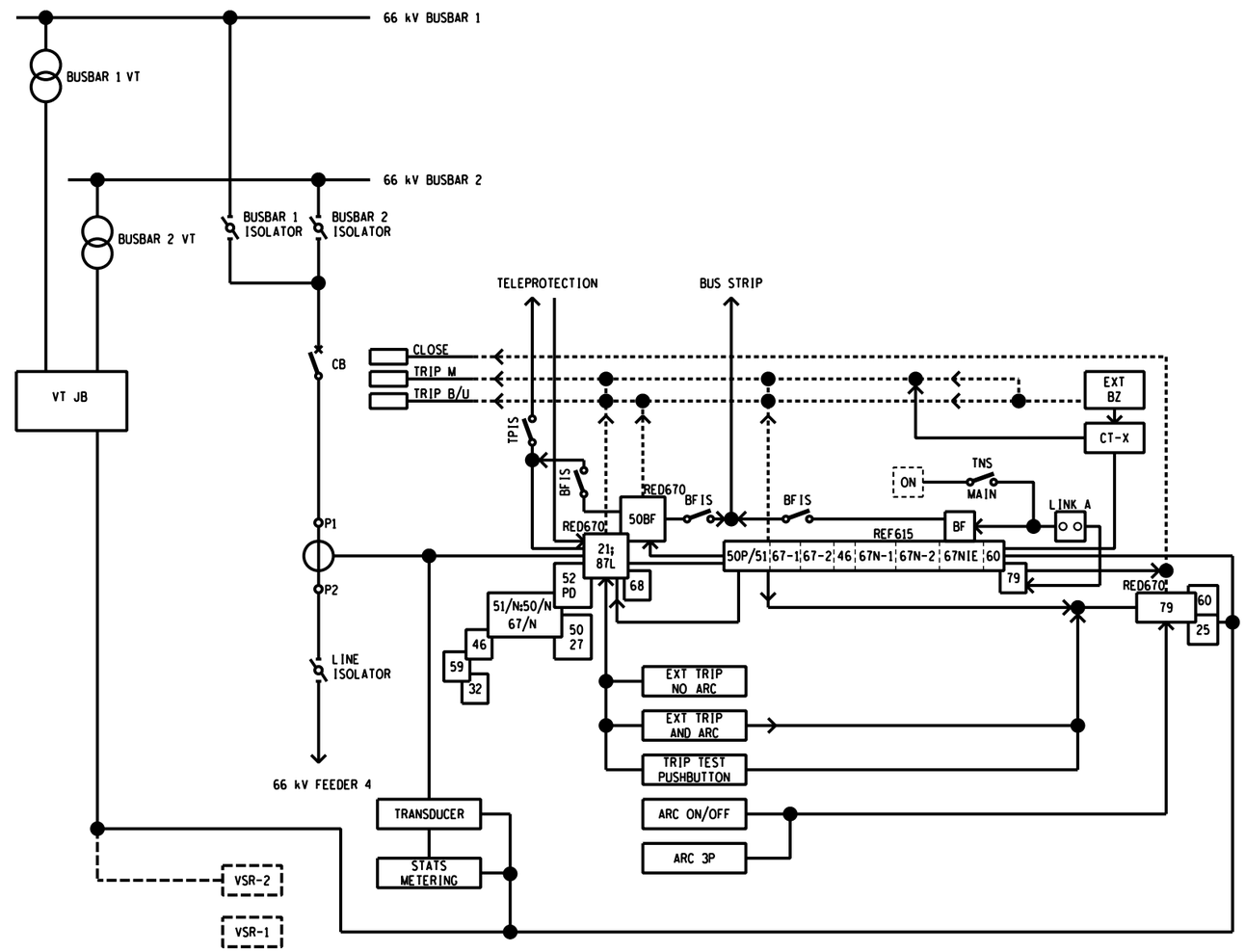
TP GAPC1 IS MASKED TO THE FOLLOWING FUNCTIONS TO ENABLE THE MULTIPLIER WHEN THE BREAKER CLOSES IF REQUIRED:
DIR HighSetOC (67-2), NonDIR InstOC (50P/51), SEF DIR EF2 (67N-1), DEF HighSet (67N-2), NonDIR_InstEF (51N-2), NegSeq_OC1/2 (46(1/2)).

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).



NOTE: VSR-1 & 2 NOT IN USE

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	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
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	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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

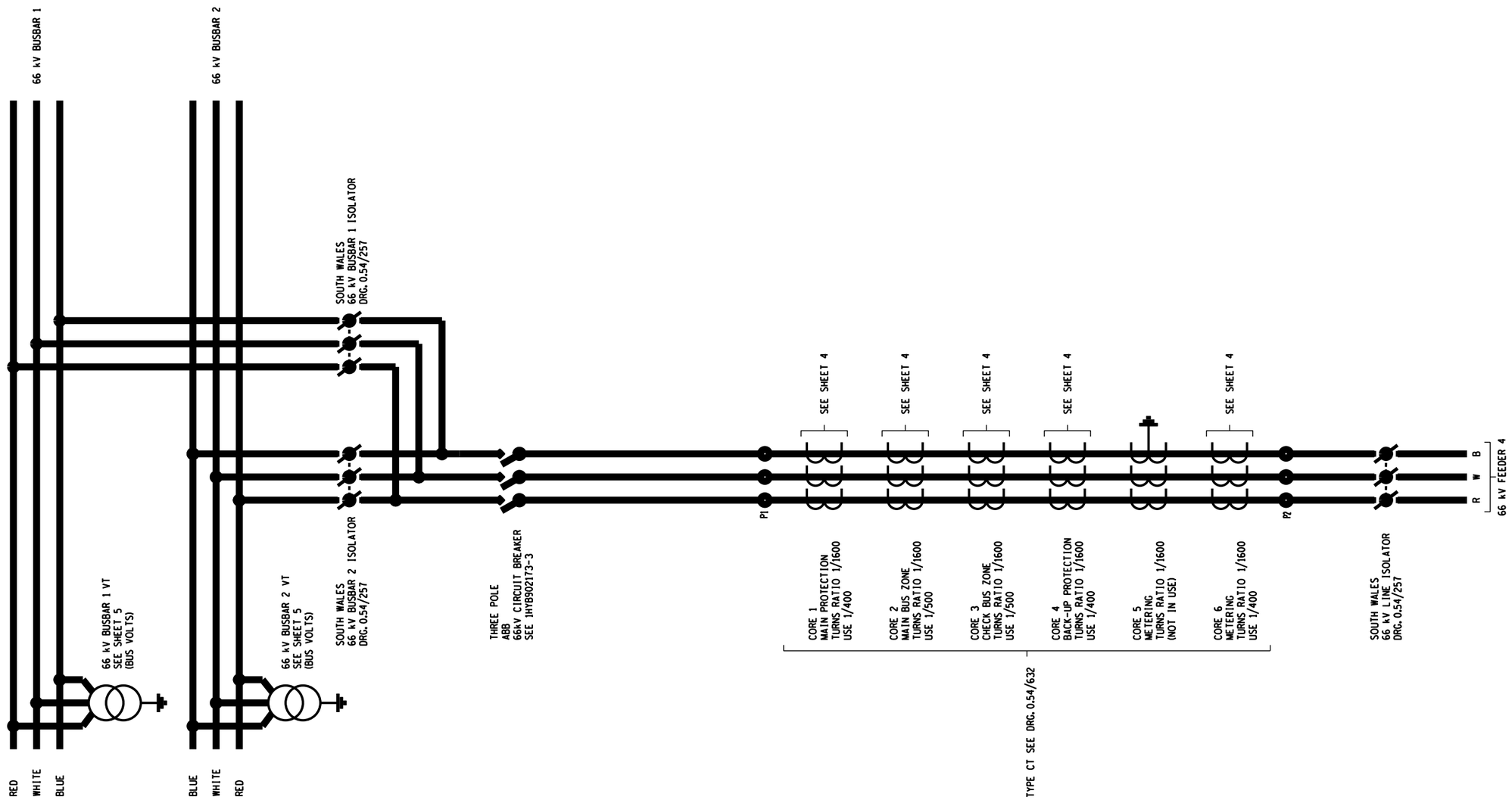
BLOUWATER SUBSTATION
66 kV FEEDER 4
LOGIC DIAGRAM

DRAWING NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	02	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 2 OF 27 REVISION 0



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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 Distribution

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED	C.KING	DESIGN APPROVED	A. CRAIB
DATE	31/10/2011	DATE	13/12/10
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011	DATE	13/12/10
DRAWN BY	A v S	DRAWN BY	C. CANNON
DATE	01/05/2011	DATE	26/02/10
SCALE			

BLOUWATER SUBSTATION
66 kV FEEDER 4
SINGLE LINE DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	03	01

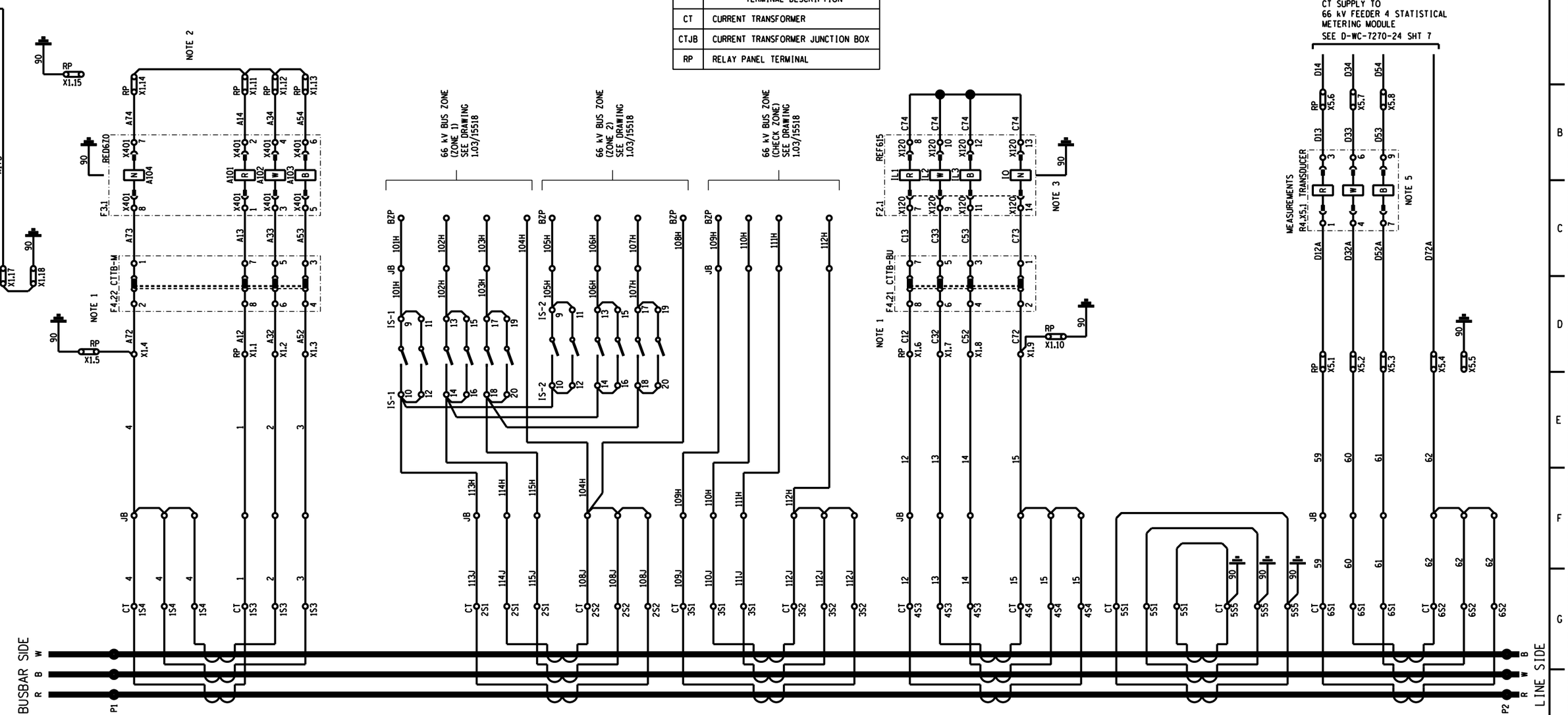
LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 3 OF 27 REVISION 0

	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.
5. JUMPERS TO BE WIRED IN BY ESKOM IF THE TRANSDUCER IS FREE ISSUED AND FITTED ON SITE.

REFERENCE DRAWINGS:

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE 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

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

BLOUWATER SUBSTATION
66 kV FEEDER 4
AC KEY DIAGRAM

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB		
DATE: 31/10/2011	DATE: 13/12/10		
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI		
DATE: 20/10/2011	DATE: 13/12/10		
DRAWN BY: A v S	DRAWN BY: C. CANNON		
DATE: 01/05/2011	DATE: 26/02/10		
SCALE		SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270		64	04	00

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 4 OF 27 REVISION 0

LINE VOLTS
(LINE VT JB)
(NOT IN USE)

LVT X1.7 — G91 — RP X1.43 — G91
LVT X1.8 — G92 — RP X1.44 — G92

F2.3.5 MCB(VT-SC) 2A

G91 1 2 G93 (WHITE)
G92 3 4 G94 (NEUTRAL/BLUE)

F3.1 RED670
X401 19 A110 — SYNCHRONISING CHECK VOLTAGE (NOTE 3) (NOTE 4)
X401 20
X401 21 A111 — DIRECTIONAL EARTH FAULT FUNCTION (INTERNALLY DERIVED)
X401 22

F2.1 REF615
X130 17 U0 — DIRECTIONALITY (ZERO SEQUENCE) VOLTAGE INPUT (INTERNALLY DERIVED)
X130 18

F4.24 VTTB-BU
F2.3.3 MCB(VT-BU) 2A

E11 8 7 E12 1 2 E13 — E13 11 U1 R 12 — DIRECTIONALITY RED VOLTAGE INPUT
E31 6 5 E32 3 4 E33 — E33 13 U2 W 14 — DIRECTIONALITY WHITE VOLTAGE INPUT
E51 4 3 E52 5 6 E53 — E53 15 U3 B 16 — DIRECTIONALITY BLUE VOLTAGE INPUT
E70 2 1 E72 — E72

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.
6. JUMPERS TO BE WIRED IN BY ESKOM IF THE TRANSDUCER IS FREE ISSUED AND FITTED ON SITE.

NOTE:
VSR-1 AND VSR-2 ARE INSTALLED AND MUST BE REMOVED AND BRIDGES INSTALLED AS SHOWN

66 kV/110 V VT SUPPLY
SEE DRG 1.03/15511

VT JB 401H — RP X1.19 — E10 — SEE NOTE 1&2 (OPTIONAL) R1.1 VSR-1 — E11 — E11 — RP X1.27 — E11
VT JB 402H — RP X1.20 — E30 — E31 — E31 — RP X1.28 — E31
VT JB 403H — RP X1.21 — E50 — E51 — E51 — RP X1.29 — E51
VT JB 404H — RP X1.22 — E70 — E70 — E70 — RP X1.30 — E70

F4.23 VTTB-M
F2.3.1 MCB(VT-M) 2A

E11 8 7 E111 1 2 E112 — E112 13 A107 R 14 — IMPEDANCE VT AND RUNNING VOLTS (NOTE 4)
E31 6 5 E131 3 4 E132 — E132 15 A108 W 16
E51 4 3 E151 5 6 E152 — E152 17 A109 B 18
E70 2 1 E172 — E172

F3.1 RED670

RP X2.1
X2.2
X2.3
X2.4

E312 X1.31 — E212
E332 X1.32 — E232
E352 X1.33 — E252
E372 X1.34 — E372

SEE NOTE 1&2 (OPTIONAL) R1.2 VSR-2

RP X1.23 — E20 — E11
X1.24 — E40 — E31
X1.25 — E60 — E51
X1.26 — E70 — E70
X1.35 — E412 — E212
X1.36 — E432 — E232
X1.37 — E452 — E252
X1.38 — E372 — E372

E212A
E232A
E252A
E372A
66 kV/110 V VT SUPPLY TO 66 kV FEEDER 4 STATS METER MODULE SEE D-WC-7270 SET 24 SHT 7

R4.X5.2 MCB(VT-T) 2A

RP X1.39 — E212 — E212A 1 2 E213 — E213 2
RP X1.40 — E232 — E232A 3 4 E233 — E233 5
RP X1.41 — E252 — E252A 5 6 E253 — E253 8
RP X1.42 — E372 — E372A — E372A 11

R4.X5.1 MEASUREMENTS TRANSDUCER

NOTE 1
NOTE 6

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

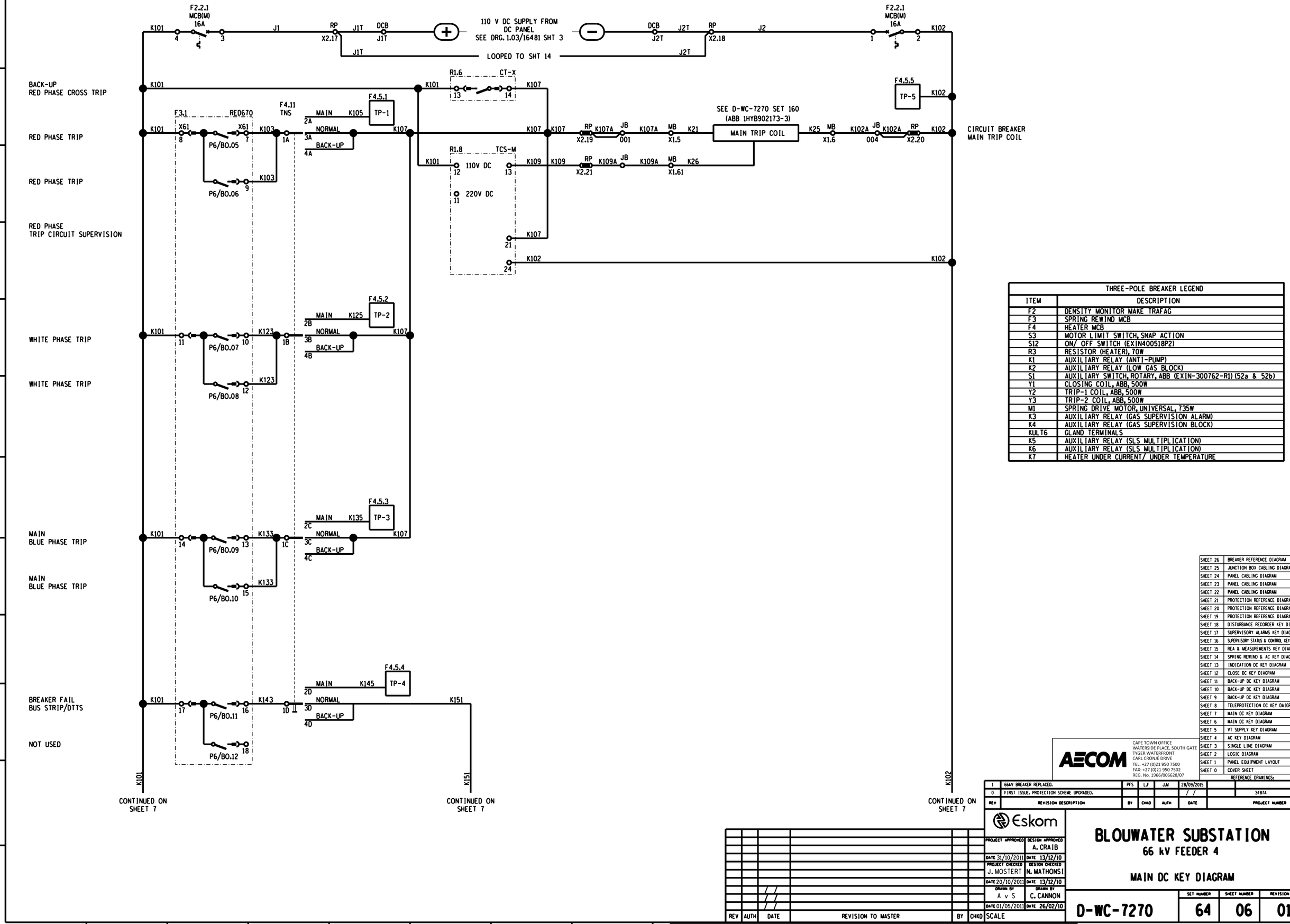
BLOUWATER SUBSTATION
66 kV FEEDER 4
VT SUPPLY KEY DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	05	00

LEVELS 1 2 10 11 13 14 16 17 19 23 25 28 30 31
PANEL TYPE DESIGNATION 4FZD-3920
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 5 OF 27 REVISION 0



THREE-POLE BREAKER LEGEND	
ITEM	DESCRIPTION
F2	DENSITY MONITOR MAKE TRAFAG
F3	SPRING REWIND MCB
F4	HEATER MCB
S3	MOTOR LIMIT SWITCH, SNAP ACTION
S12	ON/ OFF SWITCH (EXIN400518P2)
R3	RESISTOR (HEATER), 70W
K1	AUXILIARY RELAY (ANTI-PUMP)
K2	AUXILIARY RELAY (LOW GAS BLOCK)
S1	AUXILIARY SWITCH, ROTARY, ABB (EXIN-300762-R1) (52a & 52b)
Y1	CLOSING COIL, ABB, 500W
Y2	TRIP-1 COIL, ABB, 500W
Y3	TRIP-2 COIL, ABB, 500W
M1	SPRING DRIVE MOTOR, UNIVERSAL, 735W
K3	AUXILIARY RELAY (GAS SUPERVISION ALARM)
K4	AUXILIARY RELAY (GAS SUPERVISION BLOCK)
KULT6	GLAND TERMINALS
K5	AUXILIARY RELAY (SLS MULTIPLICATION)
K6	AUXILIARY RELAY (SLS MULTIPLICATION)
K7	HEATER UNDER CURRENT/ UNDER TEMPERATURE

REFERENCE DRAWINGS:	
SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	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	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom

PROJECT APPROVED	DESIGN APPROVED
	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
MAIN DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	06	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 6 OF 27 REVISION 0

CONTINUED FROM SHEET 6

CONTINUED FROM SHEET 6

CONTINUED FROM SHEET 6

EXTERNAL DIRECT INTERTRIP SEND

BACK-UP OVERCURRENT AND EARTH FAULT TRIP (HIGH SET) NOTE 3

BACK-UP OVERCURRENT TRIP (IDMT/DT) NOTE 3

BACK-UP EARTH FAULT TRIP (IDMT/DT) NOTE 3

BUS ZONE TRIP

CIRCUIT BREAKER CLOSED

CIRCUIT BREAKER OPEN

PROTECTION NOT HEALTHY AUXILIARY 1

SETTING GROUP 2 EXTERNAL CONTROL

SETTING GROUP 3 EXTERNAL CONTROL

BACK-UP PROTECTION FAIL-SELF CHECK

BACK-UP PROTECTION VT FUSE FAIL

DC FAIL BACK-UP

MAIN PROTECTION MAIN IED POWER SUPPLY

F4.11 TNS — MAIN 2F — NORMAL 3F — BACK-UP 4F

F2.1 REF615 — SO 1 — SO 1 — PO 1

BUS ZONE TRIPPING PANEL SEE DRG. 1.03/15519

SEE D-WC-7270 SET 160 (ABB 1HYB902173-3)

SEE D-WC-7270 SET 160 (ABB 1HYB902173-3)

R3F.2 D2 — R3F.3 D3

R2.4 PNH-X1

R3R.2 DCF-BU

F2.1 REF615 — SO 2

F3.1 RED670 — EXT-DTTS — P8/BI.03 — DIRECT INTERTRIP SEND TO REMOTE END (BLOCKED VIA BFIS OR TPIS SET OFF)

BU IED 3PT/A — P8/BI.04 — BACK-UP IED THREE PHASE TRIP, BREAKER FAIL INITIATE AND START AUTO RECLOSE NOTE 2

BU IED 3PT/NA — P8/BI.05 — BACK-UP IED THREE PHASE TRIP, BREAKER FAIL INITIATE AND AUTO RECLOSE CANCEL

R1.6 CT-X — CROSS TRIP AUXILIARY

F2.1 REF615 — EXT BZ TRIP — BI 2 — EXTERNAL BUSZONE TRIP, BREAKER FAIL INITIATE AND NO CLOSE

F3.1 RED670 — EXT BZ TRIP — P3/BI.01 — EXTERNAL BUSZONE TRIP, BREAKER FAIL INITIATE AND NO CLOSE

CB-CLS — P4/BI.01

F2.1 REF615 — CB-CLS — BI 3

CB-OPN — BI 4

F3.1 RED670 — CB-OPN — P4/BI.02

PNH1 — P4/BI.08

SG2 — P4/BI.05

F2.1 REF615 — SG2 — BI 5

SG3 — BI 6

F3.1 RED670 — SG3 — P4/BI.06

F3.1 RED670 — PSU

CONTINUED ON SHEET 8

CONTINUED ON SHEET 8

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'.

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
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	3487A
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	

Eskom

BLOUWATER SUBSTATION
66 kV FEEDER 4
MAIN DC KEY DIAGRAM

PROJECT APPROVED	C.KING
DESIGN APPROVED	A. CRAIB
DATE	31/10/2011
DATE	13/12/10
PROJECT CHECKED	J. MOSTERT
DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011
DATE	13/12/10
DRAWN BY	A v S
DRAWN BY	C. CANNON
DATE	01/05/2011
DATE	26/02/10
SCALE	

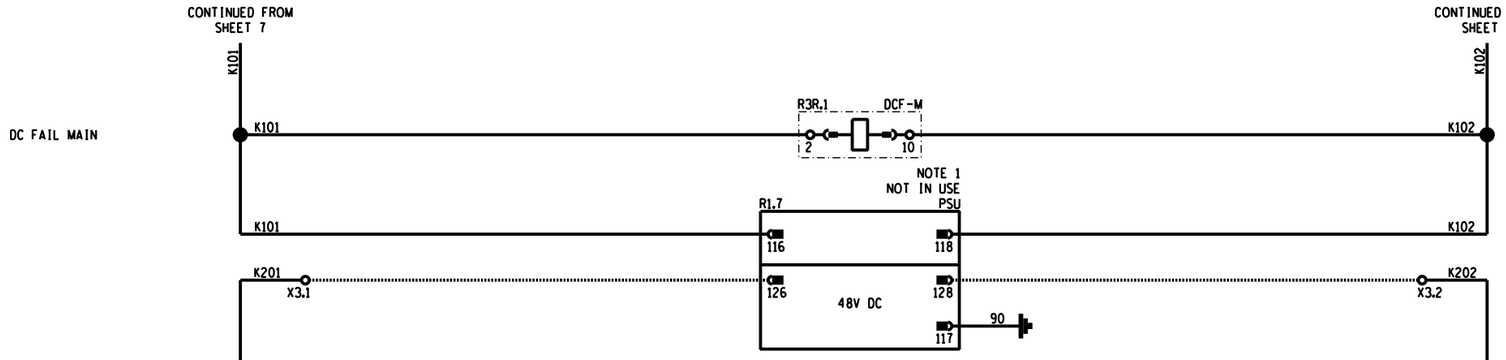
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	07	01

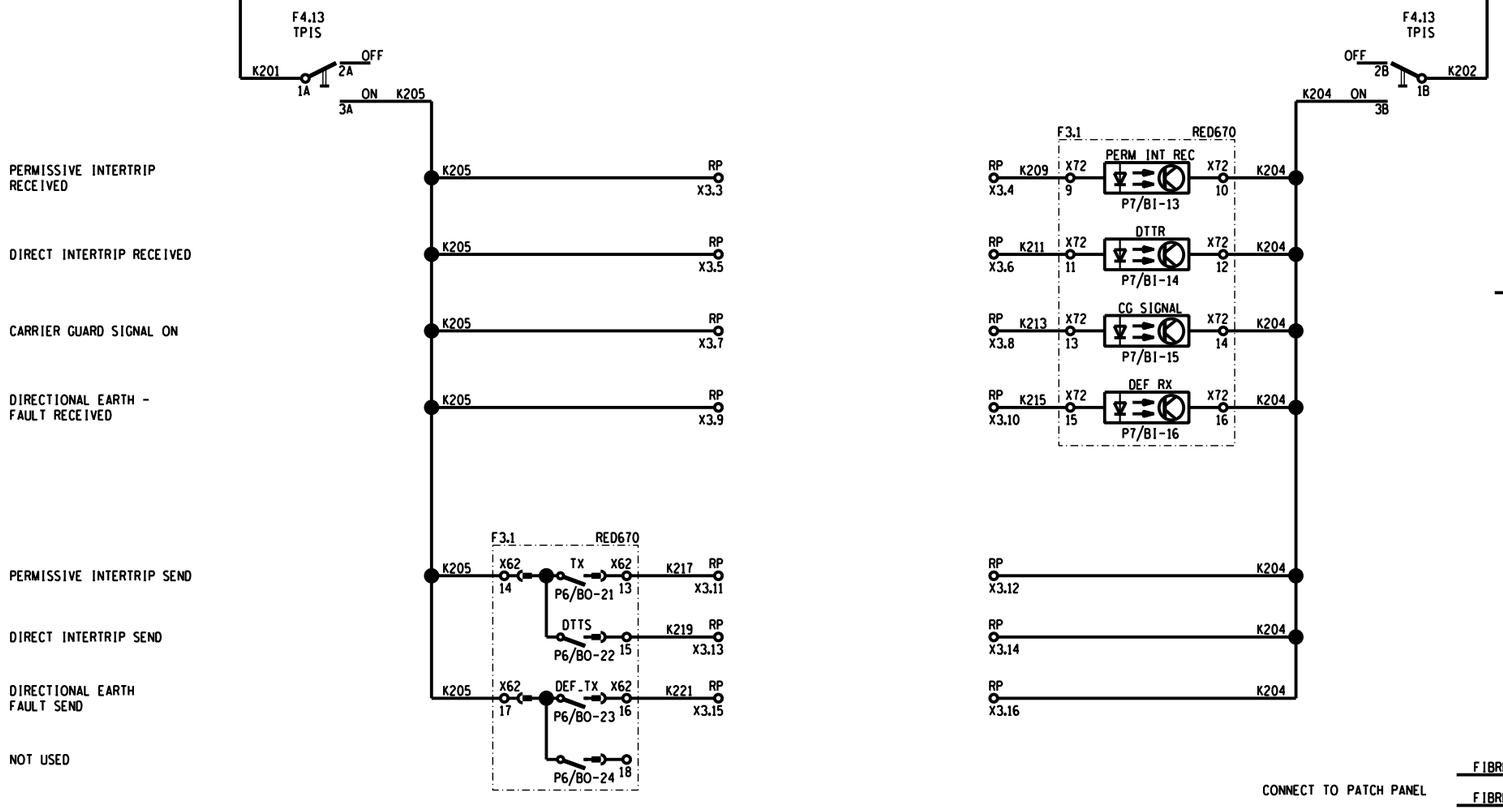
PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 7 OF 27 REVISION 0



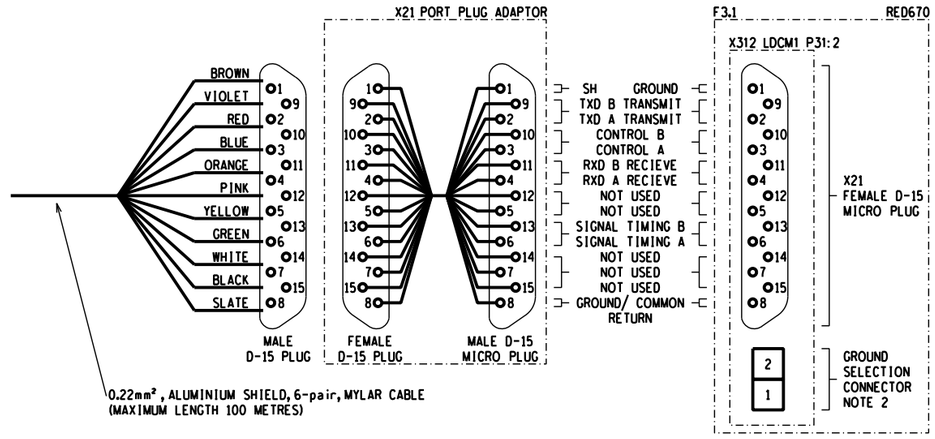
POWER LINE CARRIER OR NSD570 EXTERNAL TELEPROTECTION OR SIMILAR ITEM



NOT IN USE

X21 INTERNAL COMMUNICATION/TELEPROTECTION (OPTIONAL)

NOTE 3



FIBRE INTERNAL COMMUNICATION/TELEPROTECTION AND/ OR DIFFERENTIAL (OPTIONAL)

NOTE 3

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
REFERENCE DRAWINGS:	

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.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	SECOND TELEPROTECTION CARD ADDED	JF	BBH	LMB	21/01/2019	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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 Distribution

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
TELEPROTECTION DC KEY DIAGRAM

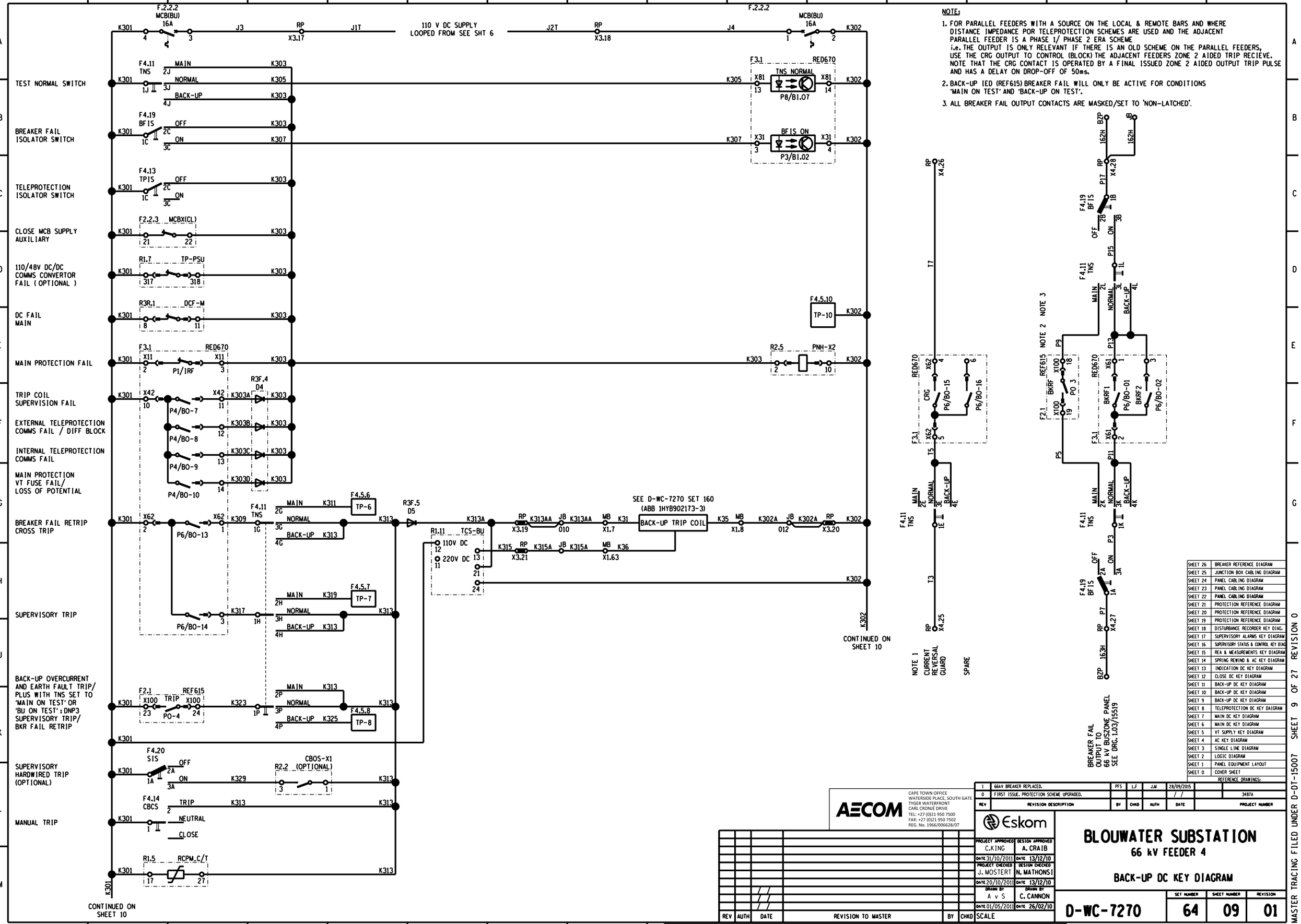
DRAWING NUMBER	SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	08	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 8 OF 27 REVISION 0



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. BACK-UP IED (REF615) BREAKER FAIL WILL ONLY BE ACTIVE FOR CONDITIONS 'MAIN ON TEST' AND 'BACK-UP ON TEST'.
3. ALL BREAKER FAIL OUTPUT CONTACTS ARE MASKED/SET TO 'NON-LATCHED'.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

PROJECT APPROVED	C.KING	DESIGN APPROVED	A. CRAIB
DATE	31/10/2011	DATE	13/12/10
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011	DATE	13/12/10
DRAWN BY	A v S	DRAWN BY	C. CANNON
DATE	01/05/2011	DATE	26/02/10

BLOUWATER SUBSTATION

66 kV FEEDER 4

BACK-UP DC KEY DIAGRAM

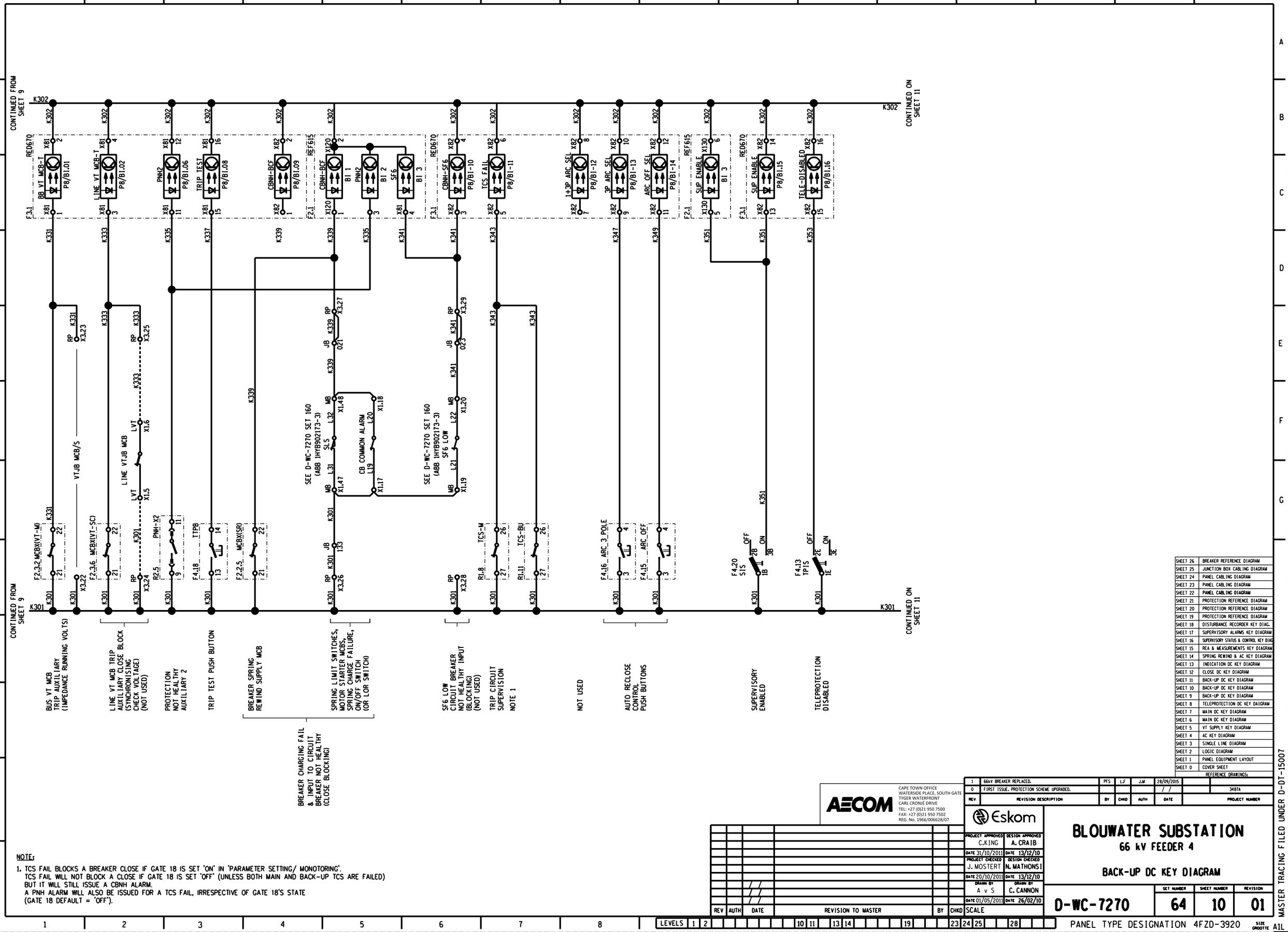
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	09	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 9 OF 27 REVISION 0



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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 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
1	66kV BREAKER REPLACED.	PFS	L.F	J.M	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom

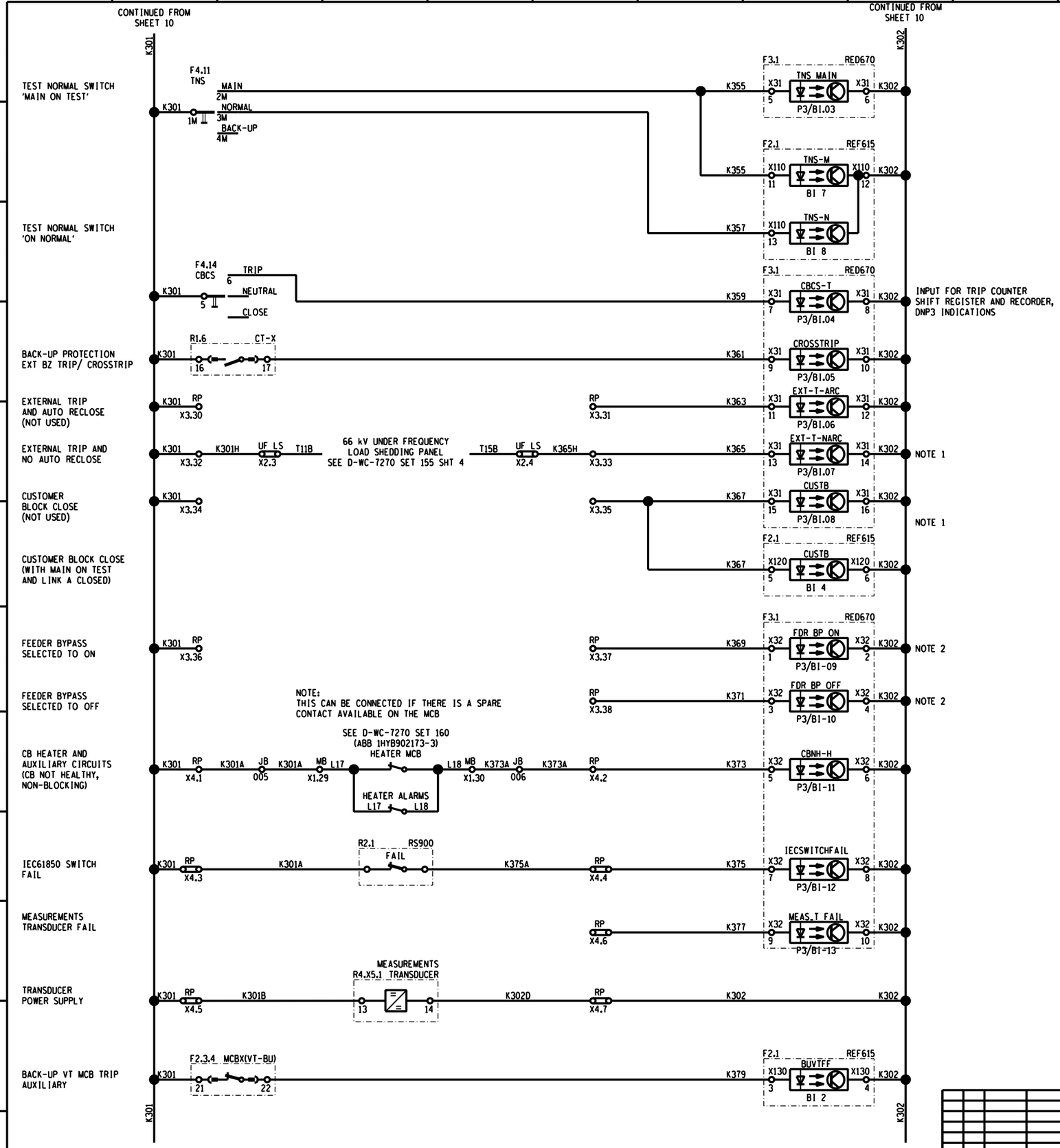
PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
BACK-UP DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	10	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28
PANEL TYPE DESIGNATION 4FZD-3920
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007



NOTE:

1. A PERMANENT INPUT IS REQUIRED TO BLOCK AN EXTERNAL CLOSE.
2. THIS BYPASS LOGIC IS USED FOR BOTH THE SUPERVISORY DNP3 STATUS AND THE HMI DISPLAY.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED	C.KING	DESIGN APPROVED	A. CRAIB
DATE	31/10/2011	DATE	13/12/10
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011	DATE	13/12/10
DRAWN BY	A v S	DRAWN BY	C. CANNON
DATE	01/05/2011	DATE	26/02/10
SCALE			

BLOUWATER SUBSTATION

66 kV FEEDER 4

BACK-UP DC KEY DIAGRAM

DRAWING NUMBER	SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	11	01

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 11 OF 27 REVISION 0

CONTINUED FROM SHEET 11

CONTINUED FROM SHEET 11

BUSBAR 1 ISOLATOR VOLTAGE SELECTION (OPTIONAL) (NOT USED)

BUSBAR 2 ISOLATOR VOLTAGE SELECTION (OPTIONAL) (NOT USED)

MAIN CT SHORTING RELAY ON BYPASS (OPTIONAL) (NOT USED)

BACK-UP CT SHORTING RELAY ON BYPASS (OPTIONAL) (NOT USED)

MAIN CT SHORTING RELAY OFF BYPASS (OPTIONAL) (NOT USED)

BACK-UP CT SHORTING RELAY OFF BYPASS (OPTIONAL) (NOT USED)

SF6 GAS MONITORING SUPPLY (NOT USED)

SEE D-WC-7270 SET 160 (ABB 1HYB902173-3)

SPRING LIMIT SWITCH MULTIPLYING CONTACTS SUPPLY (NOT USED)

SUPPLY FOR OPTIONAL REMOTE ENGINEERING ACCESS CONTINUED ON SHT 15 NOTE 2

SUPPLY FOR OPTIONAL EXT DISTURBANCE RECORDER CONTINUED ON SHT 18 NOTE 2

SUPPLY FOR DNP3 SUPERVISORY STATUS CONTINUED ON SHEET 16

BACK-UP PROTECTION DC SUPPLY

CLOSE FROM AUTO RECLOSE FUNCTION OR EXTERNAL CLOSE INPUT OR INTERNAL SUPERVISORY DNP3 CLOSE

CLOSE ON MAIN ON TEST WITH NO SYNCH CHECK

EXTERNAL HARDWIRED SUPERVISORY CLOSE (OPTIONAL)

EXTERNAL CLOSE INPUT

SNUBBER CIRCUIT

CLOSE FROM AUTO RECLOSE FUNCTION OR EXTERNAL CLOSE INPUT

CONTINUED ON SHEET 13

CONTINUED ON SHEET 13

BACK-UP IED CLOSE FROM EXTERNAL CLOSE INPUT OR INTERNAL SUPERVISORY DNP3 CLOSE

NOTE 1 (OPTIONAL) VSR-1

NOTE 1 (OPTIONAL) VSR-2

R3R.3 (OPTIONAL) MCTS

R3R.4 (OPTIONAL) BCTS

R3R.3 (OPTIONAL) MCTS

R3R.4 (OPTIONAL) BCTS

F4.20 SIS

R2.3 (OPTIONAL) CBCS-X1

F4.14 CBCS

F4.11 TNS

F4.5.9 TP-9

R1.8 TCS-M

R1.11 TCS-BU

R2F.1 CBC-CR

F3.1 RED670 P4/BO.06

F3.1 RED670 EXT CLOSE P3/BI-14

F2.1 REF615 BKR CLOSE BI 1

F2.1 REF615

F2.2.4 MCB(CL) 10A

F2.2.4 MCB(CL) 10A

R1.5 RCPM.C/T

SF6 MON.

SLS MULTIPLYING

CLOSE COIL

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.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JJM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	A v S
DATE	01/05/2011
DRAWN BY	C. CANNON
DATE	26/02/10

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

SCALE

BLOUWATER SUBSTATION
66 kV FEEDER 4

CLOSE DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
64	12	01

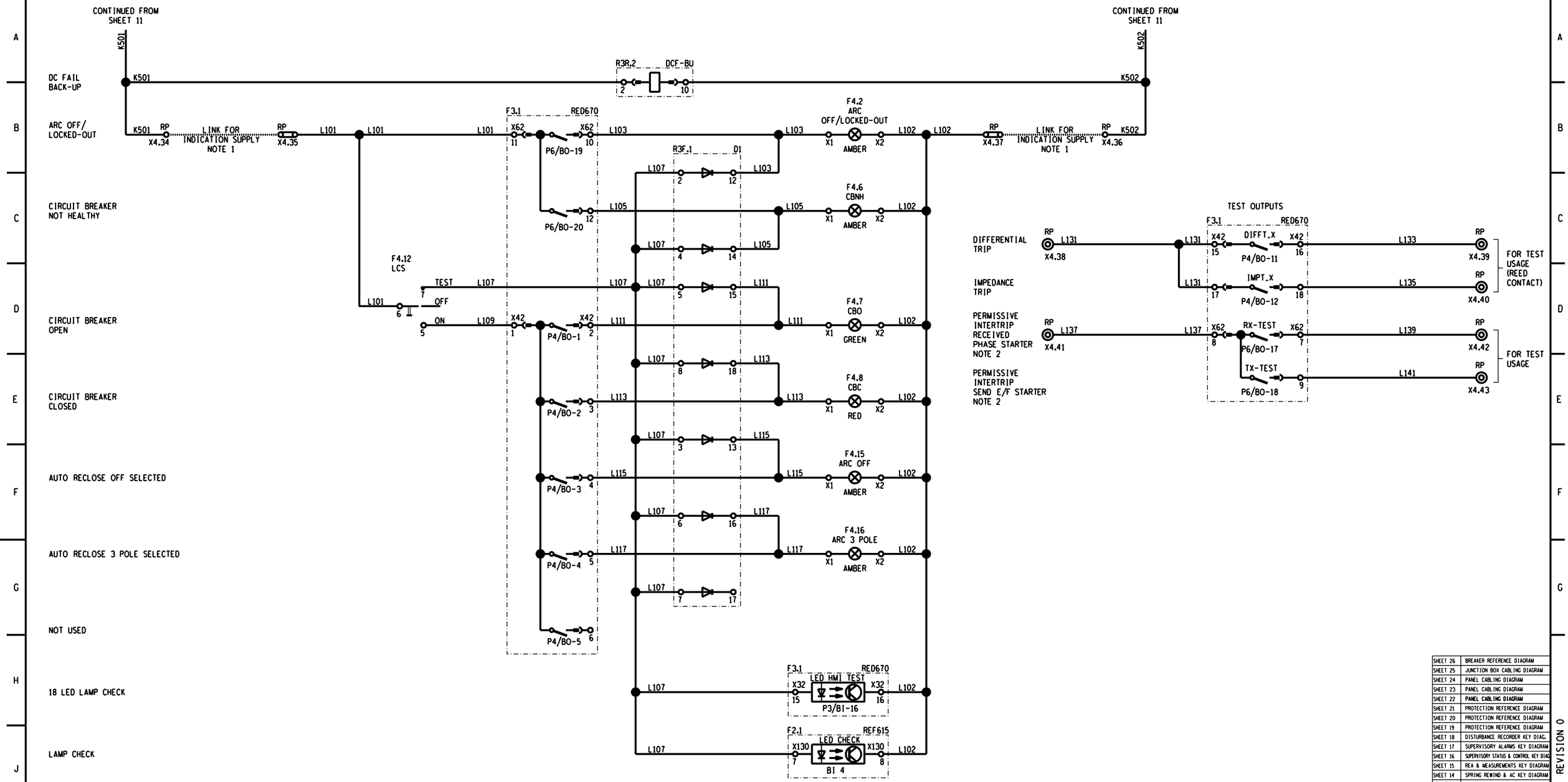
D-WC-7270

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

LEVELS 1 2 10 11 13 14 19 23 24 25 28

MASTER TRACING FILED UNDER D-DT-15007 SHEET 12 OF 27 REVISION 0



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).

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
INDICATION DC KEY DIAGRAM

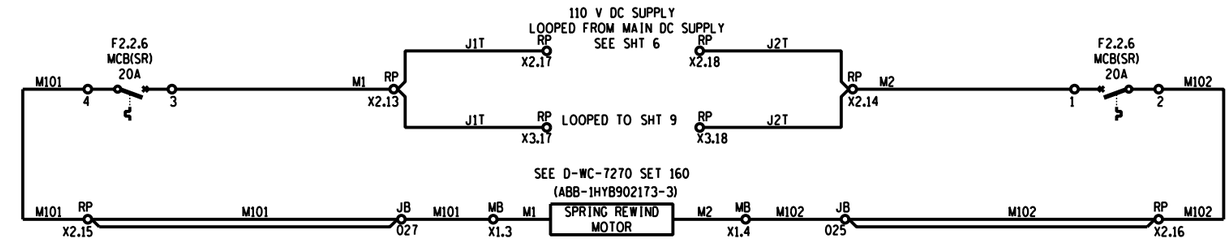
DRG NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	13	00

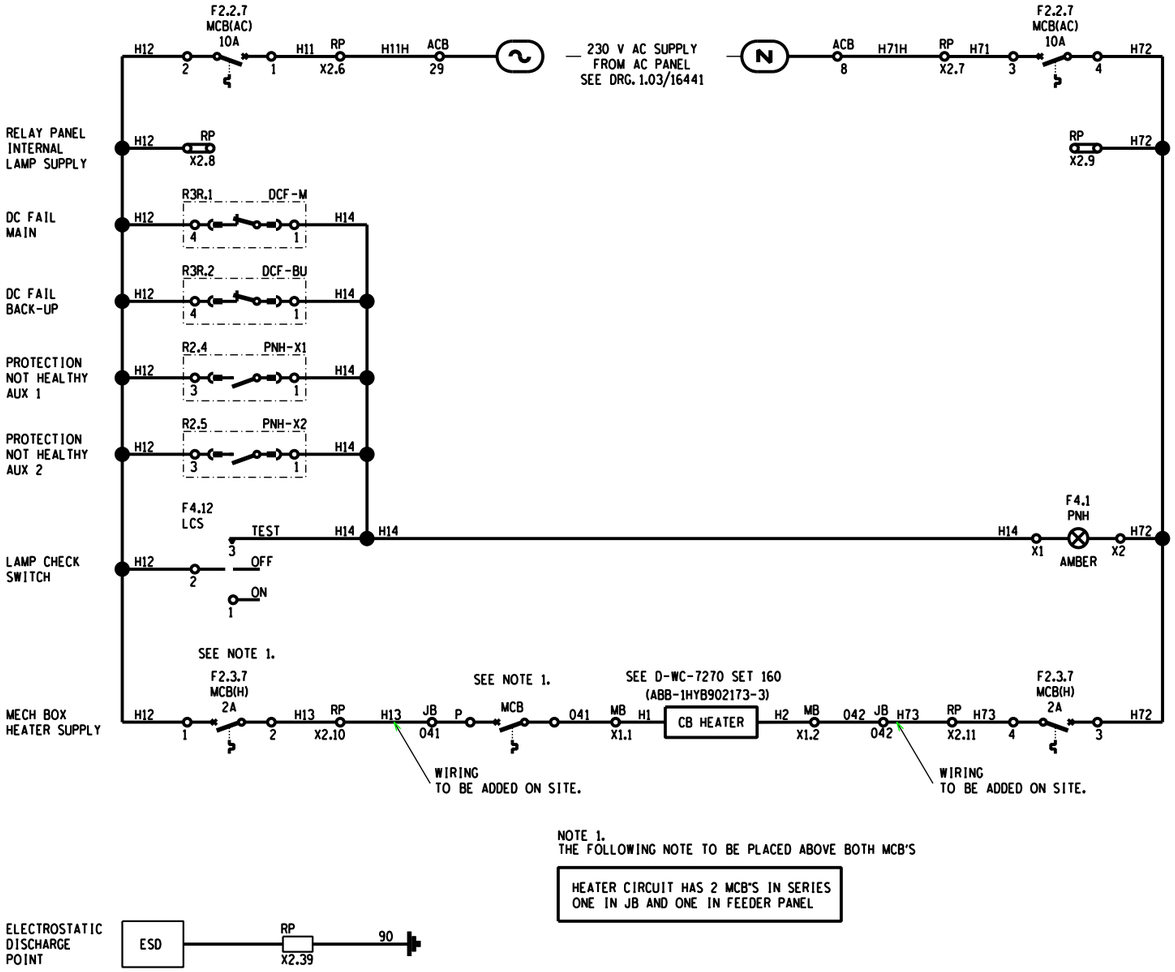
PANEL TYPE DESIGNATION 4FZD-3920

MASTER TRACING FILED UNDER D-DT-15007 SHEET 13 OF 27 REVISION 0

LEVELS 1 2 10 11 13 14 19 23 24 25 28

SIZE GROOTTE A1L





NOTE 1.
THE FOLLOWING NOTE TO BE PLACED ABOVE BOTH MCB'S

HEATER CIRCUIT HAS 2 MCB'S IN SERIES
ONE IN JB AND ONE IN FEEDER PANEL

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
1	66kV BREAKER REPLACED.	PFS	L.F	J.M	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
SPRING REWIND AND AC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	14	01

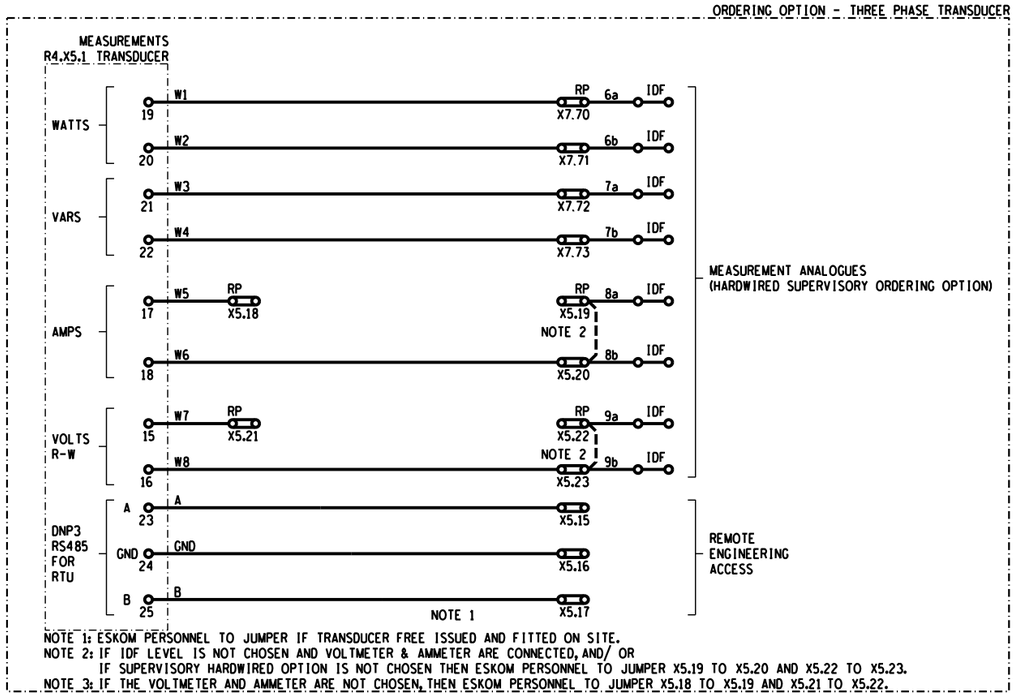
LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

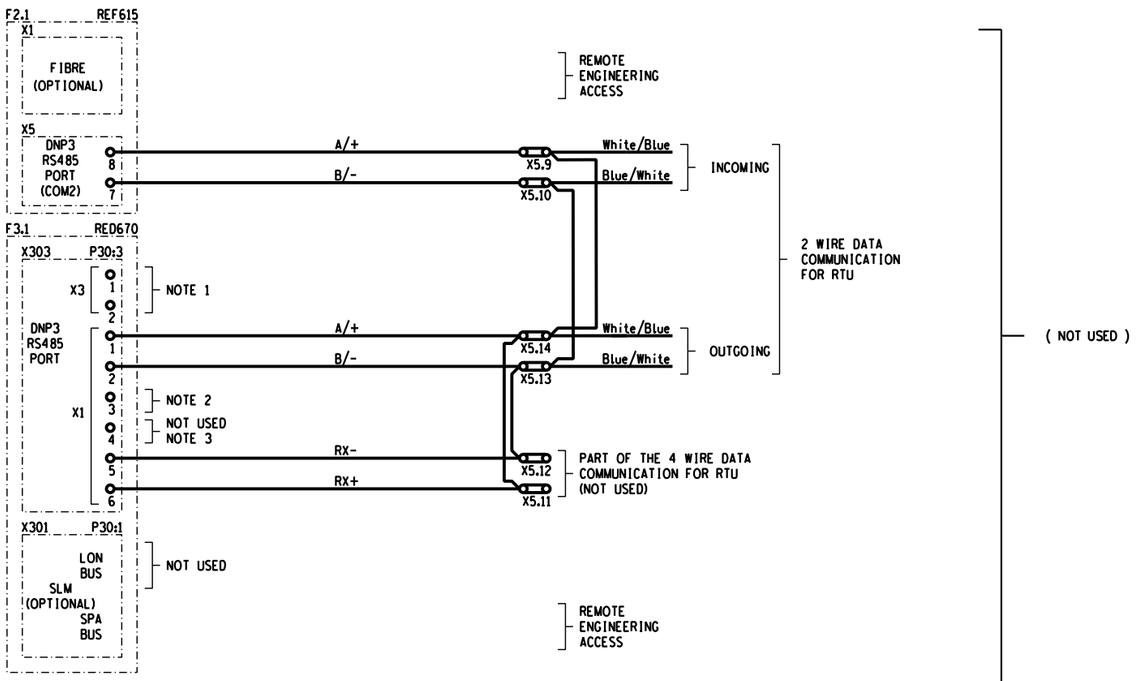
SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 14 OF 27 REVISION 0

MEASUREMENTS AND REA



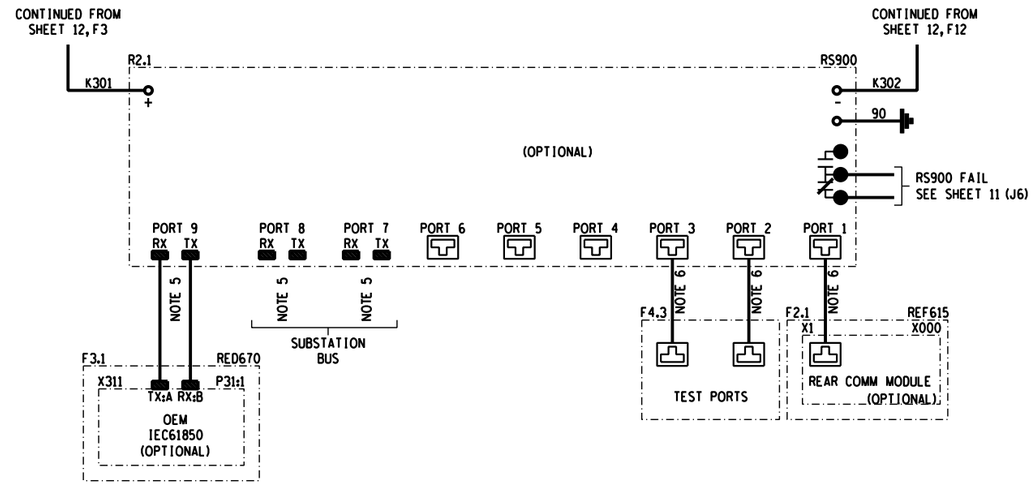
NOTE 1: ESKOM PERSONNEL TO JUMPER IF TRANSDUCER FREE ISSUED AND FITTED ON SITE.
NOTE 2: IF IDF LEVEL IS NOT CHOSEN AND VOLTMETER & AMMETER ARE CONNECTED, AND/ OR
IF SUPERVISORY HARDWIRED OPTION IS NOT CHOSEN THEN ESKOM PERSONNEL TO JUMPER X5.19 TO X5.20 AND X5.22 TO X5.23.
NOTE 3: IF THE VOLTMETER AND AMMETER ARE NOT CHOSEN, THEN ESKOM PERSONNEL TO JUMPER X5.18 TO X5.19 AND X5.21 TO X5.22.



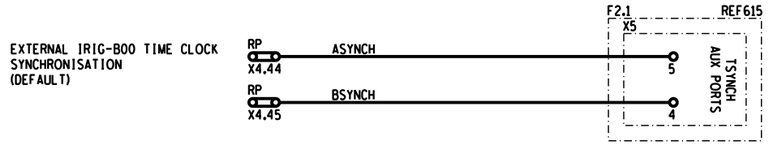
NOTE:

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 RECIEVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
3. TERMINATION RESISTOR FOR RECIEVER 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

REMOTE ENGINEERING ACCESS IEC61850 (OPTIONAL)



TIME SYNCHRONISATION NOTE 4



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
REA AND MEASUREMENTS KEY DIAG

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	15	00

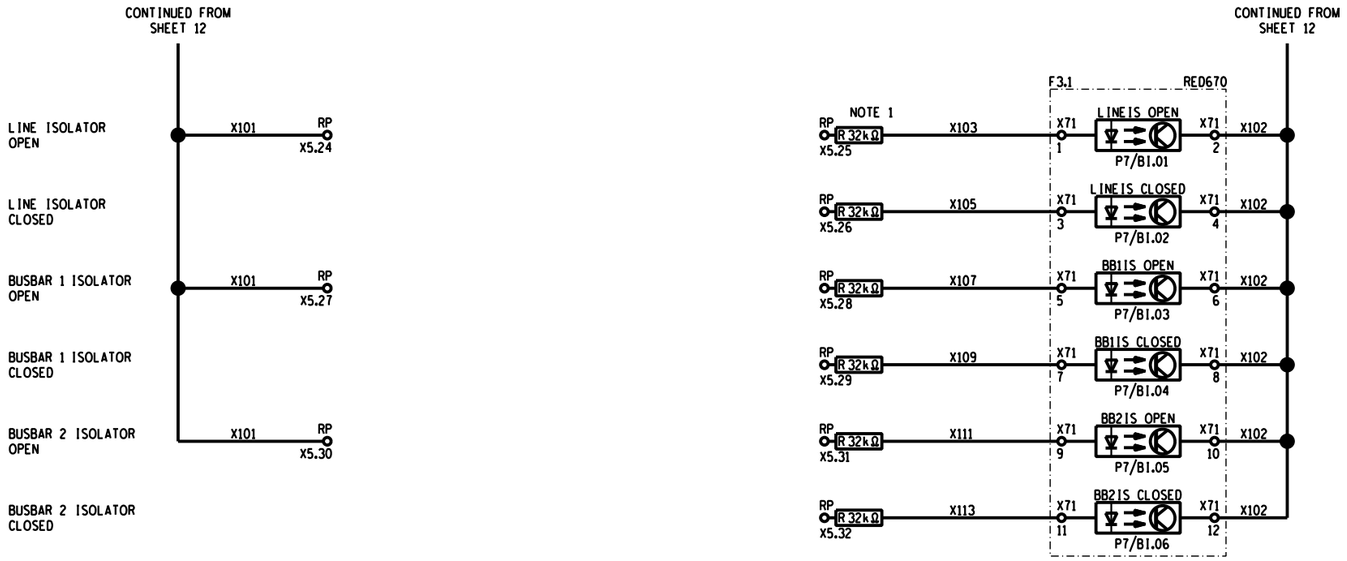
PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 1 2 10 11 13 14 19 23 24 25 28

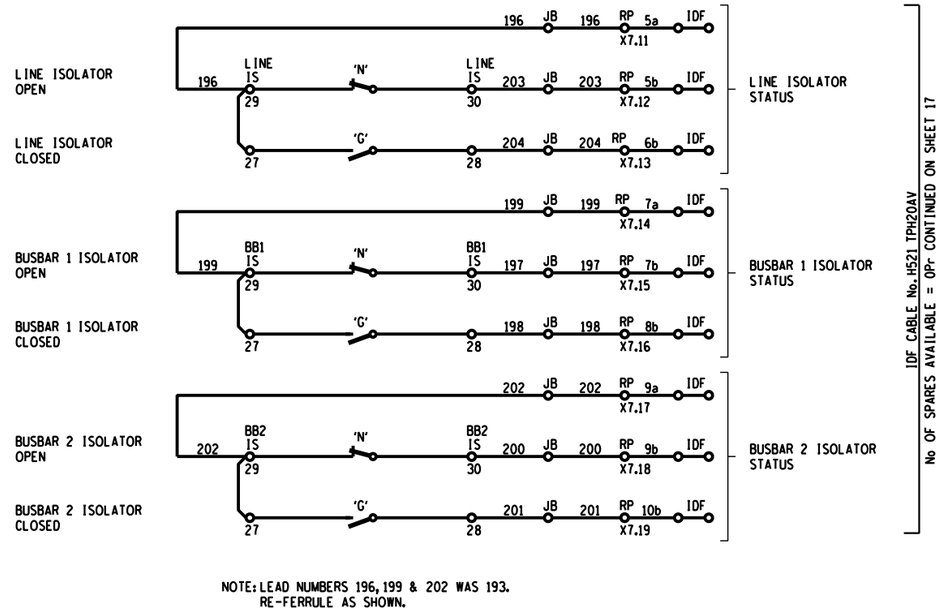
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 15 OF 27 REVISION 0

SUPERVISORY STATUS 48V DC (DNP3 OPTIONAL & HMI DISPLAY)

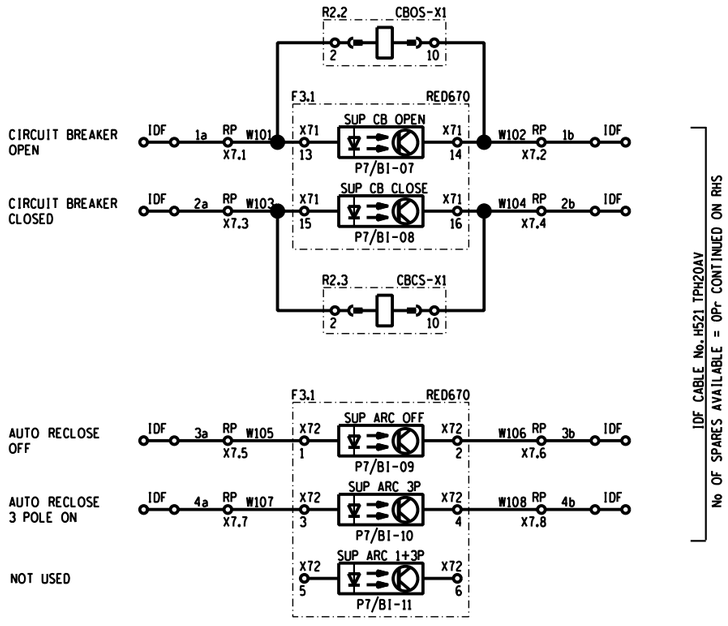


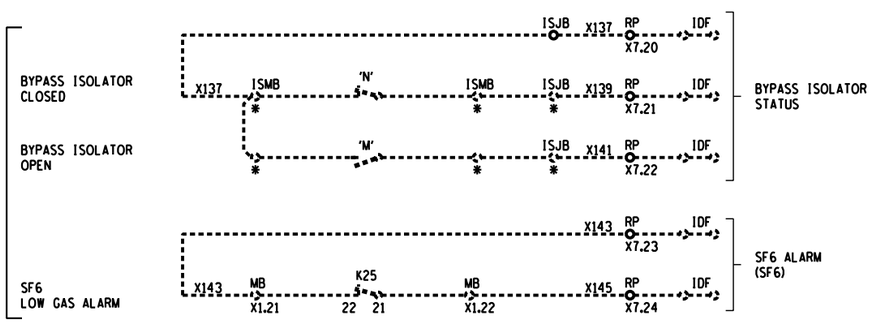
SUPERVISORY STATUS (HARDWIRED OPTIONAL)



NOTE: LEAD NUMBERS 196, 199 & 202 WAS 193.
RE-FERRULE AS SHOWN.

SUPERVISORY CONTROLS 48V DC (HARDWIRED OPTIONAL)





NOTE:
1. FOR 220V DC SUPPLY, RESISTOR = 64kΩ

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 4
SUPERVIS. STATUS & CONTROL KEY

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	16	00

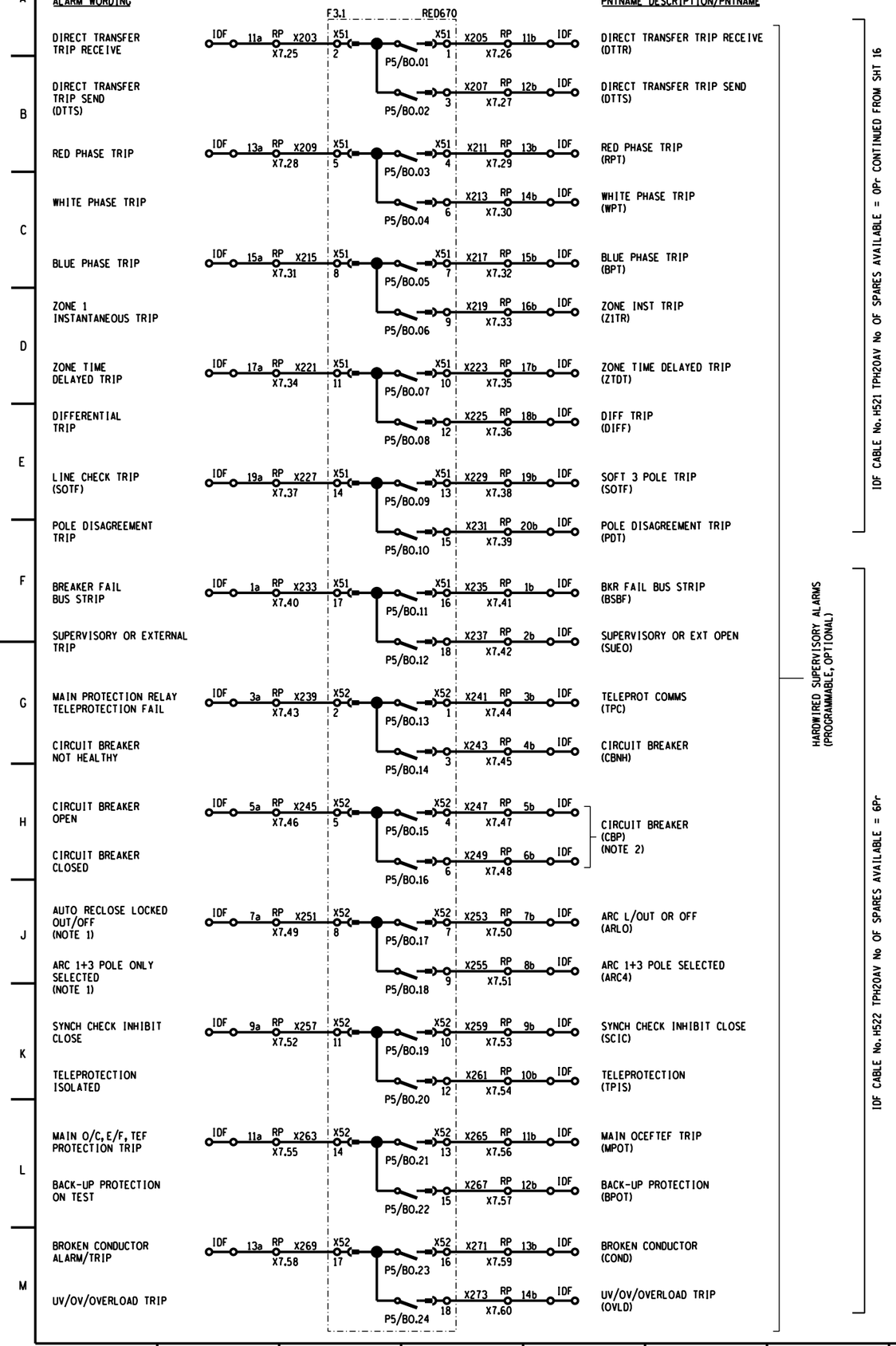
LEVELS 2 10 11 13 14 23 24 28

PANEL TYPE DESIGNATION 4FZD-3920

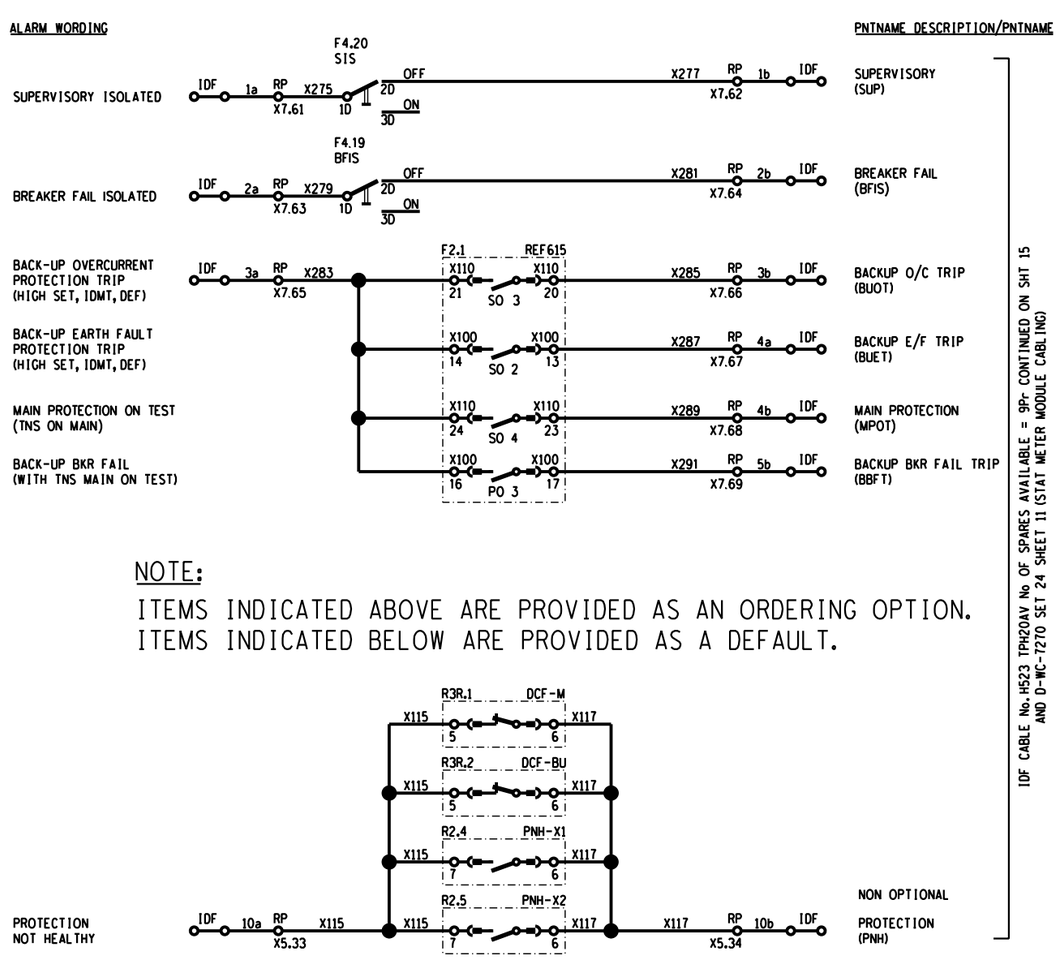
SIZE GROOVE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 16 OF 27 REVISION 0

HARDWIRED SUPERVISORY ALARMS (OPTIONAL)



HARDWIRED SUPERVISORY ALARMS (OPTIONAL)



NOTE:

ITEMS INDICATED ABOVE ARE PROVIDED AS AN ORDERING OPTION.
ITEMS INDICATED BELOW ARE PROVIDED AS A DEFAULT.

NOTE:

1. A SAVING OF ONE ALARM POINT (ARC 3 POLE ONLY SELECTED) IS OBTAINED BY USING DOUBLE BIT INDICATION ON TWO ARC ALARMS.

   WITH DOUBLE BIT INDICATION, THE CONTROL POSITIONS GIVE THE FOLLOWING STATES:

ARC 1+3 P ONLY SELECTED	ARC LOCKED OUT/OFF	STATE NAME	PNTNAME DESC.	PNTNAME
0	0	3PSEL	AUTORECLOSE	ARCP
0	1	OFF/L OUT	AUTORECLOSE	ARCP
1	0	1+3P SEL	AUTORECLOSE	ARCP
1	1	L/OUT	AUTORECLOSE	ARCP

2. DOUBLE BIT INDICATION SHOULD BE USED.

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
SUPERVISORY ALARMS KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	17	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 17 OF 27 REVISION 0

DISTURBANCE RECORDER/ ADDITIONAL SUPERVISORY ALARMS (OPTIONAL)

NOTE 2

IDF 1aa

IDF 3aa

IDF 5aa

IDF 7aa

IDF 9aa

NOTE 2

1bb IDF

2bb IDF

3bb IDF

4bb IDF

5bb IDF

6bb IDF

7bb IDF

8bb IDF

9bb IDF

10bb IDF

NOT USED

2. SUFFIX ADDED TO DISTINGUISH FROM 50 PAIR CABLE.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			
		/ /			
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4

DISTURBANCE RECORDER KEY DIAG

D-WC-7270	SET NUMBER	SHEET NUMBER	REVISION
	64	18	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVTE A1L

LEVELS 1 2 10 11 13 14 19 23 24 25 28

MASTER TRACING FILED UNDER D-DT-15007 SHEET 18 OF 27 REVISION 0

X11 P1

POWER SUPPLY	X11 4 — PSU — X11 5	SHT 7
READY	P1/IRF 2 — 1	NOT USED
FAIL	P1/IRF 2 — 3	SHT 9

X401 P40 — RED670

RED PHASE CURRENT	A101 R: X401 1 — X401 2	SHT 4
WHITE PHASE CURRENT	A102 W: 3 — 4	SHT 4
BLUE PHASE CURRENT	A103 B: 5 — 6	SHT 4
NEUTRAL CURRENT	A104 N: 8 — 7	SHT 4
MUTUAL IMP COMPENSATION	A106 N: X401 12 — X401 11	SHT 4
SYNCH CHECK VOLTAGE (VT)	A110: 19 — 20	SHT 5
DIR E/F FUNCTION	A111: 21 — 22	SHT 5
RED PHASE VOLTAGE	A107 R: 13 — 14	SHT 5
WHITE PHASE VOLTAGE	A108 W: 15 — 16	SHT 5
BLUE PHASE VOLTAGE	A109 B: 17 — 18	SHT 5

X71 P7 (48V DC) — RED670

LINE ISOLATOR OPEN	LINE1-OPEN: X71 1 — X71 2 (IO1/B1-01)	SHT 16
LINE ISOLATOR CLOSED	LINE1-CLOSED: 3 — 4 (IO1/B1-02)	SHT 16
BB1 ISOLATOR OPEN	BB1I-OPEN: 5 — 6 (IO1/B1-03)	SHT 16
BB1 ISOLATOR CLOSED	BB1I-CLOSED: 7 — 8 (IO1/B1-04)	SHT 16
BB2 ISOLATOR OPEN	BB2I-OPEN: 9 — 10 (IO1/B1-05)	SHT 16
BB2 ISOLATOR CLOSED	BB2I-CLOSED: 11 — 12 (IO1/B1-06)	SHT 16
SUPERVISORY CIRCUIT BKR OPEN	CB-OPEN: 13 — 14 (IO1/B1-07)	SHT 16
SUPERVISORY CIRCUIT BKR CLOSED	CB-CLOSE: 15 — 16 (IO1/B1-08)	SHT 16

X61 P6 — RED670

BUS STRIP OUTPUT EXT	BKRF1: X61 2 — X61 1 (P6/BO-01)	SHT 9
BUS STRIP OUTPUT EXT	BKRF2: 3 (P6/BO-02)	SHT 9
FEEDER ON BYPASS TX TELE	TX REMOTE 3P ARC SELECT: 5 — 4 (P6/BO-03)	NOT USED
SPARE	6 (P6/BO-04)	NOT USED
RED PHASE TRIP	8 — 7 (P6/BO-05)	SHT 6
RED PHASE TRIP	9 (P6/BO-06)	SHT 6
WHITE PHASE TRIP	11 — 10 (P6/BO-07)	SHT 6
WHITE PHASE TRIP	12 (P6/BO-08)	SHT 6
MAIN BLUE PHASE TRIP	14 — 13 (P6/BO-09)	SHT 6
BLUE PHASE TRIP	15 (P6/BO-10)	SHT 6
BKR FAIL BUS STRIP/ DTTS	17 — 16 (P6/BO-11)	SHT 6
BLOCK BU E/F PROTECTION	18 (P6/BO-12)	NOT USED

X51 P5 — RED670

DTTR	P5/BO.01: X51 2 — X51 1	SHT 17
DTTS	P5/BO.02: 3	SHT 17
RED PHASE TRIP	P5/BO.03: 5 — 4	SHT 17
WHITE PHASE TRIP	P5/BO.04: 6	SHT 17
BLUE PHASE TRIP	P5/BO.05: 8 — 7	SHT 17
ZONE INST TRIP	P5/BO.06: 9	SHT 17
ZONE TIME DELAYED TRIP	P5/BO.07: 11 — 10	SHT 17
DIFF TRIP	P5/BO.08: 12	SHT 17
LINE CHECK TRIP	P5/BO.09: 14 — 13	SHT 17
POLE DISAGREEMENT TRIP	P5/BO.10: 15	SHT 17
BREAKER FAIL BUS STRIP	P5/BO.11: 17 — 16	SHT 17
SUP/EXT. TRIP	P5/BO.12: 18	SHT 17

X41 P4 — RED670

BREAKER POLES CLOSED/PD	CB-CLS: X41 1 — X41 2 (P4/BI.01)	SHT 7
BREAKER POLES OPEN/PD	CB-OPN: 3 — 4 (P4/BI.02)	SHT 7
SPARE	5 — 6 (P4/BI.03)	SPARE
SPARE	7 — 8 (P4/BI.04)	SPARE
SETTING G2 EXT CONTROL	SG2: 9 — 10 (P4/BI.05)	SHT 7
SETTING G3 EXT CONTROL	SG3: 11 — 12 (P4/BI.06)	SHT 7
SPARE	13 — 14 (P4/BI.07)	SPARE
PROTECTION NOT HEALTHY AUXILIARY 1	PNH1: 15 — 16 (P4/BI.08)	SHT 7

X31 P3 — RED670

BUSZONE TRIP	EXT BZ TRIP: X31 1 — X31 2 (P3/BI.01)	SHT 7
BKR FAIL ISOLATOR ON	BFIS-ON: 3 — 4 (P3/BI.02)	SHT 9
TNS MAIN ON TEST	TNS-M: 5 — 6 (P3/BI.03)	SHT 11
EXT TRIP SWITCH/ SUP	CBCS-T: 7 — 8 (P3/BI.04)	SHT 11
BACK-UP PROT/ BZ TRIP/ CROSSTRIP	CROSSTRIP: 9 — 10 (P3/BI.05)	SHT 11
EXT TRIP AND ARC	EXT-T-ARC: 11 — 12 (P3/BI.06)	SHT 11
EXT TRIP AND NO ARC	EXT-T-NARC: 13 — 14 (P3/BI.07)	SHT 11
CUSTOMER BLOCK CLOSE	CUSTB: 15 — 16 (P3/BI.08)	SHT 11

X81 P8 — RED670

BUS VT MCB TRIP	BB VT MCB-T: X81 1 — X81 2 (P8/BI.01)	SHT 10
LINE VT MCB TRIP	LINE VT MCB-T: 3 — 4 (P8/BI.02)	SHT 10
DTTS	EXT-DTTS: 5 — 6 (P8/BI.03)	SHT 7
BF INITIATE ARC1, 3PT	3PT/BFI/ARC: 7 — 8 (P8/BI.04)	SHT 7
BF INITIATE 3PT NARC	3PT/BFI/NARC: 9 — 10 (P8/BI.05)	SHT 7
PROTECTION NOT HEALTHY AUXILIARY 2	PNH2: 11 — 12 (P8/BI.06)	SHT 10
TNS NORMAL	TNS-N: 13 — 14 (P8/BI.07)	SHT 9
TRIP TEST	TRIP TEST: 15 — 16 (P8/BI.08)	SHT 10

X72 P7 (48V DC) — RED670

SUPERVISORY ARC OFF	ARC-OFF: 1 — 2 (P7/BI-09)	SHT 16
SUPERVISORY ARC 3P	3P ARC-ON: 3 — 4 (P7/BI-10)	SHT 16
SUPERVISORY ARC 1+3P	1+3P ARC ON: 5 — 6 (P7/BI-11)	NOT USED
REMOTE FEEDER ON BYPASS	RX REMOTE 3P ARC SELECT: 7 — 8 (P7/BI-12)	NOT USED
RX	RX: 9 — 10 (P7/BI-13)	SHT 8
DTTR	DTTR: 11 — 12 (P7/BI-14)	SHT 8
CARRIER GUARD SIGNAL ON	CGS: 13 — 14 (P7/BI-15)	SHT 8
DIR E/F RECIEVED	DEF_RX: 15 — 16 (P7/BI-16)	SHT 8

X62 P6 — RED670

BKR FAIL RETRIP/ CROSSTRIP	X62 2 — X62 1 (P6/BO-13)	SHT 9
SUPERVISORY TRIP	3 (P6/BO-14)	SHT 9
CRG	CRG: 5 — 4 (P6/BO-15)	SHT 9
SPARE	6 (P6/BO-16)	NOT USED
PERMISSIVE INTERTRIP RECIEVED	RX-TEST: 8 — 7 (P6/BO-17)	SHT 13
PERMISSIVE INTERTRIP SEND	TX-TEST: 9 (P6/BO-18)	SHT 13
ARC OFF/LO	CRG: 11 — 10 (P6/BO-19)	SHT 13
CBNH	12 (P6/BO-20)	SHT 13
TX	TX: 14 — 13 (P6/BO-21)	SHT 8
DTTS	DTTS: 15 (P6/BO-22)	SHT 8
DIR E/F SEND	DEF_TX: 17 — 16 (P6/BO-23)	SHT 8
SPARE	18 (P6/BO-24)	NOT USED

X52 P5 — RED670

MAIN PROT RELAY TELEPROT FAIL	01/BO-13: X52 2 — X52 1	SHT 17
CIRCUIT BREAKER NOT HEALTHY	01/BO-14: 3	SHT 17
CIRCUIT BREAKER OPEN	01/BO-15: 5 — 4	SHT 17
CIRCUIT BREAKER CLOSED	01/BO-16: 6	SHT 17
ARC LO/OFF	01/BO-17: 8 — 7	SHT 17
1 AND 3 POLE ONLY	01/BO-18: 9	SHT 17
SYNCH CHECK INHIBIT CLOSE	01/BO-19: 11 — 10	SHT 17
TELEPROTECTION ISOLATED	01/BO-20: 12	SHT 17
MAIN O/C,E/F,TEF PROTECTION TRIP	01/BO-21: 14 — 13	SHT 17
BACK-UP PROTECTION ON TEST	01/BO-22: 15	SHT 17
BROKEN COND	01/BO-23: 17 — 16	SHT 17
UV/OV/OVERLOAD	01/BO-24: 18	SHT 17

X42 P4 — RED670

IND CIRCUIT BREAKER OPEN	P4/BO-1: 1 — 2	SHT 13
IND CIRCUIT BREAKER CLOSED	P4/BO-2: 3	SHT 13
IND ARC OFF	P4/BO-3: 4	SHT 13
IND ARC 3 POLE	P4/BO-4: 5	SHT 13
IND ARC 1+3 POLE	P4/BO-5: 6	NOT USED
BKR CLOSE PULSE	P4/BO-6: 7 — 9	SHT 12
	8	NOT USED
TCS FAIL	P4/BO-7: 10 — 11	SHT 9
EXTERNAL COMMS FAIL	P4/BO-8: 12	SHT 9
INTERNAL COMMS FAIL	P4/BO-9: 13	SHT 9
MAIN PROT VT FUSE FAIL	P4/BO-10: 14	SHT 9
DIFFERENTIAL TRIP	DIFFT_X: 15 — 16 (P4/BO-11)	SHT 13
IMPEDANCE TRIP	IMPT_X: 17 — 18 (P4/BO-12)	SHT 13

X32 P3 — RED670

FEEDER BYPASS ON	FDR BP-ON: X32 1 — X32 2 (P8/BI.09)	SHT 11
FEEDER BYPASS OFF	FDR BP-OFF: 3 — 4 (P8/BI.10)	SHT 11
CBNH-HEATER FAIL	CBNH-H: 5 — 6 (P8/BI.11)	SHT 11
IEC61850 SWITCH FAIL	IEC SWITCH FAIL: 7 — 8 (P8/BI.12)	SHT 11
MEAS TRANSDUCER FAIL	MEAS_T FAIL: 9 — 10 (P8/BI.13)	SHT 11
EXTERNAL CLOSE	EXTERNAL CLOSE: 11 — 12 (P8/BI.14)	SHT 12
SPARE	13 — 14 (P8/BI.15)	SPARE
LED TEST	LED CHECK: 15 — 16 (P8/BI.16)	SHT 13

X82 P8 — RED670

BREAKER CHARGING FAIL	CBNH-BCF: X82 1 — X82 2 (P8/BI.09)	SHT 10
TCS FAIL	CBNH-SF6: 3 — 4 (P8/BI.10)	SHT 10
EXTERNAL CLOSE INPUT	TCS-FAIL: 5 — 6 (P8/BI.11)	SHT 10
1+3 POLE ARC	1+3 POLE ARC: 7 — 8 (P8/BI.12)	NOT USED
3 POLE ARC	3 POLE ARC: 9 — 10 (P8/BI.13)	SHT 10
ARC OFF	ARC OFF: 11 — 12 (P8/BI.14)	SHT 10
SUPERVISORY ENABLED	SUP ENABLE: 13 — 14 (P8/BI.15)	SHT 10
TELEPROTECTION DISABLED	TELE-DISABLED: 15 — 16 (P8/BI.16)	SHT 10

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

BLOUWATER SUBSTATION
66 kV FEEDER 4
PROTECTION REFERENCE DIAGRAM

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10
SCALE	

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	19	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 19 OF 27 REVISION 0

F4.1 PNH — X1 AMBER X2 — SHT 14

F4.2 ARC OFF/LOCKED-OUT — X1 AMBER X2 — SHT 13

F4.6 CBNH — X1 AMBER X2 — SHT 13

F4.7 CBO — X1 GREEN X2 — SHT 13

F4.8 CBC — X1 RED X2 — SHT 13

R3F.1 D1

1–11	SPARE
2–12	SHT 13
3–13	SHT 13
4–14	SHT 13
5–15	SHT 13
6–16	SHT 13
7–17	SHT 13
8–18	SHT 13

R3F.2 D2

	SHT 7
	SHT 7

R3F.3 D3

	SHT 7
	SPARE

R3F.4 D4

	SHT 9
	SHT 9
	SHT 9
	SHT 9

R3F.5 D5

	SHT 9
	SPARE

F2.2.1 MCB(M) 16A — 1–2 SHT 6; 3–4 SHT 6

F2.2.2 MCB(BU) 16A — 1–2 SHT 9; 3–4 SHT 9

F2.2.4 MCB(CL)

1–2	SHT 12
3–4	SHT 12
AUX 21–22	SHT 9
13–14	SPARE

F2.2.6 MCB(SR) 20A

1–2	SHT 14
3–4	SHT 14
AUX 21–22	SHT 10
13–14	SPARE

F2.3.1 MCB(VT-M) 2A

RED PHASE VT 1–2	SHT 5
WHITE PHASE VT 3–4	SHT 5
BLUE PHASE VT 5–6	SHT 5
AUX 21–22	SHT 10
13–14	SPARE

F2.3.3 MCB(VT-BU) 2A

RED PHASE VT 1–2	SHT 5
WHITE PHASE VT 3–4	SHT 5
BLUE PHASE VT 5–6	SHT 5
AUX 21–22	SHT 11
13–14	SPARE

F2.3.6 MCB(VT-SC) 2A

1–2	SHT 5
3–4	SHT 5
AUX 21–22	SHT 10
13–14	SPARE

F2.3.7 MCB(H) 6A — 1–2 SHT 14; 3–4 SHT 14

R4.X5.2 MCB(VT-T) 2A

RED PHASE VT 1–2	SHT 5
WHITE PHASE VT 3–4	SHT 5
BLUE PHASE VT 5–6	SHT 5

R1.5 RCPM_C/T — SNUBBER CIRCUIT 11–21 SHT 12; 17–27 SHT 9

F4.11 TNS

MAIN 2A		SHT 6
1A	NORMAL 3A	
	BACKUP 4A	
MAIN 2B		SHT 6
1B	NORMAL 3B	
	BACKUP 4B	
MAIN 2C		SHT 6
1C	NORMAL 3C	
	BACKUP 4C	
12 MAIN 2D		
1D	NORMAL 3D	SHT 6
	BACKUP 4D	
MAIN 2E		
1E	NORMAL 3E	SHT 9
	BACKUP 4E	
MAIN 2F		
1F	NORMAL 3F	SHT 7
	BACKUP 4F	
MAIN 2G		
1G	NORMAL 3G	SHT 9
	BACKUP 4G	
MAIN 2H		
1H	NORMAL 3H	SHT 9
	BACKUP 4H	
MAIN 2J		
1J	NORMAL 3J	SHT 9
	BACKUP 4J	
MAIN 2P		
1P	NORMAL 3P	SHT 9
	BACKUP 4P	
MAIN 2K		
1K	NORMAL 3K	SHT 9
	BACKUP 4K	
MAIN 2L		
1L	NORMAL 3L	SHT 9
	BACKUP 4L	
MAIN 2M		
1M	NORMAL 3M	SHT 11
	BACKUP 4M	
MAIN 2N		
1N	NORMAL 3N	SHT 12
	BACKUP 4N	

F2.2.7 MCB(AC) 10A — 1–2 SHT 14; 3–4 SHT 14

R1.8 TCS-M — SHT 6 220V DC 11 / 110V DC 12; SHT 6 21 → 13 SHT 6; 15 SHT 10; 17–25; 27–26; 16; FAULT; OK; 24 SHT 6

R1.11 TCS-BU — SHT 6 220V DC 11 / 110V DC 12; SHT 6 21 → 13 SHT 9; 15 SHT 10; 17–25; 27–26; 16; FAULT; OK; 24 SHT 9

F4.16 ARC 3 POLE — 3–4 SHT 10; X1 AMBER X2 SHT 13

F4.15 ARC OFF — 3–4 SHT 10; X1 AMBER X2 SHT 13

R1.6 CT-X RXMA 1 — 2250Ω 11–21 SHT 7

13–15	SHT 6
16–18	SPARE
12–22	SPARE
23–25	SPARE
26–28	SHT 11

R2F.1 CBC-CR RXMB 1 — (+) 2250Ω (−) 11–12 SHT 12

13–14	SHT 12
15–16	SHT 12
17–18	SPARE
(+) 2250Ω (−) 21–22	SPARE
23–24	SPARE
25–26	SPARE
27–28	SPARE

F4.12 LCS

7 TEST / 6 OFF / 5 ON	SHT 13
3 TEST / 2 OFF / 1 ON	SHT 14

F4.17 ARC 1+3 POLE — 3–4 SHT 10; X1 AMBER X2 SHT 13

F4.18 TTPB — 13–14 SHT 10

F4.13 TPIS

1A OFF 2A / ON 3A	SHT 8
1B OFF 2B / ON 3B	SHT 8
1C OFF 2C / ON 3C	SHT 9
1D OFF 2D / ON 3D	SHT 14
1E OFF 2E / ON 3E	SHT 10

F4.14 CBCS

2 TRIP / 1 NORMAL / CLOSE	SHT 9
TRIP / 3 NORMAL / 4 CLOSE	SHT 12
6 TRIP / 5 NORMAL / CLOSE	SHT 11
TRIP / 7 NORMAL / 8 CLOSE	SPARE

F4.19 BFIS

1A OFF 2A / ON 3A	SHT 9
1B OFF 2B / ON 3B	SHT 9
1C OFF 2C / ON 3C	SHT 9
1D OFF 2D / ON 3D	SHT 17

F4.20 SIS

1A OFF 2A / ON 3A	SHT 9
1B OFF 2B / ON 3B	SHT 10
1C OFF 2C / ON 3C	SHT 12
1D OFF 2D / ON 3D	SHT 17 (OPTIONAL)
1E OFF 2E / ON 3E	SPARE
1F OFF 2F / ON 3F	SPARE

R1.7 TP-PSU — 110V DC 116 / 48V DC 126; 118; 128; 117; 317–318 SHT 9

R1.1 VSR-1 (OPTIONAL)

+ 122 – 121	SHT 12
113–114	SHT 5
115–116	SHT 5
117–118	SPARE
123–124	SPARE
213–214	SHT 5
227–228	SHT 5
225–226	SHT 5
223–224	SHT 5
+ 212 – 211	SHT 12

R1.2 VSR-2 (OPTIONAL)

+ 122 – 121	SHT 12
113–114	SHT 5
115–116	SHT 5
117–118	SPARE
123–124	SPARE
213–214	SHT 5
227–228	SHT 5
225–226	SHT 5
223–224	SHT 5
+ 212 – 211	SHT 12

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 4
PROTECTION REFERENCE DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

SCALE

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	20	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 20 OF 27 REVISION 0

R3R.1 — DCF-M

2 — 10		SHT 8
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 9

R3R.2 — DCF-BU

2 — 10		SHT 13
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 7

R2.1 — RS900

FAIL		SHT 11

R2.2 — CBOS-X1

2 — 10		SHT 16
3 — 1		SHT 9

R2.3 — CBCS-X1

2 — 10		SHT 16
7 — 11	3	SHT 12

R2.4 — PNH-X1

2 — 10		SHT 7
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 7

R2.5 — PNH-X2

2 — 10		SHT 9
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 10

R4.X5.1 — MEASUREMENTS

R4.X5.1 TRANSDUCER

WATTS	19	SHT 15
	20	SHT 15
VARS	21	SHT 15
	22	SHT 15
AMPS	17	SHT 15
	18	SHT 15
VOLTS R-W	15	SHT 15
	16	SHT 15
DNP3 RS485 FOR RTU	A 23	SHT 15
	GND 24	SHT 15
	B 25	SHT 15

RED PHASE VT	R 2	SHT 5
WHITE PHASE VT	W 5	SHT 5
BLUE PHASE VT	B 8	SHT 5
NEUTRAL	N 11	SHT 5
RED PHASE CURRENT	R 1 — 3	SHT 4
WHITE PHASE CURRENT	W 4 — 6	SHT 4
BLUE PHASE CURRENT	B 7 — 9	SHT 4
POWER SUPPLY	PSU 13 — 14	SHT 11

F2.1 — REF615 DIRECTIONAL

POWER SUPPLY	X100 1 — X100 2	SHT 12
BKR CLOSE	X130 1 — BI 1 — X130 2	SHT 12
VT MCB TRIP	BI 2 3 — 4	SHT 11
SIS ENABLED	BI 3 5 — 6	SHT 10
LAMP CHECK	BI 4 7 — 8	SHT 13
RED PHASE VT	U1 11 — 12	SHT 5
WHITE PHASE VT	U2 13 — 14	SHT 5
BLUE PHASE VT	U3 15 — 16	SHT 5
NEUTRAL	U0 17 — 18	SHT 5
CHARGING FAIL	X120 1 — BI 1 — X120 2	SHT 10
PNH-X2	BI 2 3	SHT 10
SF6 GAS LOW	BI 3 4	SHT 10
CUSTOMER CLOSE BLOCK	BI 4 5 — 6	SHT 11
RED PHASE CURRENT	IL1 R 7 — 8	SHT 4
WHITE PHASE CURRENT	IL2 W 9 — 10	SHT 4
BLUE PHASE CURRENT	IL3 B 11 — 12	SHT 4
NEUTRAL CURRENT	IL4 14 — 13	SHT 4
E/F BLOCK	X110 1 — BI 1 — X110 2	NOT USED
BUSZONE TRIP	BI 2 3 — 4	SHT 7
BKR CLOSED	BI 3 5 — 6	SHT 7
BKR OPEN	BI 4 7	SHT 7
SETTING GROUP ALT 2	BI 5 8 — 9	SHT 7
SETTING GROUP ALT 3	BI 6 10	SHT 7
TNS MAIN TEST	BI 7 11 — 12	SHT 11
TNS NORMAL	BI 8 13	SHT 11
BU O/C IDMT/DT TRIP	X110 15 — SO 1 — 14	SHT 7
VTFF	SO 2 18 — 17	SHT 7
BU O/C TRIP	SO 3 21 — 20	SHT 17
TNS ON MAIN	SO 4 24 — 23	SHT 17
NOT USED	IRF 5	SHT 7
BACK-UP FAIL	X100 4 — X100 3	
BU E/F IDMT/DT TRIP	X100 6 — PO 1 — X100 7	SHT 7
CLOSE MAIN ON TEST	PO 2 8 — 9	SHT 12

F2.1 CONTINUED

BU O/C & E/F TRIP HIGHSET	X100 12 — 10	SHT 7
BU E/F TRIP	SO 1 14 — 13	SHT 17
BU BKR FAIL TRIP	SO 2 16 — 17	SHT 17
BU BKR FAIL TRIP	PO 3 19 — 18	SHT 9
BU (GENERAL) TRIP	PO 3 22 — 21	SHT 18
BU (GENERAL) TRIP	PO 4 23 — 24	SHT 9

SHEET 26	BREAKER REFERENCE DIAGRAM	
SHEET 25	JUNCTION BOX CABLING DIAGRAM	
SHEET 24	PANEL CABLING DIAGRAM	
SHEET 23	PANEL CABLING DIAGRAM	
SHEET 22	PANEL CABLING DIAGRAM	
SHEET 21	PROTECTION REFERENCE DIAGRAM	
SHEET 20	PROTECTION REFERENCE DIAGRAM	
SHEET 19	PROTECTION REFERENCE DIAGRAM	
SHEET 18	DISTURBANCE RECORDER KEY DIAG.	
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM	
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	
SHEET 14	SPRING REWIND & AC KEY DIAGRAM	
SHEET 13	INDICATION DC KEY DIAGRAM	
SHEET 12	CLOSE DC KEY DIAGRAM	
SHEET 11	BACK-UP DC KEY DIAGRAM	
SHEET 10	BACK-UP DC KEY DIAGRAM	
SHEET 9	BACK-UP DC KEY DIAGRAM	
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	
SHEET 7	MAIN DC KEY DIAGRAM	
SHEET 6	MAIN DC KEY DIAGRAM	
SHEET 5	VT SUPPLY KEY DIAGRAM	
SHEET 4	AC KEY DIAGRAM	
SHEET 3	SINGLE LINE DIAGRAM	
SHEET 2	LOGIC DIAGRAM	
SHEET 1	PANEL EQUIPMENT LAYOUT	
SHEET 0	COVER SHEET	

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

SCALE

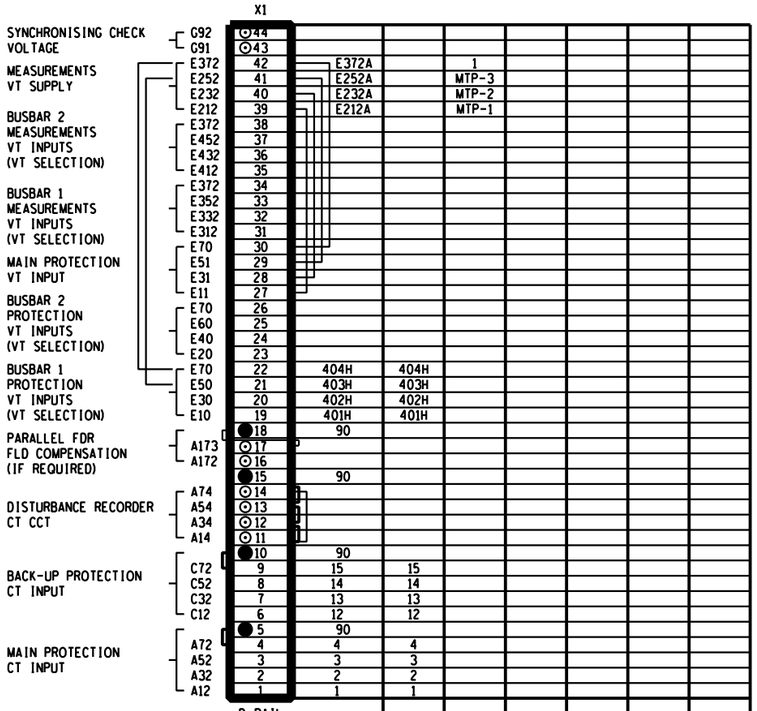
BLOUWATER SUBSTATION
66 kV FEEDER 4
PROTECTION REFERENCE DIAGRAM

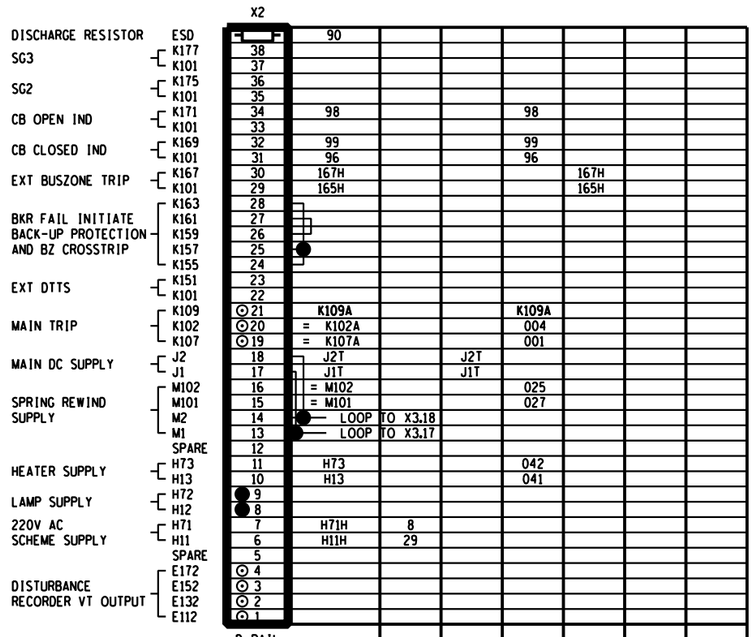
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	21	00

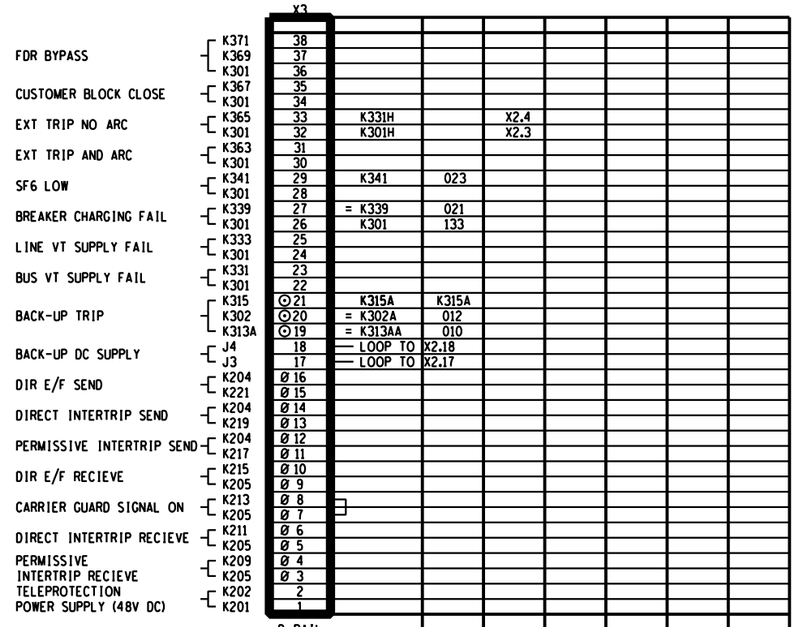
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 21 OF 27 REVISION 0







CABLE NUMBER	H509	-				
CABLE SIZE	19	-				
NUMBER OF SPARES	3	-				
DESTINATION	JUNCTION BOX	BUS WIRING TO STAT METER MODULE				

CABLE NUMBER	H524	H515	H508	H513		
CABLE SIZE	4	2	37	4		
NUMBER OF SPARES	2	-	3	0		
DESTINATION	AC PANEL	DC BOARD	JUNCTION BOX	66 kV BUS ZONE PANEL		

CABLE NUMBER	H508	H518				
CABLE SIZE	-	2				
NUMBER OF SPARES	-	0				
DESTINATION	JUNCTION BOX	UNDERFREQUENCY LOAD SHEDDING PANEL				

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
   ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
   ● 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
   * D2.5/5 SN ADD ENTRELEC TERMINALS
   X M4/8 SF ENTRELEC TERMINALS
   □ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
   [R] M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED
5. NOTE THAT D6/8 ST1 RS TERMINALS WILL 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.

LOOPED TERMINALS	
RP	X2.17-X3.17; X2.18-X 3.18;
LINE ISOL	29-27;
B/B 1 ISOL	29-27;
B/B 2 ISOL	29-27;

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM

REFERENCE DRAWINGS:

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
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

BLOUWATER SUBSTATION
66 kV FEEDER 4
PANEL CABLING DIAGRAM

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	22	01

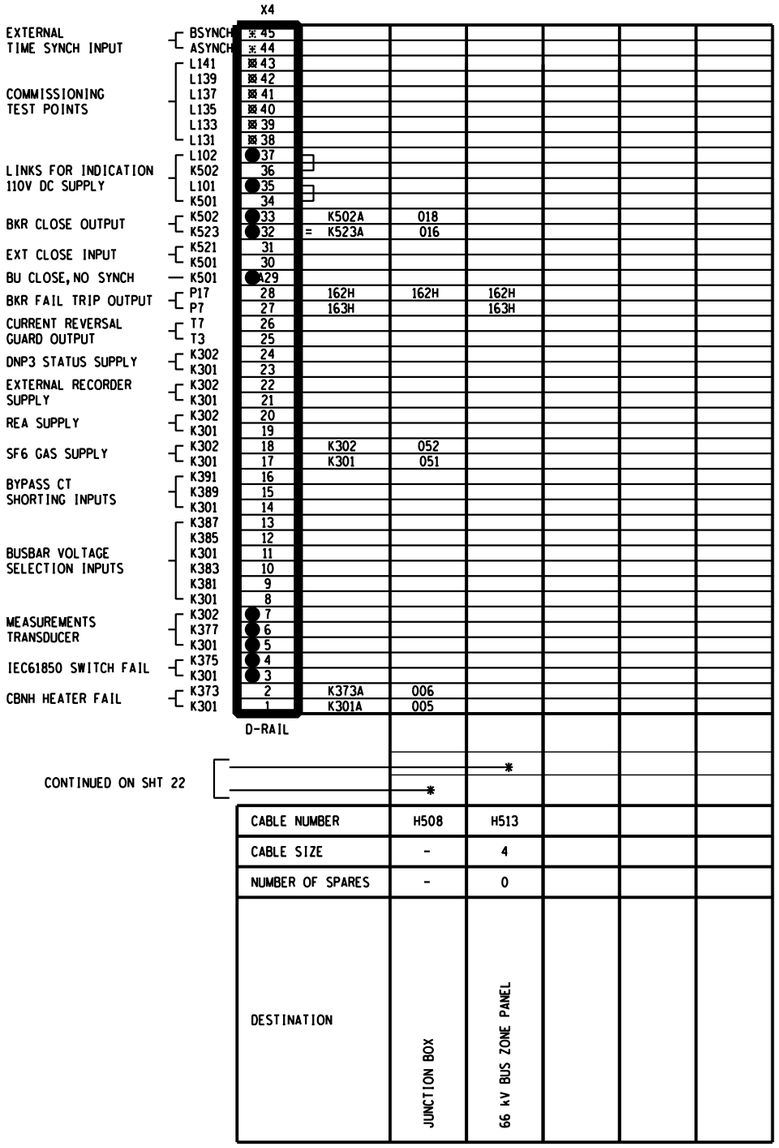
REV | AUTH | DATE | REVISION TO MASTER | BY | CHKD

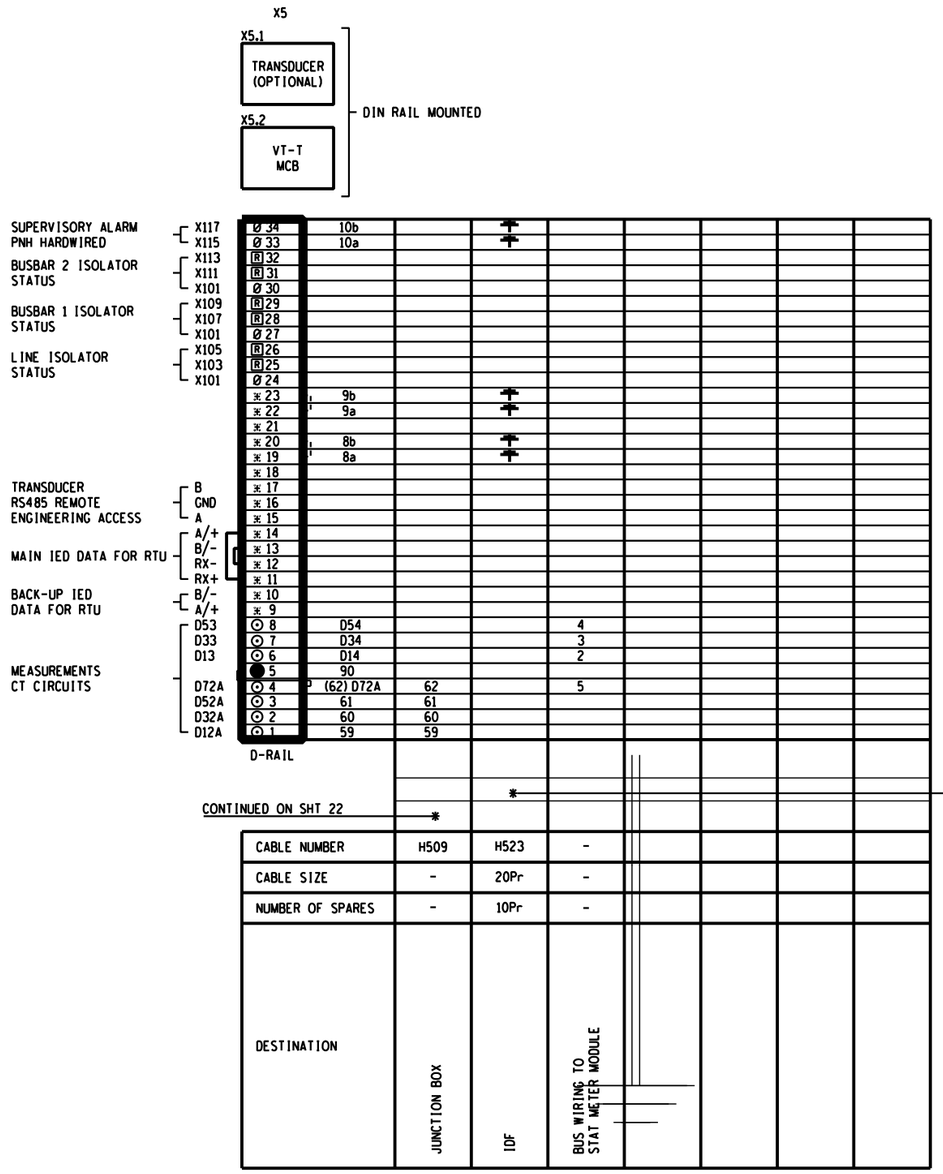
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

LEVELS 1 2 10 11 13 14 19 23 24 25 28

MASTER TRACING FILED UNDER D-DT-15007 SHEET 22 OF 27 REVISION 0





SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REFERENCE DRAWINGS:

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
- ● 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 TERMINALS
- ⊠ 4mm BANANA PLUG FEMALE SOCKET (INSTALLED IN CENTRE SPACING OF TERMINAL)
- [R] M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

REV	DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	66kV BREAKER REPLACED.	PFS	LF	JM	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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	C.KING
DATE	31/10/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	A v S
DATE	01/05/2011
DRAWN BY	C. CANNON
DATE	26/02/10
SCALE	

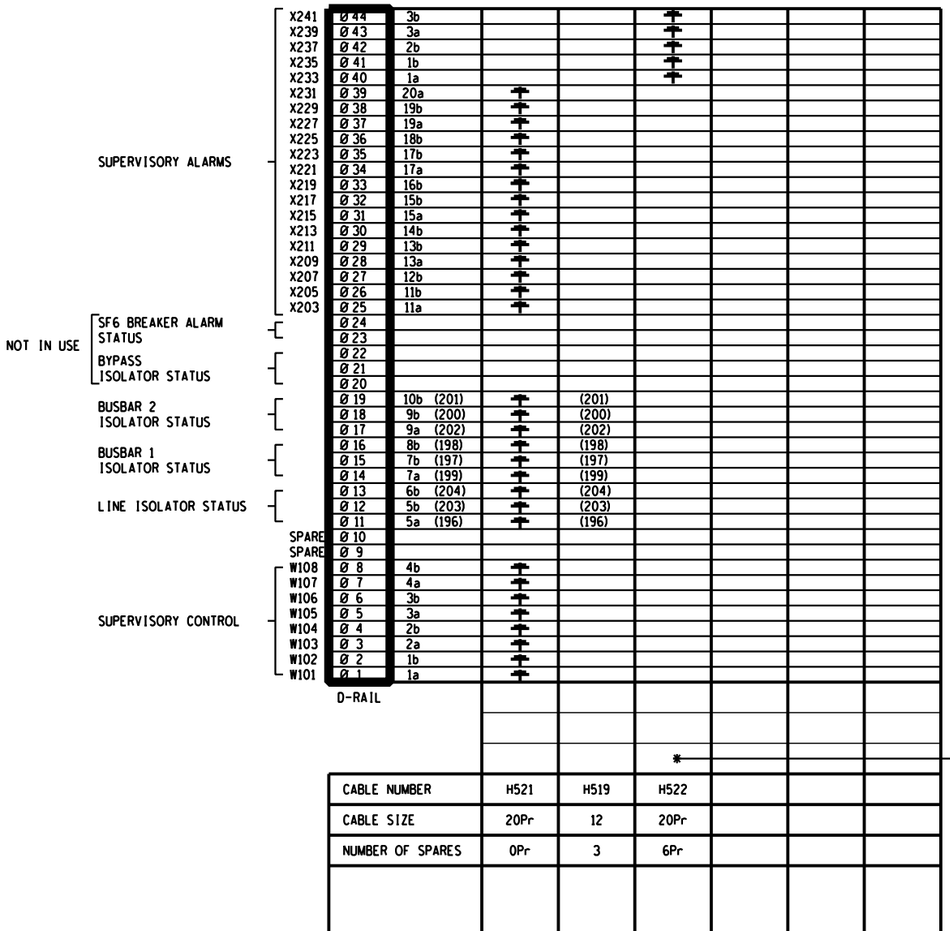
BLOUWATER SUBSTATION
66 kV FEEDER 4
PANEL CABLING DIAGRAM

DRAWING NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	23	01

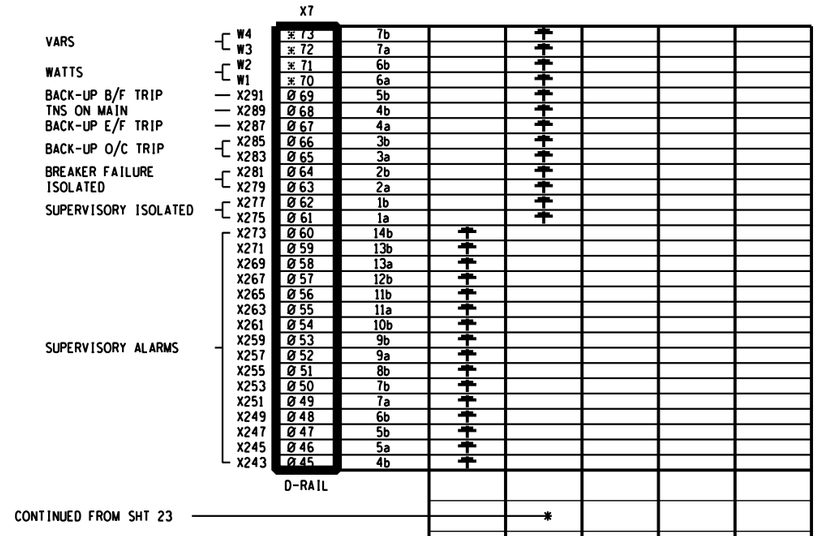
PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 23 OF 27 REVISION 0



CABLE NUMBER	H521	H519	H522			
CABLE SIZE	20Pr	12	20Pr			
NUMBER OF SPARES	0Pr	3	6Pr			
DESTINATION	I D F	JUNCTION BOX	I D F			



CABLE NUMBER	H522	H523			
CABLE SIZE	-	-			
NUMBER OF SPARES	-	-			
DESTINATION	I D F	I D F			

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
- ● 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 TERMINALS
- R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

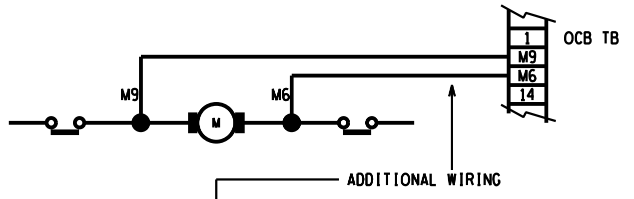
BLOUWATER SUBSTATION
66 kV FEEDER 4
PANEL CABLING DIAGRAM

DRAWING NUMBER	SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	24	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 24 OF 27 REVISION 0



NOTE:
CT STAR POINT CHANGED TO
LINE SIDE
CHANGE TO BE DONE ON SITE

		6					5		
X2.19	K107A =		001	X1.5			029		
X2.20	K102A =		004	X1.6			031		
X4.1	K301A	005		X1.29	X2.10	H13	041		X1.1
X4.2	K373A	006		X1.30	X2.11	H73	042		X1.2
			007				043		
X3.19	K313AA =		010	X1.7			044		
X3.20	K302A =		012	X1.8			045		
X4.32	K523A =		016	X1.11			046		
			013				027	M101	X1.3
X4.33	K502A =		018	X1.12	X2.31		96		X1.31
		019					97		
					X2.34		98		X1.40
		026			X2.32		99		X1.32
X2.15	M101 =		027				100		
		030					101		
X4.17	K301	051		X1.15	X3.26	K103	133		X1.47
X4.18	K302	052		X1.16			139		
		002					140		
		003					169		
		009					171		
		011					173		
		015					174		
		017							
X3.21	K315A		K315A	X1.63					
X3.27	K339 =	021		X1.48					
X3.29	K341 =	023		X1.20					
		024							
X2.16	M102 =		025	X1.4					
		028			X2.21	K109A	K109A		X1.61
3	NUMBER OF SPARES			13	-				-
37	NUMBER OF CORES			37	-				-
H508	CABLE NUMBERS			H507	H508				H507
RELAY PANEL	DESTINATION			66kV BREAKER MB	RELAY PANEL				66kV BREAKER MB

				4					
1S3				1		X1.1			
	1S3			2		X1.2			
		1S3		3		X1.3			
1S4				4		X1.4			
	1S4		4						
		1S4	4						
2S1				113H				10	10
	2S1			114H				14	14
		2S1		115H				18	18
2S2				108H			108H		
	2S2		108H						
		2S2	108H		104JH		104H		
3S1				109H			109H		
	3S1			110H			110H		
		3S1		111H			111H		
3S2				112H			112H		
	3S2		112H						
		3S2	112H						
4S3				12		X1.6			
	4S3			13		X1.7			
		4S3		14		X1.8			
4S4				15		X1.9			
	4S4		15						
		4S4	15						
6S1				59		X5.1			
	6S1			60		X5.2			
		6S1		61		X5.3			
6S2				62		X5.4			
	6S2		62						
		6S2	62						
2	2	2				3	0	4	4
12	12	12				19	12	19	19
H501	H502	H503				H509	H512	H504	H505
Rϕ CT	Wϕ CT	Bϕ CT				RELAY PANEL	BUS ZONE CT's PANEL	BUSBAR 1 ISOLATOR	BUSBAR 2 ISOLATOR

			3							2					1
		X1.19	401H		2	2									
		X1.20	402H		4	4			29	199	X7.14				
		X1.21	403H		6	6		29		202	X7.17				
		X1.22	404H		33	33	29			196	X7.11				
	160H		160H		21										
	161H		161H			21			30	197	X7.15				
	162H		162H		22				28	198	X7.16				P
				162H		22		30		200	X7.18				
								28		201	X7.19				
101H			101H		9		30			203	X7.12				
102H			102H		13		28			204	X7.13				
103H			103H		17										
105H			105H			9									N
106H			106H			13									
107H			107H			17									
												R	R	R	
												W	W	W	
												B	B	B	
												N	N	N	
-	1	-			-	-	1	-	-		3	-	-	NUMBER OF SPARES	
-	4	-			-	-	4	-	-		12	4	4	NUMBER OF CORES	
H512	H513	H509			H504	H505	H506	H505	H504		H519	7	8	CABLE NUMBERS	
BUS ZONE CT's PANEL	BUS ZONE PROTECTION PANEL	RELAY PANEL			BUSBAR 1 ISOLATOR	BUSBAR 2 ISOLATOR	LINE ISOLATOR	BUSBAR 2 ISOLATOR	BUSBAR 1 ISOLATOR		RELAY PANEL	LOOP CABLES SEE DRG 1.03/16414		DESTINATION	

NOTES

1. SPARE CABLE LEADS TO BE LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
2. = DENOTES TWO CABLE CORES CONNECTED IN PARALLEL.
3. LEAD NUMBER SHOWN THUS: K101 INDICATES NO CHANGE OF LEAD NUMBER AT TERMINAL STRIP.
4. LEAD NUMBER SHOWN THUS: K101 ▭ K103 INDICATES LEAD NUMBER CHANGES AT TERMINAL STRIP.

LOOPED TERMINALS		
CT's Rϕ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
CT's Wϕ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
CT's Bϕ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
66kV MB	X1.9-X1.15; X1.10-X1.16; X1.17-X1.19-X1.47; X1.18-X1.48; X1.31-X1.39;	
B/B 1 ISOL	29-27; 21-23; 22-24; 9-11; 10-12; 13-15; 14-16; 17-19; 18-20;	
B/B 2 ISOL	29-27; 21-23; 22-24; 9-11; 10-12; 13-15; 14-16; 17-19; 18-20;	
LINE ISOL.	29-27;	

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

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM
REFERENCE DRAWINGS:					

SCALE :

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
1	66kV BREAKER REPLACED.	PFS	L.F	J.M	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

AUTH: C.KING
DATE: 31/10/2011
CHKD: J. MOSTERT
DATE: 20/10/2011
DRAWN: A v S
DATE: 01/05/2011

BLOUWATER SUBSTATION
66 kV FEEDER 4
JUNCTION BOX CABLING DIAGRAM

D-WC-7270

SET	SHEET	REVISION
64	25	01

AIL

110 V DC SPRING REWIND SUPPLY (LOOP CABLES SEE 1.03/16414)

+SR

-SR

CONTRACTOR

SALR45 TIMER

11000PIV

1k ohm 10W

22v5w

LOR 'l'

LOR 'm'

LOR 'k'

PB

SEE SHT 14

SEE SHT 7

SEE SHT 7

DISCONNECT ON SITE

BRIDGE TO BE ADDED ON SITE

BRIDGE TO BE ADDED ON SITE

LOR 'j'

LOR 'h'

SEE SHT 10

DISCONNECT ON SITE

DISCONNECT ON SITE

LOCAL CS(a)

LOR 'f'

CLOSING SPRING RELEASE COIL

KEY SW.

LOR 'g'

SEE SHT 12

ADD ON SITE

LOR 'b'

MAIN TRIP COIL No 1

LOR 'c'

SEE SHT 6

LOCAL CS(a)

LOR 'd'

BACK UP TRIP COIL No 2

LOR 'e'

SEE SHT 9

DISCONNECT ON SITE

380/220 V AC SUPPLY LOOP CABLES SEE DRG. 1.03/16414

OCB HEATER CIRCUIT

OCB HEATER

MCB

DISCONNECT ON SITE

SEE SHEET 16 FOR NEW SUPERVISORY STATUS ALARMS

OCB OPEN

OCB CLOSED

B/B 1 ISOLATOR OPEN

B/B 1 ISOLATOR CLOSED

B/B 2 ISOLATOR OPEN

B/B 2 ISOLATOR CLOSED

LINE ISOLATOR OPEN

LINE ISOLATOR CLOSED

DISCONNECT ON SITE

NOT USED

REYROLLE BREAKER
SEE 0.54/832 REV 1.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
1	66kV BREAKER REPLACED.	PFS	L.F	J.M	28/09/2015	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 4
BREAKER REFERENCE DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

DRG NUMBER	SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	64	26	01

LEVELS 10

SIZE A1L

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	0	13/12/2010	
1	PANEL EQUIPMENT LAYOUT	0	13/12/2010	
2	LOGIC DIAGRAM	0	13/12/2010	
3	SINGLE LINE DIAGRAM	0	13/12/2010	
4	AC KEY DIAGRAM	0	13/12/2010	
5	VT SUPPLY KEY DIAGRAM	0	13/12/2010	
6	MAIN DC KEY DIAGRAM	0	13/12/2010	
7	MAIN DC KEY DIAGRAM	0	13/12/2010	
8	TELEPROTECTION DC KEY DIAGRAM	0	13/12/2010	
9	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
10	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
11	BACK-UP DC KEY DIAGRAM	0	13/12/2010	
12	CLOSE DC KEY DIAGRAM	0	13/12/2010	
13	INDICATION DC KEY DIAGRAM	0	13/12/2010	
14	SPRING REWIND AND AC KEY DIAGRAM	0	13/12/2010	
15	REA AND MEASUREMENTS KEY DIAGRAM	0	13/12/2010	
16	SUPERVISORY STATUS & CONTROL KEY DIAGRAM	0	13/12/2010	
17	SUPERVISORY ALARMS KEY DIAGRAM	0	13/12/2010	
18	DISTURBANCE RECORDER KEY DIAGRAM	0	13/12/2010	
19	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
20	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
21	PROTECTION REFERENCE DIAGRAM	0	13/12/2010	
22	PANEL CABLING DIAGRAM	0	13/12/2010	
23	PANEL CABLING DIAGRAM	0	13/12/2010	
24	PANEL CABLING DIAGRAM	0	13/12/2010	
~~25~~	~~ISOLATOR JUNCTION BOX~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
~~26~~	~~LINE VTJB LAYOUT & KEY DIAGRAM~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
~~27~~	~~CABLE BLOCK DIAGRAM~~ (SHEET NOT USED)	~~0~~	~~13/12/2010~~	
25	JUNCTION BOX CABLING	REV 0	18/02/2011	SHEET ADDED FOR (SITE SPECIFIC) APPLICATION
26	BREAKER REFERENCE DIAGRAM	REV 0	18/02/2011	SHEET ADDED FOR (SITE SPECIFIC) APPLICATION

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2	4FZD3920 DISTANCE/ DIFFERENTIAL SCHEME	17	
3		18	
4		19	THREE PHASE MEASUREMENTS TRANSDUCER (ORDERING OPTION - ACTOM AREVA i5MT FREE ISSUED)
5		20	
6		21	
7		22	
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	
12		27	
13	STANDARD OUTDOOR HV ABB CIRCUIT-BREAKER 36-72.5kV (AS PER ABB DRAWINGS 1HYB902173-100 REV D)	28	IEC-61850/ETHERNET COMMS (ORDERING OPTION)
14	VOLTAGE SELECTOR RELAY (VSR) DOUBLE BUSBAR (ORDERING OPTION)	29	
15		30	

θ MUTUALLY EXCLUSIVE LEVELS/SHEETS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.
x MUTUALLY INCLUSIVE LEVELS/SHEETS.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

PLEASE NOTE!!!!!!!!!!

WHEN USING THIS SCHEME PLEASE MAKE SURE THAT REFERENCE FILE title4TM7100r1 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

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
COVER SHEET

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	00	00

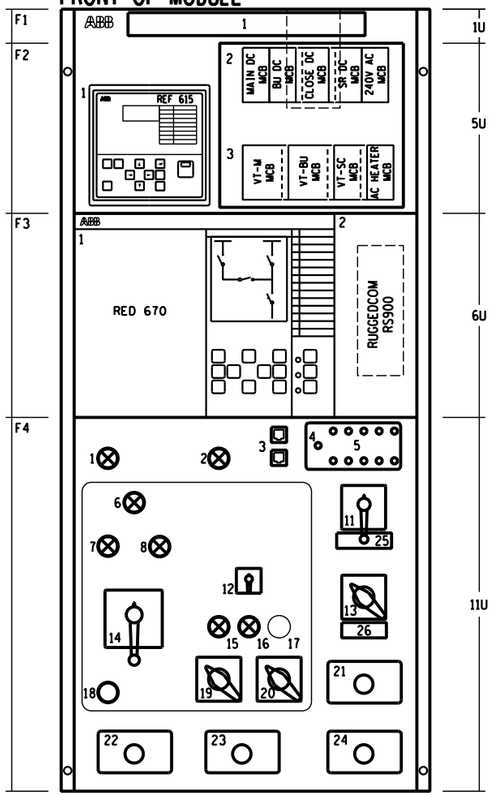
LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

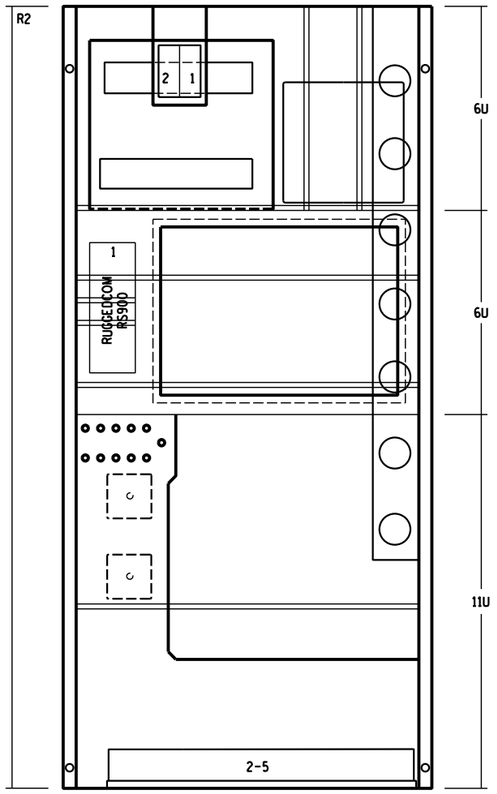
SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 0 OF 27 REVISION 0

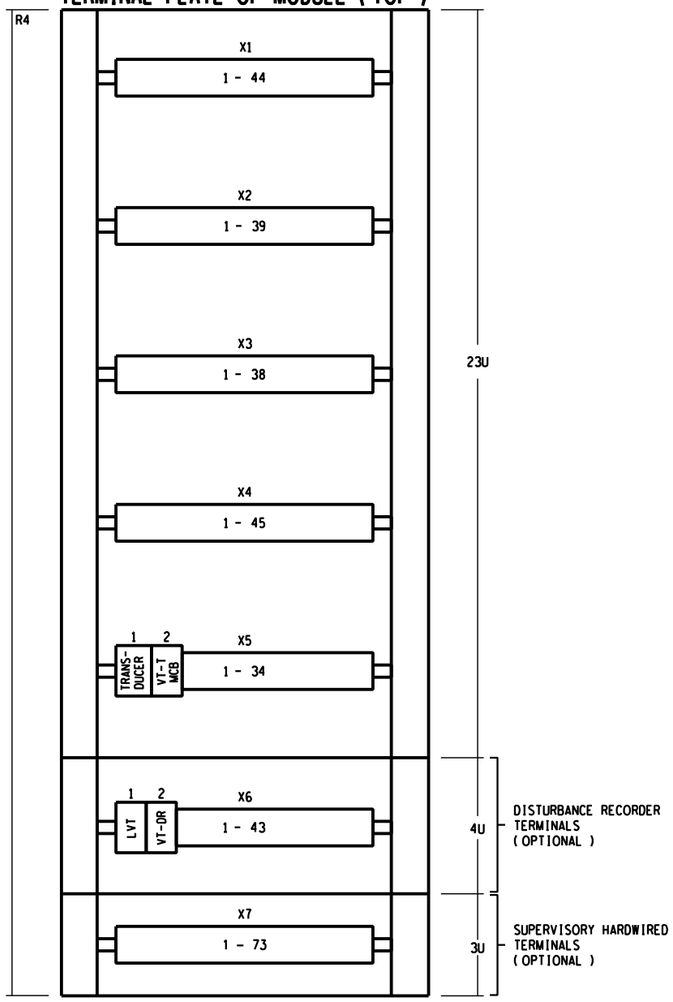
FRONT OF MODULE



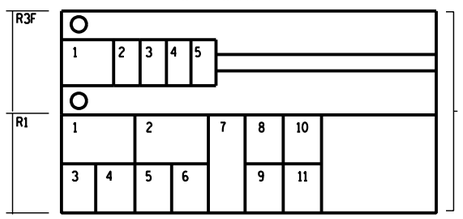
REAR OF MODULE



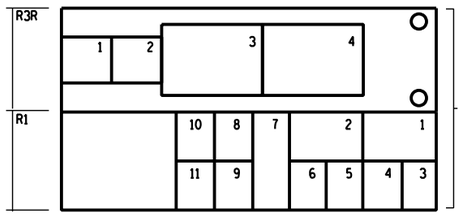
TERMINAL PLATE OF MODULE (TOP)



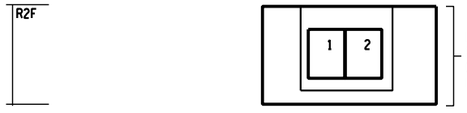
INTERNAL TO MODULE



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 = 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				
INTERNAL TO MODULE								
R1	1		VSR-1	ISOLATOR 1 REPEAT RELAY	(* AN=110V DC, AS=220V DC)	(NOT USED)	RK251205AN	ABB
	2		VSR-2	ISOLATOR 2 REPEAT RELAY	(* AN=110V DC, AS=220V DC)	(NOT USED)	RK251205AN	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	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)		RXMB 1 AN	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-U048DC3L	ABB
	3		CBCS-X1	CIRCUIT BREAKER CLOSE SUPERVISORY AUXILIARY 1 RELAY	(48V DC)	(OPTIONAL)	CR-U048DC3L	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
						(3 PHASE)	SINEAX CAM/;STAT;5MT	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		(NOT USED) (1 AMP)	S202-C 1	ABB
	X6.2		MCB (VT-DR)	DISTURBANCE RECORDER VT SUPPLY MCB	(3 POLE)	(NOT USED) (1 AMP)	S203-C 1	ABB

BAY NAME "ISCOR 2/YSTERVARK TEE" 66 kV FEEDER 5

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	FEEDER NAME CHANGE	JF	BBH	LMB	31/01/2019	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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 Distribution

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

PROJECT APPROVED	DESIGN APPROVED A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY A v S	DRAWN BY C. CANNON
DATE 01/05/2011	DATE 26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 5
PANEL EQUIPMENT LAYOUT

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	01

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOVE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 1 OF 27 REVISION 0

LEVELS 1 2 10 11 13 14 19 23 24 25 28

RED670 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 6FZD3100 AND 6FZD3300 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) NOT USED

GT-05) NOT USED

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) RESERVED

GT-10) NOT USED

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-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 MANUALY 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):

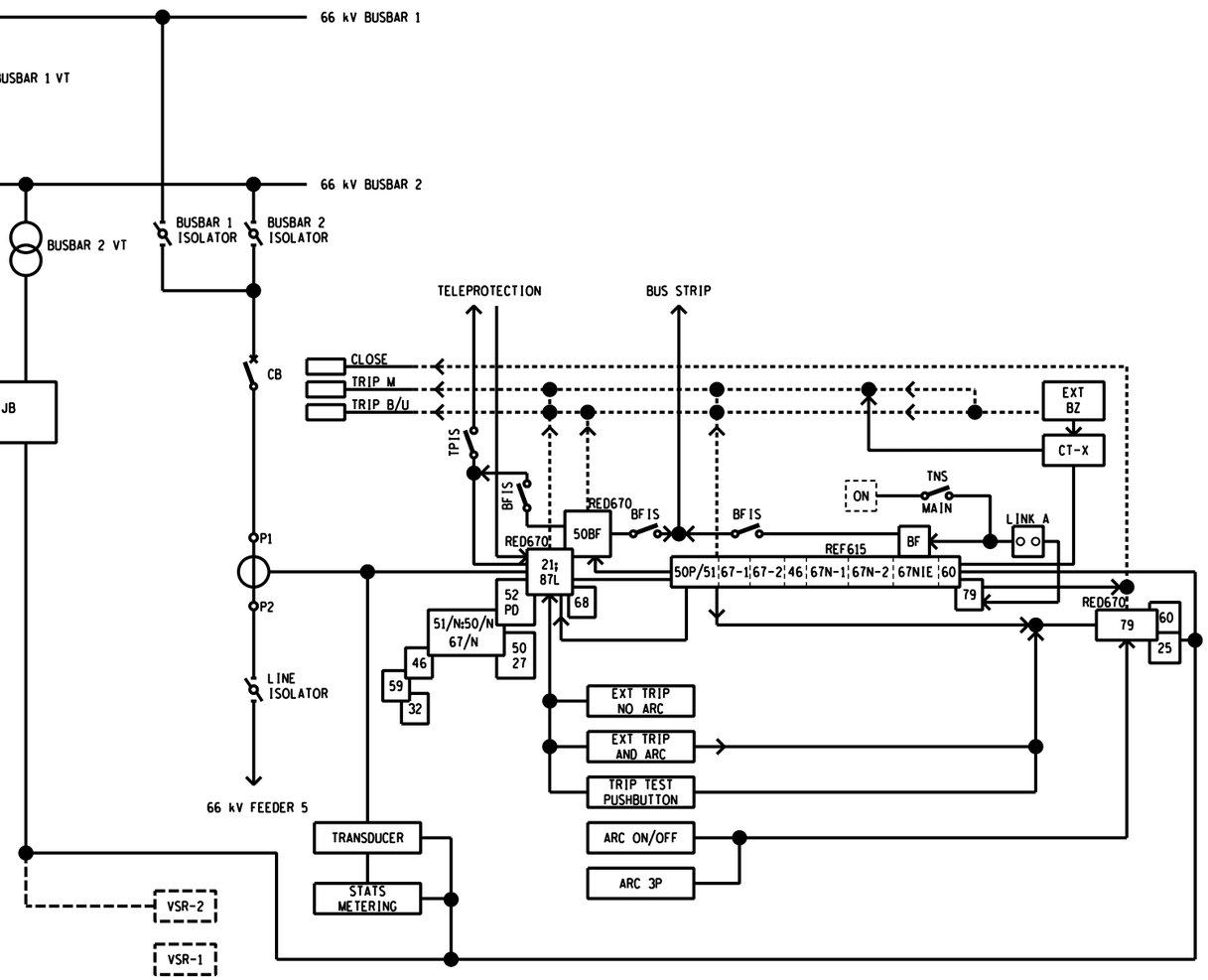
TP GAPC1 IS MASKED TO THE FOLLOWING FUNCTIONS TO ENABLE THE MULTIPLIER WHEN THE BREAKER CLOSES IF REQUIRED:
DIR HighSetOC (67-2), NonDIR InstOC (50P/51), SEF DIR EF2 (67N-1), DEF HighSet (67N-2), NonDIR_InstEF (51N-2), NegSeq_OC1/2 (46(1/2)).

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).



NOTE: VSR-1 & 2 NOT IN USE

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	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
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	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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

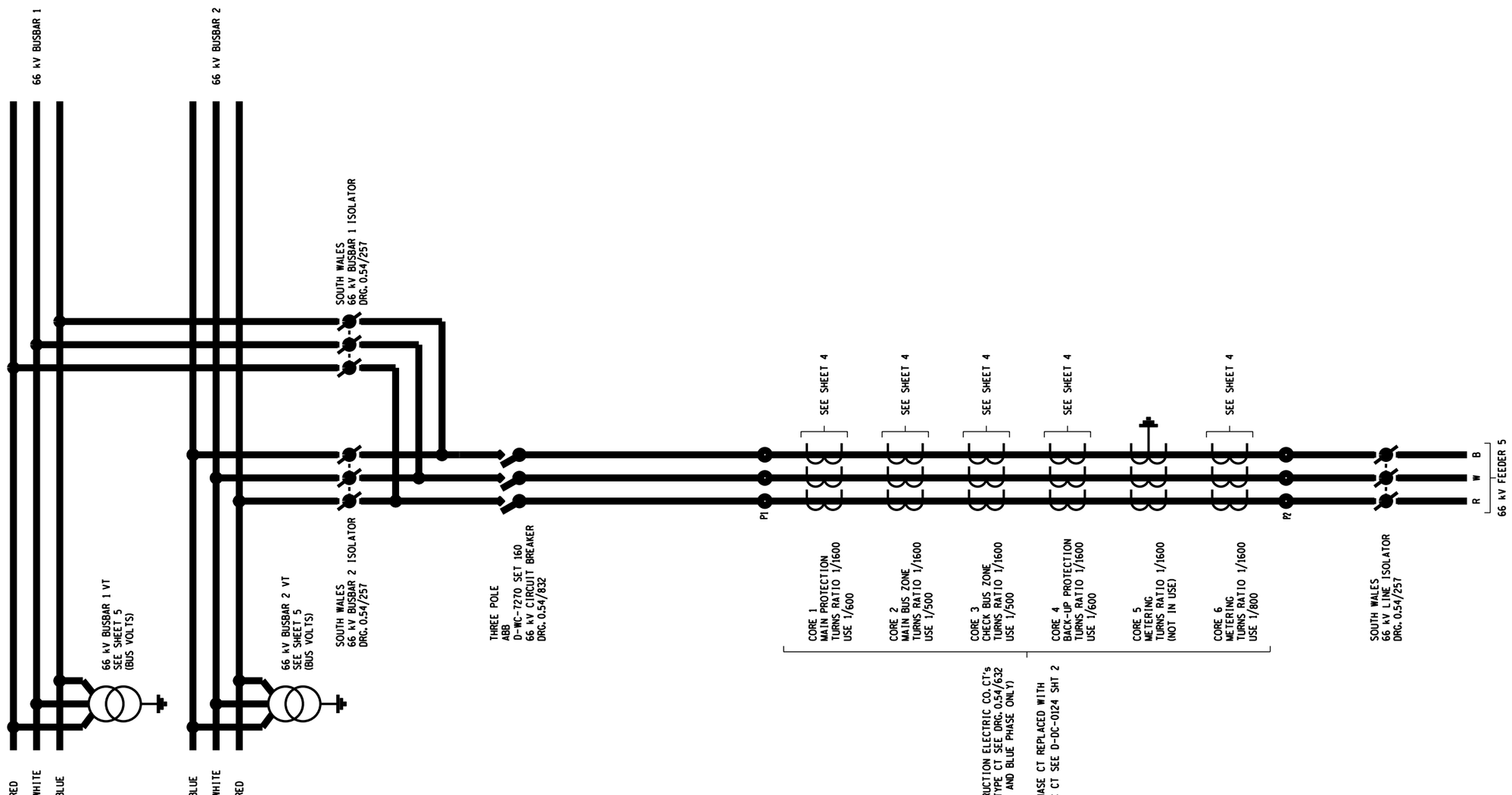
BLOUWATER SUBSTATION
66 kV FEEDER 5
LOGIC DIAGRAM

DRAWING NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	02	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 2 OF 27 REVISION 0



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	POST TYPE CT SEE DRG. 0.54/632	PFS	JM	TM	21/09/2018	
01	CT RATIO CHANGED	NB	NB	TM	06/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
SINGLE LINE DIAGRAM

D-WC-7270	SET NUMBER	SHEET NUMBER	REVISION
	65	03	02

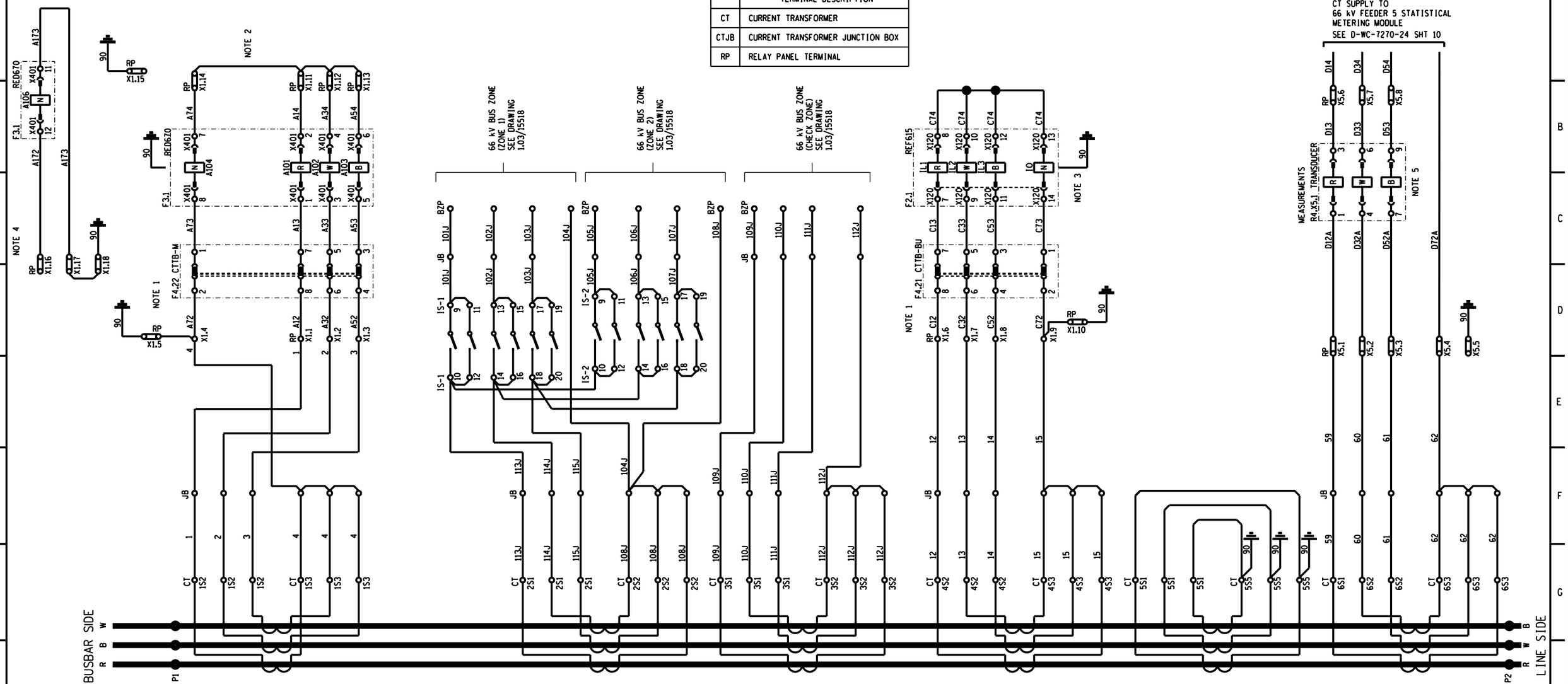
LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 3 OF 27 REVISION 0

	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.
5. JUMPERS TO BE WIRED IN BY ESKOM IF THE TRANSDUCER IS FREE ISSUED AND FITTED ON SITE.

REFERENCE DRAWINGS:

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	RED PHASE CT REPLACED.	PFS	JM	TM	21/09/2018	
1	CT RATIO CHANGED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

BLOUWATER SUBSTATION
66 kV FEEDER 5
AC KEY DIAGRAM

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

DRAWING NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65 04	02

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 4 OF 27 REVISION 0

LINE VOLTS
(LINE VT JB)
(NOT IN USE)

LVT X1.7 — G91 — RP X1.43 — G91
LVT X1.8 — G92 — RP X1.44 — G92

F2.3.5 MCB(VT-SC) 2A

G91 1 2 G93 (WHITE)
G92 3 4 G94 (NEUTRAL/BLUE)

F3.1 RED670
X401 19 A110 — SYNCHRONISING CHECK VOLTAGE (NOTE 3) (NOTE 4)
X401 20
A111 21 — DIRECTIONAL EARTH FAULT FUNCTION (INTERNALLY DERIVED)
22

F2.1 REF615
X130 17 U0 — DIRECTIONALITY (ZERO SEQUENCE) VOLTAGE INPUT (INTERNALLY DERIVED)
18

F4.24 VTTB-BU

F2.3.3 MCB(VT-BU) 2A

E11 8 7 E12 1 2 E13 — U1 R 11 12 — DIRECTIONALITY RED VOLTAGE INPUT
E31 6 5 E32 3 4 E33 — U2 W 13 14 — DIRECTIONALITY WHITE VOLTAGE INPUT
E51 4 3 E52 5 6 E53 — U3 B 15 16 — DIRECTIONALITY BLUE VOLTAGE INPUT
E70 2 1 E72

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.
6. JUMPERS TO BE WIRED IN BY ESKOM IF THE TRANSDUCER IS FREE ISSUED AND FITTED ON SITE.

NOTE:
VSR-1 AND VSR-2 ARE INSTALLED AND MUST BE REMOVED AND BRIDGES INSTALLED AS SHOWN

66 kV/110 V VT SUPPLY
SEE DRG 1.03/15511

VT JB
401J — RP X1.19 — E10 — SEE NOTE 1&2 (OPTIONAL) R1.1 VSR-1 — E11 — E11 — RP X1.27 — E11
402J — RP X1.20 — E30 — E31 — E31 — RP X1.28 — E31
403J — RP X1.21 — E50 — E51 — E51 — RP X1.29 — E51
404J — RP X1.22 — E70 — E70 — E70 — RP X1.30 — E70

E312 X1.31 — E212
E332 X1.32 — E232
E352 X1.33 — E252
E372 X1.34 — E372

SEE NOTE 1&2 (OPTIONAL) R1.2 VSR-2

RP X1.23 — E20 — E11
E40 X1.24 — E31
E60 X1.25 — E51
E70 X1.26 — E70
E412 X1.35 — E212
E432 X1.36 — E232
E452 X1.37 — E252
E372 X1.38 — E372

NOTE 1

F4.23 VTTB-M

F2.3.1 MCB(VT-M) 2A

E11 8 7 E111 1 2 E112
E31 6 5 E131 3 4 E132
E51 4 3 E151 5 6 E152
E70 2 1 E172

F3.1 RED670
E112 — X401 13 A107 R X401 14
E132 — X401 15 A108 W 16
E152 — X401 17 A109 B 18
E172

IMPEDANCE VT AND RUNNING VOLTS (NOTE 4)

RP X2.1
X2.2
X2.3
X2.4

MTP-1 MCB-1
2A
MCB-2
2A
MCB-3
2A

E212A
E232A
E252A
E372A
} 66 kV/110 V VT SUPPLY TO 66 kV FEEDER 5 STATS METER MODULE SEE D-WC-7270 SET 24 SHT 10

R4.X5.2 MCB(VT-T) 2A

RP X1.39 — E212A 1 2 E213 — R4.X5.1 MEASUREMENTS TRANSDUCER 2
RP X1.40 — E232A 3 4 E233 — 5
RP X1.41 — E252A 5 6 E253 — 8
RP X1.42 — E372A — 11

NOTE 6

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

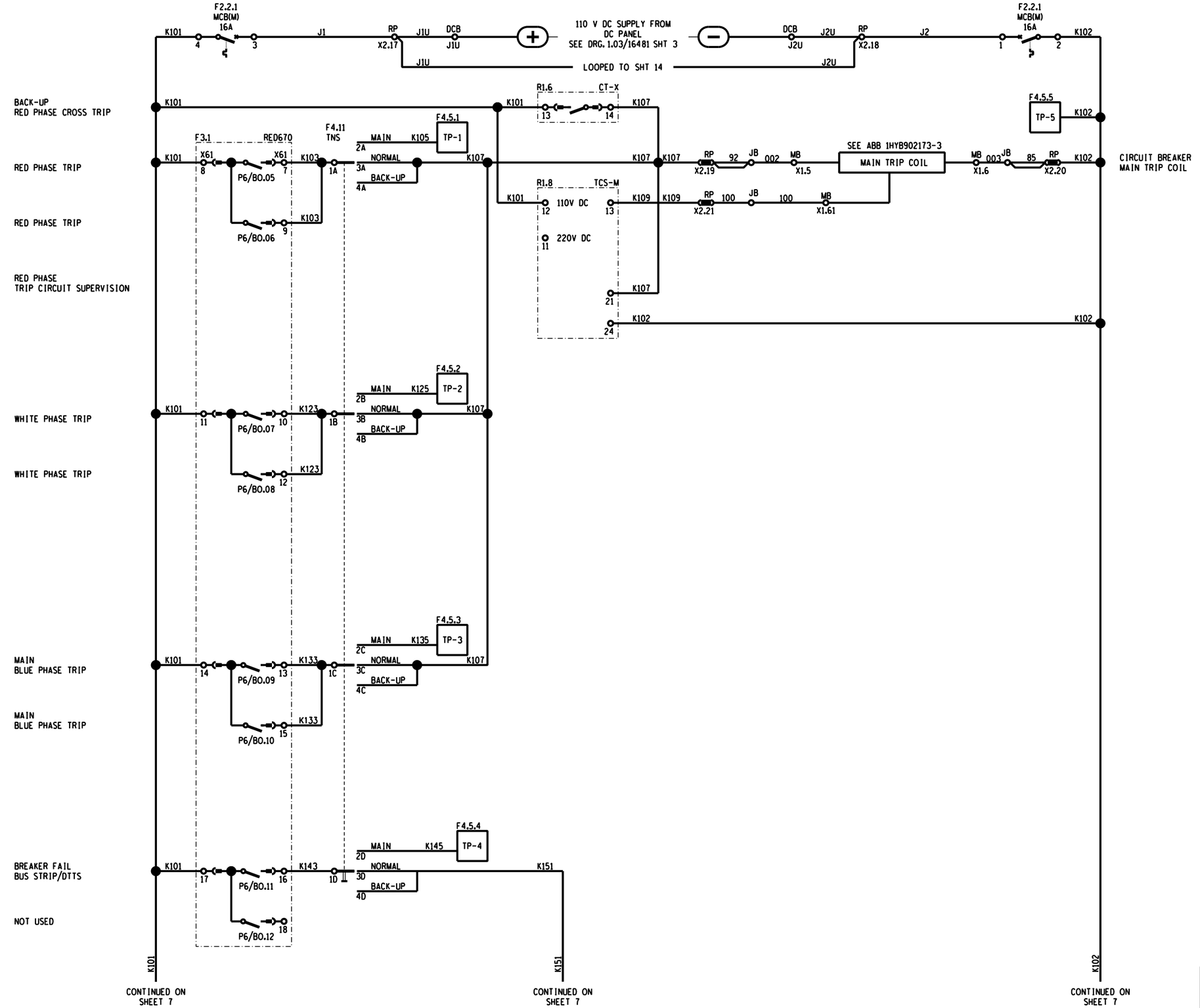
BLOUWATER SUBSTATION
66 kV FEEDER 5
VT SUPPLY KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	05	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 5 OF 27 REVISION 0



THREE-POLE BREAKER LEGEND	
ITEM	DESCRIPTION
F2	DENSITY MONITOR MAKE TRAFAG
F3	SPRING REWIND MCB
F4	HEATER MCB
S3	MOTOR LIMIT SWITCH, SNAP ACTION
S12	ON/ OFF SWITCH (EXIN400518P2)
R3	RESISTOR (HEATER), 70W
K1	AUXILIARY RELAY (ANTI-PUMP)
K2	AUXILIARY RELAY (LOW GAS BLOCK)
S1	AUXILIARY SWITCH, ROTARY, ABB (EXIN-300762-R1) (52a & 52b)
Y1	CLOSING COIL, ABB, 500W
Y2	TRIP-1 COIL, ABB, 500W
Y3	TRIP-2 COIL, ABB, 500W
M1	SPRING DRIVE MOTOR, UNIVERSAL, 735W
K3	AUXILIARY RELAY (GAS SUPERVISION ALARM)
K4	AUXILIARY RELAY (GAS SUPERVISION BLOCK)
KULT6	GLAND TERMINALS
K5	AUXILIARY RELAY (SLS MULTIPLICATION)
K6	AUXILIARY RELAY (SLS MULTIPLICATION)
K7	HEATER UNDER CURRENT/ UNDER TEMPERATURE

REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
MAIN DC KEY DIAGRAM

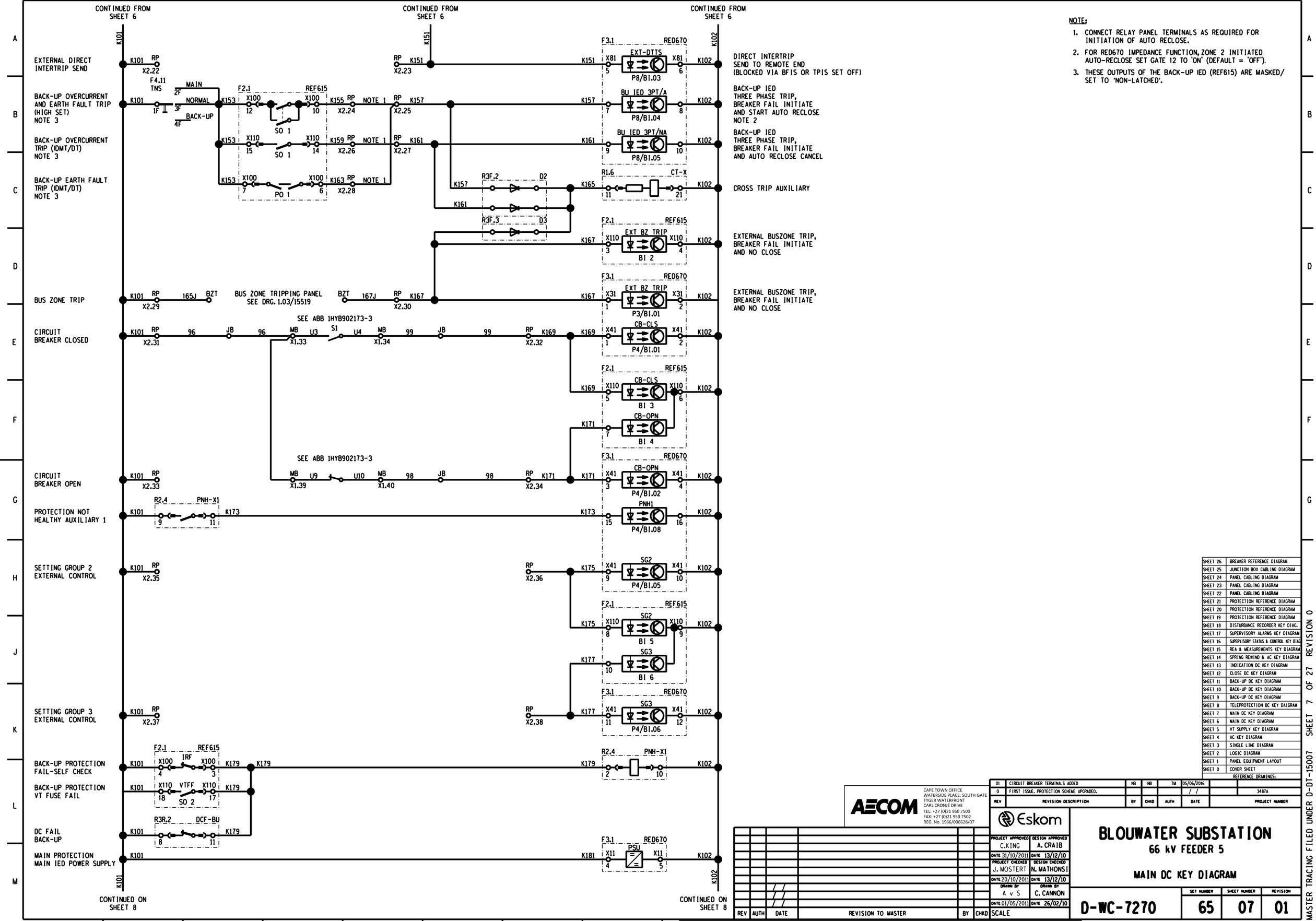
D-WC-7270	SET NUMBER	SHEET NUMBER	REVISION
	65	06	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 6 OF 27 REVISION 0



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'.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/06/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

PROJECT APPROVED	C.KING	DESIGN APPROVED	A. CRAIB
DATE	31/10/2011	DATE	13/12/10
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011	DATE	13/12/10
DRAWN BY	A v S	DRAWN BY	C. CANNON
DATE	01/05/2011	DATE	26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 5
MAIN DC KEY DIAGRAM

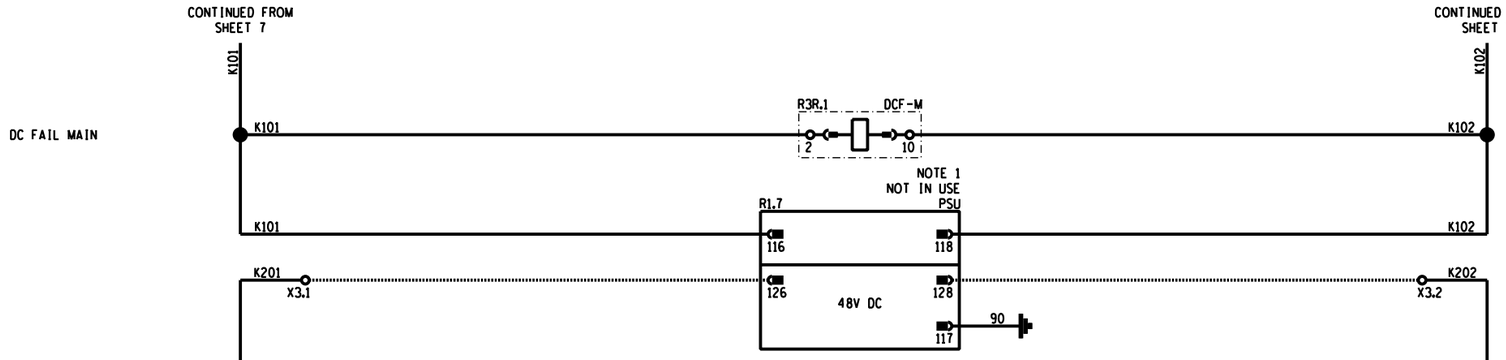
DRG NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	07	01

LEVELS 1 2 10 11 13 14 19 23 24 25 28

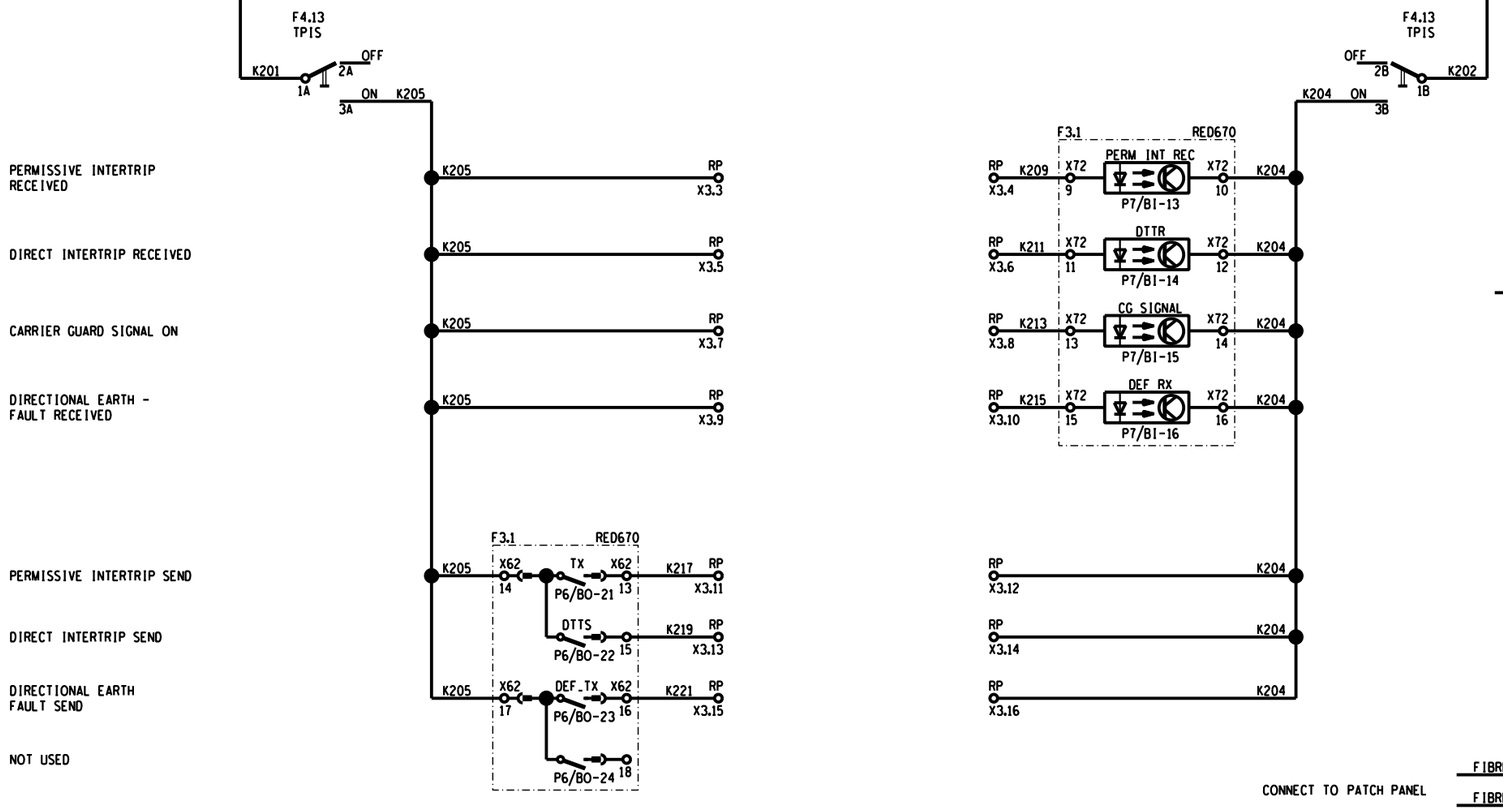
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 7 OF 27 REVISION 0



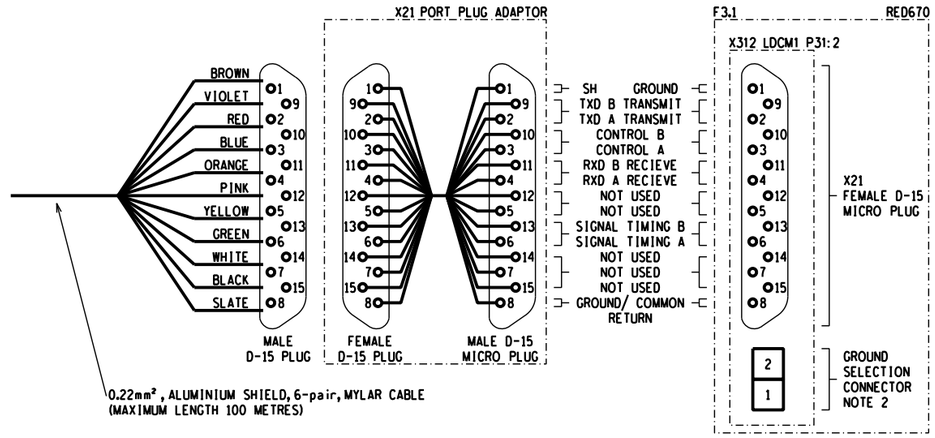
POWER LINE CARRIER OR NSD570 EXTERNAL TELEPROTECTION OR SIMILAR ITEM



NOT IN USE

X21 INTERNAL COMMUNICATION/TELEPROTECTION (OPTIONAL)

NOTE 3



FIBRE INTERNAL COMMUNICATION/TELEPROTECTION AND/ OR DIFFERENTIAL (OPTIONAL)

NOTE 3

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
REFERENCE DRAWINGS:	

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.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	SECOND TELEPROTECTION CARD ADDED	JF	BBH	LMB	31/01/2019	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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 Distribution

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
TELEPROTECTION DC KEY DIAGRAM

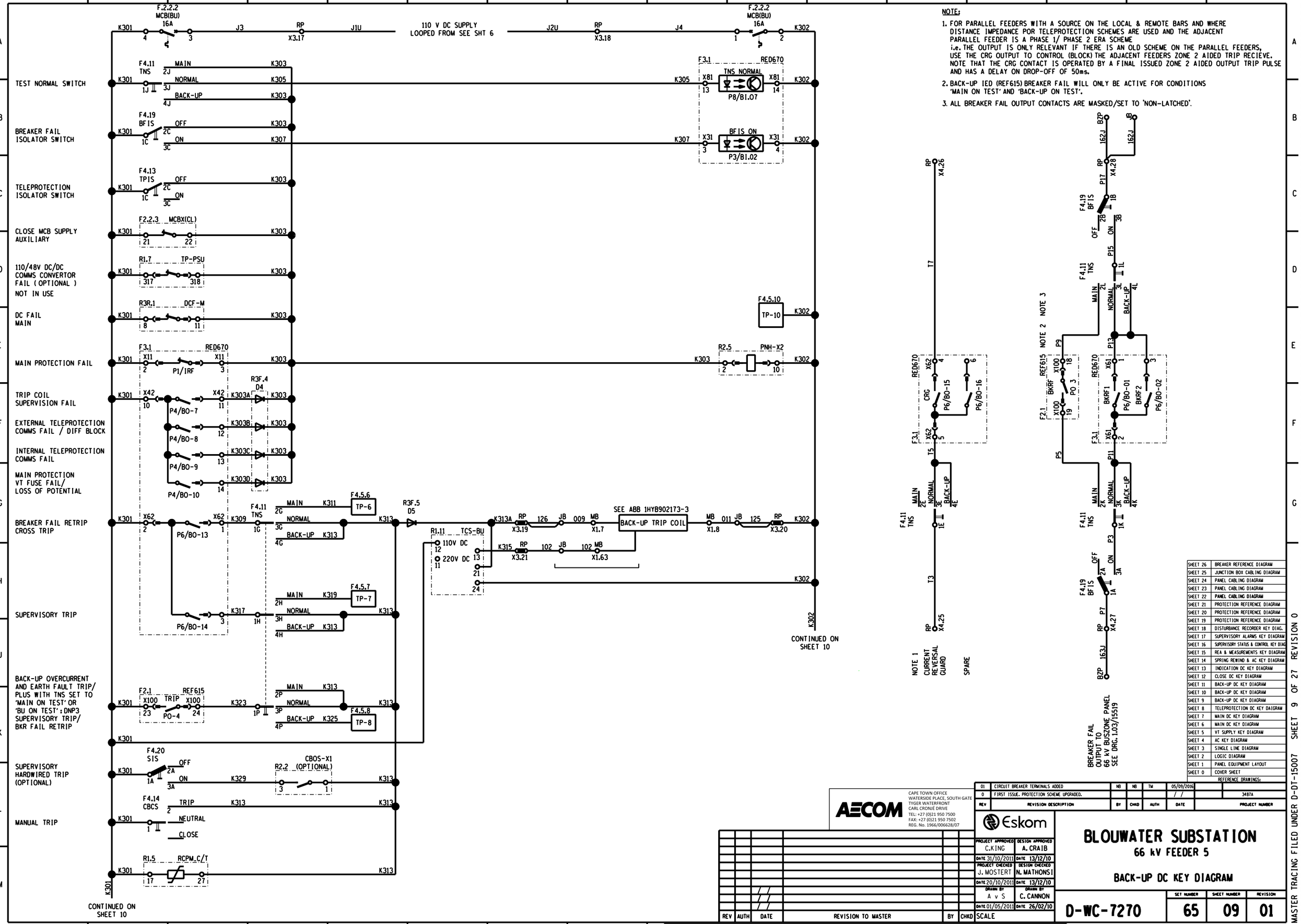
DRG NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	08	01

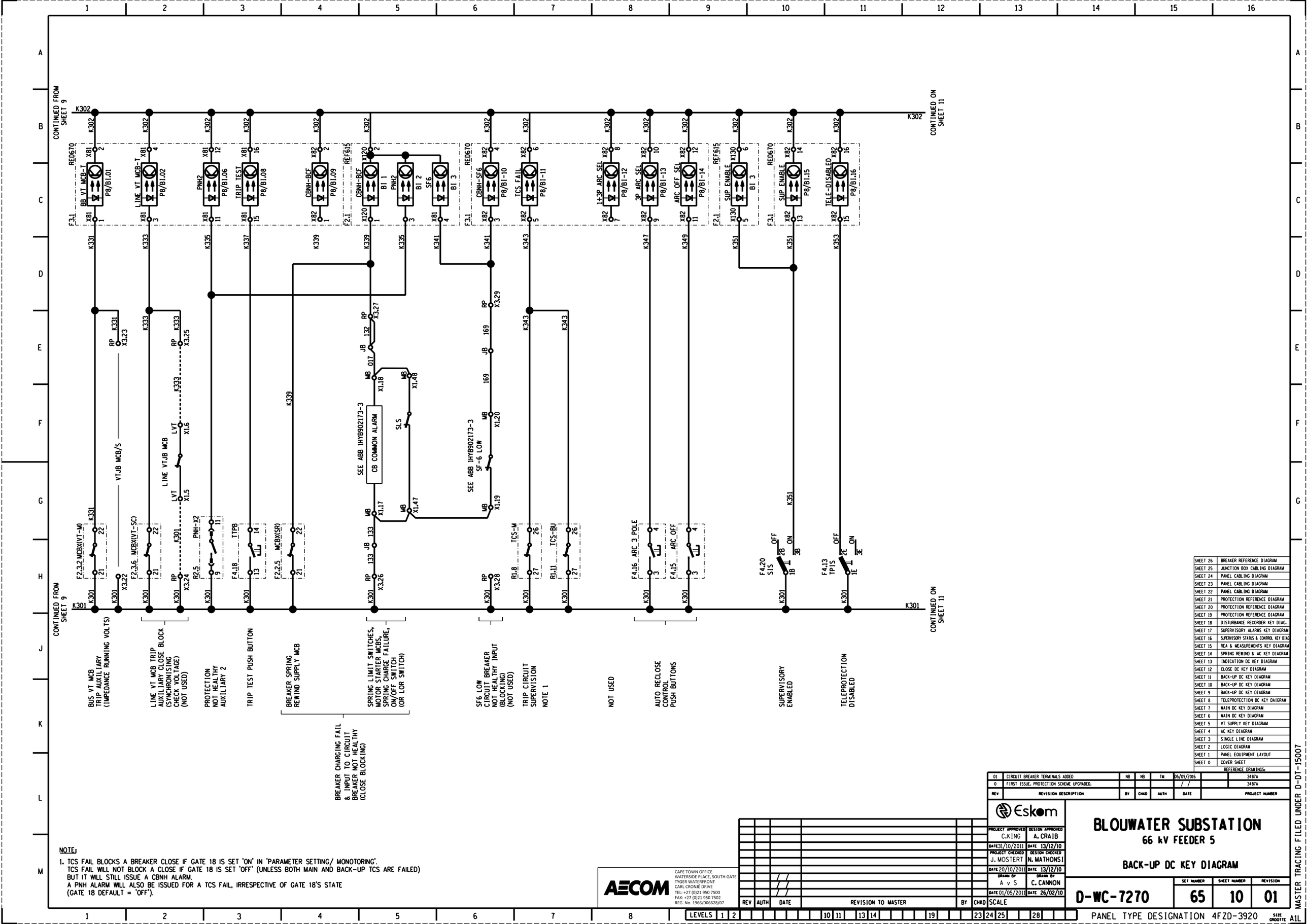
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

LEVELS 1 2 10 11 13 14 19 23 24 25 28

MASTER TRACING FILED UNDER D-DT-15007 SHEET 8 OF 27 REVISION 0


F.2.2.2 MCB(BU) 16A
K301 4 3 J3 RP X3.17 J1U
110 V DC SUPPLY LOOPED FROM SEE SHT 6
J2U RP X3.18 J4
F.2.2.2 MCB(BU) 16A
1 2 K302
TEST NORMAL SWITCH
F4.11 TNS
MAIN 2J K303
NORMAL 3J K305
BACK-UP 4J K303
BREAKER FAIL ISOLATOR SWITCH
F4.19 BFIS
OFF 2C K303
ON 3C K307
TELEPROTECTION ISOLATOR SWITCH
F4.13 TPIS
OFF 2C K303
ON 3C
CLOSE MCB SUPPLY AUXILIARY
F2.2.3 MCBX(CL)
21 22 K303
110/48V DC/DC COMMS CONVERTOR FAIL (OPTIONAL) NOT IN USE
R1.7 TP-PSU
317 318 K303
DC FAIL MAIN
R3R.1 DCF-M
8 11 K303
MAIN PROTECTION FAIL
F3.1 RED670
X11 2 P1/IRF X11 3 K303
TRIP COIL SUPERVISION FAIL
EXTERNAL TELEPROTECTION COMMS FAIL / DIFF BLOCK
INTERNAL TELEPROTECTION COMMS FAIL
MAIN PROTECTION VT FUSE FAIL/ LOSS OF POTENTIAL
X42 10 P4/BO-7 X42 11 K303A
R3F.4 D4
P4/BO-8 12 K303B
P4/BO-9 13 K303C
P4/BO-10 14 K303D
K303
BREAKER FAIL RETRIP CROSS TRIP
X62 2 P6/BO-13 X62 1 K309
F4.11 TNS 1G
MAIN K311 2G
NORMAL 3G
BACK-UP K313 4G
F4.5.6 TP-6
R3F.5 D5
K313
SUPERVISORY TRIP
P6/BO-14 3 K317 1H
MAIN K319 2H
NORMAL 3H
BACK-UP K313 4H
F4.5.7 TP-7
BACK-UP OVERCURRENT AND EARTH FAULT TRIP/ PLUS WITH TNS SET TO 'MAIN ON TEST' OR 'BU ON TEST' : DNP3 SUPERVISORY TRIP/ BKR FAIL RETRIP
F2.1 REF615
X100 23 TRIP PO-4 X100 24 K323 1P
MAIN K313 2P
NORMAL 3P
BACK-UP K325 4P
F4.5.8 TP-8
SUPERVISORY HARDWIRED TRIP (OPTIONAL)
F4.20 SIS
OFF 2A
ON 3A K329
1A
CBOS-X1 (OPTIONAL)
R2.2 3 1
MANUAL TRIP
F4.14 CBCS
TRIP 2 K313
NEUTRAL 1
CLOSE
R1.5 RCPM_C/T
17 27
CONTINUED ON SHEET 10
F3.1 RED670
TNS NORMAL X81 13 14 X81 K302
P8/BI.07
BFIS ON X31 3 4 X31 K302
P3/BI.02
F4.5.10 TP-10 K302
R2.5 PNH-X2 K303 2 10 K302
R1.11 TCS-BU
110V DC 12
220V DC 13
11
21
24
K313A RP X3.19 126 JB 009 MB X1.7
SEE ABB 1HYB902173-3
BACK-UP TRIP COIL
MB X1.8 011 JB 125 RP X3.20 K302
K315 RP X3.21 102 JB 102 MB X1.63
K302
CONTINUED ON SHEET 10
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. BACK-UP IED (REF615) BREAKER FAIL WILL ONLY BE ACTIVE FOR CONDITIONS 'MAIN ON TEST' AND 'BACK-UP ON TEST'.
3. ALL BREAKER FAIL OUTPUT CONTACTS ARE MASKED/SET TO 'NON-LATCHED'.
RP X4.26
T7
RED670 X62 4 CRG P6/BO-15 6 P6/BO-16
F3.1 X62 5
T5
F4.11 TNS MAIN 2E NORMAL 3E BACK-UP 4E
1E
T3
RP X4.25
NOTE 1 CURRENT REVERSAL GUARD
SPARE
B2P 162J RP X4.28 P17 1B
F4.19 BFIS OFF 2B ON 3B
P15 1L
F4.11 TNS MAIN 2L NORMAL 3L BACK-UP 4L
NOTE 2 NOTE 3
P9 P13
REF615 X100 18 BKRF PO 3 19 F2.1 X100
RED670 X61 1 BKRF1 P6/BO-01 3 BKRF2 P6/BO-02
F3.1 X61 2
P5 P11
F4.11 TNS MAIN 2K NORMAL 3K BACK-UP 4K
1K
P3
F4.19 BFIS OFF 2A ON 3A
1A
P7
RP X4.27
B2P 163J
BREAKER FAIL OUTPUT TO 66 kV BUSZONE PANEL SEE DRG. 1.03/19519
SHEET 26 BREAKER REFERENCE DIAGRAM
SHEET 25 JUNCTION BOX CABLING DIAGRAM
SHEET 24 PANEL CABLING DIAGRAM
SHEET 23 PANEL CABLING DIAGRAM
SHEET 22 PANEL CABLING DIAGRAM
SHEET 21 PROTECTION REFERENCE DIAGRAM
SHEET 20 PROTECTION REFERENCE DIAGRAM
SHEET 19 PROTECTION REFERENCE DIAGRAM
SHEET 18 DISTURBANCE RECORDER KEY DIAG.
SHEET 17 SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16 SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15 REA & MEASUREMENTS KEY DIAGRAM
SHEET 14 SPRING REWIND & AC KEY DIAGRAM
SHEET 13 INDICATION DC KEY DIAGRAM
SHEET 12 CLOSE DC KEY DIAGRAM
SHEET 11 BACK-UP DC KEY DIAGRAM
SHEET 10 BACK-UP DC KEY DIAGRAM
SHEET 9 BACK-UP DC KEY DIAGRAM
SHEET 8 TELEPROTECTION DC KEY DIAGRAM
SHEET 7 MAIN DC KEY DIAGRAM
SHEET 6 MAIN DC KEY DIAGRAM
SHEET 5 VT SUPPLY KEY DIAGRAM
SHEET 4 AC KEY DIAGRAM
SHEET 3 SINGLE LINE DIAGRAM
SHEET 2 LOGIC DIAGRAM
SHEET 1 PANEL EQUIPMENT LAYOUT
SHEET 0 COVER SHEET
REFERENCE DRAWINGS:
01 CIRCUIT BREAKER TERMINALS ADDED NB NB TM 05/09/2016
0 FIRST ISSUE. PROTECTION SCHEME UPGRADED. / / 3487A
REV REVISION DESCRIPTION BY CHKD AUTH DATE PROJECT NUMBER
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 C.KING DESIGN APPROVED A. CRAIB
DATE 31/10/2011 DATE 13/12/10
PROJECT CHECKED J. MOSTERT DESIGN CHECKED N. MATHONSI
DATE 20/10/2011 DATE 13/12/10
DRAWN BY A v S DRAWN BY C. CANNON
DATE 01/05/2011 DATE 26/02/10
REV AUTH DATE REVISION TO MASTER BY CHKD SCALE
BLOUWATER SUBSTATION
66 kV FEEDER 5
BACK-UP DC KEY DIAGRAM
D-WC-7270
SET NUMBER 65
SHEET NUMBER 09
REVISION 01
LEVELS 1 2 10 11 13 14 19 23 24 25 28
PANEL TYPE DESIGNATION 4FZD-3920
SIZE GROOVTE A1L
MASTER TRACING FILED UNDER D-DT-15007 SHEET 9 OF 27 REVISION 0



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REFERENCE DRAWINGS:

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').

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	3487A
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
BACK-UP DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	10	01

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007

CONTINUED FROM SHEET 10

CONTINUED FROM SHEET 10

NOTE:
1. A PERMANENT INPUT IS REQUIRED TO BLOCK AN EXTERNAL CLOSE.
2. THIS BYPASS LOGIC IS USED FOR BOTH THE SUPERVISORY DNP3 STATUS AND THE HMI DISPLAY.

TEST NORMAL SWITCH 'MAIN ON TEST'

TEST NORMAL SWITCH 'ON NORMAL'

BACK-UP PROTECTION EXT BZ TRIP/ CROSSTRIP

EXTERNAL TRIP AND AUTO RECLOSE (NOT USED)

EXTERNAL TRIP AND NO AUTO RECLOSE

CUSTOMER BLOCK CLOSE (NOT USED)

CUSTOMER BLOCK CLOSE (WITH MAIN ON TEST AND LINK A CLOSED)

FEEDER BYPASS SELECTED TO ON

FEEDER BYPASS SELECTED TO OFF

NOTE:
THIS CAN BE CONNECTED IF THERE IS A SPARE CONTACT AVAILABLE ON THE MCB

CB HEATER AND AUXILIARY CIRCUITS (CB NOT HEALTHY, NON-BLOCKING)

SEE ABB 1HYB902173-3

IEC61850 SWITCH FAIL

MEASUREMENTS TRANSDUCER FAIL

TRANSDUCER POWER SUPPLY

BACK-UP VT MCB TRIP AUXILIARY

INPUT FOR TRIP COUNTER SHIFT REGISTER AND RECORDER, DNP3 INDICATIONS

NOTE 1

NOTE 1

NOTE 2

NOTE 2

CONTINUED ON SHEET 12

CONTINUED ON SHEET 12

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	5/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

PROJECT APPROVED	DESIGN APPROVED
C. KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 5
BACK-UP DC KEY DIAGRAM

DRAWING NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	11	01

PANEL TYPE DESIGNATION 4FZD-3920

MASTER TRACING FILED UNDER D-DT-15007 SHEET 11 OF 27 REVISION 0

CONTINUED FROM SHEET 11

CONTINUED FROM SHEET 11

BUSBAR 1 ISOLATOR VOLTAGE SELECTION (OPTIONAL) (NOT USED)

BUSBAR 2 ISOLATOR VOLTAGE SELECTION (OPTIONAL) (NOT USED)

MAIN CT SHORTING RELAY ON BYPASS (OPTIONAL) (NOT USED)

BACK-UP CT SHORTING RELAY ON BYPASS (OPTIONAL) (NOT USED)

MAIN CT SHORTING RELAY OFF BYPASS (OPTIONAL) (NOT USED)

BACK-UP CT SHORTING RELAY OFF BYPASS (OPTIONAL) (NOT USED)

SF6 GAS MONITORING SUPPLY (NOT USED)

SEE ABB 1HYB902173-3 SF6 MONITOR

SEE ABB 1HYB902173-3 SPRING LIMIT SWITCH CIRCUIT

SPRING LIMIT SWITCH MULTIPLYING CONTACTS SUPPLY (NOT USED)

EXTERNAL CLOSE INPUT

SUPPLY FOR OPTIONAL REMOTE ENGINEERING ACCESS CONTINUED ON SHT 15 NOTE 2

SUPPLY FOR OPTIONAL EXT DISTURBANCE RECORDER CONTINUED ON SHT 18 NOTE 2

SUPPLY FOR DNP3 SUPERVISORY STATUS CONTINUED ON SHEET 16

BACK-UP PROTECTION DC SUPPLY

F2.1 REF615

F2.2.4 MCB(CL) 10A

F4.5.9 TP-9

CLOSE FROM AUTO RECLOSE FUNCTION OR EXTERNAL CLOSE INPUT OR INTERNAL SUPERVISORY DNP3 CLOSE

F3.1 RED670 P4/BO.06

R1.8 TCS-M

R1.11 TCS-BU

R2F.1 CBC-CR

CLOSE ON MAIN ON TEST WITH NO SYNCH CHECK

F4.11 TNS MAIN NORMAL BACK-UP

F4.14 CBCS TRIP NEUTRAL CLOSE

EXTERNAL HARDWIRED SUPERVISORY CLOSE (OPTIONAL)

F4.20 SIS OFF ON

R2.3 (OPTIONAL) CBCS-X1

F3.1 RED670 EXT CLOSE P3/BI-14

F2.1 REF615 BKR CLOSE BI 1

BACK-UP IED CLOSE FROM EXTERNAL CLOSE INPUT OR INTERNAL SUPERVISORY DNP3 CLOSE

SNUBBER CIRCUIT

R1.5 RCPM C/T

SEE ABB 1HYB902173-3 CLOSE COIL

CLOSE FROM AUTO RECLOSE FUNCTION OR EXTERNAL CLOSE INPUT

R2F.1 CBC-CR

CONTINUED ON SHEET 13

CONTINUED ON SHEET 13

NOTE 1 (OPTIONAL) VSR-1

NOTE 1 (OPTIONAL) VSR-2

R3R.3 (OPTIONAL) MCTS

R3R.4 (OPTIONAL) BCTS

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.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

PROJECT APPROVED	C.KING
DESIGN APPROVED	A. CRAIB
DATE	31/10/2011
DATE	13/12/10
PROJECT CHECKED	J. MOSTERT
DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011
DATE	13/12/10
DRAWN BY	A v S
DRAWN BY	C. CANNON
DATE	01/05/2011
DATE	26/02/10
SCALE	

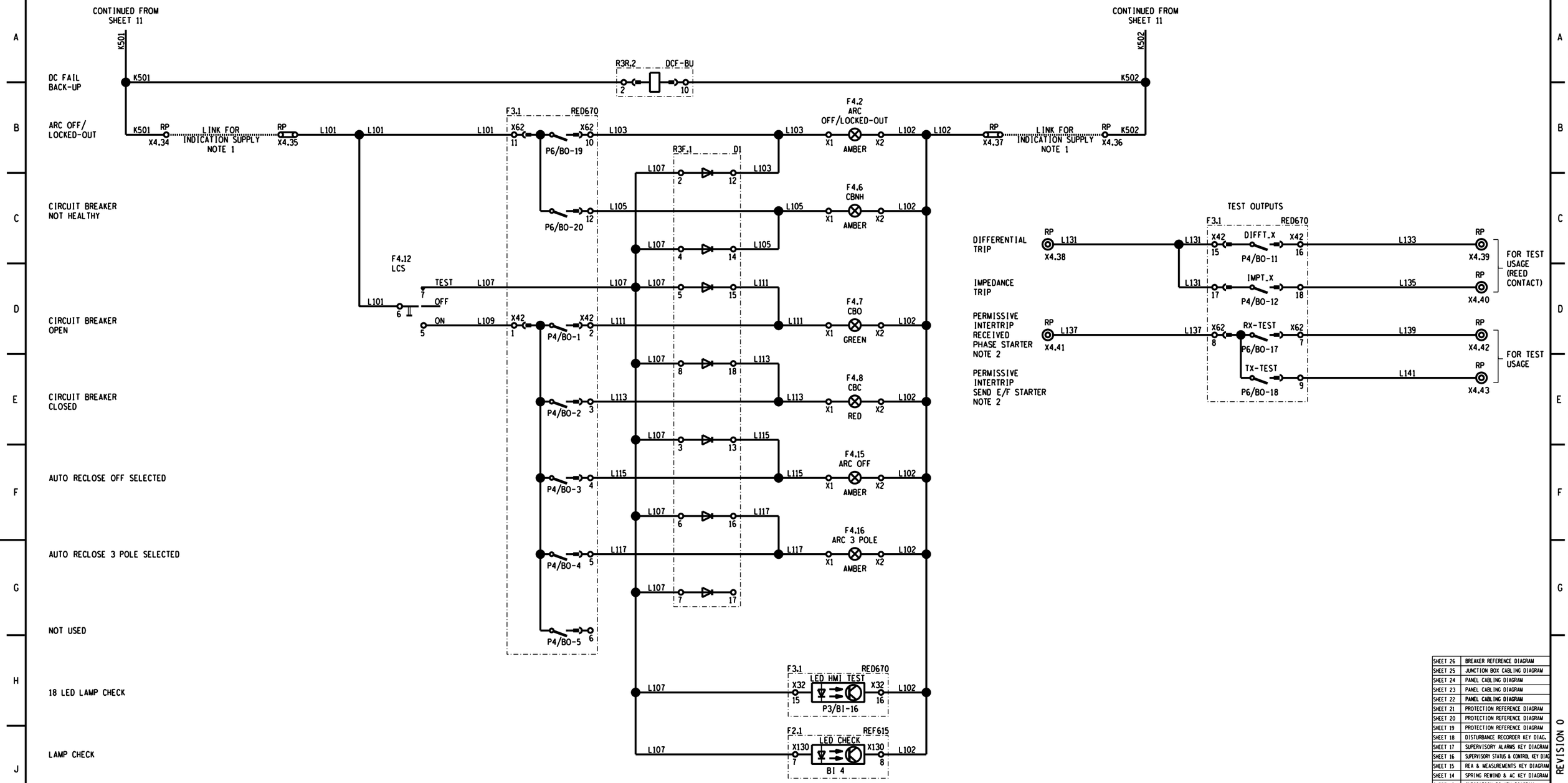
BLOUWATER SUBSTATION
66 kV FEEDER 5
CLOSE DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	12	01

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 12 OF 27 REVISION 0



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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).

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
INDICATION DC KEY DIAGRAM

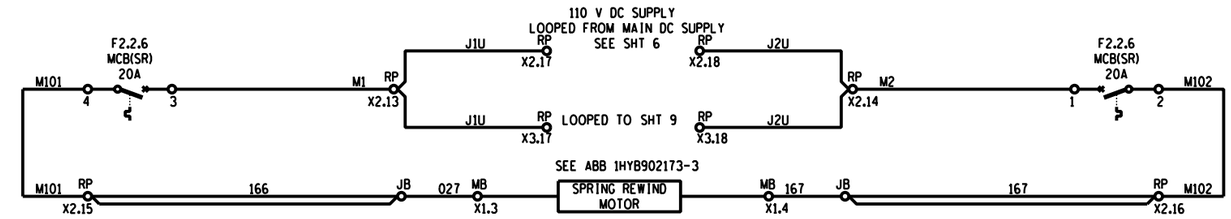
DRG NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	13	00

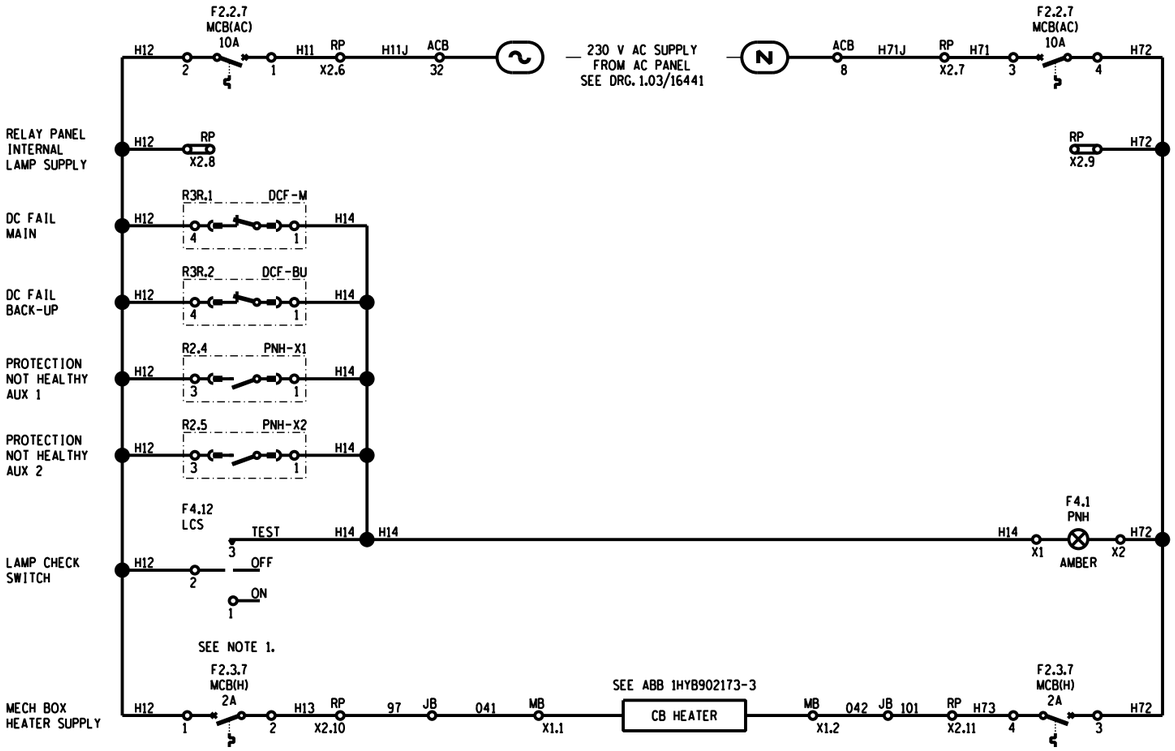
PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 1 2 10 11 13 14 19 23 24 25 28

SIZE GROOTTE A1L

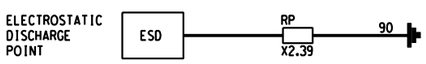
MASTER TRACING FILED UNDER D-DT-15007 SHEET 13 OF 27 REVISION 0





NOTE 1.
THE FOLLOWING NOTE TO BE PLACED ABOVE BOTH MCB'S

HEATER CIRCUIT HAS 2 MCB'S IN SERIES
ONE IN JB AND ONE IN FEEDER PANEL



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom

PROJECT APPROVED	C.KING
DESIGN APPROVED	A. CRAIB
DATE	31/10/2011
DATE	13/12/10
PROJECT CHECKED	J. MOSTERT
DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011
DATE	13/12/10
DRAWN BY	A v S
DRAWN BY	C. CANNON
DATE	01/05/2011
DATE	26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
SPRING REWIND AND AC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	14	01

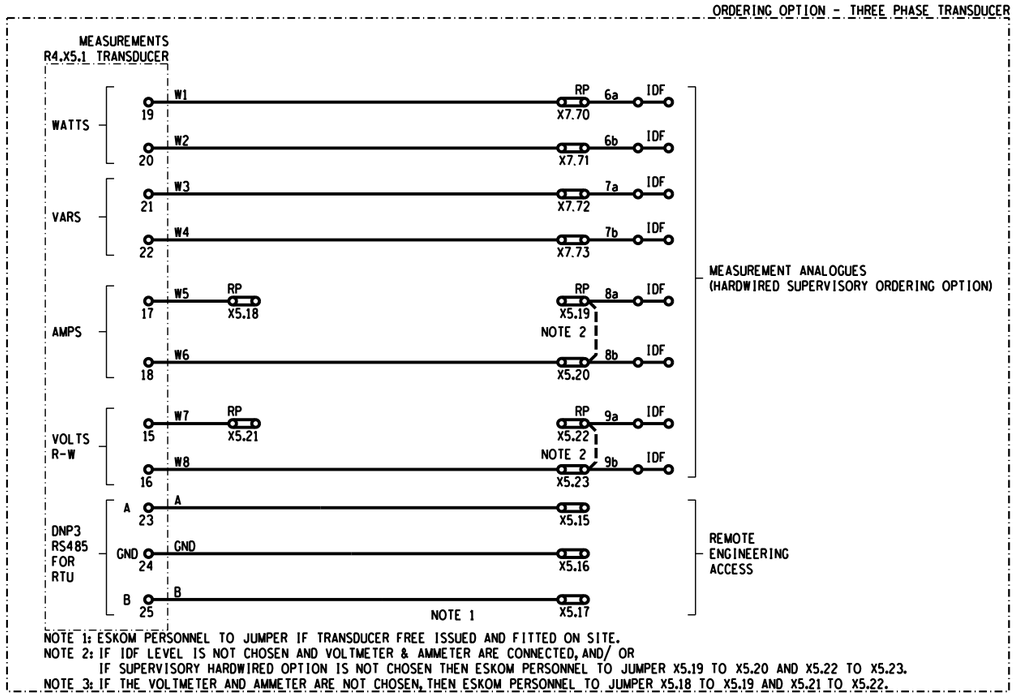
LEVELS 1 2 10 11 13 14 19 23 24 25 28

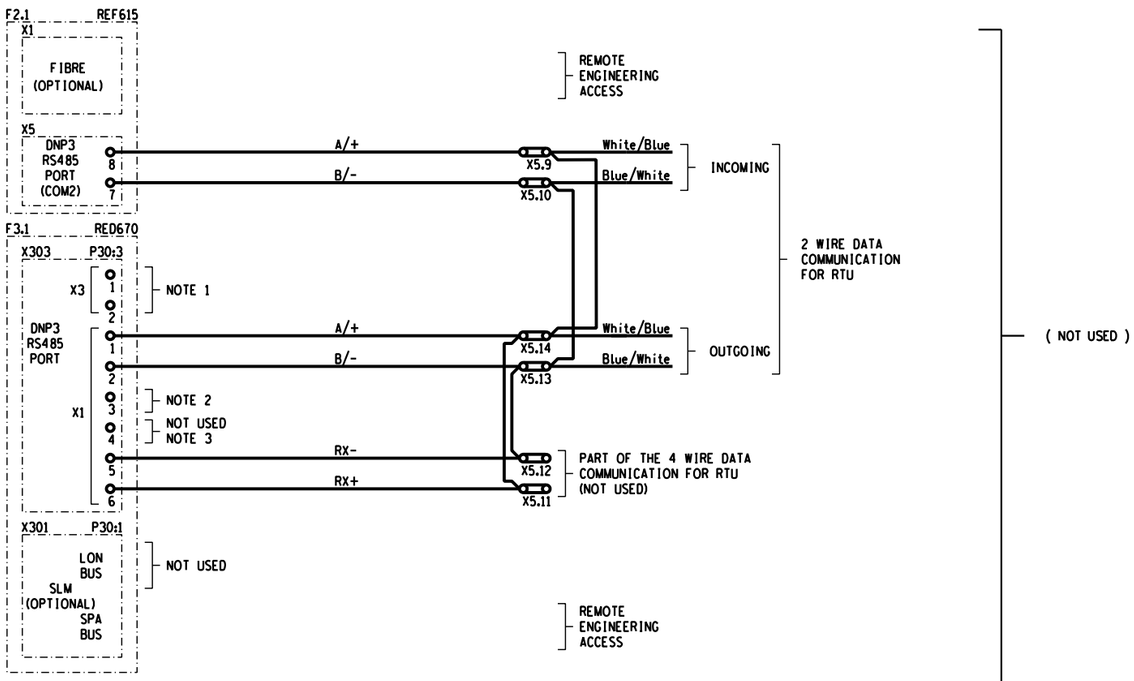
PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 14 OF 27 REVISION 0

MEASUREMENTS AND REA

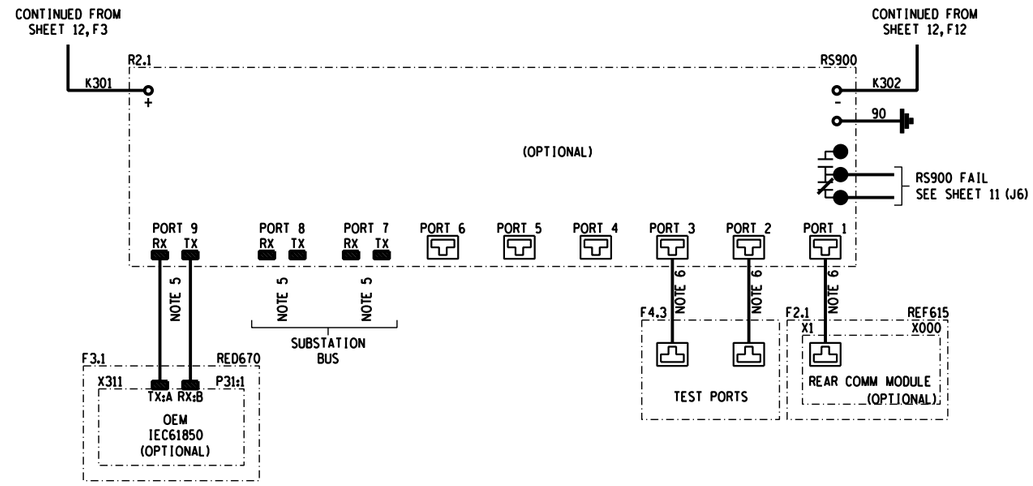




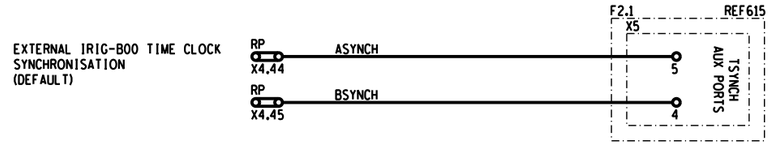
NOTE:

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 RECIEVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
3. TERMINATION RESISTOR FOR RECIEVER 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

REMOTE ENGINEERING ACCESS IEC61850 (OPTIONAL)



TIME SYNCHRONISATION NOTE 4



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5

REA AND MEASUREMENTS KEY DIAG

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	15	00

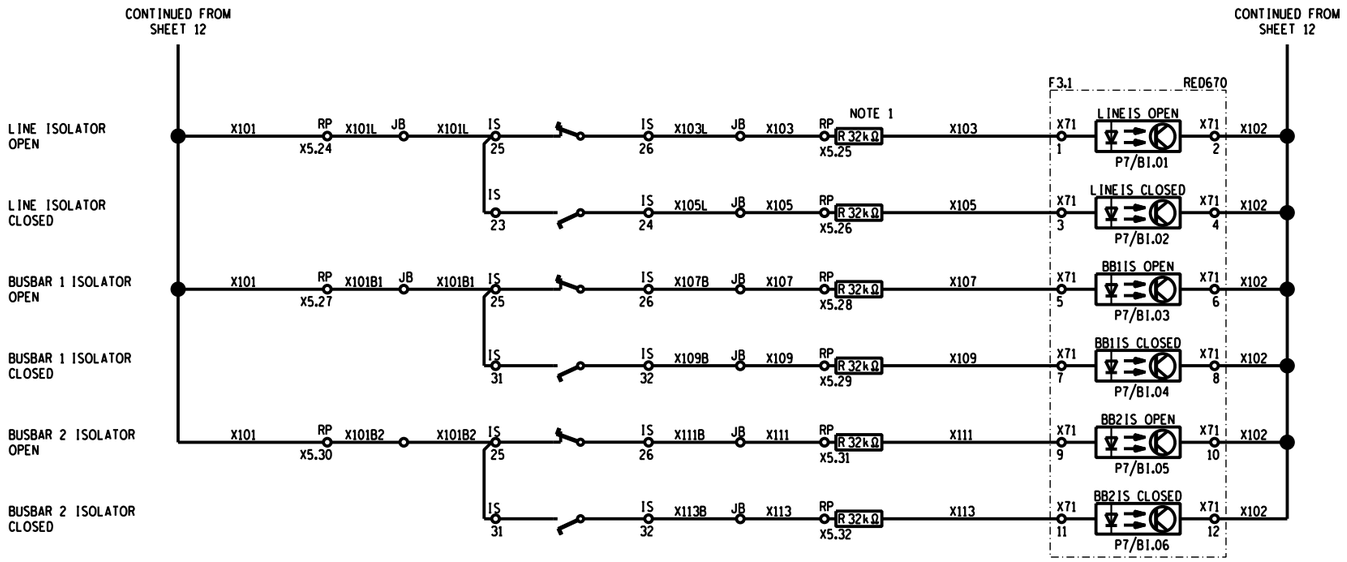
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

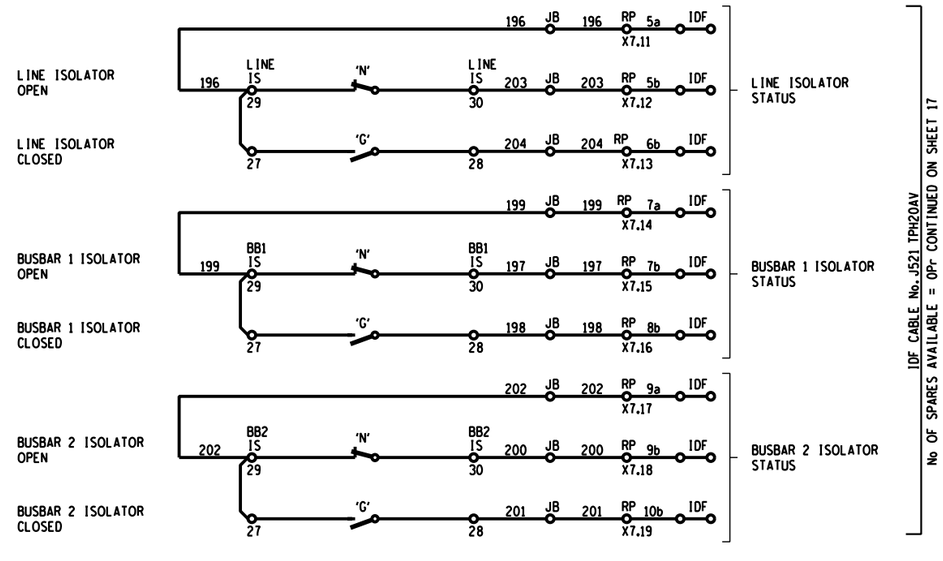
LEVELS 1 2 10 11 13 14 19 23 24 25 28

MASTER TRACING FILED UNDER D-DT-15007 SHEET 15 OF 27 REVISION 0

SUPERVISORY STATUS 48V DC (DNP3 OPTIONAL & HMI DISPLAY)

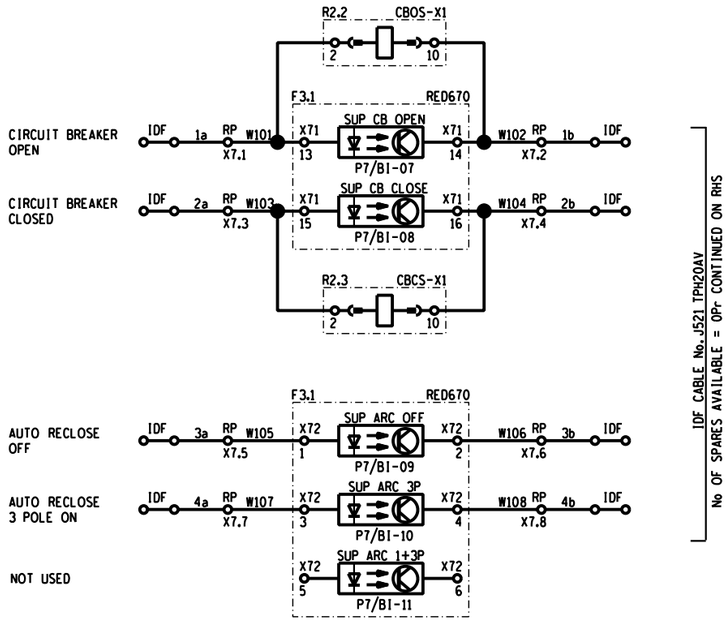


SUPERVISORY STATUS (HARDWIRED OPTIONAL)

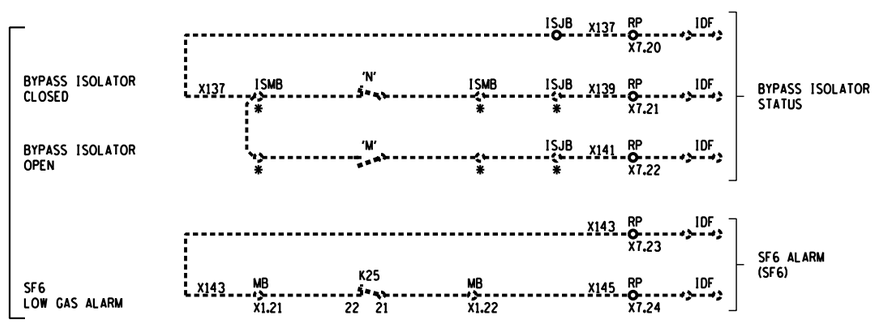


NOTE: LEAD NUMBERS 196, 199 & 202 WAS 193.
RE-FERRULE AS SHOWN.

SUPERVISORY CONTROLS 48V DC (HARDWIRED OPTIONAL)



NOTE:
1. FOR 220V DC SUPPLY, RESISTOR = 64kΩ



SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

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

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
			SCALE		

PROJECT APPROVED	C.KING
DATE	31/10/2011
PROJECT CHECKED	J. MOSTERT
DATE	20/10/2011
DRAWN BY	A v S
DATE	01/05/2011
DESIGN APPROVED	A. CRAIB
DATE	13/12/10
DESIGN CHECKED	N. MATHONSI
DATE	13/12/10
DRAWN BY	C. CANNON
DATE	26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 5
SUPERVIS. STATUS & CONTROL KEY

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	16	01

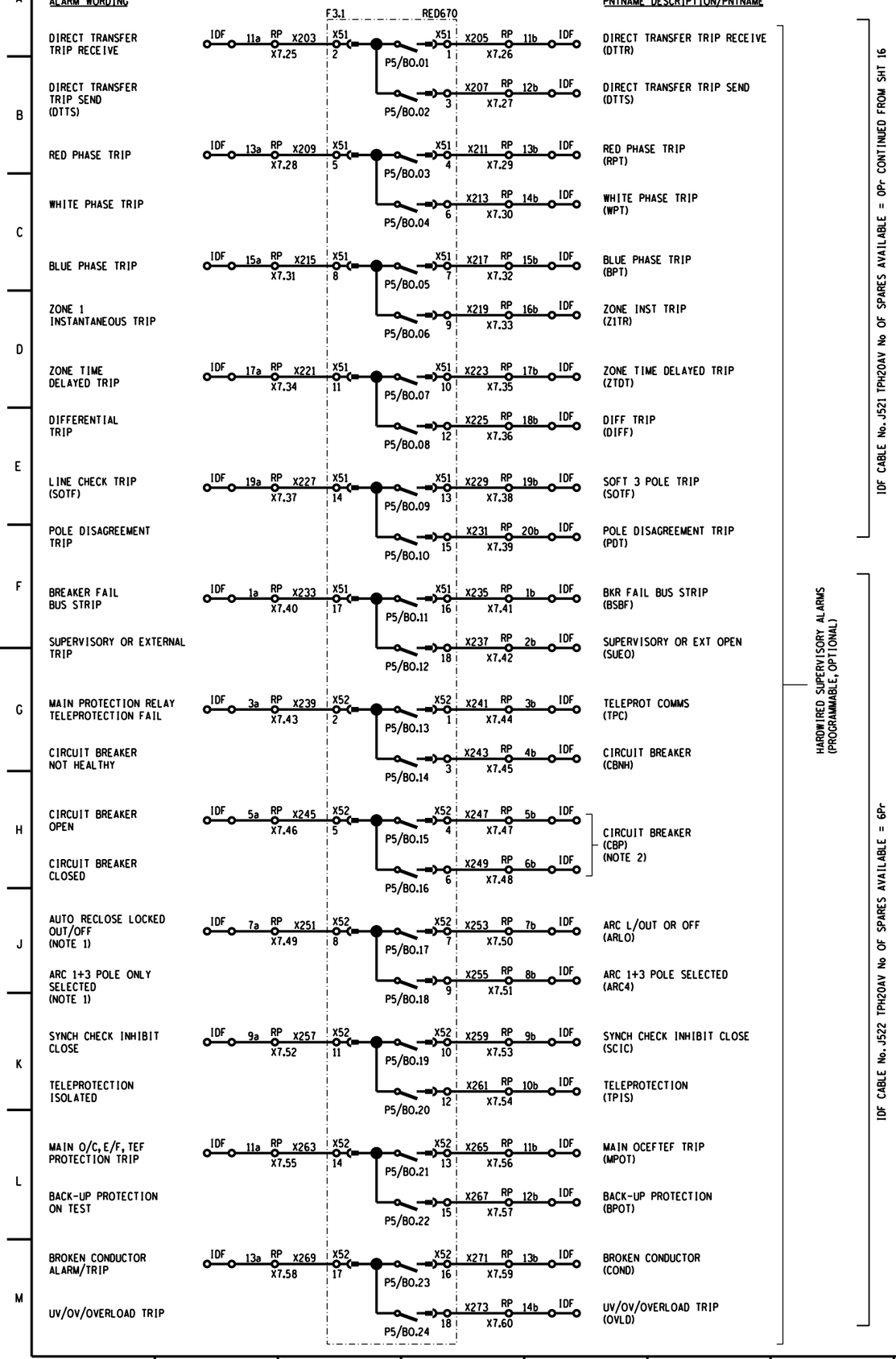
PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 2 10 11 13 14 23 24 28

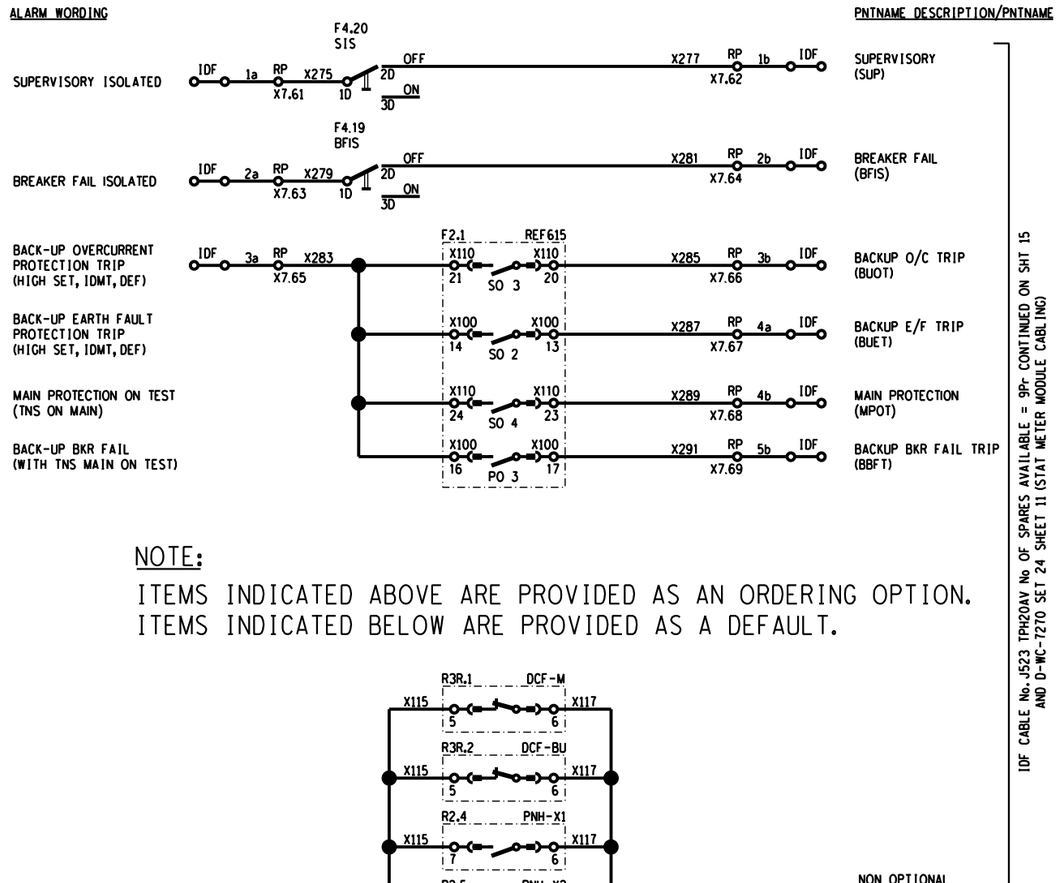
SIZE GROOVE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 16 OF 27 REVISION 0

HARDWIRED SUPERVISORY ALARMS (OPTIONAL)



HARDWIRED SUPERVISORY ALARMS (OPTIONAL)



NOTE:

ITEMS INDICATED ABOVE ARE PROVIDED AS AN ORDERING OPTION.
ITEMS INDICATED BELOW ARE PROVIDED AS A DEFAULT.

NOTE:

1. A SAVING OF ONE ALARM POINT (ARC 3 POLE ONLY SELECTED) IS OBTAINED BY USING DOUBLE BIT INDICATION ON TWO ARC ALARMS.

   WITH DOUBLE BIT INDICATION, THE CONTROL POSITIONS GIVE THE FOLLOWING STATES:

ARC 1+3 P ONLY SELECTED	ARC LOCKED OUT/OFF	STATE NAME	PNTNAME DESC.	PNTNAME
0	0	3PSEL	AUTORECLOSE	ARCP
0	1	OFF/L OUT	AUTORECLOSE	ARCP
1	0	1+3P SEL	AUTORECLOSE	ARCP
1	1	L/OUT	AUTORECLOSE	ARCP

2. DOUBLE BIT INDICATION SHOULD BE USED.

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom Distribution

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
SUPERVISORY ALARMS KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	17	00

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GRODTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 17 OF 27 REVISION 0

DISTURBANCE RECORDER/ ADDITIONAL SUPERVISORY ALARMS (OPTIONAL)

NOTE 2

IDF 1aa

IDF 3aa

IDF 5aa

IDF 7aa

IDF 9aa

NOTE 2

1bb IDF

2bb IDF

3bb IDF

4bb IDF

5bb IDF

6bb IDF

7bb IDF

8bb IDF

9bb IDF

10bb IDF

NOT USED

2. SUFFIX ADDED TO DISTINGUISH FROM 50 PAIR CABLE.

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			
		/ /			
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
DISTURBANCE RECORDER KEY DIAG

D-WC-7270	SET NUMBER	SHEET NUMBER	REVISION
	65	18	00

PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 1 2 10 11 13 14 19 23 24 25 28

SIZE GROOVE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 18 OF 27 REVISION 0

X11 P1

POWER SUPPLY	PSU (X11 4 – X11 5)	SHT 7
READY	P1/IRF (2 – 1)	NOT USED
FAIL	P1/IRF (2 – 3)	SHT 9

X401 P40 — RED670

RED PHASE CURRENT	A101 R (X401 1 – X401 2)	SHT 4
WHITE PHASE CURRENT	A102 W (3 – 4)	SHT 4
BLUE PHASE CURRENT	A103 B (5 – 6)	SHT 4
NEUTRAL CURRENT	A104 N (8 – 7)	SHT 4
MUTUAL IMP COMPENSATION	A106 N (X401 12 – X401 11)	SHT 4
SYNCH CHECK VOLTAGE (VT)	A110 (19 – 20)	SHT 5
DIR E/F FUNCTION	A111 (21 – 22)	SHT 5
RED PHASE VOLTAGE	A107 R (13 – 14)	SHT 5
WHITE PHASE VOLTAGE	A108 W (15 – 16)	SHT 5
BLUE PHASE VOLTAGE	A109 B (17 – 18)	SHT 5

X71 P7 (48V DC) — RED670

LINE ISOLATOR OPEN	LINE1-OPEN (X71 1 – X71 2) IO1/BI-01	SHT 16
LINE ISOLATOR CLOSED	LINE1-CLOSED (3 – 4) IO1/BI-02	SHT 16
BB1 ISOLATOR OPEN	BB11-OPEN (5 – 6) IO1/BI-03	SHT 16
BB1 ISOLATOR CLOSED	BB11-CLOSED (7 – 8) IO1/BI-04	SHT 16
BB2 ISOLATOR OPEN	BB21-OPEN (9 – 10) IO1/BI-05	SHT 16
BB2 ISOLATOR CLOSED	BB21-CLOSED (11 – 12) IO1/BI-06	SHT 16
SUPERVISORY CIRCUIT BKR OPEN	CB-OPEN (13 – 14) IO1/BI-07	SHT 16
SUPERVISORY CIRCUIT BKR CLOSED	CB-CLOSE (15 – 16) IO1/BI-08	SHT 16

X81 P8 — RED670

BUS VT MCB TRIP	BB VT MCB-T (X81 1 – X81 2) P8/BI.01	SHT 10
LINE VT MCB TRIP	LINE VT MCB-T (3 – 4) P8/BI.02	SHT 10
DTTS	EXT-DTTS (5 – 6) P8/BI.03	SHT 7
BF INITIATE ARC1, 3PT	3PT/BF1/ARC (7 – 8) P8/BI.04	SHT 7
BF INITIATE 3PT NARC	3PT/BF1/NARC (9 – 10) P8/BI.05	SHT 7
PROTECTION NOT HEALTHY AUXILIARY 2	PNH2 (11 – 12) P8/BI.06	SHT 10
TNS NORMAL	TNS-N (13 – 14) P8/BI.07	SHT 9
TRIP TEST	TRIP TEST (15 – 16) P8/BI.08	SHT 10

X72 P7 (48V DC) — RED670

SUPERVISORY ARC OFF	ARC-OFF (1 – 2) P7/BI-09	SHT 16
SUPERVISORY ARC 3P	3P ARC-ON (3 – 4) P7/BI-10	SHT 16
SUPERVISORY ARC 1+3P	1+3P ARC ON (5 – 6) P7/BI-11	NOT USED
REMOTE FEEDER ON BYPASS	RX REMOTE 3P ARC SELECT (7 – 8) P7/BI-12	NOT USED
RX	RX (9 – 10) P7/BI-13	SHT 8
DTTR	DTTR (11 – 12) P7/BI-14	SHT 8
CARRIER GUARD SIGNAL ON	CGS (13 – 14) P7/BI-15	SHT 8
DIR E/F RECIEVED	DEF_RX (15 – 16) P7/BI-16	SHT 8

X82 P8 — RED670

BREAKER CHARGING FAIL	CBNH-BCF (X82 1 – X82 2) P8/BI.09	SHT 10
TCS FAIL	CBNH-SF6 (3 – 4) P8/BI.10	SHT 10
EXTERNAL CLOSE INPUT	TCS-FAIL (5 – 6) P8/BI.11	SHT 10
1+3 POLE ARC	1+3 POLE ARC (7 – 8) P8/BI.12	NOT USED
3 POLE ARC	3 POLE ARC (9 – 10) P8/BI.13	SHT 10
ARC OFF	ARC OFF (11 – 12) P8/BI.14	SHT 10
SUPERVISORY ENABLED	SUP ENABLE (13 – 14) P8/BI.15	SHT 10
TELEPROTECTION DISABLED	TELE-DISABLED (15 – 16) P8/BI.16	SHT 10

X61 P6 — RED670

BUS STRIP OUTPUT EXT	BKRF1 (X61 2 – X61 1) P6/BO-01	SHT 9
BUS STRIP OUTPUT EXT	BKRF2 (3) P6/BO-02	SHT 9
FEEDER ON BYPASS TX TELE	TX REMOTE 3P ARC SELECT (5 – 4) P6/BO-03	NOT USED
SPARE	(6) P6/BO-04	NOT USED
RED PHASE TRIP	(8 – 7) P6/BO-05	SHT 6
RED PHASE TRIP	(9) P6/BO-06	SHT 6
WHITE PHASE TRIP	(11 – 10) P6/BO-07	SHT 6
WHITE PHASE TRIP	(12) P6/BO-08	SHT 6
MAIN BLUE PHASE TRIP	(14 – 13) P6/BO-09	SHT 6
BLUE PHASE TRIP	(15) P6/BO-10	SHT 6
BKR FAIL BUS STRIP/ DTTS	(17 – 16) P6/BO-11	SHT 6
BLOCK BU E/F PROTECTION	(18) P6/BO-12	NOT USED

X62 P6 — RED670

BKR FAIL RETRIP/ CROSSTRIP	(X62 2 – X62 1) P6/BO-13	SHT 9
SUPERVISORY TRIP	(3) P6/BO-14	SHT 9
CRG	CRG (5 – 4) P6/BO-15	SHT 9
SPARE	(6) P6/BO-16	NOT USED
PERMISSIVE INTERTRIP RECIEVED	RX-TEST (8 – 7) P6/BO-17	SHT 13
PERMISSIVE INTERTRIP SEND	TX-TEST (9) P6/BO-18	SHT 13
ARC OFF/LO	CRG (11 – 10) P6/BO-19	SHT 13
CBNH	(12) P6/BO-20	SHT 13
TX	TX (14 – 13) P6/BO-21	SHT 8
DTTS	DTTS (15) P6/BO-22	SHT 8
DIR E/F SEND	DEF_TX (17 – 16) P6/BO-23	SHT 8
SPARE	(18) P6/BO-24	NOT USED

X51 P5 — RED670

DTTR	P5/BO.01 (X51 2 – X51 1)	SHT 17
DTTS	P5/BO.02 (3)	SHT 17
RED PHASE TRIP	P5/BO.03 (5 – 4)	SHT 17
WHITE PHASE TRIP	P5/BO.04 (6)	SHT 17
BLUE PHASE TRIP	P5/BO.05 (8 – 7)	SHT 17
ZONE INST TRIP	P5/BO.06 (9)	SHT 17
ZONE TIME DELAYED TRIP	P5/BO.07 (11 – 10)	SHT 17
DIFF TRIP	P5/BO.08 (12)	SHT 17
LINE CHECK TRIP	P5/BO.09 (14 – 13)	SHT 17
POLE DISAGREEMENT TRIP	P5/BO.10 (15)	SHT 17
BREAKER FAIL BUS STRIP	P5/BO.11 (17 – 16)	SHT 17
SUP/EXT. TRIP	P5/BO.12 (18)	SHT 17

X52 P5 — RED670

MAIN PROT RELAY TELEPROT FAIL	01/BO-13 (X52 2 – X52 1)	SHT 17
CIRCUIT BREAKER NOT HEALTHY	01/BO-14 (3)	SHT 17
CIRCUIT BREAKER OPEN	01/BO-15 (5 – 4)	SHT 17
CIRCUIT BREAKER CLOSED	01/BO-16 (6)	SHT 17
ARC LO/OFF	01/BO-17 (8 – 7)	SHT 17
1 AND 3 POLE ONLY	01/BO-18 (9)	SHT 17
SYNCH CHECK INHIBIT CLOSE	01/BO-19 (11 – 10)	SHT 17
TELEPROTECTION ISOLATED	01/BO-20 (12)	SHT 17
MAIN O/C,E/F,TEF PROTECTION TRIP	01/BO-21 (14 – 13)	SHT 17
BACK-UP PROTECTION ON TEST	01/BO-22 (15)	SHT 17
BROKEN COND	01/BO-23 (17 – 16)	SHT 17
UV/OV/OVERLOAD	01/BO-24 (18)	SHT 17

X41 P4 — RED670

BREAKER POLES CLOSED/PD	CB-CLS (X41 1 – X41 2) P4/BI.01	SHT 7
BREAKER POLES OPEN/PD	CB-OPN (3 – 4) P4/BI.02	SHT 7
SPARE	(5 – 6) P4/BI.03	SPARE
SPARE	(7 – 8) P4/BI.04	SPARE
SETTING G2 EXT CONTROL	SG2 (9 – 10) P4/BI.05	SHT 7
SETTING G3 EXT CONTROL	SG3 (11 – 12) P4/BI.06	SHT 7
SPARE	(13 – 14) P4/BI.07	SPARE
PROTECTION NOT HEALTHY AUXILIARY 1	PNH1 (15 – 16) P4/BI.08	SHT 7

X42 P4 — RED670

IND CIRCUIT BREAKER OPEN	P4/BO-1 (1 – 2)	SHT 13
IND CIRCUIT BREAKER CLOSED	P4/BO-2 (3)	SHT 13
IND ARC OFF	P4/BO-3 (4)	SHT 13
IND ARC 3 POLE	P4/BO-4 (5)	SHT 13
IND ARC 1+3 POLE	P4/BO-5 (6)	NOT USED
BKR CLOSE PULSE	P4/BO-6 (7 – 9)	SHT 12
TCS FAIL	P4/BO-7 (10 – 11)	SHT 9
EXTERNAL COMMS FAIL	P4/BO-8 (12)	SHT 9
INTERNAL COMMS FAIL	P4/BO-9 (13)	SHT 9
MAIN PROT VT FUSE FAIL	P4/BO-10 (14)	SHT 9
DIFFERENTIAL TRIP	DIFFT_X (15 – 16) P4/BO-11	SHT 13
IMPEDANCE TRIP	IMPT_X (17 – 18) P4/BO-12	SHT 13

X31 P3 — RED670

BUSZONE TRIP	EXT BZ TRIP (X31 1 – X31 2) P3/BI.01	SHT 7
BKR FAIL ISOLATOR ON	BFIS-ON (3 – 4) P3/BI.02	SHT 9
TNS MAIN ON TEST	TNS-M (5 – 6) P3/BI.03	SHT 11
EXT TRIP SWITCH/ SUP	CBCS-T (7 – 8) P3/BI.04	SHT 11
BACK-UP PROT/ BZ TRIP/ CROSSTRIP	CROSSTRIP (9 – 10) P3/BI.05	SHT 11
EXT TRIP AND ARC	EXT-T-ARC (11 – 12) P3/BI.06	SHT 11
EXT TRIP AND NO ARC	EXT-T-NARC (13 – 14) P3/BI.07	SHT 11
CUSTOMER BLOCK CLOSE	CUSTB (15 – 16) P3/BI.08	SHT 11

X32 P3 — RED670

FEEDER BYPASS ON	FDR BP-ON (X32 1 – X32 2) P8/BI.09	SHT 11
FEEDER BYPASS OFF	FDR BP-OFF (3 – 4) P8/BI.10	SHT 11
CBNH-HEATER FAIL	CBNH-H (5 – 6) P8/BI.11	SHT 11
IEC61850 SWITCH FAIL	IEC SWITCH FAIL (7 – 8) P8/BI.12	SHT 11
MEAS TRANSDUCER FAIL	MEAS_T FAIL (9 – 10) P8/BI.13	SHT 11
EXTERNAL CLOSE	EXTERNAL CLOSE (11 – 12) P8/BI.14	SHT 12
SPARE	(13 – 14) P8/BI.15	SPARE
LED TEST	LED CHECK (15 – 16) P8/BI.16	SHT 13

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE: 31/10/2011	DATE: 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE: 20/10/2011	DATE: 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE: 01/05/2011	DATE: 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
PROTECTION REFERENCE DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	19	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 19 OF 27 REVISION 0

F4.1 PNH
X1 AMBER X2 SHT 14

F4.2 ARC OFF/LOCKED-OUT
X1 AMBER X2 SHT 13

F4.6 CBNH
X1 AMBER X2 SHT 13

F4.7 CBO
X1 GREEN X2 SHT 13

F4.8 CBC
X1 RED X2 SHT 13

R3F.1 D1
1–11 SPARE
2–12 SHT 13
3–13 SHT 13
4–14 SHT 13
5–15 SHT 13
6–16 SHT 13
7–17 SHT 13
8–18 SHT 13

R3F.2 D2
SHT 7
SHT 7

R3F.3 D3
SHT 7
SPARE

R3F.4 D4
SHT 9
SHT 9
SHT 9
SHT 9

R3F.5 D5
SHT 9
SPARE

F2.2.1 MCB(M) 16A
1–2 SHT 6
3–4 SHT 6

F2.2.2 MCB(BU) 16A
1–2 SHT 9
3–4 SHT 9

F2.2.4 MCB(CL)
1–2 SHT 12
3–4 SHT 12
AUX 21–22 SHT 9
13–14 SPARE

F2.2.6 MCB(SR) 20A
1–2 SHT 14
3–4 SHT 14
AUX 21–22 SHT 10
13–14 SPARE

F2.3.1 MCB(VT-M) 2A
RED PHASE VT 1–2 SHT 5
WHITE PHASE VT 3–4 SHT 5
BLUE PHASE VT 5–6 SHT 5
AUX 21–22 SHT 10
13–14 SPARE

F2.3.3 MCB(VT-BU) 2A
RED PHASE VT 1–2 SHT 5
WHITE PHASE VT 3–4 SHT 5
BLUE PHASE VT 5–6 SHT 5
AUX 21–22 SHT 11
13–14 SPARE

F2.3.6 MCB(VT-SC) 2A
1–2 SHT 5
3–4 SHT 5
AUX 21–22 SHT 10
13–14 SPARE

F2.3.7 MCB(H) 6A
1–2 SHT 14
3–4 SHT 14

R4.X5.2 MCB(VT-T) 2A
RED PHASE VT 1–2 SHT 5
WHITE PHASE VT 3–4 SHT 5
BLUE PHASE VT 5–6 SHT 5

R1.5 RCPM_C/T
SNUBBER CIRCUIT 11–21 SHT 12
17–27 SHT 9

F4.11 TNS
1A MAIN 2A SHT 6
NORMAL 3A SHT 6
BACKUP 4A
1B MAIN 2B SHT 6
NORMAL 3B SHT 6
BACKUP 4B
1C MAIN 2C SHT 6
NORMAL 3C SHT 6
BACKUP 4C
12 MAIN 2D SHT 6
1D NORMAL 3D SHT 6
BACKUP 4D
1E MAIN 2E SHT 9
NORMAL 3E SHT 9
BACKUP 4E
1F MAIN 2F SHT 7
NORMAL 3F SHT 7
BACKUP 4F
1G MAIN 2G SHT 9
NORMAL 3G SHT 9
BACKUP 4G
1H MAIN 2H SHT 9
NORMAL 3H SHT 9
BACKUP 4H
1J MAIN 2J SHT 9
NORMAL 3J SHT 9
BACKUP 4J
1P MAIN 2P SHT 9
NORMAL 3P SHT 9
BACKUP 4P
1K MAIN 2K SHT 9
NORMAL 3K SHT 9
BACKUP 4K
1L MAIN 2L SHT 9
NORMAL 3L SHT 9
BACKUP 4L
1M MAIN 2M SHT 11
NORMAL 3M SHT 11
BACKUP 4M
1N MAIN 2N SHT 12
NORMAL 3N SHT 12
BACKUP 4N

F2.2.7 MCB(AC) 10A
1–2 SHT 14
3–4 SHT 14

R1.8 TCS-M
SHT 6 220V DC 110V DC SHT 6
11 12 21
13 SHT 6
15 17 SHT 10
25 27
26
16
FAULT OK
24 SHT 6

R1.11 TCS-BU
SHT 6 220V DC 110V DC SHT 6
11 12 21
13 SHT 9
15 17 SHT 10
25 27
26
16
FAULT OK
24 SHT 9

F4.16 ARC 3 POLE
3–4 SHT 10
X1 AMBER X2 SHT 13

F4.15 ARC OFF
3–4 SHT 10
X1 AMBER X2 SHT 13

R1.6 CT-X RXMA 1
2250Ω 11–21 SHT 7
13–15 SHT 6
16–18 SPARE
12–22 SPARE
23–25 SPARE
26–28 SHT 11

R2F.1 CBC-CR RXMB 1
(+) 2250Ω (-) 11–12 SHT 12
13–14 SHT 12
15–16 SHT 12
17–18 SPARE
(+) 2250Ω (-) 21–22 SPARE
23–24 SPARE
25–26 SPARE
27–28 SPARE

F4.12 LCS
7 TEST
6 OFF SHT 13
5 ON
3 TEST
2 OFF SHT 14
1 ON

F4.17 ARC 1+3 POLE
3–4 SHT 10
X1 AMBER X2 SHT 13

F4.18 TTPB
13–14 SHT 10

F4.13 TPIS
1A OFF 2A ON 3A SHT 8
1B OFF 2B ON 3B SHT 8
1C OFF 2C ON 3C SHT 9
1D OFF 2D ON 3D SHT 14
1E OFF 2E ON 3E SHT 10

F4.14 CBCS
TRIP 2 NORMAL 1 CLOSE SHT 9
TRIP 3 NORMAL 4 CLOSE SHT 12
TRIP 6 NORMAL 5 CLOSE SHT 11
TRIP 7 NORMAL 8 CLOSE SPARE

F4.19 BFIS
1A OFF 2A ON 3A SHT 9
1B OFF 2B ON 3B SHT 9
1C OFF 2C ON 3C SHT 9
1D OFF 2D ON 3D SHT 17

F4.20 SIS
1A OFF 2A ON 3A SHT 9
1B OFF 2B ON 3B SHT 10
1C OFF 2C ON 3C SHT 12
1D OFF 2D ON 3D SHT 17 (OPTIONAL)
1E OFF 2E ON 3E SPARE
1F OFF 2F ON 3F SPARE

R1.1 VSR-1 (OPTIONAL)
+ 122 – 121 SHT 12
113–114 SHT 5
115–116 SHT 5
117–118 SPARE
123–124 SPARE
213–214 SHT 5
227–228 SHT 5
225–226 SHT 5
223–224 SHT 5
+ 212 – 211 SHT 12

R1.2 VSR-2 (OPTIONAL)
+ 122 – 121 SHT 12
113–114 SHT 5
115–116 SHT 5
117–118 SPARE
123–124 SPARE
213–214 SHT 5
227–228 SHT 5
225–226 SHT 5
223–224 SHT 5
+ 212 – 211 SHT 12

R1.7 TP-PSU
110V DC 116–118 SHT 8
48V DC 126–128
117
317–318 SHT 9

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
PROTECTION REFERENCE DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	20	00

LEVELS 1 2 10 11 13 14 19 23 24 25 28

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 20 OF 27 REVISION 0

R3R.1 — DCF-M

2 — 10		SHT 8
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 9

R3R.2 — DCF-BU

2 — 10		SHT 13
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 7

R2.1 — RS900

FAIL		SHT 11

R2.2 — CBOS-X1

2 — 10		SHT 16
3	1	SHT 9

R2.3 — CBCS-X1

2 — 10		SHT 16
7	3	SHT 12
11		

R2.4 — PNH-X1

2 — 10		SHT 7
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 7

R2.5 — PNH-X2

2 — 10		SHT 9
3 — 4	1	SHT 14
7 — 5	6	SHT 17
9 — 8	11	SHT 10

R4.X5.1

		MEASUREMENTS
R4.X5.1 TRANSDUCER		
WATTS	19	SHT 15
	20	SHT 15
VARS	21	SHT 15
	22	SHT 15
AMPS	17	SHT 15
	18	SHT 15
VOLTS R-W	15	SHT 15
	16	SHT 15
DNP3 RS485 FOR RTU	A 23	SHT 15
	GND 24	SHT 15
	B 25	SHT 15
RED PHASE VT	2 R	SHT 5
WHITE PHASE VT	5 W	SHT 5
BLUE PHASE VT	8 B	SHT 5
NEUTRAL	11 N	SHT 5
RED PHASE CURRENT	1 R 3	SHT 4
WHITE PHASE CURRENT	4 W 6	SHT 4
BLUE PHASE CURRENT	7 B 9	SHT 4
POWER SUPPLY	PSU 13 — 14	SHT 11

F2.1 — REF615 DIRECTIONAL

POWER SUPPLY	X100 1 — X100 2	SHT 12
BKR CLOSE	BI 1: X130 1 — X130 2	SHT 12
VT MCB TRIP	BI 2: 3 — 4	SHT 11
SIS ENABLED	BI 3: 5 — 6	SHT 10
LAMP CHECK	BI 4: 7 — 8	SHT 13
RED PHASE VT	U1: 11 — 12	SHT 5
WHITE PHASE VT	U2: 13 — 14	SHT 5
BLUE PHASE VT	U3: 15 — 16	SHT 5
NEUTRAL	U0: 17 — 18	SHT 5
CHARGING FAIL	BI 1: X120 1 — X120 2	SHT 10
PNH-X2	BI 2: 3	SHT 10
SF6 GAS LOW	BI 3: 4	SHT 10
CUSTOMER CLOSE BLOCK	BI 4: 5 — 6	SHT 11
RED PHASE CURRENT	IL1 R: 7 — 8	SHT 4
WHITE PHASE CURRENT	IL2 W: 9 — 10	SHT 4
BLUE PHASE CURRENT	IL3 B: 11 — 12	SHT 4
NEUTRAL CURRENT	IL4: 14 — 13	SHT 4
E/F BLOCK	BI 1: X110 1 — X110 2	NOT USED
BUSZONE TRIP	BI 2: 3 — 4	SHT 7
BKR CLOSED	BI 3: 5 — 6	SHT 7
BKR OPEN	BI 4: 7	SHT 7
SETTING GROUP ALT 2	BI 5: 8 — 9	SHT 7
SETTING GROUP ALT 3	BI 6: 10	SHT 7
TNS MAIN TEST	BI 7: 11 — 12	SHT 11
TNS NORMAL	BI 8: 13	SHT 11
BU O/C IDMT/DT TRIP	X110 SO 1: 15 — 14	SHT 7
VTFF	SO 2: 18 — 17	SHT 7
BU O/C TRIP	SO 3: 21 — 20	SHT 17
TNS ON MAIN	SO 4: 24 — 23	SHT 17
NOT USED	IRF: 5	
BACK-UP FAIL	X100: 4 — X100 3	SHT 7
BU E/F IDMT/DT TRIP	X100: 6 — X100 7 PO 1	SHT 7
CLOSE MAIN ON TEST	8 — 9 PO 2	SHT 12

F2.1 CONTINUED

BU O/C & E/F TRIP HIGHSET	X100: 12 — 10 SO 1	SHT 7
BU E/F TRIP	14 — 13 SO 2	SHT 17
BU BKR FAIL TRIP	16 — 17 PO 3	SHT 17
BU BKR FAIL TRIP	19 — 18 PO 3	SHT 9
BU (GENERAL) TRIP	22 — 21 PO 4	SHT 18
BU (GENERAL) TRIP	23 — 24 PO 4	SHT 9

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10

BLOUWATER SUBSTATION
66 kV FEEDER 5
PROTECTION REFERENCE DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

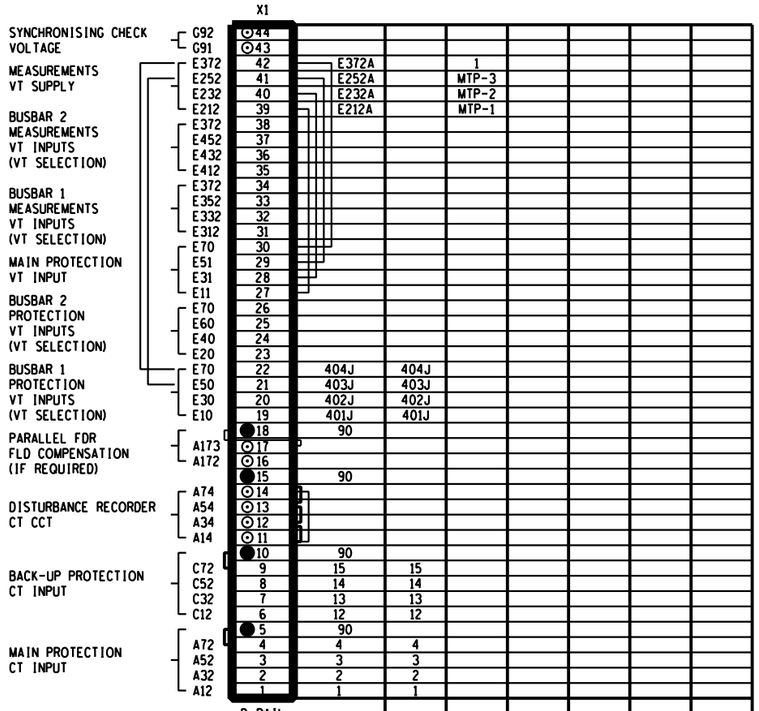
SCALE

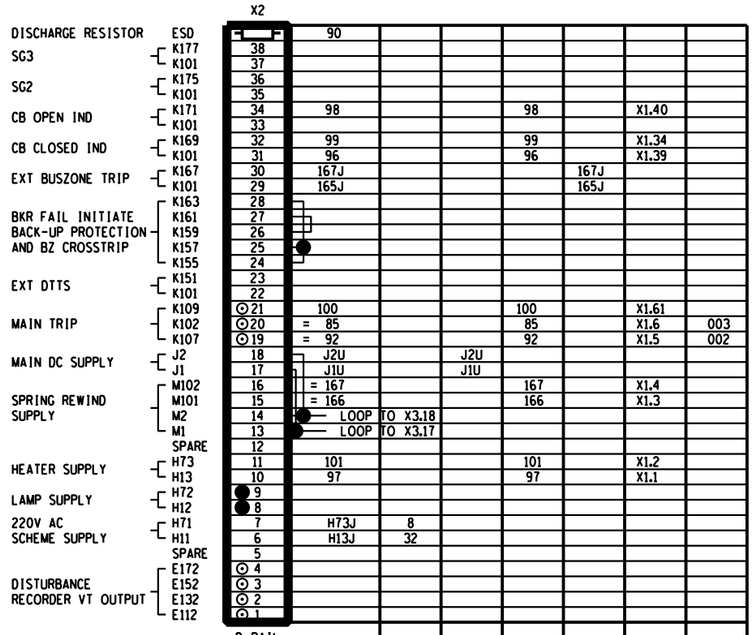
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	21	00

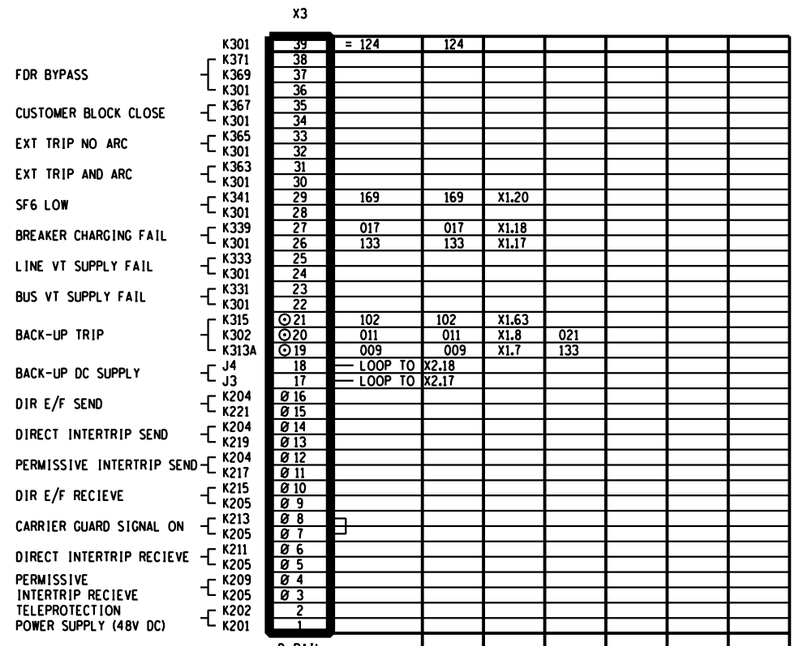
PANEL TYPE DESIGNATION 4FZD-3920

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 21 OF 27 REVISION 0







CONTINUED ON SHT 23

CONTINUED ON SHT 23

CONTINUED ON SHT 23

CABLE NUMBER	J509	-
CABLE SIZE	19	-
NUMBER OF SPARES	3	-
DESTINATION	JUNCTION BOX	BUS WIRING TO STAT METER MODULE

CABLE NUMBER	J524	J515	J508	J516	J507	-
CABLE SIZE	4	2	37	4	37	-
NUMBER OF SPARES	2	-	8	0	15	-
DESTINATION	AC PANEL	DC BOARD	JUNCTION BOX	66 kV BUS ZONE PANEL	66kV CIRCUIT BREAKER MB	JUNCTION BOX LOOP CABLE

CABLE NUMBER	J508	J507	-
CABLE SIZE	-		-
NUMBER OF SPARES	-		-
DESTINATION	JUNCTION BOX	66kV CIRCUIT BREAKER MB	JUNCTION BOX LOOP CABLE

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
   ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
   ● 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
   * D2.5/5 SN ADD ENTRELEC TERMINALS
   X M4/8 SF ENTRELEC TERMINALS
   □ M4/6SNTS ENTRELEC SHORTING STRIP (ORANGE) SPRING LOADED TERMINALS
   [R] M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED
5. NOTE THAT D6/8 ST1 RS TERMINALS WILL 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.

LOOPED TERMINALS	
RP	X2.17-X3.17; X2.18-X 3.18;
LINE ISOL	29-27; 23-25;
B/B 1 ISOL	29-27; 25-31;
B/B 2 ISOL	29-27; 25-31;
OCB MB	X1.33-X1.39; X1.18-X1.48; X1.17-X1.19-X1.47;
OCB MB	X1.3-X1.9-X1.15; X1.4-X1.10-X1.16;

REFERENCE DRAWINGS:

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE 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

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

Eskom

BLOUWATER SUBSTATION
66 kV FEEDER 5
PANEL CABLING DIAGRAM

PROJECT APPROVED	C.KING	DESIGN APPROVED	A. CRAIB
DATE	31/10/2011	DATE	13/12/10
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	N. MATHONSI
DATE	20/10/2011	DATE	13/12/10
DRAWN BY	A v S	DRAWN BY	C. CANNON
DATE	01/05/2011	DATE	26/02/10
SCALE			

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

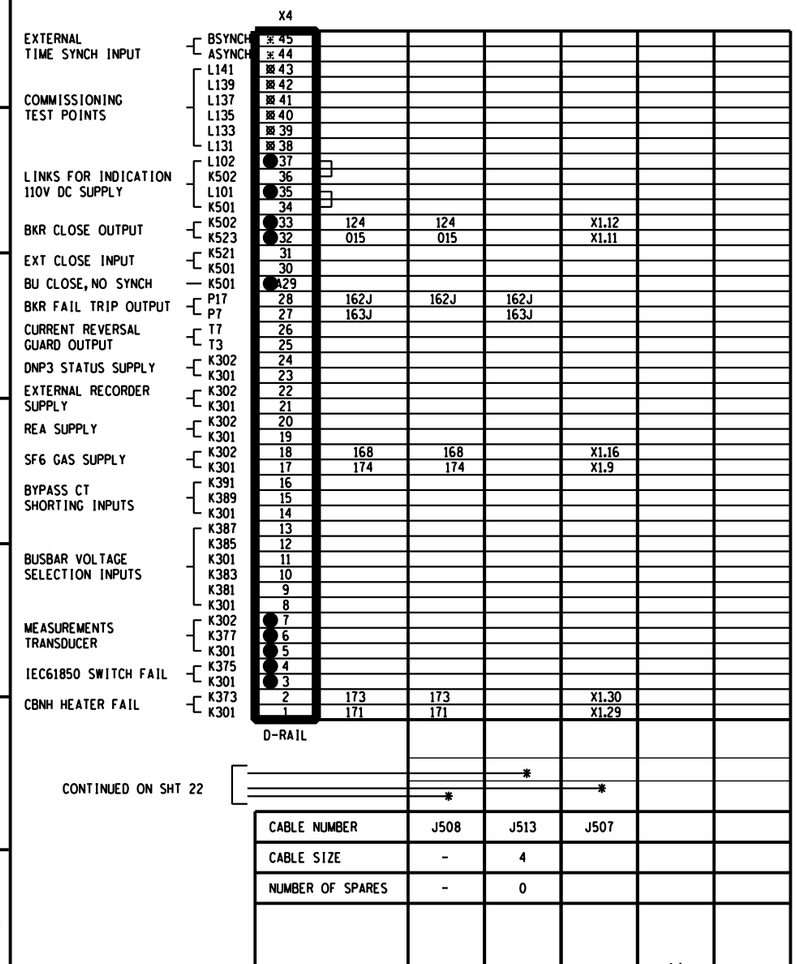
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	22	01

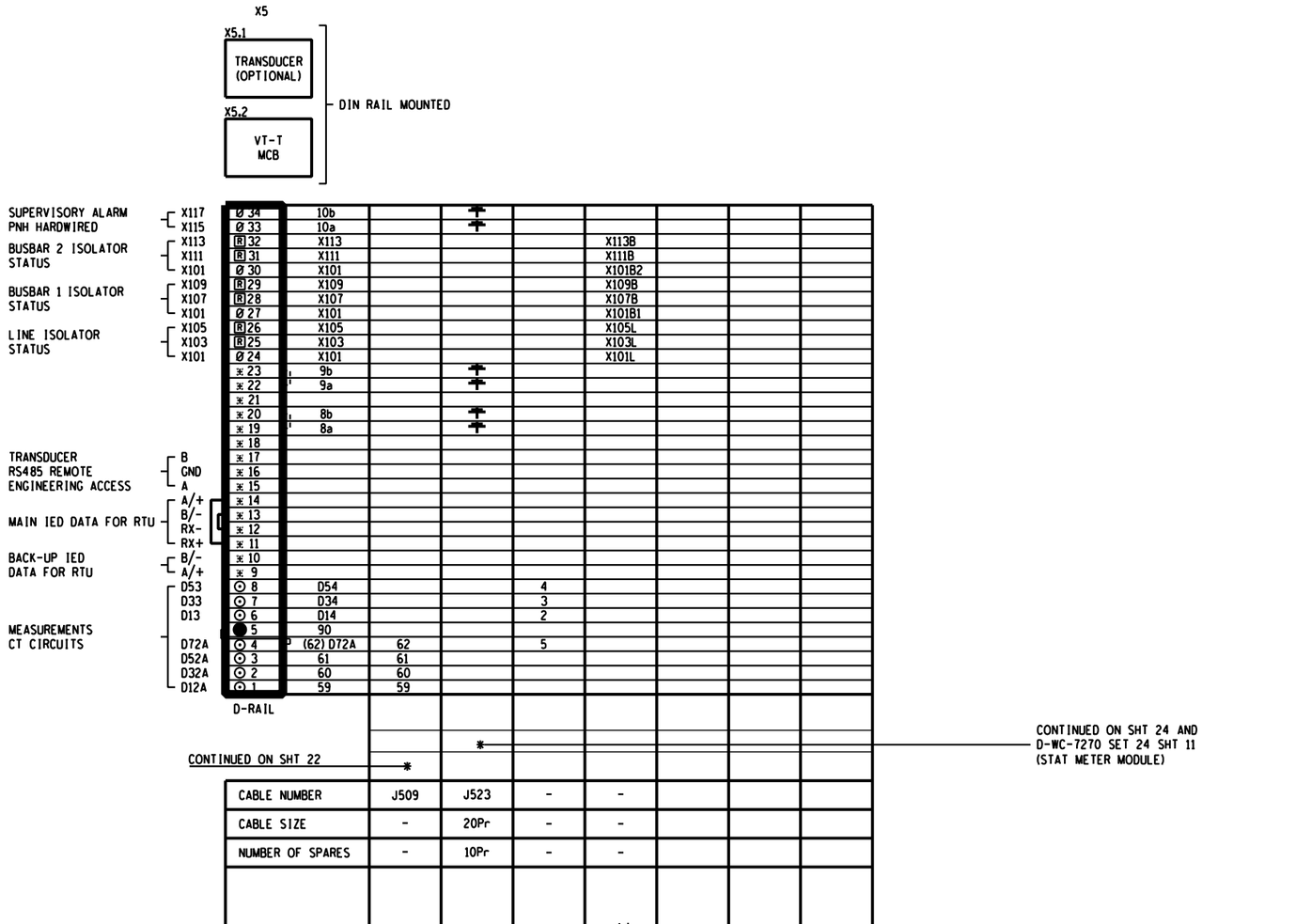
PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 1 2 10 11 13 14 19 23 24 25 28

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 22 OF 27 REVISION 0





SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

NOTE:

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
- ● 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 TERMINALS
- ⊠ 4mm BANANA PLUG FEMALE SOCKET (INSTALLED IN CENTRE SPACING OF TERMINAL)
- [R] M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

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
01	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	05/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD

Eskom

PROJECT APPROVED: C.KING	DESIGN APPROVED: A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED: J. MOSTERT	DESIGN CHECKED: N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY: A v S	DRAWN BY: C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
PANEL CABLING DIAGRAM

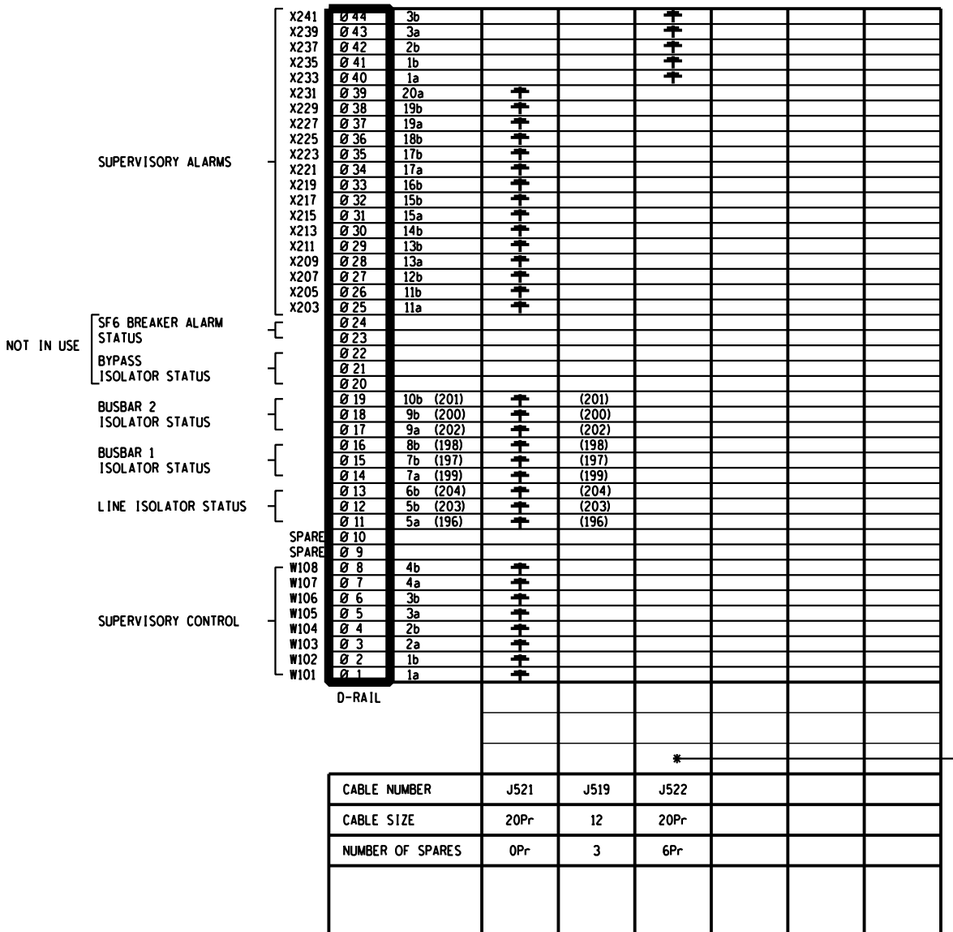
DRG NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	23	01

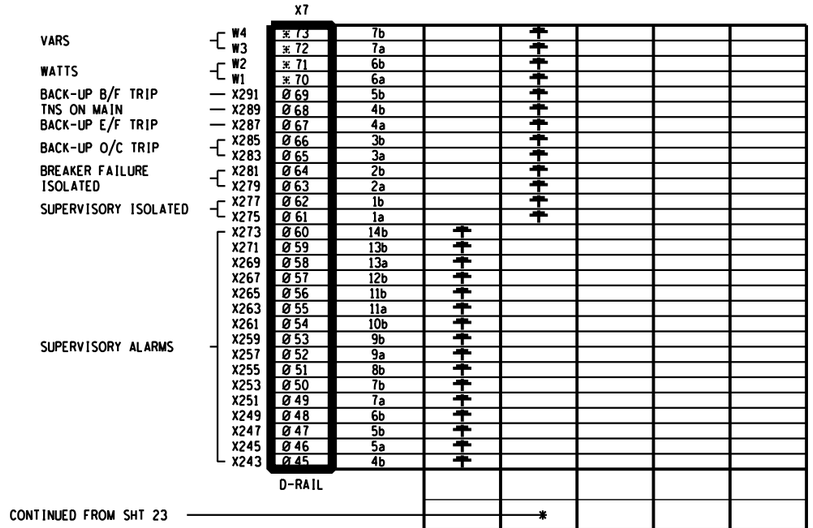
PANEL TYPE DESIGNATION 4FZD-3920

LEVELS 1 2 10 11 13 14 19 23 24 25 28

SIZE GROOTTE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 23 OF 27 REVISION 0





CABLE NUMBER	J521	J519	J522			
CABLE SIZE	20Pr	12	20Pr			
NUMBER OF SPARES	0Pr	3	6Pr			
DESTINATION	I D F	JUNCTION BOX	I D F			

CABLE NUMBER	J522	J523			
CABLE SIZE	-	-			
NUMBER OF SPARES	-	-			
DESTINATION	I D F	I D F			

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DIAGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

NOTE;

1. SEE CABLE BLOCK DIAGRAM FOR PREFIXING.

STANDARD TERMINALS USED ARE ENTRELEC M10/10.RS
- ⊗ MB10/12SF ENTRELEC FUSE TERMINALS
- ● 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 TERMINALS
- R M4/6 RS SPRING LOADED ENTRELEC WITH RESISTOR INSERTED

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			
		/ /			
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 31/10/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
PANEL CABLING DIAGRAM

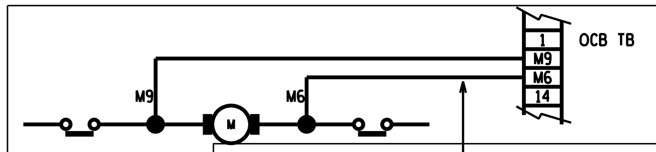
DRG NUMBER	SHT NUMBER	REVISION
D-WC-7270	65	24	00

PANEL TYPE DESIGNATION 4FZD-3920

SIZE A1L

MASTER TRACING FILED UNDER D-DT-15007 SHEET 24 OF 27 REVISION 0

NOTE:
CT STAR POINT CHANGED TO LINE SIDE
CHANGE TO BE DONE ON SITE



ADDITIONAL WIRING

Terminal strip 6

OCB MB (J507)	RELAY PANEL (J508)		6	
	X2.19	92 =	92	002
	X2.20	85 =	85	003
	X5.27		X101B1	
12		124 =	124	124
		126 =	126	009
		125 =	125	011
	X5.28		X107B	
		136 =	136	015
	X5.29		X109B	
	X5.30		X101B2	
	X2.31	96	96	
	X5.31		X111B	
		166 =	166	027
5	X2.19	002	002	
6	X2.20	003	003	
	X5.32		X113B	
7	X3.19	009	009	
8	X3.20	011	011	
	X5.24		X101L	
11	X4.32	015	015	
18	X3.27	017	017	132
	X5.25		X103L	
		132	132	
63	X3.21	102	102	102
	X5.26		X105L	
4	X2.16	167	167	
16	X4.18	168	168	168
13	5	NUMBER OF SPARES		
37	37	NUMBER OF CORES		
J507	J508	CABLE NUMBERS		
OCB MB	RELAY PANEL	DESTINATION		

Terminal strip 5

RELAY PANEL (J508)		5		OCB MB (J507)
		029		55
		031		4
X2.10	H13	041		60
X2.11	H73	042		59
		043		
		044		
		045		
		046		
X2.15		027	166	3
X2.31		96		39
X2.10	97	97	97	1
X2.34	98	98	98	40
X2.32	99	99	99	34
X2.21	100	100	100	61
X2.11	101	101	101	2
X3.26	133	133	133	17
		139		
		140		
X3.29		169	169	20
X4.1		171	171	29
X4.2		173	173	30
X4.17		174	174	9
X2.21		K109A		18
-				-
-				-
J508				J507
RELAY PANEL				OCB MB

Terminal strip 4

Rφ CT (J501)	Wφ CT (J502)	Bφ CT (J503)		4		RELAY PANEL (J509)	BUS ZONE CT's PANEL (J512)	BUSBAR 1 ISOLATOR (J504)	BUSBAR 2 ISOLATOR (J505)
1S2				1		X1.1			
	1S2			2		X1.2			
		1S2		3		X1.3			
1S3				4		X1.4			
	1S3		4						
		1S3	4						
2S1				113J				10	10
	2S1			114J				14	14
		2S1		115J				18	18
2S2				108J			108J		
	2S2		108J						
		2S2	108J		104J		104J		
3S1				109J			109J		
	3S1			110J			110J		
		3S1		111J			111J		
3S2				112J			112J		
	3S2		112J						
		3S2	112J						
4S2				12		X1.6			
	4S2			13		X1.7			
		4S2		14		X1.8			
4S3				15		X1.9			
	4S3		15						
		4S3	15						
6S1				59		X5.1			
	6S2			60		X5.2			
		6S2		61		X5.3			
6S3				62		X5.4			
	6S3		62						
		6S3	62						
2	2	2				3	0	1	1
12	12	12				19	12	19	19
J501	J502	J503				J509	J512	J504	J505
Rφ CT	Wφ CT	Bφ CT				RELAY PANEL	BUS ZONE CT's PANEL	BUSBAR 1 ISOLATOR	BUSBAR 2 ISOLATOR

Terminal strips 3 and 2

BUS ZONE CT's PANEL (J512)	BUS ZONE PROTECTION PANEL (J513)	RELAY PANEL (J509)	3		BUSBAR 1 ISOLATOR (J504)	BUSBAR 2 ISOLATOR (J505)	LINE ISOLATOR (J506A)	LINE ISOLATOR (J506)	BUSBAR 2 ISOLATOR (J505)	BUSBAR 1 ISOLATOR (J504)	BUSBAR 1 ISOLATOR (J504)	BUSBAR 2 ISOLATOR (J505)	2	RELAY PANEL (J519)
		X1.19	401J		2	2								
		X1.20	402J		4	4				29			193	X7.14
		X1.21	403J		6	6			29				193	X7.17
		X1.22	404J		33	33		29					193	X7.11
	160J		160J		21									
	161J		161J			21				30			197	X7.15
	162J		162J		22					28			198	X7.16
				162J		22			30				200	X7.18
									28				201	X7.19
101J			101J		9			30					203	X7.12
102J			102J		13			28					204	X7.13
103J			103J		17									
105J			105J			9					25		X101B1	
106J			106J			13					26		X107B	
107J			107J			17					32		X109B	
												25	X101B2	
												26	X111B	
												32	X113B	
							25						X101L	
							26						X103L	
							24						X105L	
-	1	-			-	-	1	1	-	-	-	-		3
-	4	-			-	-	4	4	-	-	-	-		12
J512	J513	J509			J504	J505	J506A	J506	J505	J504	J504	J505		J519
BUS ZONE CT's PANEL	BUS ZONE PROTECTION PANEL	RELAY PANEL			BUSBAR 1 ISOLATOR	BUSBAR 2 ISOLATOR	LINE ISOLATOR	LINE ISOLATOR	BUSBAR 2 ISOLATOR	BUSBAR 1 ISOLATOR	BUSBAR 1 ISOLATOR	BUSBAR 2 ISOLATOR		RELAY PANEL

Terminal strip 1

			1
			P
			N
R	R	R	
W	W	W	
B	B	B	
N	N	N	
-	-	NUMBER OF SPARES	
4	4	NUMBER OF CORES	
7	8	CABLE NUMBERS	
LOOP CABLES SEE DRG 1.03/16414		DESTINATION	

LOOPED TERMINALS		
CT's Rφ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
CT's Wφ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
CT's Bφ	5S1-5S4-EARTH	(6S1-6S4-EARTH)
OCB	38-26; 5-9; 4-56-54; 42-28;	
B/B 1 ISOL	29-27; 21-23; 22-24; 9-11; 10-12; 13-15; 14-16; 17-19; 18-20;	
B/B 2 ISOL	29-27; 21-23; 22-24; 9-11; 10-12; 13-15; 14-16; 17-19; 18-20;	
LINE ISOL.	29-27;	

NOTES

1. SPARE CABLE LEADS TO BE LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
2. = DENOTES TWO CABLE CORES CONNECTED IN PARALLEL.
3. LEAD NUMBER SHOWN THUS: K101 (boxed) INDICATES NO CHANGE OF LEAD NUMBER AT TERMINAL STRIP.
4. LEAD NUMBER SHOWN THUS: K101 [ ] K103 INDICATES LEAD NUMBER CHANGES AT TERMINAL STRIP.

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

SHEET 9	BACK-UP DC KEY DIAGRAM	SHEET 19	PROTECTION REFERENCE DIAGRAM		
SHEET 8	TELEPROTECTION DC KEY DAIGRAM	SHEET 18	DISTURBANCE RECORDER KEY DIAG.		
SHEET 7	MAIN DC KEY DIAGRAM	SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM		
SHEET 6	MAIN DC KEY DIAGRAM	SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG	SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM	SHEET 15	REA & MEASUREMENTS KEY DIAGRAM	SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 4	AC KEY DIAGRAM	SHEET 14	SPRING REWIND & AC KEY DIAGRAM	SHEET 24	PANEL CABLING DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM	SHEET 13	INDICATION DC KEY DIAGRAM	SHEET 23	PANEL CABLING DIAGRAM
SHEET 2	LOGIC DIAGRAM	SHEET 12	CLOSE DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 11	BACK-UP DC KEY DIAGRAM	SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 10	BACK-UP DC KEY DIAGRAM	SHEET 20	PROTECTION REFERENCE DIAGRAM
REFERENCE DRAWINGS:					

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	RED PHASE CT REPLACED AND CT RATIO'S CORRECTED AS PER KEY	PFS	JM	TM	21/09/2018	
1	CIRCUIT BREAKER TERMINALS ADDED	NB	NB	TM	06/09/2016	
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

SCALE :

Eskom

BLOUWATER SUBSTATION
66 kV FEEDER 5
JUNCTION BOX CABLING DIAGRAM

AUTH: C.KING
DATE: 31/10/2011
CHKD: J. MOSTERT
DATE: 20/10/2011
DRAWN: A v S
DATE: 01/05/2011

D-WC-7270

SET	SHEET	REVISION
65	25	02

110 V DC SPRING REWIND SUPPLY (LOOP CABLES SEE 1.03/16414)

+SR

-SR

CONTRACTOR

SALR45 TIMER

11000PIV

1k ohm 10W

22v5w

LOR 'l'

LOR 'm'

LOR 'k'

PB

SEE SHT 14

LOR 'j'

DISCONNECT ON SITE

BRIDGE TO BE ADDED ON SITE

SEE SHT 7

SEE SHT 10

LOR 'h'

DISCONNECT ON SITE

LOCAL CS(a)

LOR 'f'

CLOSING SPRING RELEASE COIL

KEY SW.

LOR 'g'

SEE SHT 12

ADD ON SITE

LOR 'b'

MAIN TRIP COIL No 1

LOR 'c'

SEE SHT 6

LOR 'd'

BACK UP TRIP COIL No 2

LOR 'e'

SEE SHT 9

SEE SHEET 16 FOR NEW SUPERVISORY STATUS ALARMS

OCB OPEN

OCB CLOSED

B/B 1 ISOLATOR OPEN

B/B 1 ISOLATOR CLOSED

B/B 2 ISOLATOR OPEN

B/B 2 ISOLATOR CLOSED

LINE ISOLATOR OPEN

LINE ISOLATOR CLOSED

DISCONNECT ON SITE

NOT USED

REYROLLE BREAKER
SEE 0.54/832 REV 1.

380/220 V AC SUPPLY LOOP CABLES SEE DRG. 1.03/16414

OCB HEATER CIRCUIT

OCB HEATER

MCB

DISCONNECT ON SITE

SHEET 26	BREAKER REFERENCE DIAGRAM
SHEET 25	JUNCTION BOX CABLING DIAGRAM
SHEET 24	PANEL CABLING DIAGRAM
SHEET 23	PANEL CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PROTECTION REFERENCE DIAGRAM
SHEET 20	PROTECTION REFERENCE DIAGRAM
SHEET 19	PROTECTION REFERENCE DIAGRAM
SHEET 18	DISTURBANCE RECORDER KEY DIAG.
SHEET 17	SUPERVISORY ALARMS KEY DIAGRAM
SHEET 16	SUPERVISORY STATUS & CONTROL KEY DIAG
SHEET 15	REA & MEASUREMENTS KEY DIAGRAM
SHEET 14	SPRING REWIND & AC KEY DIAGRAM
SHEET 13	INDICATION DC KEY DIAGRAM
SHEET 12	CLOSE DC KEY DIAGRAM
SHEET 11	BACK-UP DC KEY DIAGRAM
SHEET 10	BACK-UP DC KEY DIAGRAM
SHEET 9	BACK-UP DC KEY DIAGRAM
SHEET 8	TELEPROTECTION DC KEY DAIGRAM
SHEET 7	MAIN DC KEY DIAGRAM
SHEET 6	MAIN DC KEY DIAGRAM
SHEET 5	VT SUPPLY KEY DIAGRAM
SHEET 4	AC KEY DIAGRAM
SHEET 3	SINGLE LINE DIAGRAM
SHEET 2	LOGIC DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET
	REFERENCE DRAWINGS:

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
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.				/ /	3487A

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD
		/ /			

Eskom Distribution

PROJECT APPROVED	DESIGN APPROVED
C.KING	A. CRAIB
DATE 04/11/2011	DATE 13/12/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	N. MATHONSI
DATE 20/10/2011	DATE 13/12/10
DRAWN BY	DRAWN BY
A v S	C. CANNON
DATE 01/05/2011	DATE 26/02/10
SCALE	

BLOUWATER SUBSTATION
66 kV FEEDER 5
BREAKER REFERENCE DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7270	65	26	00

LEVELS 10

SIZE A1L

10.9. Non Standard Material Specifications

11. Execution Plan and Temporary Arrangements

11.1. Constructability Plan

The proposed constructability plan below for the works at Blouwater Substation covers the major tasks to be performed, and is divided between pre-outage and outage works.

Pre - Outage Works:

- Procure new labels for 66 kV feeder protection panels.
- Procure new labels for 66 kV feeder outdoor yard HV equipment.
- Procure 2 x new teleprotection cards and fibre patch leads.

Outage Works (Note: To be undertaken on the same day as Iscor and Ystervark Substation Works):

The upgrade of the relays for the two feeders will be phased to prove the three-terminal differential logic on the first installation before upgrading the second line.

Feeder 1:

- Install new labels for 66 kV feeder protection panel.
- Install new labels for 66 kV feeder outdoor yard HV equipment.
- Upgrade RED 670 relays to include the second teleprotection card.
- Prove teleprotection circuits.
- Install fibre patch leads for second teleprotection link to Ystervark Substation.
- Prove three-terminal differential protection functionality.

Feeder 2:

- Install new labels for 66 kV feeder protection panel.
- Install new labels for 66 kV feeder outdoor yard HV equipment.
- Upgrade RED 670 relays to include the second teleprotection card.
- Prove teleprotection circuits.
- Install fibre patch leads for second teleprotection link to Ystervark Substation.
- Prove three-terminal differential protection functionality.

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

11.4. Bill of Materials

11.5. Bill of Quantities

11.6. Detailed Drawings

11.7. Non Standard Material Specification

12. HV Lines

13. MV Lines

AECOM

www.aecom.com

To enhance and sustain the world’s built, natural and social environments