

Project Name : Transnet Saldanha NMD
Upgrade - New Ystervark S/S

Project ID : 153272156

Job Name : Iscor 66 kV Breakers &
Protection Upgrade

Job ID : 153272156-00004

Final Design Package: Book 1

Prepared for
TRANSNET GROUP CAPITAL

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Quality Information

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**Additional Signatories
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1. Abbreviations

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

Abbreviation	Meaning Given to the Abbreviation
A	Ampere
AAC	All Aluminium Conductor
AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
ADSS	All-dielectric Self-supporting
Al	Aluminium
AMSL	Above Mean Sea Level
BIL	Basic Insulation Level
BoM	Bill of Materials
BoQ	Bill of Quantities
BTU	Battery Terminal Unit
CD	Compact Disc
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
FDP	Final Design Package
FO	Fibre Optic
ECSA	Engineering Council of South Africa
ENC	Eskom National Contract

Abbreviation	Meaning Given to the Abbreviation
GPR	Ground Potential Rise
GPS	Global Positioning System
HD	High Density
Hz	Hertz
HV	High Voltage
ICEW	Insulated Copper Earth Wire
ICT	Information and Communication Technology
IDMT	Inverse Definite Minimum Time
IEC	Independent Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronic Engineers
In	Nominal Current Rating
I/O	Input - Output
IP	Ingress Protection
IP	Internet Protocol
IR	Infra-Red
ISO	International Standards Organisation
JB	Junction Box
kA	Kilo Ampere
K	Kelvin
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
LOR	Local/Off/Remote Switch
LPL	Lightning Protection Level
LV	Low Voltage

Abbreviation	Meaning Given to the Abbreviation
MCB	Miniature Circuit Breaker
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
NMD	Notified Maximum Demand
NO	Normally Open
OEM	Original Equipment Manufacturer
O/C	Overcurrent
OHL	Overhead Line
OHS	Occupational Health and Safety
O&M	Operating and Maintenance
OPGW	Optical Ground Wire
°C	Degree Celsius
PC	Personal Computer
pC	Pico Coulomb
PCD	Pitch Circle Diameter
PFC	Power Factor Correction
PPS	Pulse Per Second
PTP	Precision Timing Protocol
p.u.	Per Unit
PVC	Polyvinyl Chloride
QA	Quality Assurance
QoS	Quality of Supply
RE/F	Restricted Earth Fault

Abbreviation	Meaning Given to the Abbreviation
RIO	Remote Input Output device
r.m.s	Route-Mean Square
RTC	Real Time Clock
s	seconds
SA	Surge Arrestor
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Tests
SED	Station Electric Diagram
SEF	Sensitive Earth Fault
SF ₆	Sulphur Hexafluoride
SHE	Safety, Health and Environment
SHEQ	Safety, Health and Environment and Quality
SLD	Single Line Diagram
SOC	State Owned Company
SWA	Steel Wire Armour
TEF	Technical Evaluation Forum
USB	Universal Serial Bus
uPVC	Unplasticized Polyvinyl Chloride
UV	Ultra-violet
V	Volt
VA	Volt Ampere
VT	Voltage Transformer
W	Watt
kWhr	Kilowatt Hours
XLPE	Cross Linked Polyethylene

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: <i>Specifications</i>	✓	
9.	Geotechnical Report		✓
10.	Civil: <i>Bill of Schedules</i>	✓	
11.	Civil: <i>Detailed Drawings</i>		✓
12.	Architectural: <i>Specifications</i>		✓
13.	Architectural: <i>Detailed Drawings</i>		✓
14.	Power Plant: <i>Specifications</i>	✓	
15.	Power Plant: <i>Long Lead Time Bill of Materials</i>	✓	
16.	Power Plant: <i>Final Bill of Materials</i>	✓	
17.	Power Plant: <i>Final Bill of Quantities</i>	✓	
18.	Power Plant: <i>Label Schedule</i>	✓	

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

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

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4. Assumptions, Agreements, Acceptances and Additional Notes

The current EA & EMPr do not cover the scope of works as defined in this document, due to the fact that the study was conducted prior to TEF approval for these works. At present the process is underway to amend the EA & EMPr respectively.

Design verification of the works for environmental compliance, including the commencing of construction thereof, is subject to the finalisation & conditions of the amended EA & EMPr.

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:

<u>Project Name</u>	<u>Project ID</u>
Transnet Saldanha NMD Upgrade - New Ystervark S/S	153272156
<u>Job Name</u>	<u>Job ID</u>
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
Iskor 66 kV Breakers & Protection Upgrade	153272156-00004

This final design package covers the design principles and approach for the supply and installation of new 66 kV outdoor circuit breakers, including associated protection upgrades, at Iscor 66/11 kV Substation.

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

The Fig overleaf depicts the location of Iscor Substation.



Figure 1: Iscor Substation Location

5.2. Scope of Works

The high level scope of work at Iscor Substation will be as follows:

Iscor Substation is fed via two 66 kV overhead lines from Blouwater Substation. Currently there are no 66 kV circuit breakers in the existing transformer feeder bays. Due to the tie-in of the new Ystervark 66 - 132 kV Substation onto the existing Blouwater-Iscor 66 kV overhead lines immediately before Iscor Substation, it will necessitate the installation of 2 x 66 kV circuit breakers in the existing transformer-feeder bays.

Further to the above, the existing line differential protection scheme for each feeder will not operate correctly with the introduction of the tee-off lines (for Ystervark Substation). As a result, a second teleprotection card must be installed for each respective relay and their three-terminal differential protection functionality selected. The existing transformer protection schemes for both transformers must also be modified to ensure the tripping of the new 66 kV circuit breakers.

The existing 4 x 11 kV feeds to the Port of Saldanha will also be disconnected and removed, once Transnet's Main Intake Substation has been commissioned. The Port will then be fed directly from the aforementioned Substation.

Label changes will 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 'Blouwater' is changed to Blouwater/Ystervark TEE.

5.3. Site/Environmental Conditions

Referencing Section 4 in this document, once the amended EA & EMPr has been received, the conditions applying to environmental factors such as Visual Impacts, Heritage, Vegetation, Aquatic Ecosystems, Avifauna and the like shall be confirmed.

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

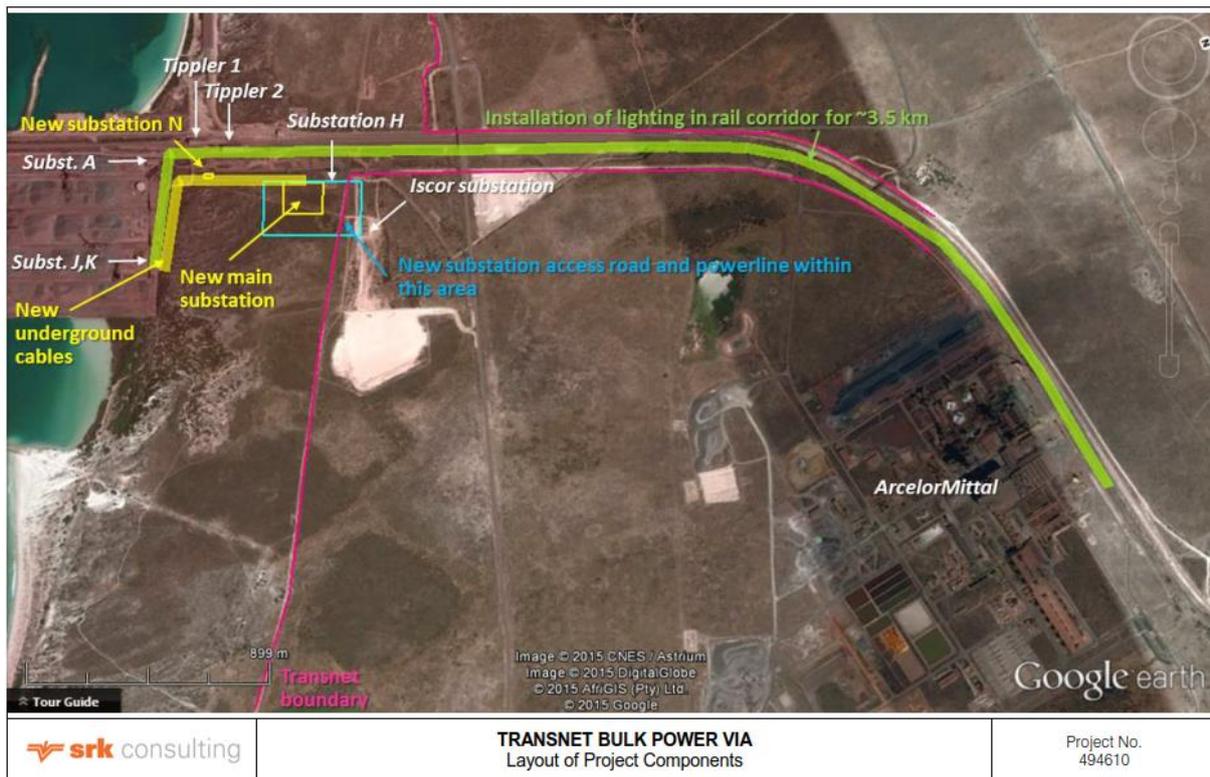


Figure 2: Original Environmental Study Layout Map of Project Components

From the above figure, it can be seen that Iscor Substation is situated next to the Port of Saldanha and the study area covering Transnet's new Main Intake Substation (includes Ystervark Substation).

Given the above the climatic, pollution level and lightning activity conditions applicable to Iscor Substation can be assumed to be same as for the Port. The climate in the area is defined as semi-arid Mediterranean, which is strongly influenced by the cold Benguela current and coastal berg wind conditions. Table 1 overleaf summarizes the climatic conditions on site:

Table 1: Site Climatic Conditions

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

The table below indicates the average monthly precipitation for the Saldanha area.

Table 2: Average Monthly Precipitation (mm): Saldanha

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

Figure 3 indicates the seasonal wind speeds and directions.

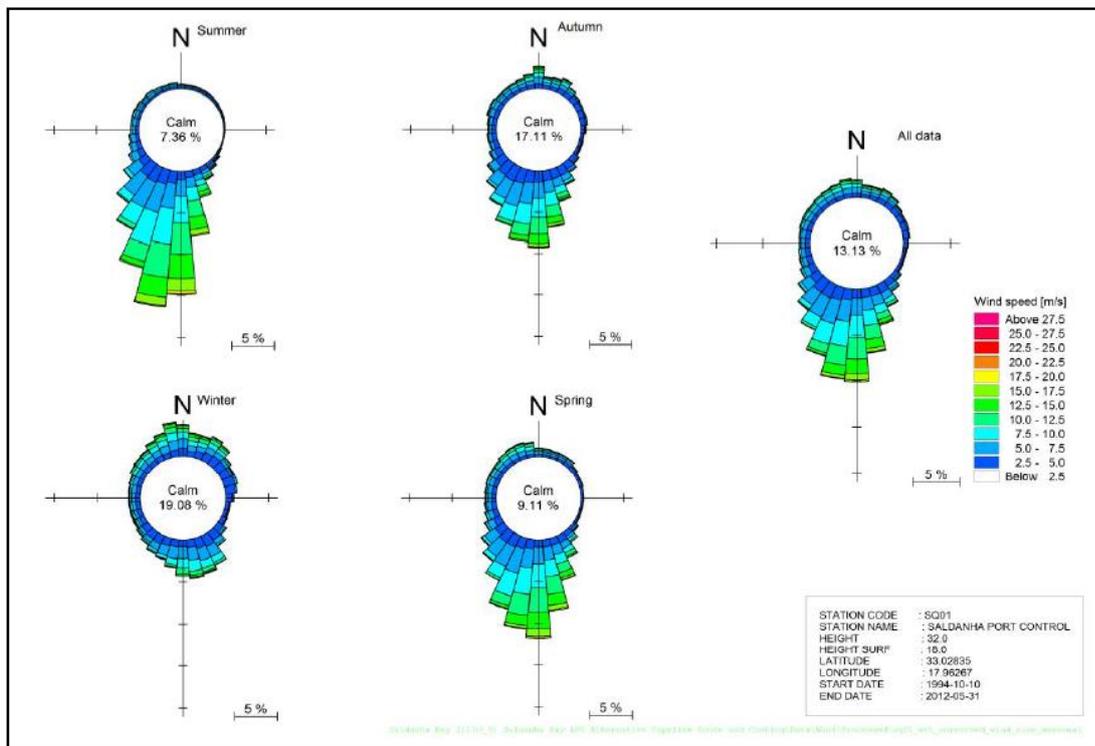


Figure 3: Seasonal Wind Roses for the Port of Saldanha

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

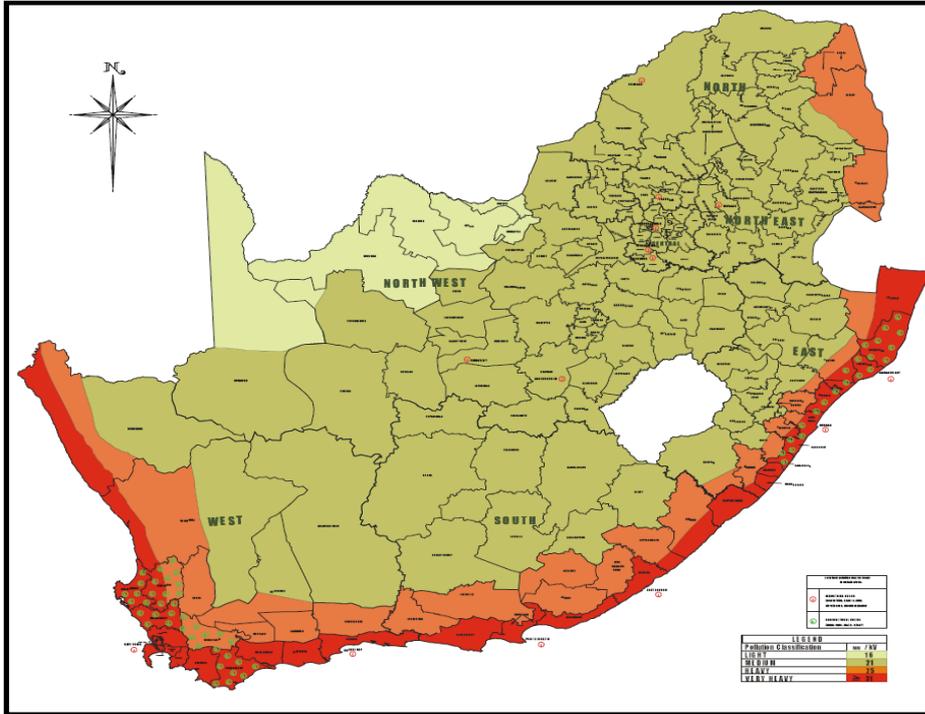


Figure 4: Pollution Map

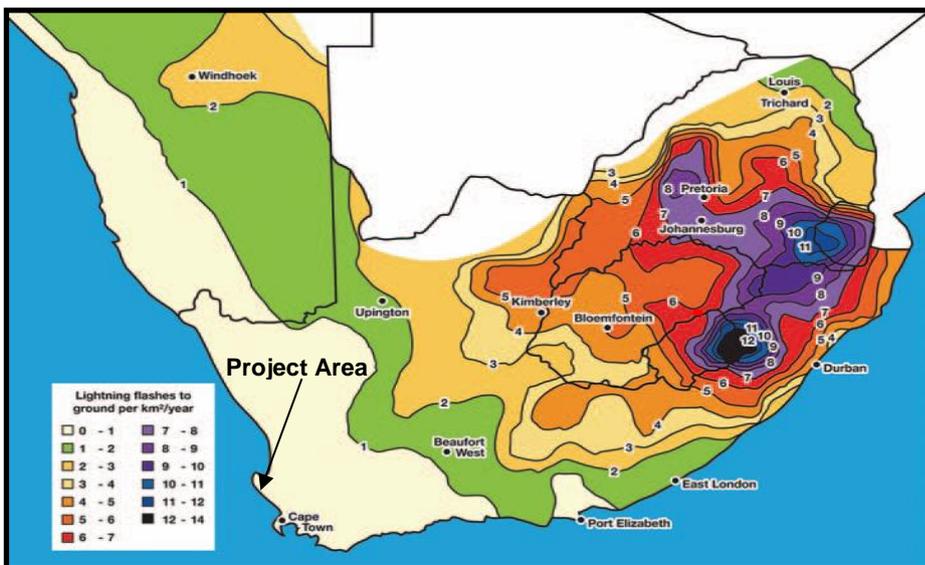


Figure 5: Lightning Ground Flash Density Map

No geotechnical study have been conducted inside Iscor Substation, as it is accepted that the existing Substation's platform will be able to cater sufficiently for the loadings of the new 66 kV circuit breakers. Furthermore, no soil resistivity tests were done as all respective equipment earths will be connected to the existing earth grid/mat.

5.4. Credit Bill of Material

Not Applicable

5.5. Existing Network Configuration

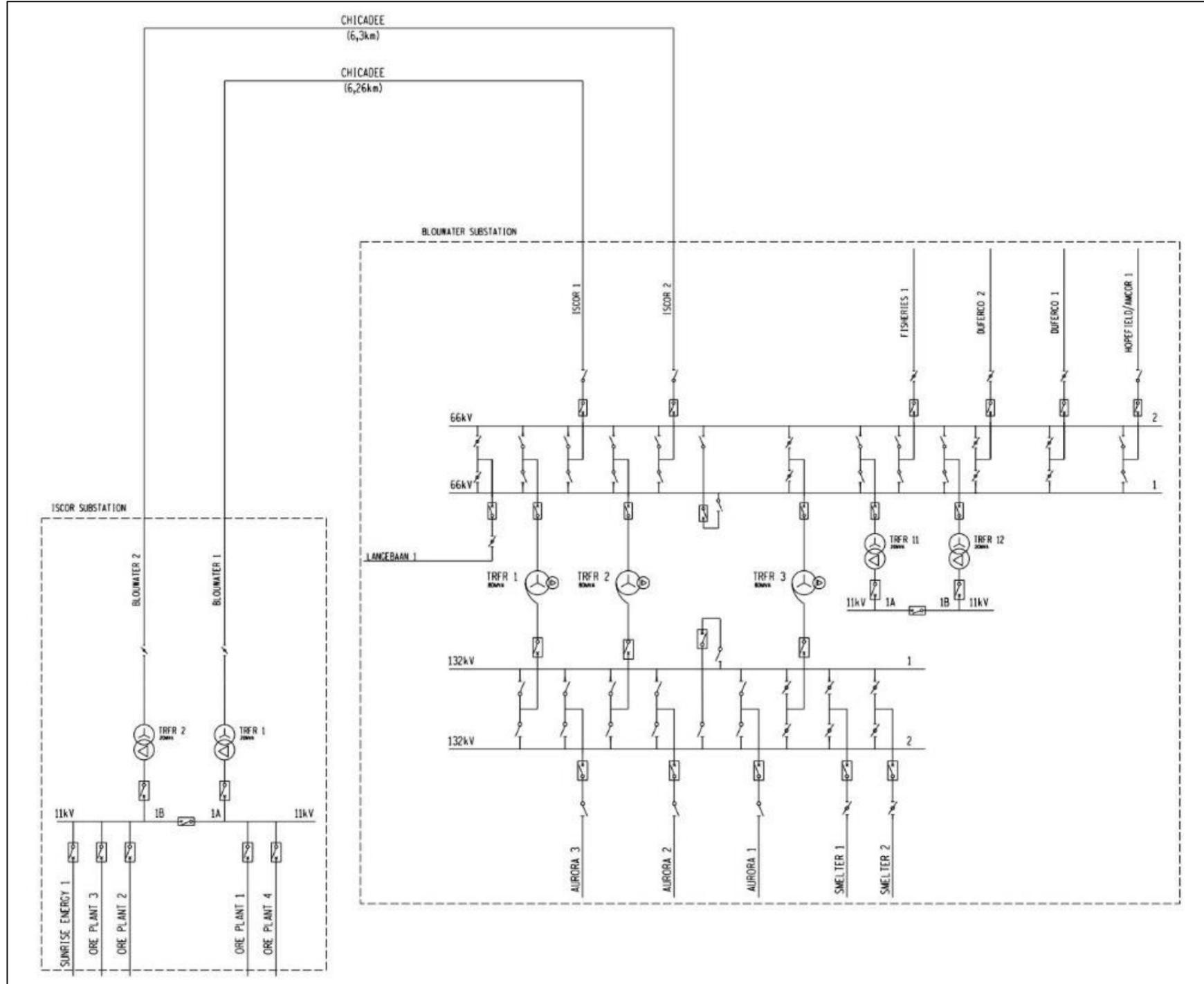


Figure 6: Existing Electrical Network Configuration - Blouwater to Iscor Substation

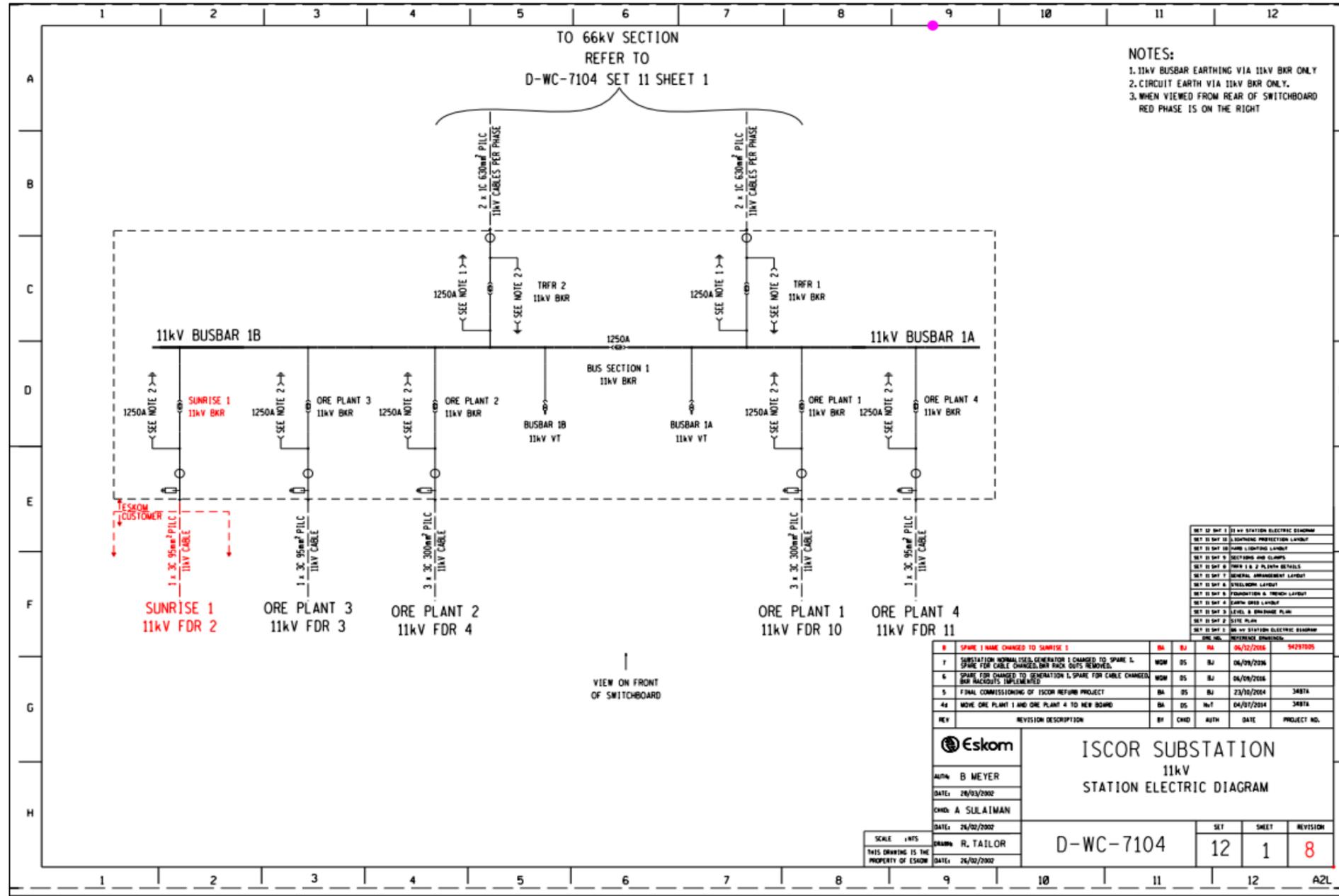


Figure 7: SED - Iscor 66/11 kV Substation (Existing)

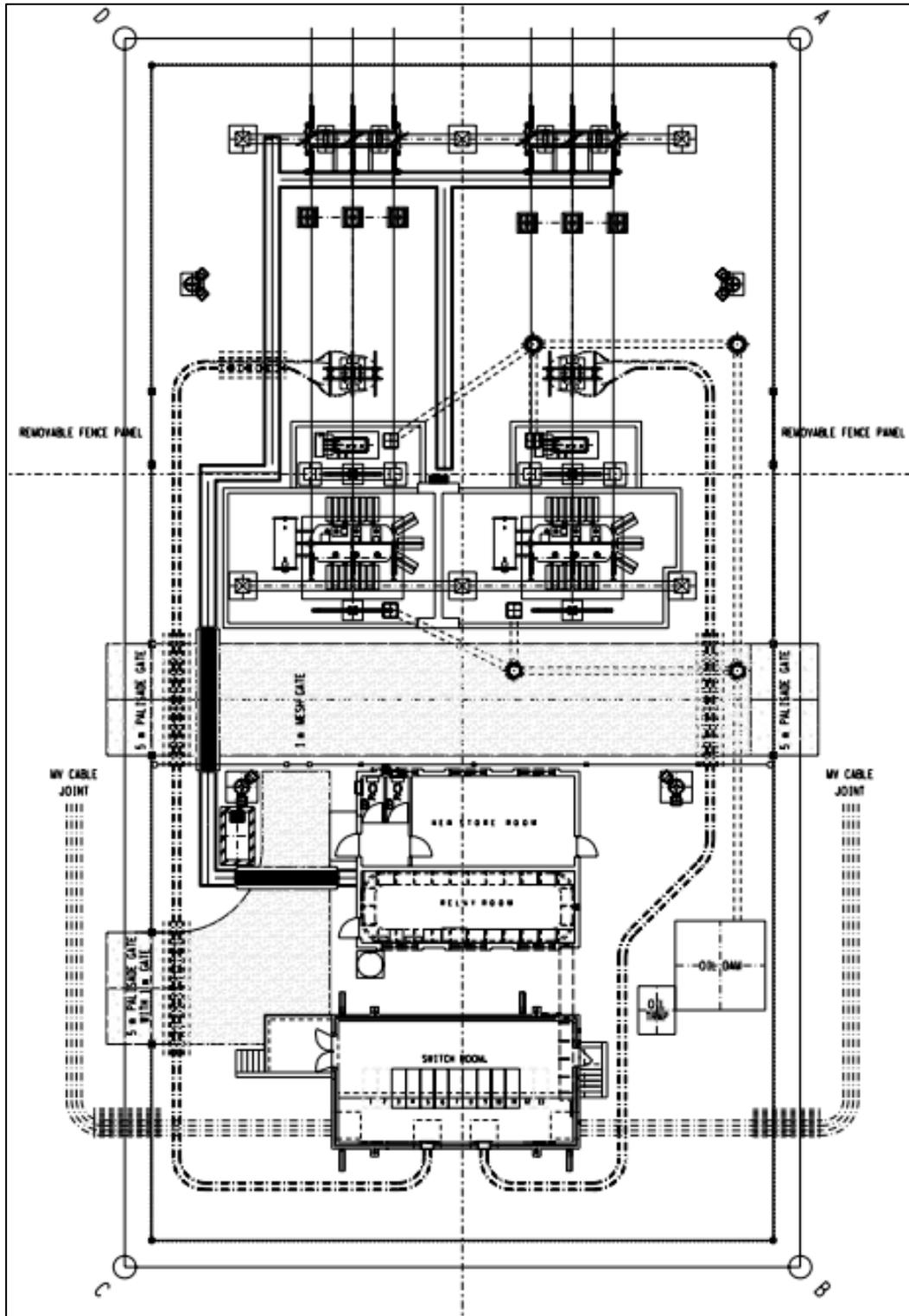


Figure 8: Layout - Iscor 66/11 kV Substation (Existing)

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

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

The maximum power rating of the 11 kV switchgear is 1250 A, ie, 23.8 MVA, which is the ultimate final maximum load that Iscor Substation can supply. Adding new switchgear will thus not resolve the upper limit of power supply, hence the required disconnection and removal of the 4 x 11 kV feeds supplying the Port. Refer also to Section 5.2.

It should be noted that the 20 MVA firm supply at Iscor Substation has on occasion been lost in the past. Since the introduction of the Port's 10.5 MVA power factor correction (PFC) facility in 2014 next to Substation A, it has facilitated an average of ± 2 MVA peak power demand reduction.

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

5.6. Proposed Network Configuration

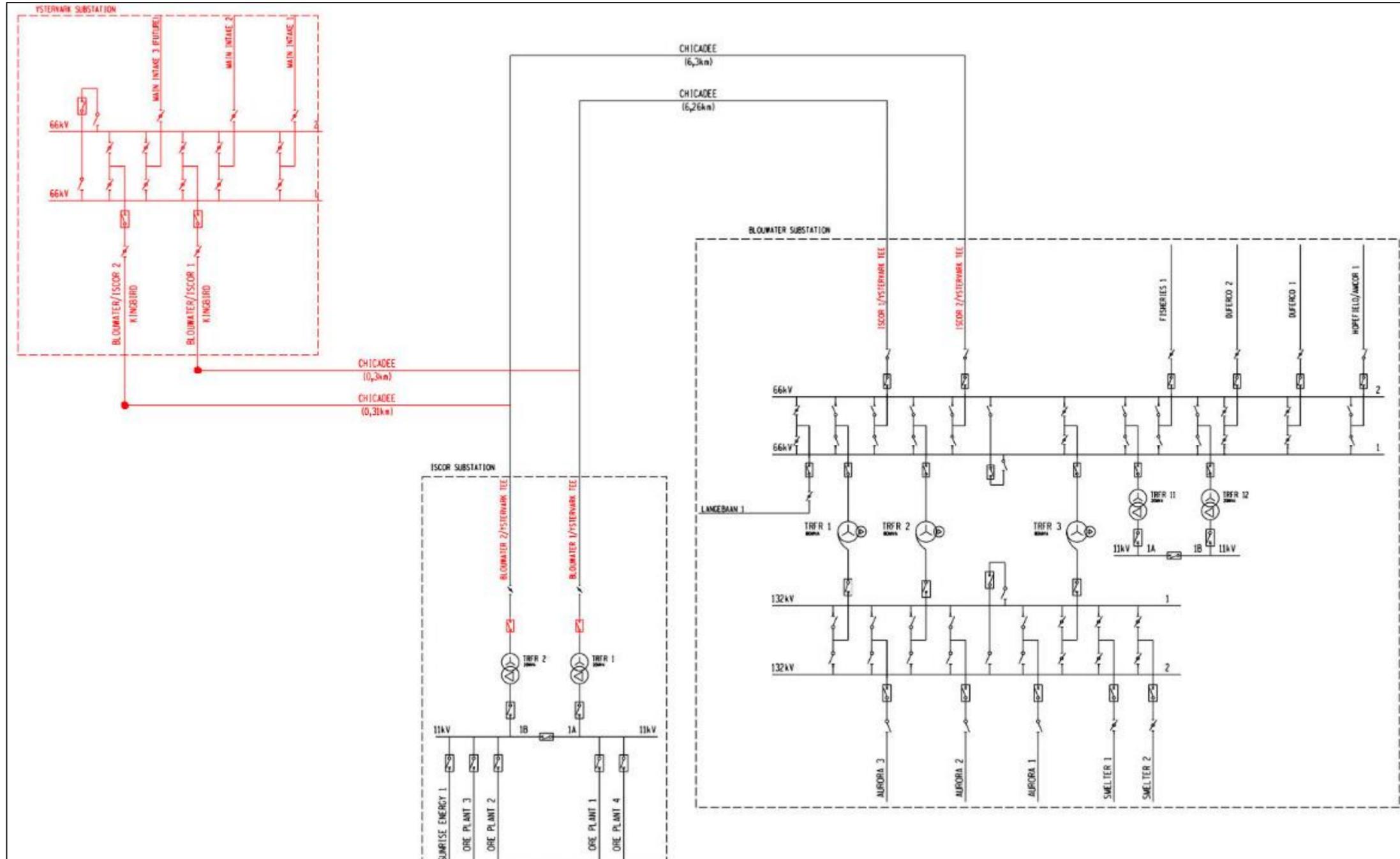


Figure 9: Proposed New Electrical Network Configuration - Blouwater to Iscor/Ystervark Substations

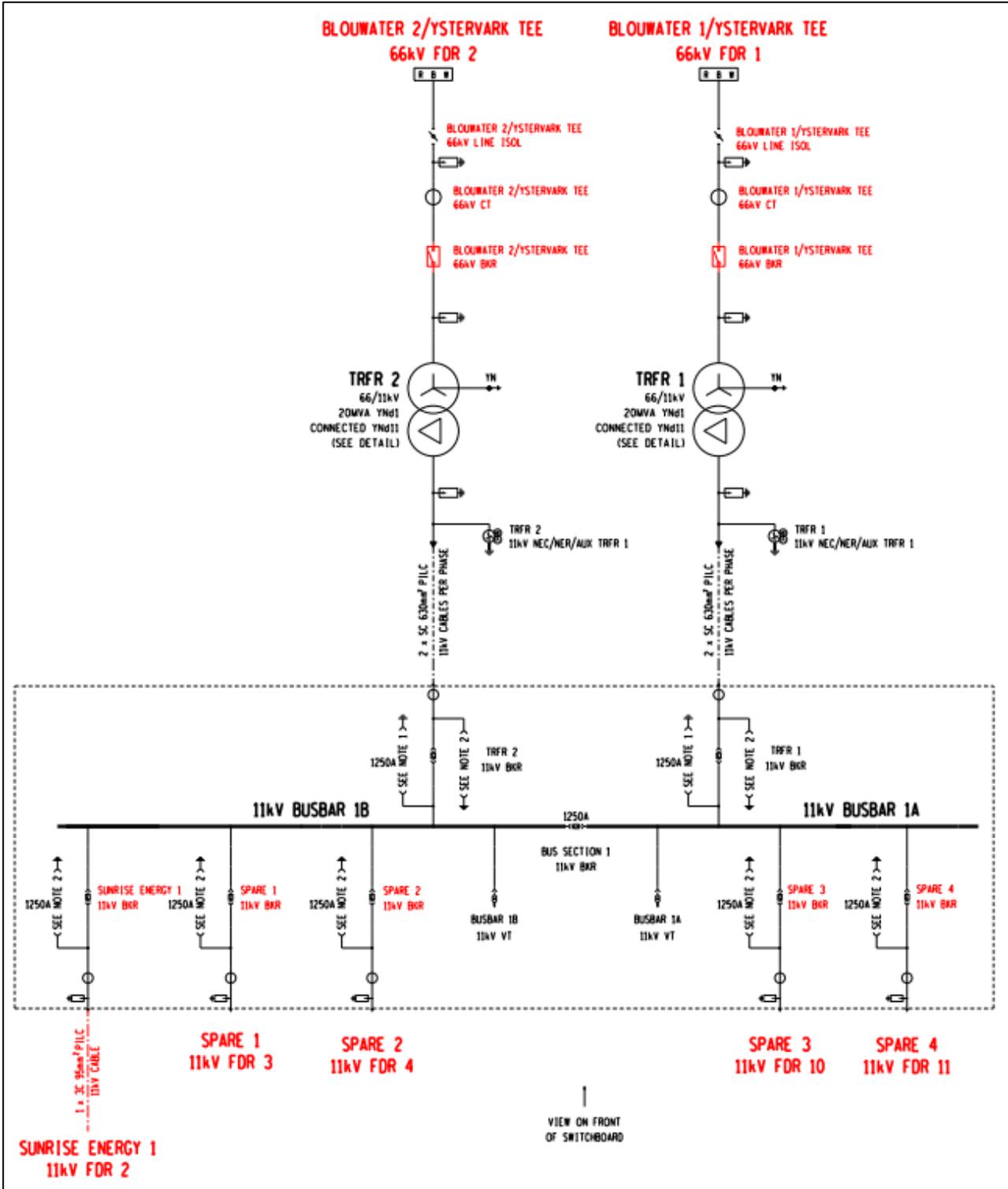


Figure 10: SED - Iscor 66/11 kV Substation (Proposed)

6. Civil

6.1. Overview

The civil works to be undertaken at Iscor Substation will include, but not necessarily be limited to the following:

- Excavation and shoring for soil for circuit breaker foundations.
- Excavation, and if needed shoring, for installation of earthing to the existing earth grid/mat for the new equipment.
- Backfilling and compaction.
- Clearing of any excess material.
- New yard stone around completed foundations and earth installations.

6.2. Specification

6.2.1. Excavations & Backfilling

All excavations and backfilling shall be done in accordance with SANS 1200 D. The removed soil shall be re-used for backfilling, whereas all excess materials shall be disposed of at a designated stockpile area as instructed by Transnet. Backfilled soil shall be compacted to 93 % MOD AASHTO, in layers no thicker than 150 mm.

New 37.5 mm, 100 mm layer yard stone shall be provided around all new foundations and earth installations, once the compaction of the soil has been completed.

As mentioned in Section 5.3 of this document, no geotechnical study have been conducted inside Iscor Substation, as it is accepted that the existing Substation's platform will be able to cater sufficiently for the loadings of the new 66 kV circuit breakers.

6.2.2. Substation Access

The Iscor Substation access does not form part of the scope of work for this project.

6.2.3. Fencing and Security

The Iscor Substation fencing and security do not form part of the scope of work for this project.

6.2.4. Trenching

Existing trenching shall be used for the 66 kV circuit breakers control circuitry.

6.3. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU BOM-18-04		REV :	0	This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
Civil										
QTY	SAP	REFERENCE	Rev	DESCRIPTION						
EARTHING										
1m³	0503015	D-DT-5240	0	Yard Stone				Total meters squared (100mm layer):		9 m²

6.4. Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM											WCOU_BOM-18-04
JOB NAME JOB NUMBER: BOM TYPE: PREPARED BY : Tel No DATE PREP. :			Job Name: Isocr 66 kV Breaker & Protection Job Number: 153272156-00004 FINAL BOM & BOQ Dirk Agenbag Tel: 021 950 7500 18 January 2019			LASTEST REV: 0					
BILL OF QUANTITIES				BASED ON MEW SUBSTATION BOQ							
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
POWER PLANT ACTIVITIES											
CIVIL ACTIVITIES											
	Excavation:										
	Excavations soft	m ³	8.2		12.35	906.50	0.75	3.00	24.60		
	Shoring										
	Shoring	m ²	1.0		12.35	226.62	0.1875	0.75	0.75		
	Backfill and compact										
	Backfill and compact (Normal)	m ³	6.0		12.35	226.62	0.1875	0.75	4.50		
	Clearing of excess material to spoil										
	Clearing of excess material to spoil	m ³	2.2		12.35	302.17	0.25	1.00			
	Stoning yard 100mm thick										
	Stoning yard 100mm thick	m ²	9		12.35	33.24	0.0275	0.11	0.99		
SUBTOTAL (CIVIL PP ACTIVITIES)									30.84		

6.5. Detailed Drawings

Not Applicable

7. Structural

7.1. Overview

The structural works to be undertaken at Iscor Substation shall include but not be limited to the following:

- Foundations for the new 2 x 66 kV circuit breakers.
- Steel support structures for the new 2 x 66 kV circuit breakers.

7.2. Specification

7.2.1. Foundations

All new foundations will be installed in accordance with SANS 1200 and SANS 2001 - CC1 latest revision. The new foundation HD bolts will be aligned for casting of concrete to a tolerance of ± 2 mm. Foundation tolerances to be in accordance with SANS 1200 G.6 degree of accuracy (DOA).

All new foundations will have 25 mm grout under base-plates only with SikaGrout 212. All HD bolts will have two nuts and two washers. The grout will be a feather finish to allow water to run free from the base-plate.

7.2.2. Steelwork

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

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

7.3. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM							
POWER PLANT							
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade			WCOU_BOM-18-04		REV: 0
JOB NUMBER:		Job Number: 153272156-00004					This document is the property of Eskom
BOM TYPE:		FINAL BOM & BOQ					
PREPARED BY :		Dirk Agenbag					
Tel No		Tel: 021 950 7500					
DATE PREP. :		18 January 2019					
STEELWORK							
QTY	SAP	REFERENCE	Rev	kV	DESCRIPTION	Mass (kg)	Total Mass (kg)
MAIN EQUIPMENT SUPPORTS							
2	0528475	D-DT-5201-2A	0	66 kV	66kV Circuit Breaker Support	265 kg	530 kg

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM								
POWER PLANT								
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade			WCOU_BOM-18-04		REV: 0	
JOB NUMBER:		Job Number: 153272156-00004					This document is the property of Eskom	
BOM TYPE:		FINAL BOM & BOQ						
PREPARED BY :		Dirk Agenbag						
Tel No		Tel: 021 950 7500						
DATE PREP. :		18 January 2019						
CONCRETE WORKS								
QTY	REFERENCE	Rev	DESCRIPTION					
MAIN EQUIPMENT SUPPORT FOUNDATIONS								
2	D-DT-5201-1B	2	66kV Circuit Breaker Foundation (Soil Type 1 & 2)				0257294	
TOTAL CONCRETE AND BRICK								
			25 MPa Concrete, use 355 kg cement, 0.70 m3 sand (max 5% moisture) and 0.78 m3 stone (19 mm). Cement : Water Ratio = 1.7					
2.8 m³	Total Concrete							
20	0404381	50kg Pockets of Cement						
2.2 m³	0216881	m³ Stone (19mm stone size)						
2.0 m³	0216882	m³ Sand						

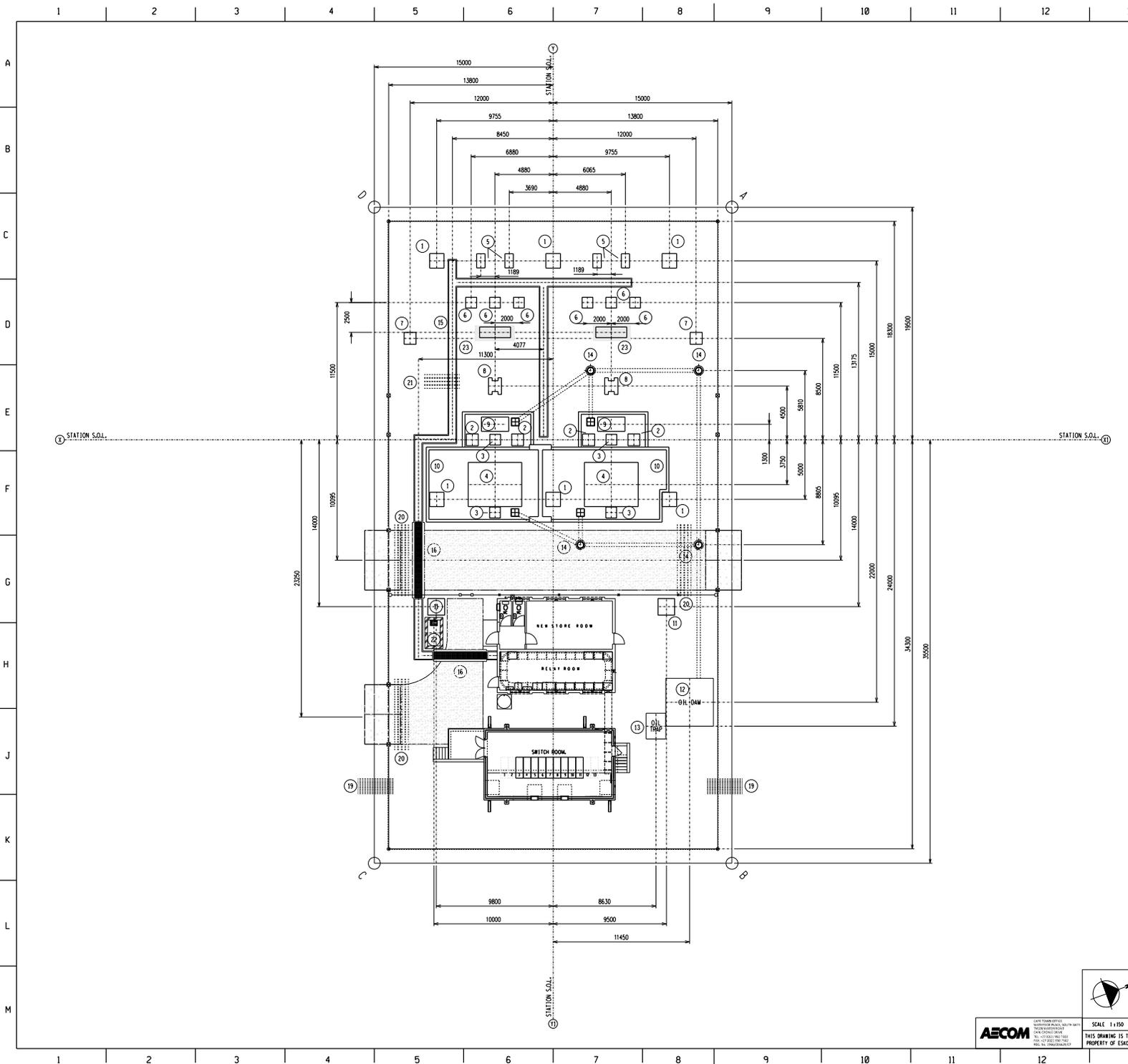
WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM									
POWER PLANT									
JOB NAME JOB NUMBER: BOM TYPE: PREPARED BY : Tel No DATE PREP. :		Job Name: Isocr 66 kV Breaker & Protection Upgrade Job Number: 153272156-00004 FINAL BOM & BOQ Dirk Agenbag Tel: 021 950 7500 18 January 2019			WCOU BOM-18-04 REV: 0				This document is the property of Eskom
HD BOLTS									
QTY	SAP	REFERENCE	Rev	DESCRIPTION	Length	Bolts / FND	Thread		
HD BOLTS FOR STANDARD FOUNDATIONS									
2		D-DT-5201-1B	2	66kV Circuit Breaker Foundation (Soil Type 1 & 2)	MK 19	500 mm	8	M24	
TOTAL BOLTS									
16	0185178	D-DT-3015	27	Rod, Threaded Galv M24x350mm Wash+Nuts					
TOTAL NUTS AND WASHERS									
32				Total M24 Nuts					

7.4. Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM											WCOU_BOM-18-04
JOB NAME JOB NUMBER: BOM TYPE: PREPARED BY : Tel No DATE PREP. :			Job Name: Iscor 66 kV Breaker & Protection Job Number: 153272156-00004 FINAL BOM & BOQ Dirk Agenbag Tel: 021 950 7500 18 January 2019				LASTEST REV : 0				
BILL OF QUANTITIES			BASED ON MEW SUBSTATION BOQ				rev. 11				
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	B, P&G %	RATE (R)	POINTS/UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
POWER PLANT ACTIVITIES											
STRUCTURAL ACTIVITIES											
Foundations											
	Setting & Marking of foundations	each	2.0		12.35	226.62	0.1875	0.75	1.50		
	Concrete formwork	m ²	2.5		12.35	302.17	0.25	1.00	2.50		
	Place concrete	m ³	2		12.35	453.25	0.375	1.50	3.00		
Finishing:											
	Finishing Foundation	each	2		12.35	75.54	0.0625	0.25	0.50		
Layout of structures:											
	Layout Structures - Lattice	ton	0.5		12.35	3021.65	2.5	10.00	5.30		
Assemble Structures											
	Assemble Structures - Lattice	ton	0.5		12.35	3021.65	2.5	10.00	5.30		
Errect Structures											
	Errect Structures	ton	0.5		12.35	3021.65	2.5	10.00	5.30		
Finishing:											
	Finishing Handing Over Documentation	stru	2		12.35	120.87	0.1	0.40	0.80		
	Finishing Torque nuts	each	32		12.35	24.17	0.02	0.08	2.56		
SUBTOTAL (STRUCTURAL PP ACTIVITIES)									26.76		

7.5. Detailed Drawings

<u>Drawing No.</u>	<u>Drawing Title</u>	<u>Rev</u>
D-WC-7104-11-05	66/11 kV - Foundation and Trench Layout	02
D-WC-7104-11-06	66/11 kV - Steelwork Layout	02



EXISTING FOUNDATION SCHEDULE:				
MARK	DESCRIPTION	USE FOR	DRAWING NO.	TOP OF FND LEVEL
1	66 kV COLUMN SUPPORT FND.	66 kV COLUMNS	0.54/326	150 mm ABOVE TL (EXISTING)
2	MV COLUMN SUPPORT FND.	MV COLUMNS	0.54/316	(EXISTING)
3	MEDIUM EQUIPMENT SUPP. FND.	TRFR 11 kV SA's	D-WC-5206 SH1	150 mm ABOVE TL
4	TRFR PLINTH	TRFR 66/11 kV	D-WC-7104 SET 11 SH1 8	(EXISTING)
5	66 kV ISOL. SUPP. FND.	66 kV ISOLATOR	D-DT-5203 SHEET 1	150 mm ABOVE TL
6	MEDIUM EQUIPMENT SUPP. FND.	66 kV CT's	D-DT-5206 SHEET 1	150 mm ABOVE TL
7	8 m LIGHT MAST SUPP. FND.	YARD LIGHTING	D-DT-5217 SHEET 1	150 mm ABOVE TL
8	CABLE SEALING END SUPP. FND.	CABLE SEALING END	D-DT-5213 SHEET 1	150 mm ABOVE TL
9	NEC/R/T SUPP. FND.	NEC/R/T	D-DT-5207 SHEET 1	150 mm ABOVE TL
10	BUND WALL	TRANSFORMER BUND WALL	D-DT-5232 SHEET 1	SEE DRAWING
11	14 m LIGHT MAST SUPP. FND.	14 m LIGHT MAST	D-DT-5217 SHEET 3	150 mm ABOVE TL
12	OIL DAM	OIL DAM	(EXISTING)	(EXISTING)
13	OIL TRAP	OIL TRAP	(EXISTING)	(EXISTING)
14	MAN HOLE	OIL DRAINAGE	(EXISTING)	(EXISTING)
15	CABLE TRENCH	CONTROL/AUXILIARY CABLES	0.54/390 SHEET 15	150 mm ABOVE TL
16	CABLE TRENCH ROAD CROSSING	TRENCH ROAD CROSSING	0.54/390 SHEET 37C	SEE DRAWING
17	18 m LONG, 110 mm φ PVC PIPES	11 kV CABLE	D-DT-8018 D-DT-0854	850 mm BELOW TL
18	12 m LONG, 250 mm φ PVC PIPES	11 kV CABLE	D-DT-8018 D-DT-0854	850 mm BELOW TL
19	3 m LONG, 110 mm φ PVC PIPES	11 kV CABLE	D-DT-8018 D-DT-0854	850 mm BELOW TL
20	6 m LONG, 250 mm φ PVC PIPES	11 kV CABLE	D-DT-8018 D-DT-0854	850 mm BELOW TL
21	3 m LONG, 250 mm φ PVC PIPES	11 kV CABLE	D-DT-8018 D-DT-0854	850 mm BELOW TL
22	CONSERVANCY TANK	WC	D-WC-7104 -13-01.00	SEE DRAWING

NEW FOUNDATION SCHEDULE:				
23	66 kV BKR SUPP. FND.	66 kV CIRCUIT BREAKER	D-DT-5200 SHEET 10	150 mm ABOVE TL

- NOTES:**
- ALL WORK TO BE DONE IN ACCORDANCE WITH SANS 1200 LATEST REVISION.
 - TOP OF EQUIPMENT FOUNDATIONS TO BE 150 mm ABOVE TERRACE LEVEL.
 - HY YARD TO HAVE A CLEAN, HARD, SOUND CRUSHED STONE OF A 25 mm MINIMUM NOMINAL SIZE, 100 mm THICK LAYER. THIS SHALL BE APPLIED AFTER INSTALLATION OF ALL EQUIPMENT AND CABLES.
 - ALL FOUNDATION I.D. BOLTS TO BE ALIGNED FOR CASTING OF CONCRETE TO A TOLERANCE OF ±2 mm. FOUNDATION TOLERANCE TO BE IN ACCORDANCE WITH SANS 1200 G.6 GRADE 11.
 - DEPTH OF EQUIPMENT FOUNDATIONS TO BE NOT LESS THAN SHOWN ON DETAIL DRAWING AND NOT LESS THAN 300 mm INTO NATURAL GROUND.
 - ALL TOP EDGES OF CONCRETE ABOVE G.L. TO HAVE 25 mm CHAMFER AT 45°.
 - ALL FOUNDATIONS TO HAVE 25 mm GROUT UNDER BASEPLATES ONLY. GROUT MIX 2:1. ALL H.D. BOLTS ARE SUPPLIED WITH 2 NUTS AND 2 WASHERS. GROUT MUST BE A FEATHERED FINISH TO ALLOW WATER TO RUN FREELY FROM THE BASEPLATE.
 - STRUCTURES SHALL BE ERRECTED ALONG, SQUARED, PLUMBED AND LEVELLED TO AN ACCURACY SPECIFIED IN SANS 1200 H.6.2.2.2 (2) - CLASS 11.
 - THE TUBULAR BUSBARS SHALL BE LEVEL, THEREFORE THE TOPS OF ALL BUSBAR FOUNDATIONS SHALL BE AT THE SAME HEIGHT AND A MINIMUM OF 150 mm ABOVE THE TERRACE LEVEL.

NO.	REVISION DESCRIPTION	BY	CHKD	DATE	PROJECT NO.
2	SUBSTATION REWORKED.	ADA	BY	30/02/2019	15327736-0004
1	SUBSTATION REWORKED.	ADA	JM	08/10/2010	34874
0	REDRAWN ON CAD AND SA'S & FIREWALL ADDED	MKS	/	/	15034

REV	REVISION DESCRIPTION	BY	CHKD	DATE	PROJECT NO.
2	SUBSTATION REWORKED.	ADA	BY	30/02/2019	15327736-0004
1	SUBSTATION REWORKED.	ADA	JM	08/10/2010	34874
0	REDRAWN ON CAD AND SA'S & FIREWALL ADDED	MKS	/	/	15034

ISCOR SUBSTATION
66/11 kV
FOUNDATION AND TRENCH LAYOUT

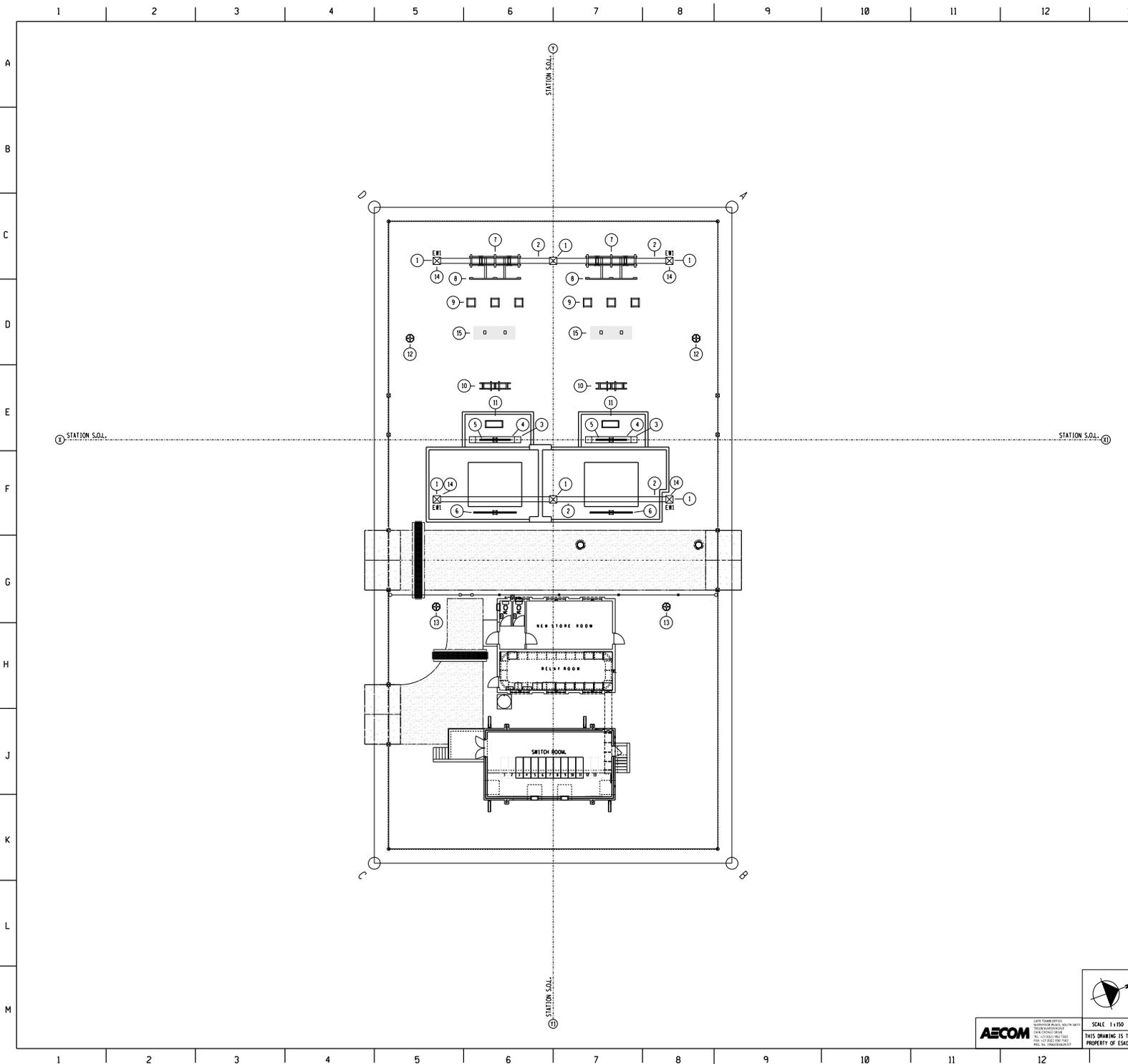
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	11	5 2



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DATE: 06/07/2004

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SCHEDULE OF EXISTING STEELWORK						
MARK	DESCRIPTION	USE FOR	DRAWING NO.	REV NO.	DRAWING NO. FOR CAPS	REV NO.
1	66 kV COLUMN TYPE B344	66 kV COLUMN	0.54/322	-	-	-
2	66 kV BEAM TYPE 9754	66 kV BEAM (T925)	0.54/323	-	-	-
EM1	EARTHWIRE SUPPORT	EM1	0.54/322	-	-	-
3	TERTIARY COLUMN TYPE 5855	11 kV COLUMNS	0.54/315	-	-	-
4	TERTIARY BEAM TYPE 3800	11 kV BEAM	0.54/315	-	-	-
5	MEDIUM EQUIP SUPPORT 3 m	TRFR 11 kV SA's	D-DT-5206 SHT 4	3	D-DT-5206 SHT 5	3
6	MEDIUM EQUIP SUPPORT 3 m	TRFR 66 kV SA's	D-DT-5206 SHT 4	3	0.54/3394	3
7	66 kV ISOL SUPP STEELWORK	66 kV ISOLATOR	D-DT-5203 SHT 2	11	-	-
8	66 kV SA BRACKET	66 kV SURGE ARRESTORS	D-DT-5219 SHT 3	4	-	-
9	MEDIUM EQUIP SUPPORT 2.5m	66 kV FOR 66kV CT's	D-DT-5206 SHT 3	8	D-DT-5206 SHT 5	3
10	CSE SUPP STEELWORK	CABLE SEALING END	D-DT-5213 SHT 2	8	-	-
11	NEC/N/T SUPP STEELWORK	NEC/N/T	SUPPLIER	9	-	-
12	8 m LIGHTING MAST	LIGHTING / LIGHTNING	D-DT-5217 SHT 2	4	-	-
13	14 m LIGHTING MAST	LIGHTING / LIGHTNING	D-DT-5217 SHT 3	8	-	-
14	LIGHTNING SPIKE	LIGHTNING PROTECTION	0.54/340	-	-	-

SCHEDULE OF NEW STEELWORK:						
15	66 kV BR SUPP STEELWORK	66 kV CIRCUIT BREAKER	D-DT-5200 SHT 2A	0	-	-

NOTES:

1. STRUCTURES SHALL BE ERRECTED, ALIGNED, SQUARED, PLUMBED AND LEVELED TO AN ACCURACY SPECIFIED IN SANS 1200 H.6.2.2.2:12 - CLASS 11.

- SET 10 SHT 1 66 kV STATION ELECTRIC DIAGRAM
- SET 10 SHT 11 LIGHTNING PROTECTION LAYOUT
- SET 10 SHT 12 LVD AND LIGHTING LAYOUT
- SET 10 SHT 4 SECTIONS AND CLAMPS
- SET 10 SHT 8 TRFR & P. PLUMBED DETAILS
- SET 10 SHT 7 GENERAL ARRANGEMENT LAYOUT
- SET 10 SHT 6 STEELWORK LAYOUT
- SET 10 SHT 3 FOUNDATION & TRENCH LAYOUT
- SET 10 SHT 4 BARS-GRID LAYOUT
- SET 10 SHT 2 LEVEL & DRAINAGE PLAN
- SET 10 SHT 5 SITE PLAN
- SET 10 SHT 1 66 kV STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	DATE	PROJECT NO.
2	SUBSTATION REWORKISHED.	ADA	RT	09/02/2019	15327256-0004
1	SUBSTATION REWORKISHED.	ADA	JM	08/10/2010	34874
0	REDRAWN ON CAD AND SA'S & FIREWALL ADDED	MAS	CK	/ /	1503A

ISCOR SUBSTATION
66/11 kV
STEELWORK LAYOUT

SET	SHEET	REVISION
	11	6 2

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DATE: 05/07/2004



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DATE: / /

DRAWN: MA Sulaiman
DATE: 05/07/2004

SET	SHEET	REVISION
	11	6 2

D-WC-7104

8. Architectural

Not Applicable

9. Power Plant

9.1. Overview

The existing Iscor Substation consists of two 66 kV feeder bays with two 66/11 kV 20 MVA transformers, which is fed from Blouwater Substation via the 66 kV Blouwater-Iscor overhead feeder lines (refer to figures 6 & 7 in Section 5.5). At present there are no HV circuit breakers inside Iscor Substation protecting the transformers. This is achieved via the breakers at Blouwater Substation.

Due to the tie-in of the new Ystervark 66 - 132 kV Substation onto the existing Blouwater-Iscor 66 kV overhead lines immediately before Iscor Substation, it will necessitate the installation of 2 x 66 kV circuit breakers in the existing 66 kV transformer-feeder bays.

The new 66 kV circuit breakers shall be installed between the 11 kV cable end support structures and the existing 66 kV CTs respectively. Referencing also to Fig 10 in Section 5.6, the below Fig's 11 & 12 depict in further detail the positions of the new 2 x 66 kV circuit breakers. It should be noted that label changes will also have to be done on the respective existing HV equipment ie. the 66 kV isolators and CTs, to ensure the current naming convention of 'Blouwater' is changed to Blouwater/Ystervark TEE.

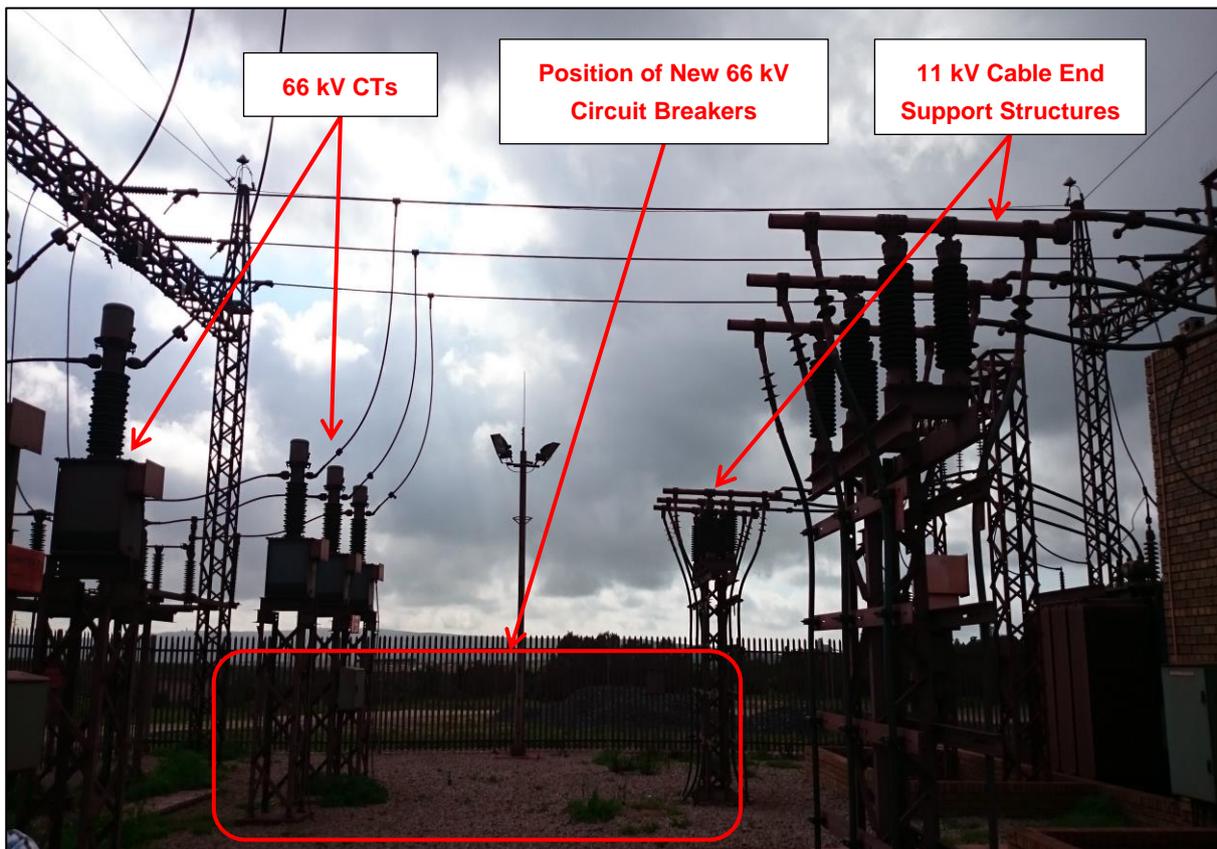


Figure 11: Iscor Substation - Visual Illustration of Position of new 66 kV Circuit Breakers

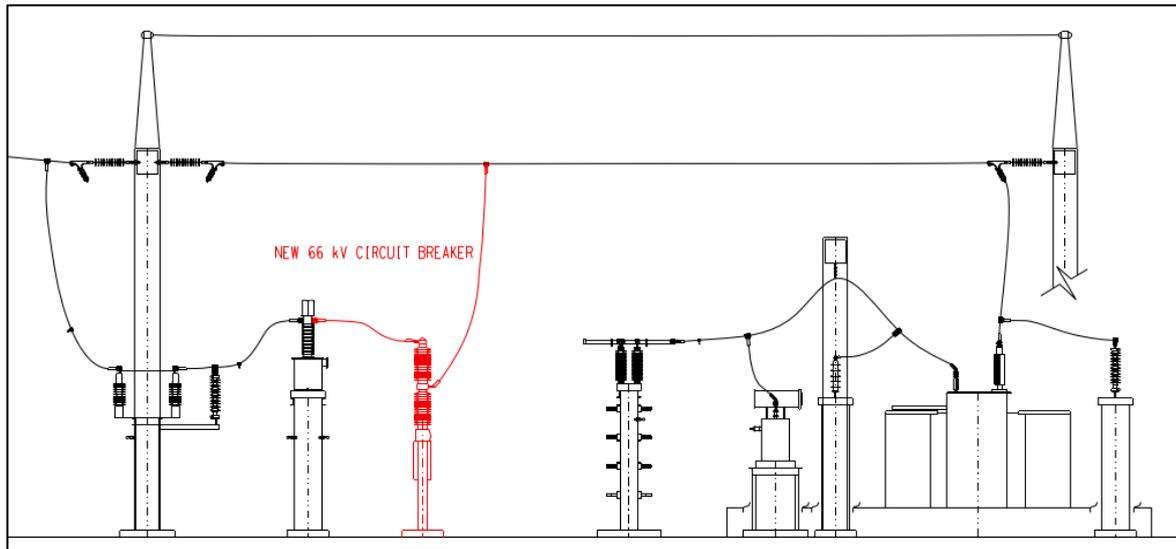


Figure 12: Iscor Substation - Section - New 66 kV Circuit Breaker Configuration

The fault levels at Iscor Substation were provided by Eskom Western Cape Operating Unit (WCOU) Network Planning Department, which are as follows:

Table 3: Iscor Substation Fault Levels

Busbar Name	I - 1 Ø (kA)	I - 3 Ø (kA)
66 kV Busbar (Iscor)	6.4	6.9

9.2. Specification

9.2.1. HV Equipment

All primary plant will comply with the 31 mm/kV creepage insulation levels. The specification of the new 66 kV circuit breakers is as follows, and in accordance with D-DT-6251. It should be noted that certain data listed in the schedule below may differ from those of the actual units to be supplied, based on Eskom's latest requirements at that time of provision of the equipment by the Contractor.

Table 4: Technical Schedule for 66 kV Outdoor Circuit Breakers

Item	Description	Specified
1	Normal Service Conditions	
1.1	Operation	3 pole
1.2	Installation	Outdoor
1.3	Altitude	≤ 1 800 amsl
1.4	Maximum ambient temperature	45 °C

Item	Description	Specified
1.5	Minimum ambient temperature	-10 °C
1.6	Relative humidity	100 %
1.7	Degree of protection	IP44
1.8	Pollution level	Severe (31 mm/kV specific creepage)
1.9	Rated nominal system voltage	66 kV
1.10	Rated maximum system voltage	72.5 kV
1.11	Rated system frequency	50 Hz
2	Rated Insulation Levels	
2.1	Rated power frequency withstand voltage (1 min)	
2.1.1	common value	140 kV
2.1.2	across the isolating distance	160 kV
2.1.3	across open CB	160 kV
2.2	Rated lightning impulse withstand voltage (1s)	
2.2.1	common value	325 kV
2.2.2	across the isolating distance	375 kV
2.2.3	across open CB	375 kV
3	Composite and/or RIP Bushings	
3.1	Rated voltage	72.5 kV
3.2	Rated Current	3150 A
3.3	Rated power frequency withstand voltage	140 kV
3.4	Rated lightning impulse withstand voltage	375 kV
3.5	Partial discharge level, ≤ 5 pC	≤ 92 kV
3.6	Creepage distance	≥ 31 mm/kV
4	Current Ratings	
4.1	Rated continuous current	2500 A
4.2	Rated short-time withstand current	25 kA
4.3	Rated short circuit duration	3 s
4.4	Rated peak withstand current	62.5 kA
4.5	Temperature rise of active parts at rated continuous current	≤ 65 °C
4.6	Temperature rise of terminals at rated continuous current	≤ 50 °C
4.7	Temperature rise of enclosure at rated continuous current	≤ 15 °C

Item	Description	Specified
5	SF₆ Gas System	
5.1	Annual SF6 leakage	< 1 % per year
6	Circuit Breaker Mechanism	
6.1	Type	SF ₆ Auto-puffer
6.2	Operating mechanism	Spring type, three-pole
6.3	Circuit-breaker mechanical endurance class	Class M2
6.4	Maximum number of mechanical operation for drive mechanism	10 000
6.5	Rated operating sequence according to IEC	O - 0.3 s - CO -1 min - CO
6.6	Stored switching sequence	O - CO
6.7	Classification of circuit-breaker according to its restrike performance (line- and cable charging breaking current)	Class C2
6.8	Maximum number of operations at rated current	5000
6.9	Short circuit breaking current	25 kA
6.10	First reference voltage	To be provided by OEM
6.11	Point of time t1	104 μs
6.12	Peak value	To be provided by OEM
6.13	Point of time t2 and t3	312 μs
6.14	Starting point td	2 μs
6.15	Rate of rise	2 μs
6.16	Characteristic For Short Line Fault	
6.16.1	Short line fault current	To be provided by OEM
6.16.2	Wave impedence	To be provided by OEM
6.16.3	Peak value	To be provided by OEM
6.16.4	Rated peak factor	1.6
6.16.5	Time delay tdL	< 0.1 μs
6.16.6	Time tL to peak uL	3.08 μs
6.16.7	Rate of rise of transient recovery voltage	7.84 kV/μs
6.16.8	Opening time	23 ± 4 ms
6.16.9	Arcing time	11.5 - 21.5 ms
6.16.10	Break time	< 50 ms
6.16.11	Closing time	30 ± 5
6.16.12	Contact speed:	To be provided by OEM

Item	Description	Specified
6.16.12.1	Opening	4.6 ± 0.5
6.16.12.2	Closing	4.6 ± 0.5
6.17	Circuit-breaker operating mechanism enclosure requirements	
6.17.1	Operating mechanisms, local control facilities and all parts requiring lubrication protected by weatherproof enclosures	Yes
6.17.2	Degree of protection for enclosures containing exposed bearings, auxiliary switches, motors and other electrical devices	IP 55
6.17.3	Degree of protection for all open areas in the circuit-breaker common base frame as well as externally mounted indicating devices (where applicable)	IP 2X
6.17.4	Degree of protection for all other enclosures	IP 54
6.17.5	Operating mechanism enclosure, handles and fixings material	316L stainless steel/ Painted aluminium
6.17.6	Maximum height to top of mechanism allows servicing from ground ($U_n \leq 132$ kV)	2000 mm
6.17.7	Front access door secured with a heavy-duty locking mechanism	Yes
6.17.8	Padlocking facility shackle diameter	6 mm
6.17.9	Front access door equipped with travel stop	Yes
6.17.10	Rigid, corrosion resistant documentation pocket provided on inside of front access door, securely attached no protrusion through door	Yes
6.17.11	Enclosure colour	RAL 7032 or Light grey ('G29')
6.18	Auxiliaries	
6.18.1	Rated voltage	110 Vdc
6.18.2	Rated current	5 Adc
6.18.3	Operating Coils	
6.18.3.1	Rated voltage	110 Vdc
6.18.3.2	Rated power	200 W
6.18.3.3	Operating current	2 Adc
6.18.4	Circuit-breaker Motor	
6.18.4.1	Rated voltage	110 Vdc
6.18.4.2	Rated power	900 W
6.18.4.3	Operating current	13 Adc
6.18.4.4	Starting current	20 Adc

Item	Description	Specified
6.18.4.5	Auxiliary contacts	5 NO + 5 NC

9.2.2. Earthing Material

All earthing will be done in accordance with Eskom standard 240-134369472 - Substation Earth Grid Design Standard and D-DT-5240. All supports will be earthed using two earth tails.

The existing earth grid/mat does not form part of this project. The new 66 kV circuit breakers steel support structures will be connected to the existing earth grid/mat.

Table 5: Technical Schedule for Copper Straps

Flat Copper Straps	
Material Type	Black Annealed Cu
Insulated or Bare	Bare
Width (mm)	50
Thickness (mm)	3
Area (mm ²)	150
kA/1 sec	26.4

9.2.3. Clamps & Conductors

Table 6: Clamp Technical Schedules

Type	Dimensions
EXC-B: Bolted/Compression	Stem: 38 mm; Conductor: 26.5 mm
ETC-C: Bolted/Compression	Run: 26.5 mm; Tap: 26.5 mm
EPC-A: Bolted/Compression	Palm: 50 mm x 50 mm; Conductor: 26.5 mm
EPC-B: Bolted/Compression	Palm: 50 mm x 50 mm; Conductor: 26.5 mm

Table 7: Technical Schedule for Centipede AAC

Centipede AAC Characteristics	
Conductor overall diameter (mm)	26.46
Area Total (mm ²)	415.22
Aluminium wire stranding/diameter (mm)	37/3.78
Conductor linear mass (kg/km)	1150
Ultimate Tensile strength (kN)	67.2
Resistance dc @ 20 °C (ohms/km)	0.0694
Modulus elasticity final (GPa)	58.6
Coefficient of Linear expansion (1/°C)	23 x 10 ⁻⁶

9.2.4. Busbar Design

No busbar design is required for the scope of work for this project.

9.2.5. Yard Lighting

No new yard lighting has been catered for Iscor Substation, as it is not part of the scope of works.

9.2.6. Lightning Shielding

The existing lightning protection of Iscor Substation shall be relied-upon.

9.2.7. Substation Security Systems

No allowance have been made for any additional security measure such as CCTV, access control or intruder alarm systems as it does not form part of scope of the project.

9.2.8. Substation HV Equipment Labels

The existing Blouwater 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.

Table 8: Yard Equipment Label Changes Required - Feeder 1

Existing	New
N/A	BLOUWATER 1/YSTERVARK TEE 66 kV BKR
BLOUWATER 1 66 kV LINE ISOLATOR	BLOUWATER 1/YSTERVARK TEE 66 kV LINE ISOLATOR
BLOUWATER 1 66 kV CT	BLOUWATER 1/YSTERVARK TEE 66 kV CT

Table 9: Yard Equipment Label Changes Required - Feeder 2

Existing	New
N/A	BLOWWATER 2/YSTERVARK TEE 66 kV BKR
BLOWWATER 2 66 kV LINE ISOLATOR	BLOWWATER 2/YSTERVARK TEE 66 kV LINE ISOLATOR
BLOWWATER 2 66 kV CT	BLOWWATER 2/YSTERVARK TEE 66 kV CT

9.3. Long Lead Time Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU_BOM-18-04		REV : 0		This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
MAIN EQUIPMENT										
QTY	SAP	REFERENCE	Rev	Voltage	DESCRIPTION	Fault Current	Stud	Current Rating	LEAD	
CIRCUIT BREAKERS										
2	0170219	D-DT-6251	8	66 kV	Circuit Breaker, Post Type	25 kA	4-hole pad	2500 A	8 mnth	

NOTE: Unless otherwise stated, all equipment creepage is 31mm/kV

9.4. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU_BOM-18-04		REV : 0		 This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
MAIN EQUIPMENT										
QTY	SAP	REFERENCE	Rev	Voltage	DESCRIPTION	Fault Current	Stud	Current Rating	LEAD	
CIRCUIT BREAKERS										
2	0170219	D-DT-6251	8	66 kV	Circuit Breaker, Post Type	25 kA	4-hole pad	2500 A	8 mnth	

NOTE: Unless otherwise stated, all equipment creepage is 31mm/kV

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU_BOM-18-04		REV : 0		 This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
EARTHING										
QTY	SAP	REFERENCE	Rev	DESCRIPTION	Total Meters :		Meters :		LEAD	
EARTHING										
0.3 coils	0400772	D-DT-6045	3	kg Flat Copper Bar (3x50mm)	10.00 m		10 m		10 m	

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU_BOM-18-04		REV : 0		 This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
CONDUCTOR										
QTY	SAP	REFERENCE	Rev	DESCRIPTION	kg/m					
CONDUCTOR AND BUSBAR TUBE										
CONDUCTOR										
66 m	0403041	D-DT-3136	13	COND, AAC CENTIPEDE 26.46D UNGRS	1.15					

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM										
POWER PLANT										
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade				WCOU_BOM-18-04		REV : 0		 This document is the property of Eskom
JOB NUMBER:		Job Number: 153272156-00004								
BOM TYPE:		FINAL BOM & BOQ								
PREPARED BY :		Dirk Agenbag								
Tel No		Tel: 021 950 7500								
DATE PREP. :		18 January 2019								
CLAMPS										
QTY	SAP	REFERENCE	Rev	DESCRIPTION	Compression	Bolted	Angle			
Bolted - Compression										
6	0401766	D-DT-6006	8	EXC-B B/Comp	26.5 mm	38 mm	0°			
6	0401754	D-DT-6010	10	ETC-C T/Comp	26.5 mm	26.5 mm	0°			
6	0401580	D-DT-6018	8	EPC-A B/Comp 50x50	26.5 mm	Palm	0°			
6	0400420	D-DT-6018	8	EPC-B B/Comp 50x50	26.5 mm	Palm	45°			

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM					
POWER PLANT					
JOB NAME		Job Name: Isocr 66 kV Breaker & Protection Upgrade		WCOU BOM-18-04	REV : 0
JOB NUMBER:		Job Number: 153272156-00004			
BOM TYPE:		FINAL BOM & BOQ			
PREPARED BY :		Dirk Agenbag			
Tel No		Tel: 021 950 7500			
DATE PREP. :		18 January 2019		This document is the property of Eskom	
MISCELLANEOUS					
QTY	SAP	REFERENCE	Rev	DESCRIPTION	
MISCELLANEOUS					
48	0163641	D-DT-3082	15	Stainless Steel Bolt & Nut : M12 x 65mm with 1 x flat washers & 1 x spring washer	Used for Palm clamps
24	0163812	D-DT-6097	4	Stainless Steel Bolt & Nut : M16 x 75mm	To attach Post Type BKR to steel
Signage					
6	Buy Out	D-DT-5047	0	Equipment/Bay Labels	Label

9.5. Final Bill of Quantities

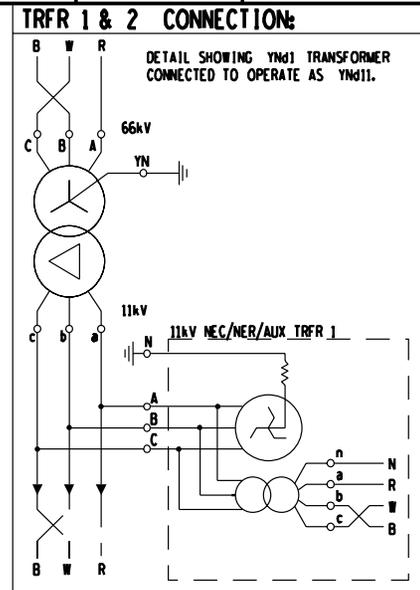
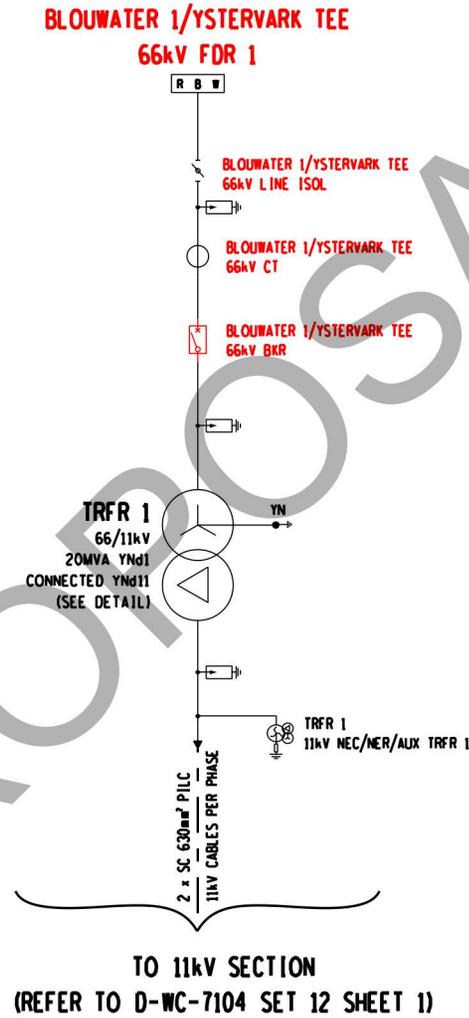
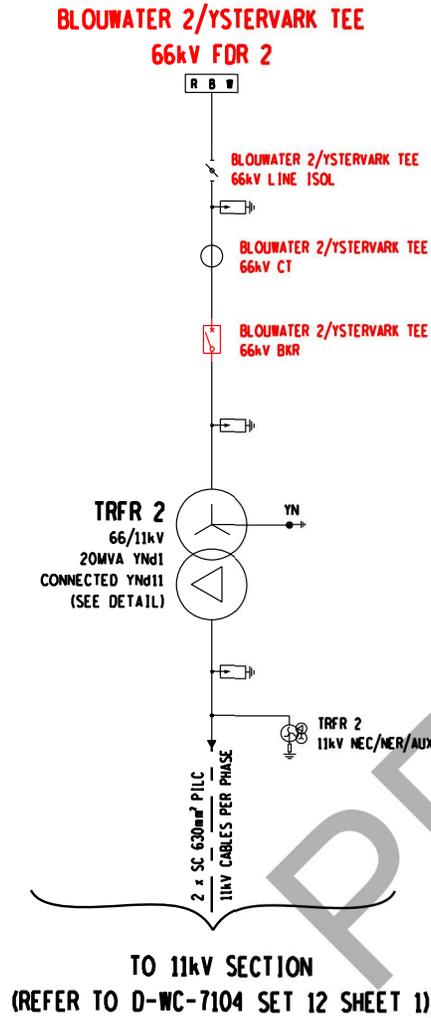
WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM											WCOU_BOM-18-04
JOB NAME JOB NUMBER: BOM TYPE: PREPARED BY : Tel No DATE PREP. :			Job Name: Isocr 66 kV Breaker & Protection Job Number: 153272156-00004 FINAL BOM & BOQ Dirk Agenbag Tel: 021 950 7500 18 January 2019			LASTEST REV : 0					
BILL OF QUANTITIES											
CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT						
					B, P&G %	RATE (R)	POINTS/UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
POWER PLANT ACTIVITIES											
ELECTRICAL ACTIVITIES											
	Earthing										
	Earthing of steel structures (per tail)	each	4		12.35	151.08	0.125	0.50		2.00	
	Bond and earth equipment	each	2		12.35	453.25	0.375	1.50		3.00	
	Erect 132/66/44 kV equipment:										
	Erect 132/66/44 kV Breakers post type	set	2		12.35	12086.60	10	40.00		80.00	
BUSBARS											
	Terminate jumper to busbar Clamp/compress bolt	each	24		12.35	543.90	0.45	1.80		43.20	
Stringing HV											
	Conductor Run Out & Hang - Single	phm	66		12.35	36.26	0.03	0.12		7.92	
	Con Tension Reg. & Terminate - Single	phm	66		12.35	302.17	0.25	1.00		66.00	
SUBTOTAL (ELECTRICAL PP ACTIVITIES)									197.12		
DISMANTLING ACTIVITIES											
	Dismantle										
	Loosen/Slacking of conductor/earth	each	6.0		12.35	241.73	0.2	0.80		4.80	
SUBTOTAL (DISMANTLING ACTIVITIES)											

9.6. Label Schedule

WCOU NED - HV SUBSTATION LABEL SCHEDULE					
JOB NAME		ISCOR 66 kV BREAKER UPGRADE		LASTEST REV :	0
JOB NUMBER:		153272156-00004			
BOM TYPE:		FINAL			
PREPARED BY :		DIRK AGENBAG			
Tel No		021 950 7500			
DATE PREP. :		30 November 2018			
Label Schedule					
QTY	MATERIAL	REFERENCE	RevNo		LABEL NO
ISOLATORS					
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 1/YSTERVARK TEE 66 kV LINE ISOLATOR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 2/YSTERVARK TEE 66 kV LINE ISOLATOR	2
CURRENT TRANSFORMERS					
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 1/YSTERVARK TEE 66 kV CT	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 2/YSTERVARK TEE 66 kV CT	2
CIRCUIT BREAKERS					
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 1/YSTERVARK TEE 66 kV BKR	2
1	FG	D-DT-5047-4 D-DT-5047-2	3 3	BLOUWATER 2/YSTERVARK TEE 66 kV BKR	2

9.7. Detailed Drawings

<u>Drawing No.</u>	<u>Drawing Title</u>	<u>Rev</u>
D-WC-7104-11-01	66 kV - Station Electric Diagram - Proposal A	5A
D-WC-7104-11-02	66/11 kV - Site Plan	01
D-WC-7104-11-04	66/11 kV - Earth Grid Layout	02
D-WC-7104-11-07	66/11 kV - General Arrangement Layout	02
D-WC-7104-11-09	66/11 kV - Sections & Clamps	02
D-WC-7104-12-01	11 kV - Station Electric Diagram - Proposal A	08A



SET NO.	REFERENCE DRAWINGS
SET 11 SHT 7	ELECTRICAL LAYOUT
SET 11 SHT 6	STEELWORK MARKING PLAN
SET 11 SHT 5	FOUNDATION LAYOUT
SET 11 SHT 4	EARTH MAT LAYOUT
SET 12 SHT 2	11kV STATION ELECTRIC DIAG
SET 11 SHT 1	66kV STATION ELECTRIC DIAG

NO	DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
5A	CIRCUIT BREAKERS ADDED AND LABEL CHANGE.	ADA	BS	CP	31/01/2019	15227256-00004
4	FINAL COMMISSIONING FOR ISCOR REFURB PROJECT	BA	DS	BJ	23/10/2014	3487A
3c	NO CHANGE, SED BROUGHT IN LINE WITH OTHER STAGE SEDs	BA	DS	MsT	04/07/2014	3487A
3b	NO CHANGE, SED BROUGHT IN LINE WITH OTHER STAGE SEDs	BA	DS	MsT	27/06/2014	3487A
3a	STAGE 2: TRFR 1 REARLY CONNECTED TO OLD TBY BOARD & CONNECT TRFR 2 TO NEW TBY BOARD	BA	DS	MsT	27/06/2014	3487A
2A	SUBSTATION REFURBISHMENT	ADA	JM	CK	08/10/2010	3487A
2	VERIFIED BY TSC	AM	MAS	JM	07/06/2010	
1B	DRAWING NUMBER WAS INCORRECT.	MMS	DAL	YS	02/02/2009	
1A	SURGE ARRESTORS ADDED	MMS	DAL	EM	21/07/2004	
0	REDESIGN TO NEW STANDARD	RT	MAS	EM	22/04/2002	1503A

Eskom

ISCOR 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

SET	SHEET	REVISION
11	1	5A

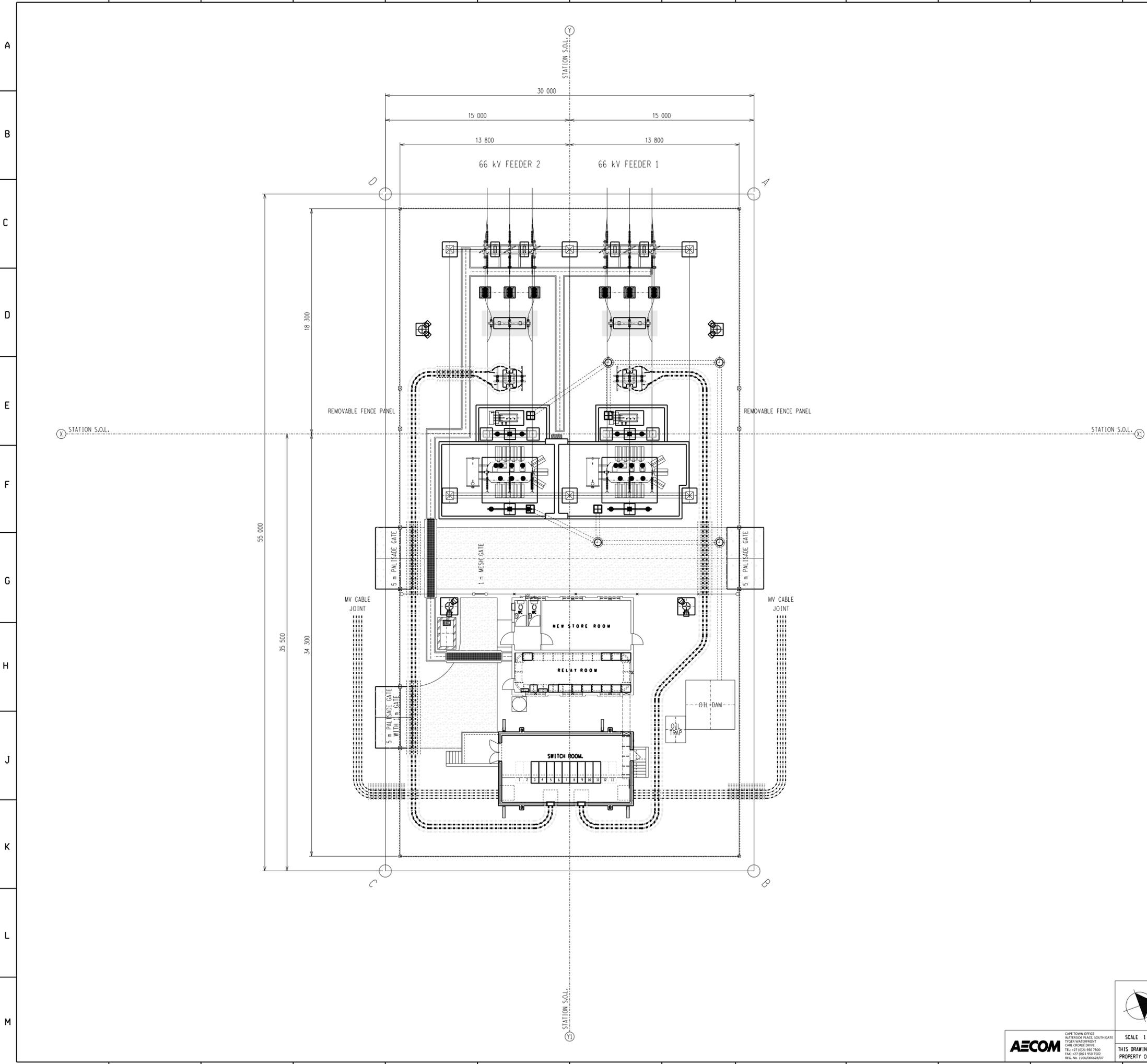
D-WC-7104

AECOM

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REC. NO.: 14850566207

SCALE: NIS

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NOTES ON SETTING OUT:

- SETTING OUT BEACONS X, XI, Y & Y1 TO BE PEGGED AND LEVELED BY ESKOM'S LAND SURVEY DEPARTMENT.

NOTES ON MV CABLES:

- ALL WORK SHALL BE IN ACCORDANCE WITH THE FOLLOWING STANDARDS AND SPECIFICATIONS:
 - SANS 0198 CODE OF PRACTICE FOR THE SELECTION, HANDLING AND INSTALLATION OF ELECTRIC POWER CABLES OF RATING NOT EXCEEDING 33 kV.
 - SCSASABK6 LATEST REV. DISTRIBUTION STANDARD PART 22: CABLES SECTION 6: MEDIUM VOLTAGE CABLING IN SUBSTATIONS.
- CABLES SHALL BE LAID IN ACCORDANCE WITH D-DT-0854 (MV CABLE TRENCH DETAILS)

FENCE LEGEND:

SYMBOL	DESCRIPTION
⊗	FENCE POST CORNER EXTERNAL
⊞	FENCE POST GATE EXTERNAL
⊠	FENCE POST GATE INTERNAL
○	FENCE POST STRAIN INTERNAL
-----	EXTERNAL FENCE STEEL PALISADE
-----	INTERNAL FENCE DIAMOND MESH

SUBSTATION CO-ORDINATES WG19

	Y	X
A	+93 092.68	+3 652 582.23
B	+93 040.87	+3 652 600.75
C	+93 050.97	+3 652 629.00
D	+93 102.77	+3 652 610.48

SET 12 SHT 1	11 kV STATION ELECTRIC DIAGRAM
SET 11 SHT 11	LIGHTNING PROTECTION LAYOUT
SET 11 SHT 10	YARD LIGHTING LAYOUT
SET 11 SHT 9	SECTIONS AND CLAMPS
SET 11 SHT 8	TRFR 1 & 2 PLINTH DETAILS
SET 11 SHT 7	GENERAL ARRANGEMENT LAYOUT
SET 11 SHT 6	STEELWORK LAYOUT
SET 11 SHT 5	FOUNDATION & TRENCH LAYOUT
SET 11 SHT 4	EARTH GRID LAYOUT
SET 11 SHT 3	LEVEL & DRAINAGE PLAN
SET 11 SHT 2	SITE PLAN
SET 11 SHT 1	66 kV STATION ELECTRIC DIAGRAM

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
1	66 kV CIRCUIT BREAKERS ADDED.	ADA	BS	CP	31/01/2019	153272156-00004
0	FIRST ISSUE, SUBSTATION REFURBISHED.				//	3487A

Eskom Distribution

ISCOR SUBSTATION
66/11 kV
SITE PLAN

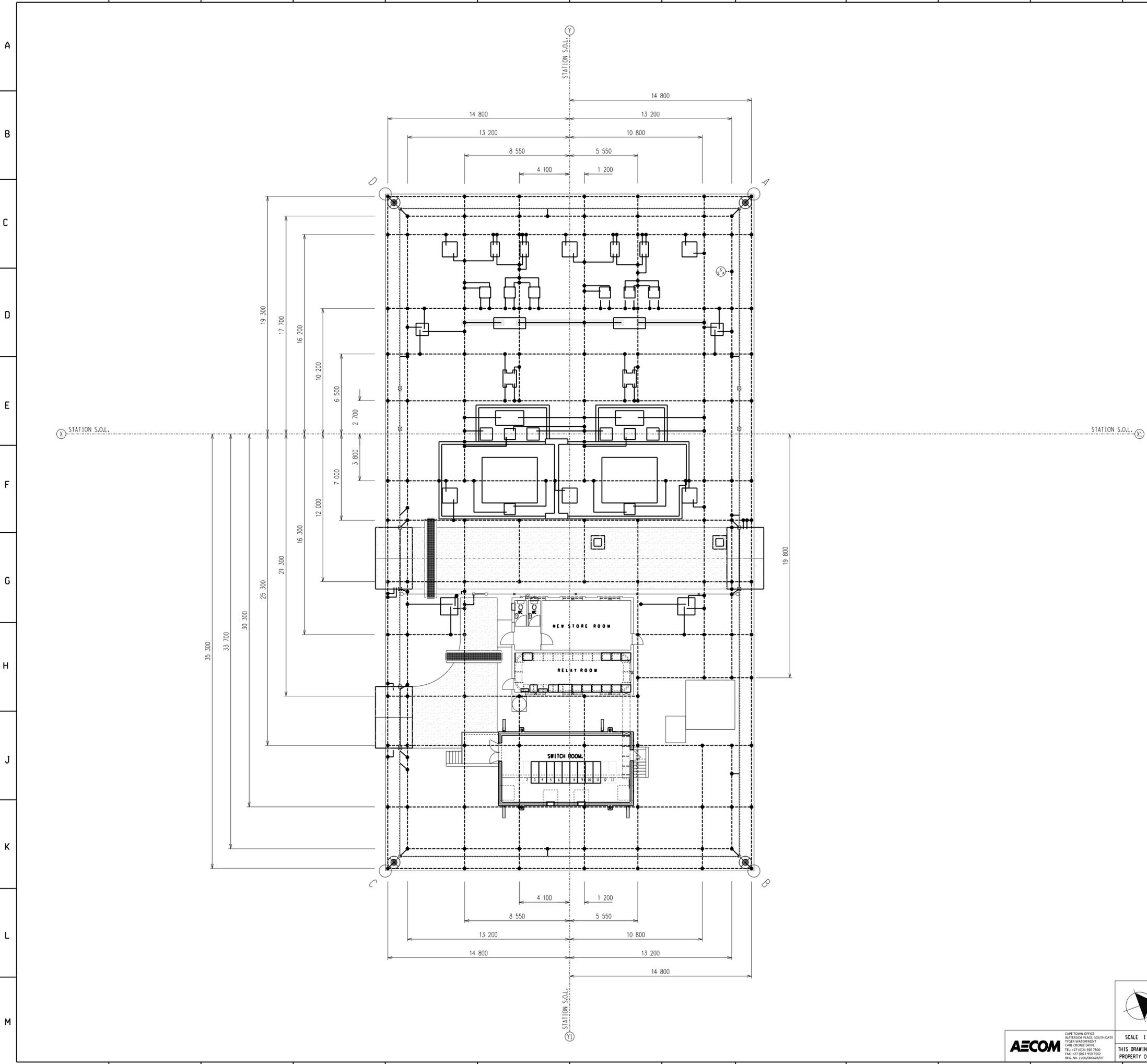
AUTH: C KING
DATE: 08/10/2010
CHKD: J MOSTERT
DATE: 08/10/2010
DRAWN: AD AGENBAG
DATE: 01/07/2010

D-WC-7104

SET	SHEET	REVISION
	11	2
		1

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TYGER WATERFRONT
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REG. NO. 1966/006628/07

SCALE 1:150
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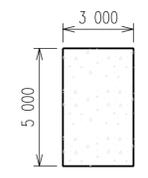


SCHEDULE:

LEGEND	DESCRIPTION
-----	MAIN EARTH GRID IS 1 x 10 mm ϕ ROUND COPPER 1 000 mm BELOW GROUND LEVEL.
-----	EARTH TAILS 3 mm x 50 mm FLAT COPPER STRAPS.
-----	NEW EARTH TAILS 3 mm x 50 mm FLAT COPPER STRAPS.
-----	BRAZED JOINTS TO BE OXY-ACETYLENE BRAZED USING 3 mm ϕ SILBRALLOY BRAZING RODS, NO CRIMPING ALLOWED.
-----	SACRIFICIAL EARTH GRID ANODES TO BE MANUFACTURED AND CONNECTED TO THE MAIN EARTH GRID AS PER DRAWING D-DT-5240 SHEET 11.
-----	200 mm ϕ HOLES TO BE DRILLED BETWEEN 3-4 m DEEP, 2 x 10 mm ϕ COPPER ELECTRODES BACKFILLED WITH BENTONITE SLURRY MIXTURE, TAILS OF ELECTRODES TO BE CONNECTED TO MAIN EARTH GRID.

- NOTES:**
- FOR STANDARD EARTHING SPECIFICATION SEE DRAWING D-DT-5240 LATEST REVISION, SPECIFICATION MENTIONS CRIMPING, BUT NO CRIMPING IS ALLOWED. ALL JOINTS TO BE SILBRALLOY BRAZING.
 - SECURITY FENCE EARTHING AT INTERVALS NOT EXCEEDING 20 m.
 - FOR CONNECTION OF MAIN EARTH GRID TO FOUNDATIONS SEE THE FOUNDATION DRAWINGS LISTED ON D-WC-7104-11-05. ALL EARTH STRAPS WILL BE CONCEALED WITHIN THE FOUNDATIONS AS DETAILED ON THE FOUNDATION DRAWINGS.
 - YARD STONE TO BE LAID 1 200 mm OUTSIDE THE PALISADE FENCE PERIMETER.

DETAIL 1: EQUI-POTENTIAL GATE SLAB



- A 300 mm THICK CONCRETE SLAB WITH DIMENSIONS SHOWN ABOVE SHALL BE PLACED AT THE 5 m GATES. ALL CONCRETE WORK SHALL COMPLY WITH SANS 1200 GA. MINIMUM 28 DAYS COMPRESSION STRENGTH SHALL BE 20 MPa NOMINAL AGGREGATE SIZE SHALL BE 19 mm.
- THE REINFORCING MESH 245 SHALL BE PLACED IN THE TOP AND BOTTOM OF THE SLAB WITH A COVER OF 50 mm. WHERE THE GROUND CONDITIONS ARE POOR, A 50 mm THICK MASS CONCRETE BLINDING LAYER SHALL BE CAST PRIOR TO THE MESH BEING PLACED. ALL REINFORCING OVERLAPS SHALL HAVE AN OVERLAP OF 350 mm.
- THE SUBGRADE MATERIAL UNDER THE SLAB SHALL BE COMPACTED TO 90% OF MOD AASHTO MAXIMUM DENSITY.
- THE MESH IS TO BE BONDED ON ONE SIDE ONLY TO THE MAIN EARTH GRID. FOUR CONNECTIONS REQUIRED AS PER D-DT-5240 SET 21 SHT 10.
- EXPANSION JOINTS NOT TO EXCEED 4 m SPACINGS (16 m sq BLOCKS).

SET 12 SHT 1	11 kV STATION ELECTRIC DIAGRAM
SET 11 SHT 11	LIGHTNING PROTECTION LAYOUT
SET 11 SHT 10	YARD LIGHTING LAYOUT
SET 11 SHT 9	SECTIONS AND CLAMPS
SET 11 SHT 8	TRFR 1 & 2 FLINTH DETAILS
SET 11 SHT 7	GENERAL ARRANGEMENT LAYOUT
SET 11 SHT 6	STEELWORK LAYOUT
SET 11 SHT 5	FOUNDATION & TRENCH LAYOUT
SET 11 SHT 4	EARTH GRID LAYOUT
SET 11 SHT 3	LEVEL & DRAINAGE PLAN
SET 11 SHT 2	SITE PLAN
SET 11 SHT 1	66 kV STATION ELECTRIC DIAGRAM REFERENCE DRAWINGS

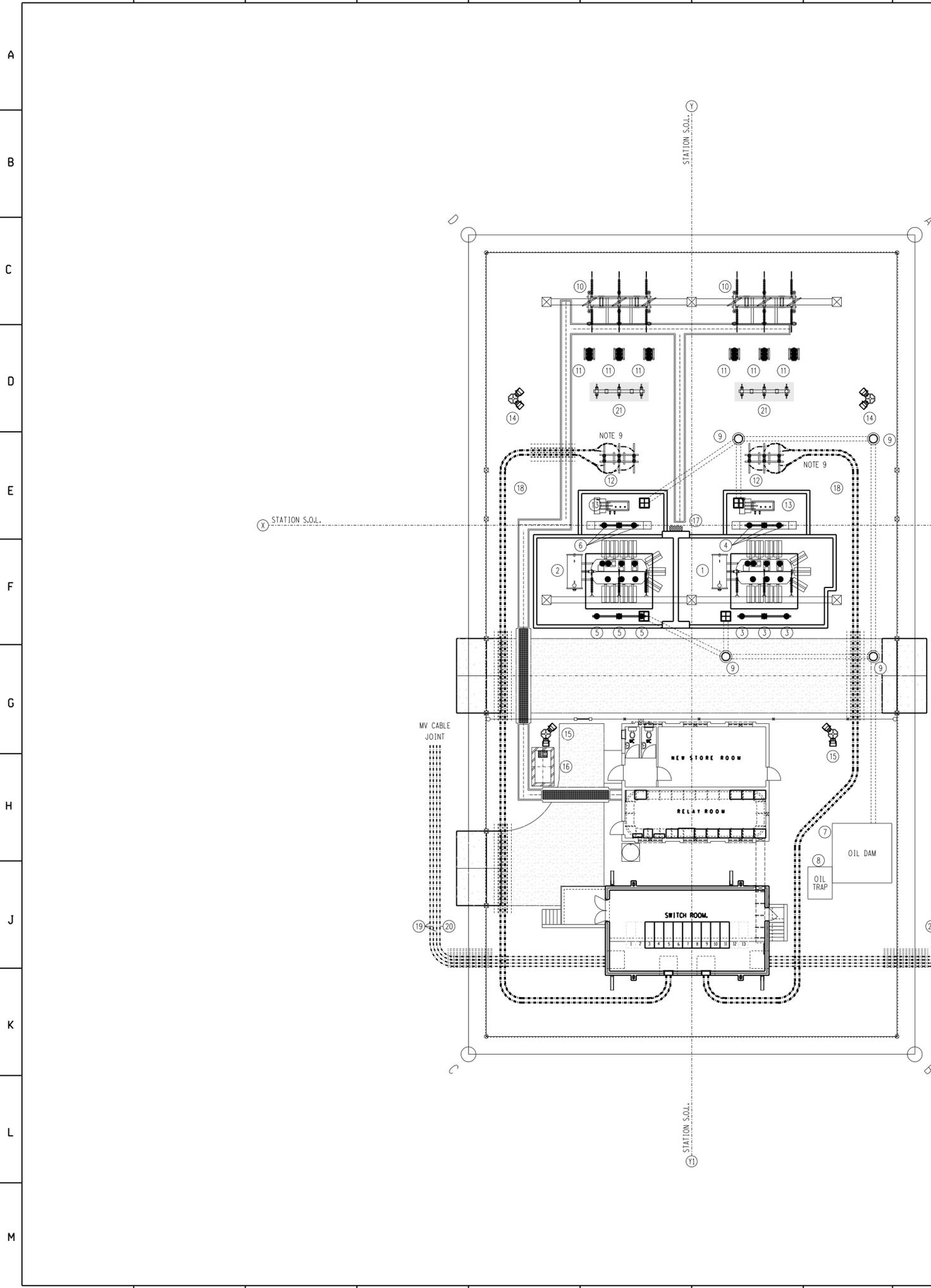
2	66 kV CIRCUIT BREAKERS ADDED.	ADA	BS	CK	31/01/2019	153272156-00004
1	SUBSTATION REFURBISHED.	ADA	JM	CK	08/10/2010	3487A
0	REDRAWN ON CAD AND SA'S & FIREWALL ADDED	MAS			/ /	1503A

	ISCOR SUBSTATION								
	66/11 kV								
EARTH GRID LAYOUT									
AUTH: / / DATE: / / CHND: / / DATE: / / DRAWN: MA Sulaiman DATE: 05/01/2004	D-WC-7104		<table border="1"> <tr> <th>SET</th> <th>SHEET</th> <th>REVISION</th> </tr> <tr> <td>11</td> <td>4</td> <td>2</td> </tr> </table>	SET	SHEET	REVISION	11	4	2
SET	SHEET	REVISION							
11	4	2							

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SCALE 1:150
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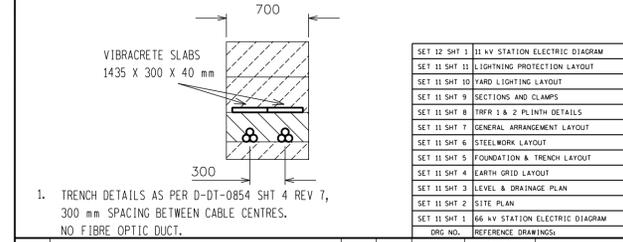


EXISTING EQUIPMENT SCHEDULE:					
MARK	DESCRIPTION	USE FOR	ORDER NO.	MANUFACTURER	OUTLINE DRAWING NO.
1	TRFR 20 MVA 66/11 kV OLTC	TRFR 1	-	ASEA	1.03/15375
2	TRFR 20 MVA 66/11 kV OLTC	TRFR 2	-	ASEA	1.03/15375
MARK	DESCRIPTION	USE FOR	DRAWING NO.	REV. NO.	
3	S/ARR S/CL 66 kV MCOV 48 kV 31 mm/kV	TRFR 1 66 kV SA's	D-DT-6212 SHEET 1	7	
4	S/ARR S/CL 11 kV MCOV 12 kV 31 mm/kV	TRFR 1 11 kV SA's	D-DT-6216 SHEET 1	7	
5	S/ARR S/CL 66 kV MCOV 48 kV 31 mm/kV	TRFR 2 66 kV SA's	D-DT-6212 SHEET 1	7	
6	S/ARR S/CL 11 kV MCOV 12 kV 31 mm/kV	TRFR 2 11 kV SA's	D-DT-6216 SHEET 1	7	
7	STANDARD OIL DRAINAGE DAM WITH LID		(EXISTING)		
8	OIL TRAP		(EXISTING)		
9	MANHOLE		(EXISTING)		
10	66 kV ISOLATOR WITH SURGE ARRESTORS		D-DT-4728 SHT 1 REV 6		
11	66 kV CURRENT TRANSFORMER		D-DT-6198 SHT 1 REV 8		
12	MV CABLE SEALING END SUPPORT 2 x 630 mm CU CABLE/PHASE		D-DT-4649 SHT 3 REV 9		
13	11 kV NEC/R/T		D-DT-6140 SHT 1 REV 9		
14	8 m LIGHTING/LIGHTNING MAST		D-DT-5217 SHT 2 REV 4		
15	14 m LIGHTING/LIGHTNING MAST		D-DT-5217 SHT 3 REV 8		
16	CONSERVANCY TANK		D-WC-7104-13-01.00		
17	YARD AC DISTRIBUTION BOARD		D-DT-9200 SHT 2 REV 2		
18	MV CABLE, 2 x 630 mm ² SINGLE CORE CU CABLE/PHASE		D-DT-8000 SHT 1 REV 6		
19	MV CABLE, 1 x 300 mm ² THREE CORE CU CABLE/PHASE		D-DT-8000 SHT 4 REV 6		
20	MV CABLE, 1 x 95 mm ² THREE CORE CU CABLE		D-DT-8000 SHT 3 REV 6		

NEW EQUIPMENT SCHEDULE:		
MARK	DESCRIPTION	DRAWING NO.
21	66 kV CIRCUIT BREAKER	D-DT-6251 SHT 1 REV 8

- NOTES:**
- ALL WORK TO BE DONE IN ACCORDANCE WITH SANS 1200 LATEST REVISION.
 - TOP OF EQUIPMENT FOUNDATIONS TO BE 150 mm ABOVE TERRACE LEVEL.
 - H.V. YARD TO HAVE A CLEAN, HARD, SOUND CRUSHED STONE OF A 38 mm MINIMUM NOMINAL SIZE, 100 mm THICK LAYER. THIS SHOULD BE APPLIED AFTER INSTALLATION OF ALL EQUIPMENT AND CABLES.
 - DEPTH OF EQUIPMENT FOUNDATIONS TO BE NOT LESS THAN SHOWN ON DETAIL DRAWING AND NOT LESS THAN 300 mm INTO NATURAL GROUND.
 - STRUCTURES SHALL BE ERECTED, ALIGNED, SQUARED, PLUMBED AND LEVELED TO AN ACCURACY SPECIFIED IN SANS 1200 H 6.2.2.c12 - CLASS II.
 - EQUIPMENT NOT FITTED WITH 26 mmφ or 38 mmφ CONNECTION PRONGS MUST BE FITTED WITH TINNED 26 mmφ OR 38 mmφ BRASS PRONGS DRILLED AND TAPPED TO APPROPRIATE SIZES.
 - ALL SURFACE AREAS OF CONDUCTOR OR CONTACT AREA OF CONNECTION CLAMPS MUST BE TREATED AS DESCRIBED PRIOR TO MAKING A CLAMPED OR CRIMPED CONNECTION.
 - a) APPLY THIN LAYER OF NON OXIDE GREASE TO SURFACE AREA.
 - b) BRUSH NON OXIDE GREASED AREA THOROUGHLY WITH A CLEAN WIRE BRUSH.
 - c) WIPE SURFACE AREA CLEAN WITH RAG AND IMMEDIATELY APPLY A FRESH LAYER OF NON OXIDE GREASE TO CLEAN SURFACE AREA.
 - d) FIT CLAMP TO CONNECTOR PRONG OR CONDUCTOR AND TORQUE TO:-
 - d.1) 8 mm GALVANIZED STEEL BOLTS - 15 Nm.
 - d.2) 10 mm GALVANIZED STEEL BOLTS - 26 Nm.
 - d.3) 12 mm GALVANIZED STEEL BOLTS - 45 Nm.
 - d.4) 8 mm S/STEEL BOLTS - 20 Nm.
 - d.5) 10 mm S/STEEL BOLTS - 35 Nm.
 - d.6) 12 mm S/STEEL BOLTS - 60 Nm.
 - d.7) 8 mm ALUMINIUM BOLTS - 10 Nm.
 - d.8) 10 mm ALUMINIUM BOLTS - 21 Nm.
 - d.9) 12 mm ALUMINIUM BOLTS - 36 Nm.
 - ALL CLAMPS FROM THE TRFR MV BUSHING TO THE 11 kV SA TO BE TAPED FIRST WITH PUTTY TAPE AND THEN COVERED WITH P23 TAPE.
 - THE FINAL POSITION OF THE MV CABLES SHALL BE DETERMINED ON SITE.
 - VIBRACRETE SLABS SHALL BE PLACED OVER THE SINGLE CORE MV CABLES, WHERE THERE IS VEHICLE ACCESS INTO THE HV YARD. SEE DETAIL 1.

DETAIL 1: VIBRACRETE SLABS FOR S/C MV CABLES IN HV YARD



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	66 kV CIRCUIT BREAKERS ADDED.	ADA	BS	CP	31/01/2019	153272156-00004
1	SUBSTATION REFURBISHED.	ADA	JM	CK	08/10/2010	3487A
0	REDRAWN ON CAD AND SA'S & FIREWALL ADDED	MAS			/ /	1503A

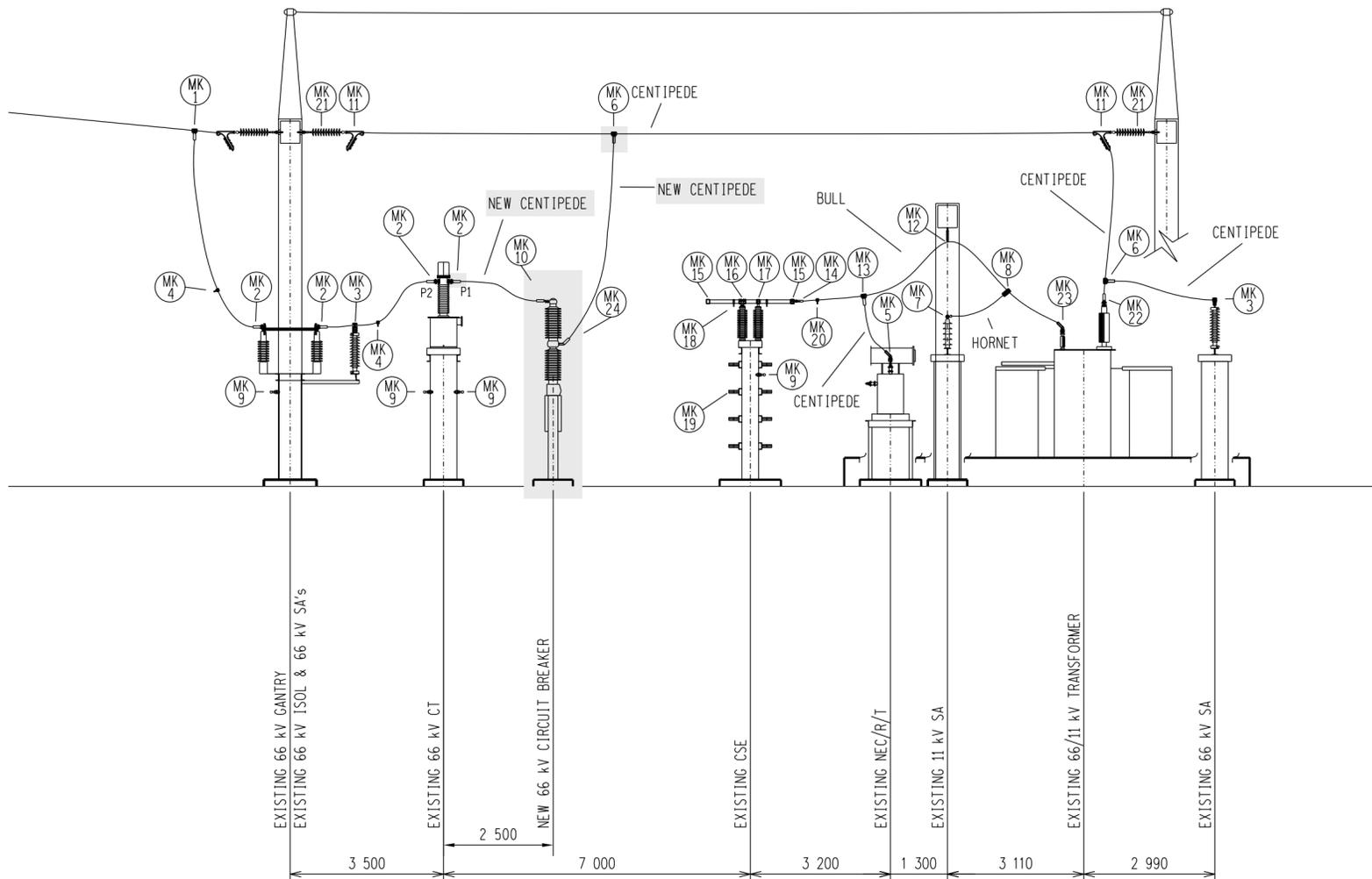
	ISCOR SUBSTATION								
	66/11 kV								
GENERAL ARRANGEMENT LAYOUT									
AUTH: / / DATE: / / CHKD: / / DATE: / / DRAWN: MA Sulaiman DATE: 05/01/2004	D-WC-7104	<table border="1"> <tr> <th>SET</th> <th>SHEET</th> <th>REVISION</th> </tr> <tr> <td>11</td> <td>7</td> <td>2</td> </tr> </table>	SET	SHEET	REVISION	11	7	2	
SET	SHEET	REVISION							
11	7	2							

AECOM
 CAPE TOWN OFFICE
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 CANNON DRIVE
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 FAX: +27 (0)21 960 7502
 REG. NO. 1996/006628/07

SCALE 1:150
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66 kV FDR 1 & 2 AND TRFR 1 & 2 BAYS



SCHEDULE				
MARK	CODE	DESCRIPTION	DRAWING NO.	CLAMP SIZE
1	UT-3	CLAMP, T R12-19 mm - T22-28 mm	D-DT-6099	12-19 - 22-28 mm
2	EXC-B	CLAMP, B/COMP 0°	D-DT-6006	26,5 - 38 mm
3	K2	CLAMP, CROSS	D-DT-6002	26,5 - 26 mm
4	EPC-26	CLAMP, PEG AL CENT	D-DT-6115	26,5 mm
5	KC 11	CLAMP, B/COMP 45°	D-DT-6006	26,5 - 38 mm
6	ETC-C	CLAMP, T/COMP 0°	D-DT-6010	26,5 - 26,5 mm
7	-	LUG, AL HORNET 1B M12	D-DT-3074	12 mm
8	K3	CLAMP, CROSS 16,3 mm - 38 mm	D-DT-6002	16 mm
9	-	JOINT, BALL PORTABLE EARTH 20 kA G/S	D-DT-6081	-
10	EPC-A	CLAMP, B/COMP 50X50 0°	D-DT-6018	26,5 mm - PALM
11	B 4	CLAMP, PISTOL 20 mm - 30 mm	D-DT-6042	20 - 30 mm
12	-	CLAMP, SUSP PIVOTED 24,0 mm - 40,0 mm	D-DT-7009	24 - 40 mm
13	TC 9	CLAMP, T/COMP 38,3 mm - 26,5 mm	D-DT-6010	38,3 - 26,5 mm
14	C1	CLAMP, S/COMP TBCT 80/38/C1 0°	D-DT-6090	38,3 mm
15	TBEC/P - 80	END CAP TBEC 80 PLAIN NO F/CLAMP	D-DT-6040	80 mm
16	TBSC80	CLAMP, BUS COUPLER TYPE TBSC80-127	D-DT-6086	80 mm
17	TBFS80	CLAMP, F/BUS SUPP TYPE TBFS80-127	D-DT-6039	80 mm
18	TBTP80	CLAMP, TUBE BUS/PALM T/ OFF TBTP80	D-DT-6117	80 mm
19	-	CLAMP, CABLE DBL 50 - 75 P/PROP BLK	D-DT-8019	50 - 75 mm
20	EPC-38	CLAMP, PEG AL BULL	D-DT-6115	38,3 mm
21	-	INSUL, L/ROD 66 kV 120 kN	D-DT-7029	-
22	KC 1	CLAMP, B/COMP 0°	D-DT-6006	26,5 - 26 mm
23	KC 4	CLAMP, B/COMP 45°	D-DT-6006	38,3 - 38 mm
24	EPC-B	CLAMP, B/COMP 50X50 45°	D-DT-6018	26,5 mm - PALM

- NOTES:
- EQUIPMENT NOT FITTED WITH 26 mmφ or 38 mmφ CONNECTION PRONGS MUST BE FITTED WITH TINNED 26 mmφ OR 38 mmφ BRASS PRONGS DRILLED AND TAPPED TO APPROPRIATE SIZES.
 - ALL SURFACE AREAS OF CONDUCTOR OR CONTACT AREA OF CONNECTION CLAMPS MUST BE TREATED AS DESCRIBED PRIOR TO MAKING A CLAMPED OR CRIMPED CONNECTION.
 - APPLY THIN LAYER OF NON OXIDE GREASE TO SURFACE AREA.
 - CLEAN NON OXIDE GREASED AREA THOROUGHLY.
 - WIPE SURFACE AREA CLEAN WITH RAG AND IMMEDIATELY APPLY FRESH LAYER OF NON OXIDE GREASE.
 - FIT CLAMP TO CONNECTOR PRONG OR CONDUCTOR AND TORQUE TO:
 - 8 mm GALVANIZED STEEL BOLTS - 15 Nm
 - 10 mm GALVANIZED STEEL BOLTS - 26 Nm
 - 12 mm GALVANIZED STEEL BOLTS - 45 Nm
 - 8 mm S/STEEL BOLTS - 20 Nm
 - 10 mm S/STEEL BOLTS - 35 Nm
 - 12 mm S/STEEL BOLTS - 60 Nm
 - 8 mm ALUMINIUM BOLTS - 10 Nm
 - 10 mm ALUMINIUM BOLTS - 21 Nm
 - 12 mm ALUMINIUM BOLTS - 36 Nm

SET	SHT	DESCRIPTION
SET 12	SHT 1	11 kV STATION ELECTRIC DIAGRAM
SET 11	SHT 11	LIGHTNING PROTECTION LAYOUT
SET 11	SHT 10	YARD LIGHTING LAYOUT
SET 11	SHT 9	SECTIONS AND CLAMPS
SET 11	SHT 8	TRFR 1 & 2 PLINTH DETAILS
SET 11	SHT 7	GENERAL ARRANGEMENT LAYOUT
SET 11	SHT 6	STEELWORK LAYOUT
SET 11	SHT 5	FOUNDATION & TRENCH LAYOUT
SET 11	SHT 4	EARTH GRID LAYOUT
SET 11	SHT 3	LEVEL & DRAINAGE PLAN
SET 11	SHT 2	SITE PLAN
SET 11	SHT 1	66 kV STATION ELECTRIC DIAGRAM

REV	DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	66 kV CIRCUIT BREAKERS ADDED.	ADA	BS	CP	31/01/2019	153272156-00004
1	SUBSTATION REFURBISHED.	ADA	JM	CK	08/10/2010	3487A
0	66 kV & 11 kV SA's ADDED	MAS			/ /	1503A

Eskom
Distribution

AUTH: _____

DATE: / /

CHKD: _____

DATE: / /

DRAWN: **MA Sulaiman**

DATE: 07/07/2004

ISCOR SUBSTATION

66/11 kV

SECTIONS & CLAMPS

D-WC-7104

SET	SHEET	REVISION
11	9	2

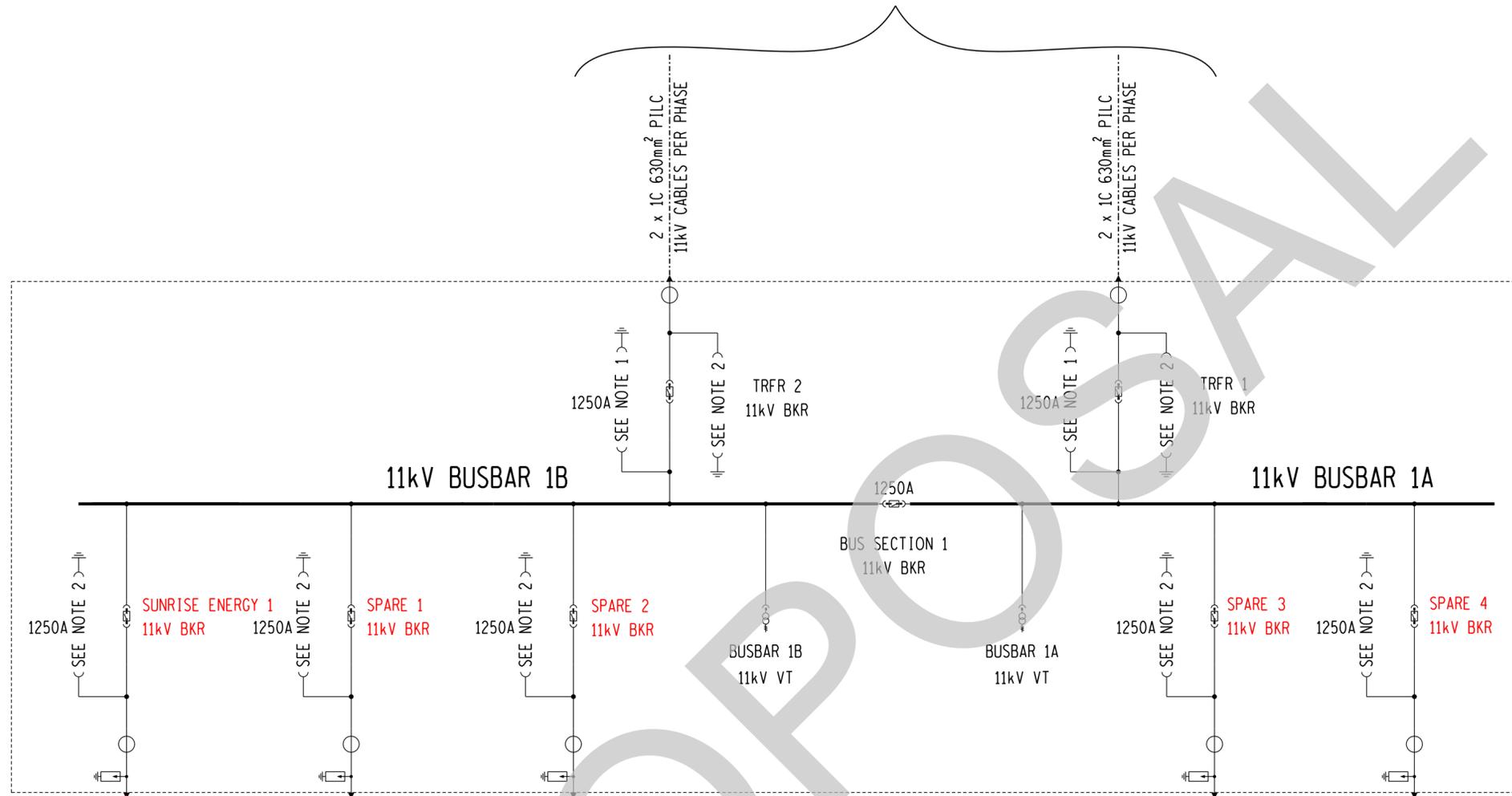
AECOM
CAPE TOWN OFFICE
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TEL: +27 (0)21 950 7500
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REG. No. 1966/00628/07

SCALE 1:100
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TO 66kV SECTION REFER TO
D-WC-7104 SET 11 SHEET 1

NOTES:

1. 11kV BUSBAR EARTHING VIA 11kV BKR ONLY
2. CIRCUIT EARTH VIA 11kV BKR ONLY.
3. WHEN VIEWED FROM REAR OF SWITCHBOARD RED PHASE IS ON THE RIGHT



SUNRISE ENERGY 1
11kV FDR 2

SPARE 1
11kV FDR 3

SPARE 2
11kV FDR 4

SPARE 3
11kV FDR 10

SPARE 4
11kV FDR 11

↑
VIEW ON FRONT
OF SWITCHBOARD

SET 12 SHT 1	11 kV STATION ELECTRIC DIAGRAM
SET 11 SHT 11	LIGHTNING PROTECTION LAYOUT
SET 11 SHT 10	YARD LIGHTING LAYOUT
SET 11 SHT 9	SECTIONS AND CLAMPS
SET 11 SHT 8	TRFR 1 & 2 PLINTH DETAILS
SET 11 SHT 7	GENERAL ARRANGEMENT LAYOUT
SET 11 SHT 6	STEELWORK LAYOUT
SET 11 SHT 5	FOUNDATION & TRENCH LAYOUT
SET 11 SHT 4	EARTH GRID LAYOUT
SET 11 SHT 3	LEVEL & DRAINAGE PLAN
SET 11 SHT 2	SITE PLAN
SET 11 SHT 1	66 kV STATION ELECTRIC DIAGRAM
DRG NO.	REFERENCE DRAWINGS:

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
8A	DISCONNECT ORE PLANT FEEDERS.	ADA	BS	CP	31/01/2019	153272156-00004
7	SUBSTATION NORMALISED. GENERATOR 1 CHANGED TO SPARE 1. SPARE FDR CABLE CHANGED. BKR RACK OUTS REMOVED.	MQM	DS	BJ	06/09/2016	
6	SPARE FDR CHANGED TO GENERATION 1. SPARE FDR CABLE CHANGED. BKR RACKOUTS IMPLEMENTED	MQM	DS	BJ	06/09/2016	
5	FINAL COMMISSIONING OF ISCOR REFURB PROJECT	BA	DS	BJ	23/10/2014	3487A

Eskom

AUTH: B MEYER

DATE: 28/03/2002

CHKD: A SULAIMAN

DATE: 26/02/2002

DRAWN: R. TAILOR

DATE: 26/02/2002

ISCOR SUBSTATION

11kV

STATION ELECTRIC DIAGRAM

PROPOSAL A

SET	SHEET	REVISION
D-WC-7104	12	1
		8A

AECOM

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REG. No. 1366/006628/07

SCALE : NTS

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9.8. Non Standard Material Specifications

Not Applicable

10. Control Plant

10.1. Overview

The Blouwater-Iscor 66 kV lines are protected using the line differential protection function of the ABB RED 670 line differential and impedance protection relays. Ystervark Substation will be connected to the 66 kV lines via two tee-in lines of approximately 300 m in length, immediately before Iscor Substation.

The existing line differential protection scheme for each feeder line 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.

The existing transformer protection schemes for both transformers at Iscor Substation must also be modified to ensure the tripping of the new 66 kV circuit breakers.

Label changes will be undertaken on the respective feeder protection panels to ensure the current naming convention of 'Blouwater' is changed to Blouwater/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. Protection - 66/11 kV Transformer 1 4TM7100 (Modified)

Currently, a modified 4TM7100 transformer protection scheme is installed on transformer 1. The scheme has been modified to include a RED 670 line distance/differential protection relay, equipped with a single fibre teleprotection card to allow for line differential protection between Blouwater and Iscor Substation.

In order to ensure the correct operation of the new circuit breaker, the tripping circuitry of the transformer protection system must be modified. HV breaker fail and a sustained fault should send a remote tripping signal to Blouwater and Ystervark Substations to ensure that a fault is cleared from the source.

The required second fibre teleprotection card will be retrofitted to the relay in order to allow for three-terminal line differential protection to be enabled in the RED 670 relay. Installation, initialising of the card and updating the masking will be undertaken by ABB on site.

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.

10.2.2. Protection - 66/11 kV Transformer 2 4TM7100 (Modified)

Currently, a modified 4TM7100 transformer protection scheme is installed on transformer 2. The scheme has been modified to include a RED 670 line distance/differential protection relay, equipped with a single fibre teleprotection card to allow for line differential protection between Blouwater and Iscor Substation.

In order to ensure the correct operation of the new circuit breaker, the tripping circuitry of the transformer protection system must be modified. HV breaker fail and a sustained fault should send a remote tripping signal to Blouwater and Ystervark Substations to ensure that a fault is cleared from the source.

The required second fibre teleprotection card will be retrofitted to the relay in order to allow for three-terminal line differential protection to be enabled in the RED 670 relay. Installation, initialising of the card and updating the masking will be undertaken by ABB on site.

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.

10.2.3. Labelling

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

Table 10: Required Panel Label Changes

Existing	New
BLOUWATER 1	BLOUWATER 1/YSTERVARK TEE
BLOUWATER 2	BLOUWATER 2/YSTERVARK TEE

10.2.4. Metering

No changes are required.

10.2.5. AC/DC

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 in the RED 670 relays of the 66/11 kV transformers 1 & 2 and the patch panels to allow for the differential protection communication.

Eskom Telecommunication department to indicate which fibre cores in the patch panel to terminate the patch leads to.

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

Not Applicable

10.4. Final Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM					
CONTROL PLANT					
JOB NAME	Job Name: Isocr 66 kV Breaker & Protection Upgrade			WCOU BOM-18-04	REV : 0
JOB NUMBER:	Job Number: 153272156-00004				This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ				
PREPARED BY :	Lize-Mari Botha				
Tel No	Tel: 021 950 7500				
DATE PREP. :	18 January 2019				
PROTECTION					
QTY	SAP	REFERENCE	Rev	DESCRIPTION	
HV FEEDER SCHEME					
HV Feeder Scheme Options					
1	0248587	D-DT-9051	0	Three Terminal Diff Option	

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM					
CONTROL PLANT					
JOB NAME	Job Name: Isocr 66 kV Breaker & Protection Upgrade			WCOU BOM-18-04	REV : 0
JOB NUMBER:	Job Number: 153272156-00004				This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ				
PREPARED BY :	Lize-Mari Botha				
Tel No	Tel: 021 950 7500				
DATE PREP. :	18 January 2019				
LV CABLE					
QTY	SAP	REFERENCE	Rev	DESCRIPTION	
CONTROL CABLES					
200 m	0404118	D-DT-3128	13	Cable 1kV 19c 2.5mm ² Cu BVX19DCV	
200 m	0404761	D-DT-3128	13	Cable 1kV 12c 2.5mm ² Cu BVX12DCV	
200 m	0400646	D-DT-3128	13	Cable 1kV 4c 2.5mm ² Cu BVX4DCV	
CABLE GLANDS					
8	0168280	D-DT-3070	12	Gland No 3 & Shroud	
8	0168279	D-DT-3070	12	Gland No 2 & Shroud	
4	0168367	D-DT-3070	12	Gland No 1 & Shroud	

PLEASE NOTE: CABLE LENGTHS ARE APPROXIMATE ONLY, ACTUAL PHYSICAL LENGTHS ARE TO BE VERIFIED ON SITE.
EXISTING CABLES TO BE REUSED WHERE POSSIBLE

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM					
CONTROL PLANT					
JOB NAME	Job Name: Isocr 66 kV Breaker & Protection Upgrade			WCOU BOM-18-04	REV : 0
JOB NUMBER:	Job Number: 153272156-00004				This document is the property of Eskom
BOM TYPE:	FINAL BOM & BOQ				
PREPARED BY :	Lize-Mari Botha				
Tel No	Tel: 021 950 7500				
DATE PREP. :	18 January 2019				
MISCELLANEOUS					
QTY	SAP	DT reference	Rev	DESCRIPTION	
10	BUY-OUT	-	-	FC, E9/125, 1310/1550nm, dB 5, Telegärtner, Order no. J08093A2205	
2	BUY-OUT	-	-	SC/APC - FC single Mode Patch Leads Ruggedised	

10.5. Final Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

WCOU_BOM-18-04

JOB NAME	Job Name: Isocr 66 kV Breaker & Protection	LASTEST REV:	0
JOB NUMBER:	Job Number: 153272156-00004		
BOM TYPE:	FINAL BOM & BOQ		
PREPARED BY :	Dirk Agenbag		
Tel No	Tel: 021 950 7500		
DATE PREP. :	18 January 2019		

BILL OF QUANTITIES

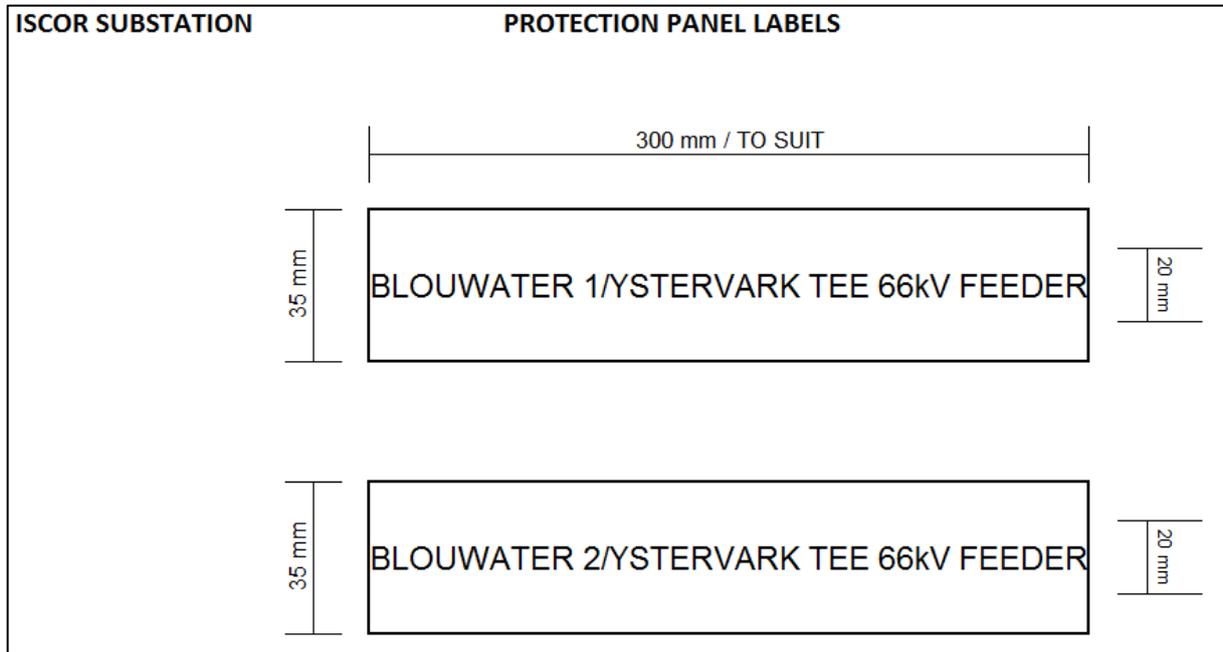
BASED ON MEW SUBSTATION BOQ

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											
Electrical installations											
	Labeling	each	6		12.35	48.35	0.04	0.16	0.96		
	Open and close Trench covers	m	200.0		12.35	96.69	0.08	0.32	64.00		
	Lay cables (< 1000V)	m	600.0		12.35	42.30	0.035	0.14	84.00		
	Glanding of Cables (per gland) (< 1000V)	each	24.0		12.35	54.39	0.045	0.18	4.32		
	Label & Loom Cable (< 1000V)	core	400.0		12.35	90.65	0.075	0.30	120.00		
	Terminate and support cable (< 1000V)	each	24.0		12.35	99.71	0.0825	0.33	7.92		
	SUBTOTAL (SP ACTIVITIES)										

10.6. Label Schedule



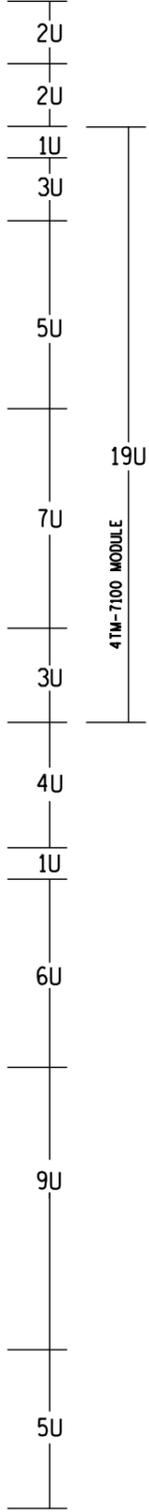
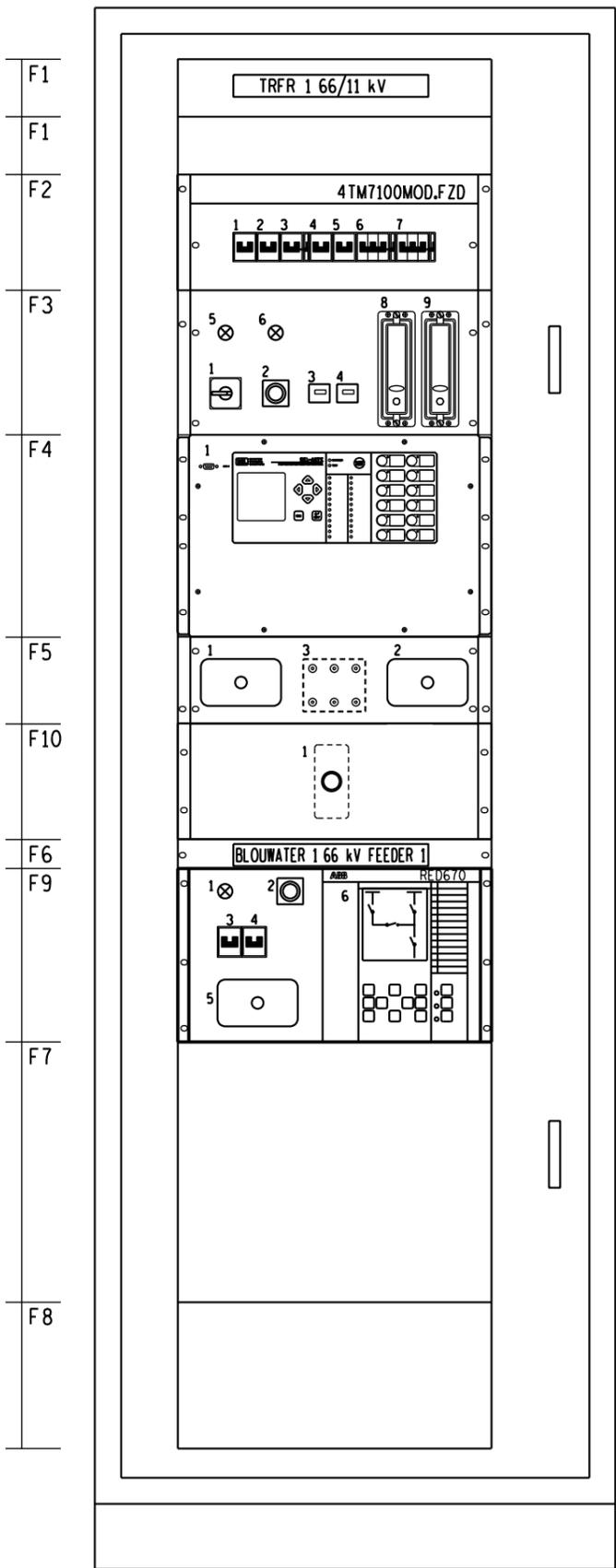
10.7. Detailed Drawings

<u>Drawing No.</u>	<u>Drawing Title</u>	<u>Rev</u>
D-WC-7104-81-00	66/11 kV Transformer 1 - Cover Sheet	00
D-WC-7104-81-01	66/11 kV Transformer 1 - Panel Equipment Layout	00
D-WC-7104-81-02	66/11 kV Transformer 1 - Front Panel Labels	00
D-WC-7104-81-03	66/11 kV Transformer 1 - Scheme Logic Diagram	01
D-WC-7104-81-04	66/11 kV Transformer 1 - Relay Logic Diagram	00
D-WC-7104-81-05	66/11 kV Transformer 1 - Relay Logic Diagram	00
D-WC-7104-81-06	66/11 kV Transformer 1 - Relay Logic Diagram	00
D-WC-7104-81-07	66/11 kV Transformer 1 - Relay Logic Diagram	00
D-WC-7104-81-08	66/11 kV Transformer 1 - AC Key Diagram	02
D-WC-7104-81-09	66/11 kV Transformer 1 - AC Key Diagram	01
D-WC-7104-81-10	66/11 kV Transformer 1 - AC Key Diagram	01
D-WC-7104-81-11	66/11 kV Transformer 1 - VT Supply Key Diagram	00
D-WC-7104-81-12	66/11 kV Transformer 1 - Main DC Key Diagram	02
D-WC-7104-81-13	66/11 kV Transformer 1 - Main DC Key Diagram	01
D-WC-7104-81-14	66/11 kV Transformer 1 - Back-Up DC Key Diagram	02
D-WC-7104-81-15	66/11 kV Transformer 1 - Back-Up DC Key Diagram	02
D-WC-7104-81-16	66/11 kV Transformer 1 - Back-Up DC Key Diagram	02
D-WC-7104-81-17	66/11 kV Transformer 1 - SPR Rewind DC, AC Key Diagram	02
D-WC-7104-81-18	66/11 kV Transformer 1 - Supervisory/Comms Key Diagram	01
D-WC-7104-81-19	66/11 kV Transformer 1 - Reference Diagram	01
D-WC-7104-81-20	66/11 kV Transformer 1 - Panel Cabling Diagram	01
D-WC-7104-81-21	66/11 kV Transformer 1 - Panel Cabling Diagram	02

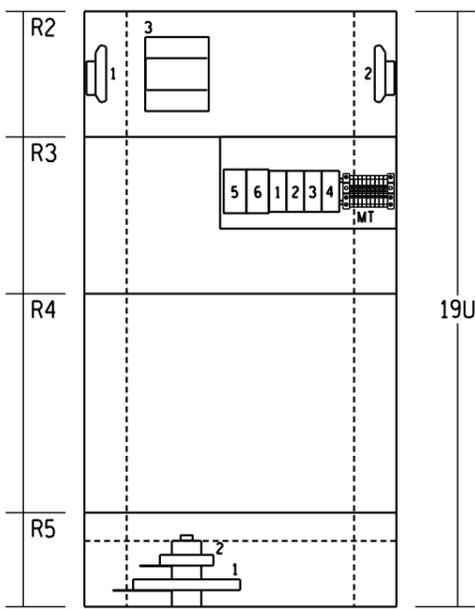
D-WC-7104-81-22	66/11 kV Transformer 1 - Panel Cabling Diagram	01
D-WC-7104-81-23	66/11 kV Transformer 1 - HV CT JB Cabling Diagram	01
D-WC-7104-81-24	66/11 kV Transformer 1 - RED 670 AC, DC & Supervisory Key Diagram	02
D-WC-7104-81-25	66/11 kV Transformer 1 - RED 670 Reference Diagram	01
D-WC-7104-83-00	66/11 kV Transformer 2 - Cover Sheet	00
D-WC-7104-83-01	66/11 kV Transformer 2 - Panel Equipment Layout	00
D-WC-7104-83-02	66/11 kV Transformer 2 - Front Panel Labels	00
D-WC-7104-83-03	66/11 kV Transformer 2 - Scheme Logic Diagram	01
D-WC-7104-83-04	66/11 kV Transformer 2 - Relay Logic Diagram	00
D-WC-7104-83-05	66/11 kV Transformer 2 - Relay Logic Diagram	00
D-WC-7104-83-06	66/11 kV Transformer 2 - Relay Logic Diagram	00
D-WC-7104-83-07	66/11 kV Transformer 2 - Relay Logic Diagram	00
D-WC-7104-83-08	66/11 kV Transformer 2 - AC Key Diagram	02
D-WC-7104-83-09	66/11 kV Transformer 2 - AC Key Diagram	01
D-WC-7104-83-10	66/11 kV Transformer 2 - AC Key Diagram	01
D-WC-7104-83-11	66/11 kV Transformer 2 - VT Supply Key Diagram	00
D-WC-7104-83-12	66/11 kV Transformer 2 - Main DC Key Diagram	02
D-WC-7104-83-13	66/11 kV Transformer 2 - Main DC Key Diagram	01
D-WC-7104-83-14	66/11 kV Transformer 2 - Back-Up DC Key Diagram	02
D-WC-7104-83-15	66/11 kV Transformer 2 - Back-Up DC Key Diagram	02
D-WC-7104-83-16	66/11 kV Transformer 2 - Back-Up DC Key Diagram	02
D-WC-7104-83-17	66/11 kV Transformer 2 - SPR Rewind DC, AC Key Diagram	02
D-WC-7104-83-18	66/11 kV Transformer 2 - Supervisory/Comms Key Diagram	01
D-WC-7104-83-19	66/11 kV Transformer 2 - Reference Diagram	00

D-WC-7104-83-20	66/11 kV Transformer 2 - Panel Cabling Diagram	01
D-WC-7104-83-21	66/11 kV Transformer 2 - Panel Cabling Diagram	02
D-WC-7104-83-22	66/11 kV Transformer 2 - Panel Cabling Diagram	01
D-WC-7104-83-23	66/11 kV Transformer 2 - HV CT JB Cabling Diagram	01
D-WC-7104-83-24	66/11 kV Transformer 2 - RED 670 AC, DC & Supervisory Key Diagram	02
D-WC-7104-83-25	66/11 kV Transformer 2 - RED 670 Reference Diagram	01
D-WC-7104-159-01	66/11 kV Transformers - Cable Block Diagram	01
D-WC-7104-159-02	11 kV Feeders & Auxiliaries - Cable Block Diagram	01
D-WC-7104-159-03	Auxiliaries - Cable Block Diagram	00

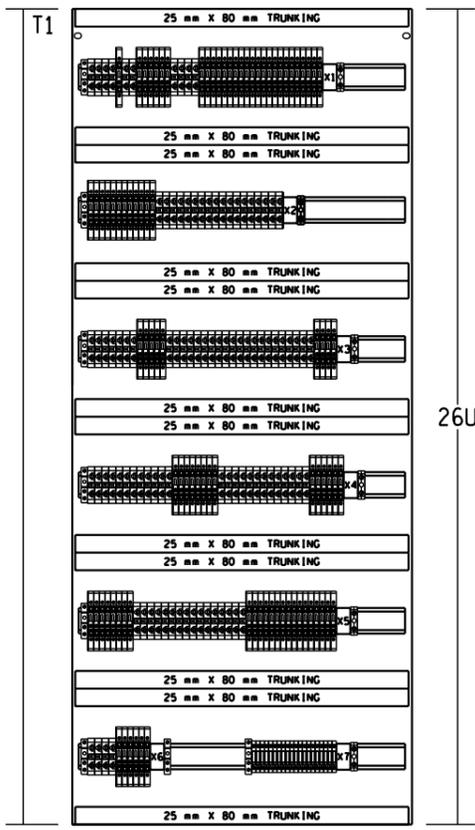
FRONT VIEW



REAR OF MODULE

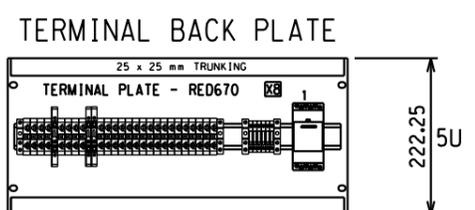


TERMINAL BACK PLATE



LOCATION	DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW				
F1		BLANKING PLATE		
F2	1	DCI MCB (M)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (MAIN CCT) (16A)	EP102UC(C16)
	2	DCI MCB (BU)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (BACK-UP CCT) (16A)	EP102UC(C16)
	3	DCI MCB (SR)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (SPRING REWIND) (20A)	EP102UC(C20)
	4	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G62(C10) & CA H
	5	MCB (H)	HEATER SUPPLY AC MINIATURE CIRCUIT-BREAKER (6A)	G62(C06)
	6	MCB (VT-HV)	HV VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02) & CA H
	7	MCB (VT-MV)	HV VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02) & CA H
F3	1	BF1	CIRCUIT-BREAKER FAIL ISOLATE SWITCH	CA-10
	2	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	MP1-10R / MCBH-20
	3	FC (HV)	HV CIRCUIT-BREAKER FAULT/TRIP COUNTER (3 DIGIT)	3099
	4	FC (MV)	MV CIRCUIT-BREAKER FAULT/TRIP COUNTER (3 DIGIT)	3099
	5	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	KRE-222-UL (230Vac)
	6	MTR-I	MASTER TRIP OPERATED INDICATION (RED)	KRE-222-UN
	8	(HI-Z) HV REF	HV HIGH IMPEDANCE RESTRICTED EARTH FAULT PROTECTION RELAY	2V73-AAA
	9	(HI-Z) MV REF	MV HIGH IMPEDANCE RESTRICTED EARTH FAULT PROTECTION RELAY	2V73-AAA
F4	1	SEL-487E	TRANSFORMER PROTECTION AND CONTROL RELAY	SEL-487E
F5	1	CTTB(HV)	HV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY
	2	CTTB(MV)	MV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY
	3	TP1-TP6	BANANA PLUG TEST POINTS (BLACK)	RC11 BK
F6		BLANKING PLATE		
F7		BLANKING PLATE		
F8		BLANKING PLATE		
F9	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (RED 670) (AMBER)	KRE-222-UL (230 Vac)
	2	TTPB	TRIP TEST PUSH BUTTON WITH COVER (RED)	CP10-10R-10/ YSF
	3	DCI MCB (M)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (RED 670 CCT) (5A)	EP102UC(C5)
	4	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (RED 670 CCT) (2A)	G62(C2)
	5	CTTB(HV) - 2	HV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK (RED 670)	PK2 4-WAY
	6	RED 670	LINE PROTECTION AND CONTROL RELAY	RED 670
F10	1	IS20	ARC FAULT RELAY	IS20(CAA)
REAR OF MODULE				
R2	1	DB1	DIODE BOARD 1 (8 TRIPPING DIODES)	10200
	2	DB2	DIODE BOARD 2 (8 TRIPPING DIODES)	10200
	3	MTR	MASTER TRIP RELAY	BJBT **
R3		MT	MODULE TERMINALS	M4/6
	1	AS-HVM	HV MAIN TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	2	AS-HVBU	HV BACK-UP TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	3	AS-MVM	MV MAIN TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	4	AS-MVBU	MV BACK-UP TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	5	SEL-2885	ADDRESSABLE RS-232 TO RS-485 CONVERTER (REMOTE ENG. ACCESS)	SEL-2885
	6	SEL-2886	RS-232 TO RS-485 CONVERTER (SCADA COMMUNICATION)	SEL-2886
R4			REAR OF SEL-487E RELAY	
R5	1	HV METROSIL	SINGLE PHASE METROSIL FOR HI-Z HV REF RELAY (6 INCH)	600A/S1/S887
	2	MV METROSIL	SINGLE PHASE METROSIL FOR HI-Z MV REF RELAY (3 INCH)	300A/S1/S646
TERMINAL BACK PLATE				
T1	X1-X7		TERMINAL RAILS (RAISED FROM BACK PLATE BY 70 mm STAND-OFF POSTS). SCHEME WIRING TERMINATED AT BOTTOM SIDE OF TERMINAL STRIPS. REFER TO SHTs 20 - 22 FOR TERMINAL BLOCK MAKES AND TYPES	
T2	X8		TERMINAL RAILS SCHEME WIRING TERMINATED AT BOTTOM SIDE OF TERMINAL STRIPS. REFER TO SHT 22 FOR TERMINAL BLOCK MAKES AND TYPES	
1	IRF-X		RED670 PNH AUXILIARY RELAY (110=110V DC)	CR-U110DC3L

** SPECIFY 110 Vdc OR 220 Vdc



SHEET	DESCRIPTION	SHEET	DESCRIPTION	SHEET	DESCRIPTION
SHEET 8	AC KEY DIAGRAM	SHEET 17	SPR REW DC AC KEY DIAGRAM	SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM	SHEET 16	BACK-UP DC KEY DIAGRAM	SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM	SHEET 15	BACK-UP DC KEY DIAGRAM	SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM	SHEET 14	BACK-UP DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM	SHEET 13	MAIN DC KEY DIAGRAM	SHEET 21	PANEL CABLING DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM	SHEET 12	MAIN DC KEY DIAGRAM	SHEET 20	PANEL CABLING DIAGRAM
SHEET 2	FRONT PANEL LABELS	SHEET 11	VT SUPPLY KEY DIAGRAM	SHEET 19	REFERENCE DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 10	AC KEY DIAGRAM	SHEET 18	SUPERVISORY/COMMS KEY DTAG
SHEET 0	COVER SHEET	SHEET 9	AC KEY DIAGRAM		

1. 1U = 44.45mm
THE SCHEME IS DESIGNED FOR MOUNTING A 19 INCH RACK SYSTEM AS PER IEC 60297.
THE MODULE AND BACK PLATE ARE 482.6mm WIDE. THE MODULE IS 300mm DEEP.

AECOM
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REG. No. 1966/00628/07

Eskom

PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL
DATE 18/01/2012 DATE 11/06/10
PROJECT CHECKED: J. MOSTERT
DESIGN CHECKED: P.A. GERBER
DATE 10/01/2012 DATE 11/06/10
DRAWN BY: A v S
DATE 25/11/2011 DATE 17/09/09

0 FIRST ISSUE, SUBSTATION REFURBISHED. 3487A

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09	

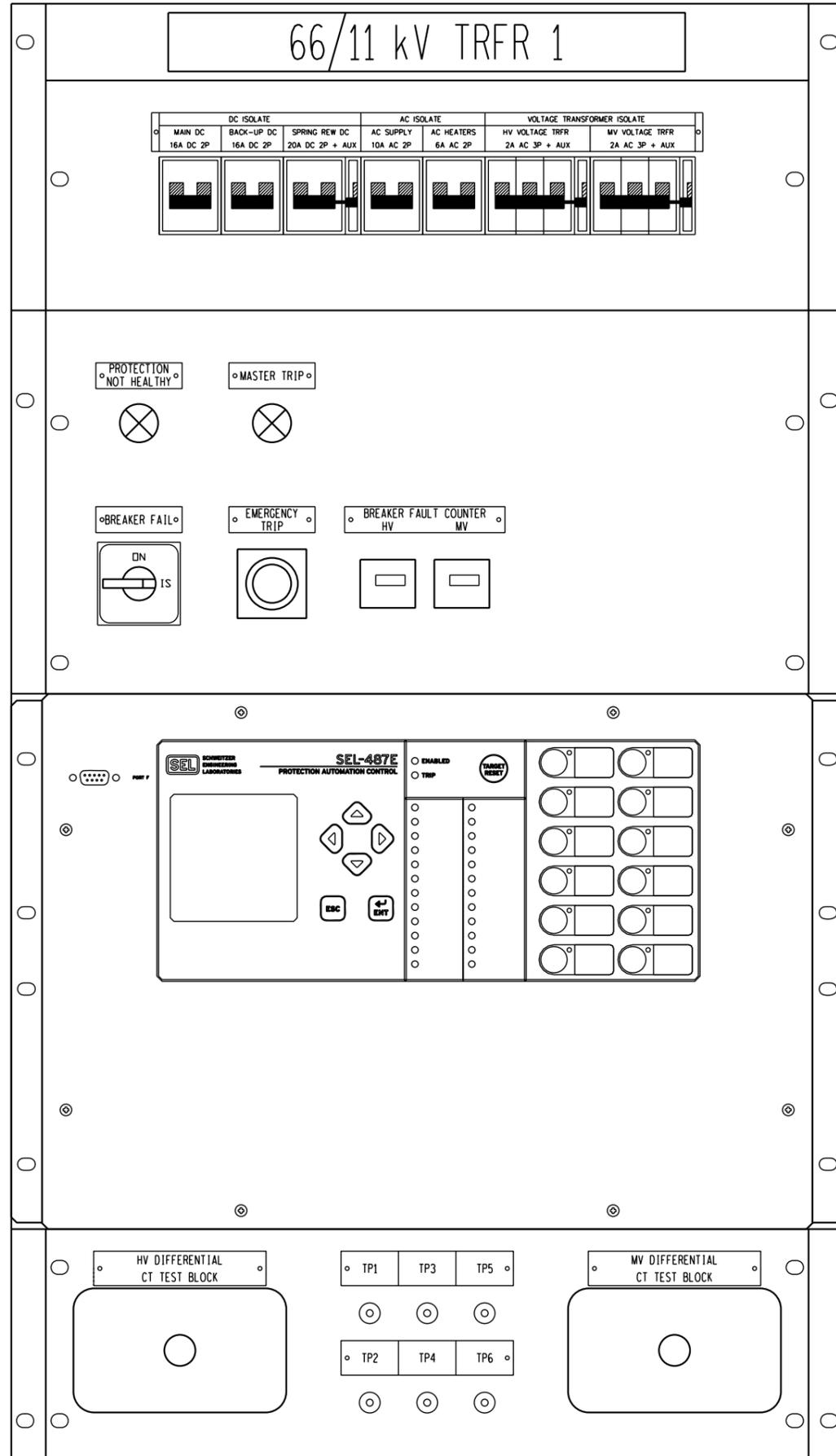
ISCOR SUBSTATION
66/11 kV TRANSFORMER 1
PANEL EQUIPMENT LAYOUT

D-WC-7104 **81** **01** **00**

SCALE 1:5 SET NUMBER SHEET NUMBER REVISION

MASTER TRACING FILED UNDER D-DT-15202 SHEET 1 OF 26 REVISION 1

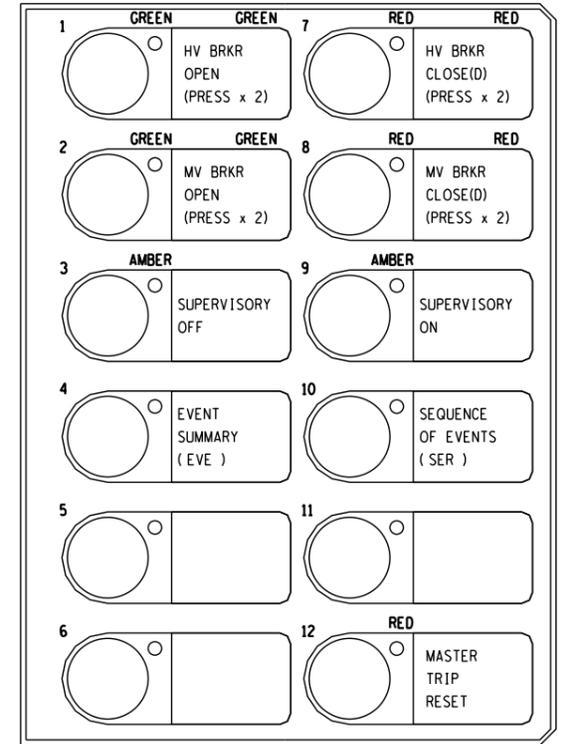
DETAIL OF SEL-487E PROGRAMMABLE LEDs AND PUSH BUTTONS



ENABLED
TRIP

TARGET RESET ← TARGET RESET & LAMP CHECK

COLOUR	NO.			NO.	COLOUR
AMBER	1	<input type="radio"/> HV BRKR NOT HEALTHY	<input type="radio"/> MV BRKR NOT HEALTHY	13	AMBER
RED	2	<input type="radio"/> HV	<input type="radio"/> MV	14	RED
RED	3	<input type="radio"/> DIFF	<input type="radio"/> REF	15	RED
RED	4	<input type="radio"/> OVERCURRENT	<input type="radio"/> EARTH FAULT	16	RED
RED	5	<input type="radio"/> SUSTAINED FAULT TIMER	<input type="radio"/> CUSTOMER CABLE FAULT	17	RED
RED	6	<input type="radio"/> HV BUS ZONE	<input type="radio"/> MV BUS ZONE	18	RED
RED	7	<input type="radio"/> TRFR PRESSURE RELIEF TRIP	<input type="radio"/> BRKR FAIL	19	RED
RED	8	<input type="radio"/> TRFR BUCHHOLZ TRIP	<input type="radio"/> TRFR BUCHHOLZ ALARM	20	AMBER
RED	9	<input type="radio"/> TRFR OIL TEMP TRIP	<input type="radio"/> TRFR OIL/WIND. TEMP ALARM	21	AMBER
RED	10	<input type="radio"/> TRFR WINDING TEMP TRIP	<input type="radio"/> TRFR OIL LEVEL/FAN FAIL ALARM	22	AMBER
RED	11	<input type="radio"/> NEC BUCHHOLZ/OIL TEMP TRIP	<input type="radio"/> NEC BUCHHOLZ/OIL TEMP ALARM	23	AMBER
RED	12	<input type="radio"/> OLTC BUCHHOLZ/PRESSURE TRIP	<input type="radio"/> OTHER ALARM	24	AMBER



NOTE 1
NOTE 1
NOTE 2

- NOTES**
- CIRCUIT-BREAKER CONTROLS REQUIRE THE RESPECTIVE BUTTON TO BE PRESSED TWICE WITHIN 3 SECONDS BEFORE ACTIVATION.
 - PRESS PUSH BUTTON 3 FOR 5 SECONDS TO ACTIVATE DNP3 TEST MODE. WHILST IN TEST MODE, PUSH BUTTON 3 MAY BE USED TO SUCCESSIVELY SIMULATE EACH DNP3 ALARM POINT TO THE SUPERVISORY SYSTEM. PRESS PUSH BUTTON 9 TO EXIT DNP3 TEST MODE.

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REW DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



Eskom

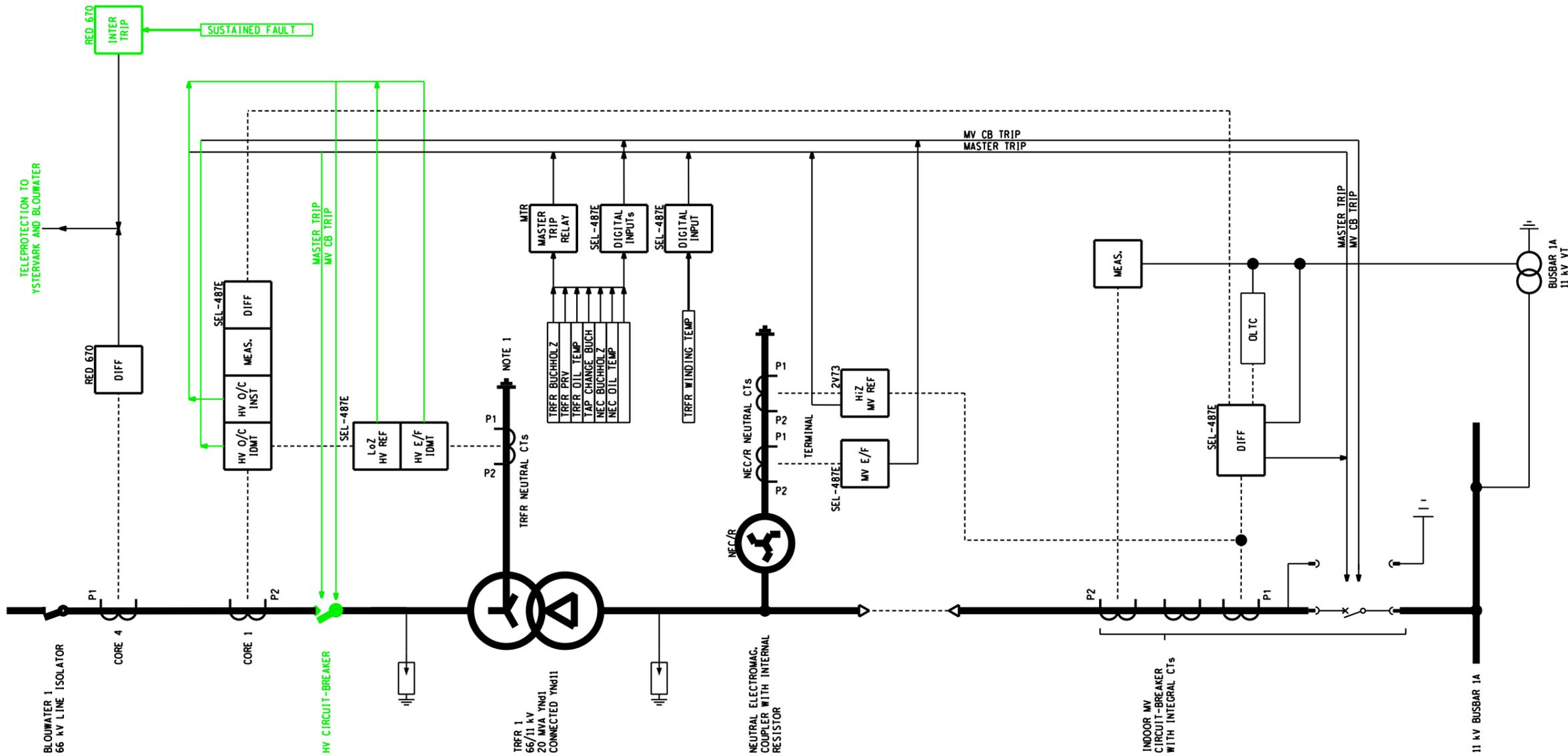
ISCOR SUBSTATION
66/11 kV TRANSFORMER 1
FRONT PANEL LABELS

D-WC-7104 **81** **02** **00**

SET NUMBER SHEET NUMBER REVISION

REV	AUTH	DATE	REVISION DESCRIPTION	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011
0			FIRST ISSUE, SUBSTATION REFURBISHED.			DATE 17/09/09

MASTER TRACING FILED UNDER D-DT-15202 SHEET 2 OF 26 REVISION 1



NOTES
 1. THE EARTHING OF TRANSFORMER NEUTRALS SHALL BE IN ACCORDANCE WITH DPL 34-2149.

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPRVISORY/COMMS KEY DIAG
SHEET 17	SPI REV DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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 REG. No. 1966/006628/07

1	66KV CIRCUIT BREAKER ADDED	JF	BS	LMB	21/01/2010	
0	FIRST ISSUE, SUBSTATION REFURBISHED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

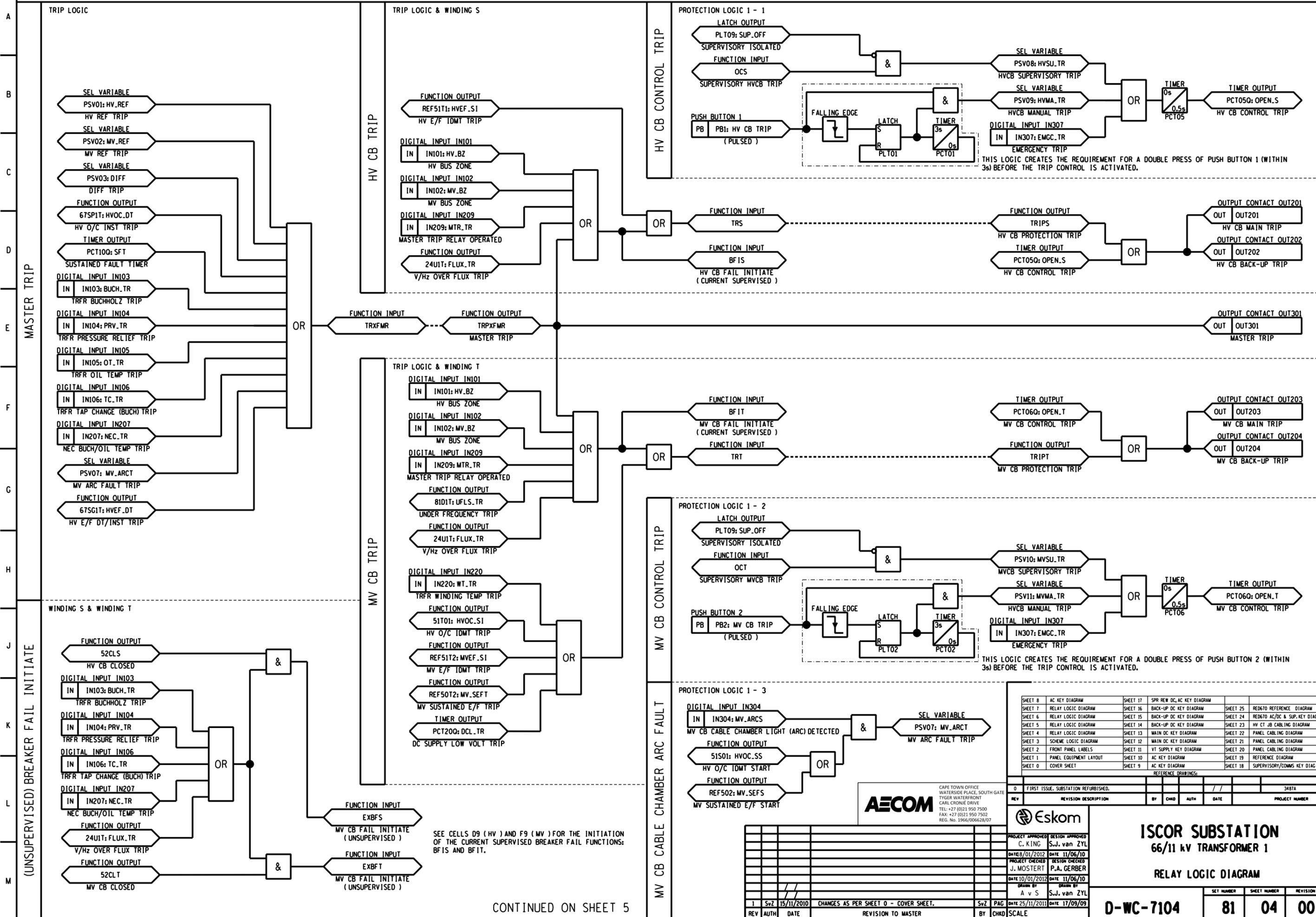
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PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	DRAWN BY
A v S	S.J. van ZYL

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1
SCHEME LOGIC DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

D-WC-7104	81	03	01
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SEL-487E RELAY PROGRAMMABLE LOGIC - TRIPPING LOGIC



SEE CELLS D9 (HV) AND F9 (MV) FOR THE INITIATION OF THE CURRENT SUPERVISED BREAKER FAIL FUNCTIONS: BFIS AND BFIT.

CONTINUED ON SHEET 5

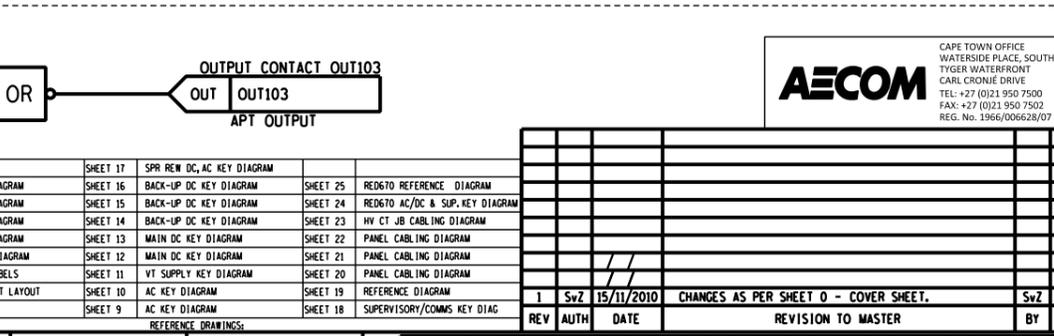
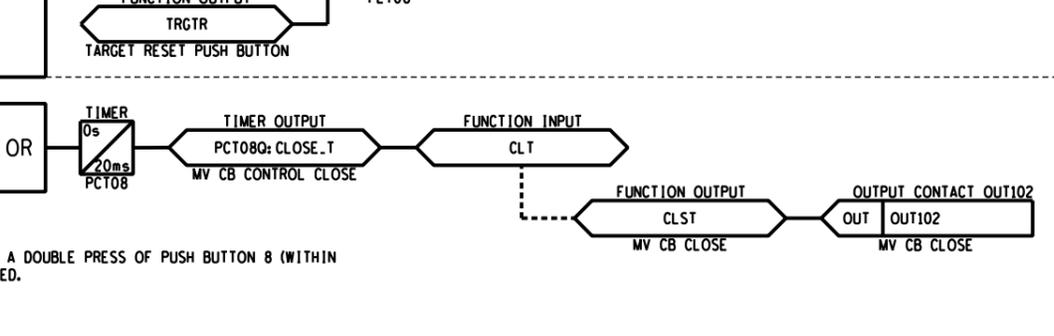
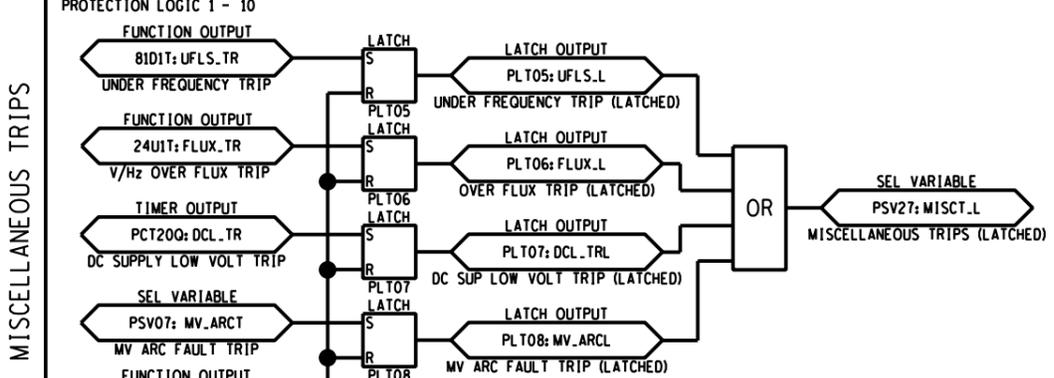
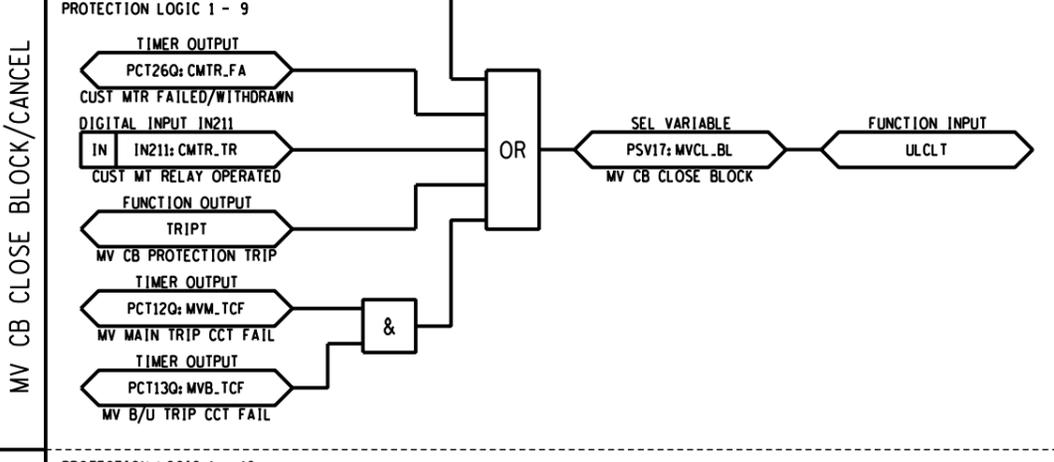
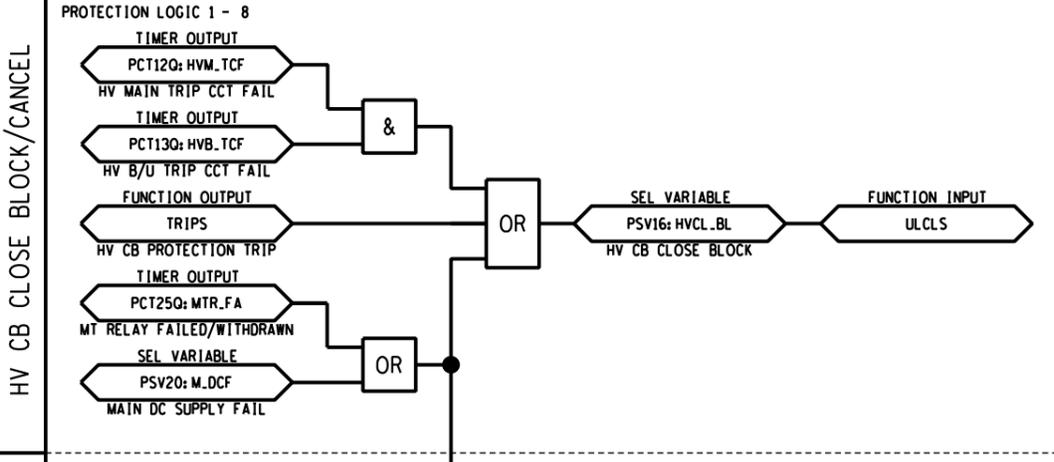
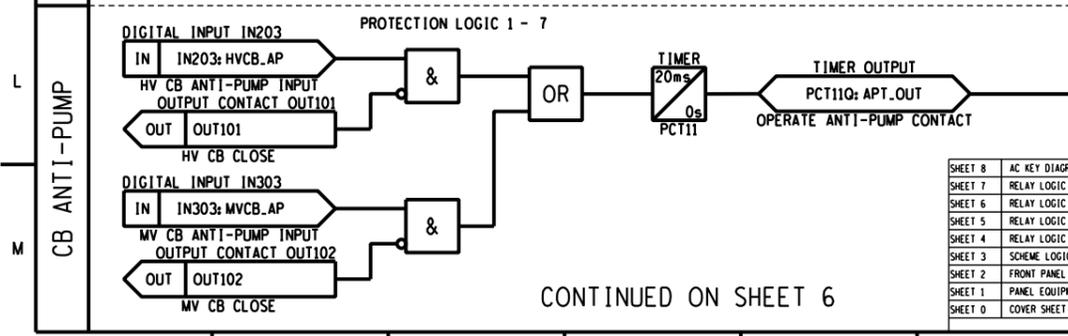
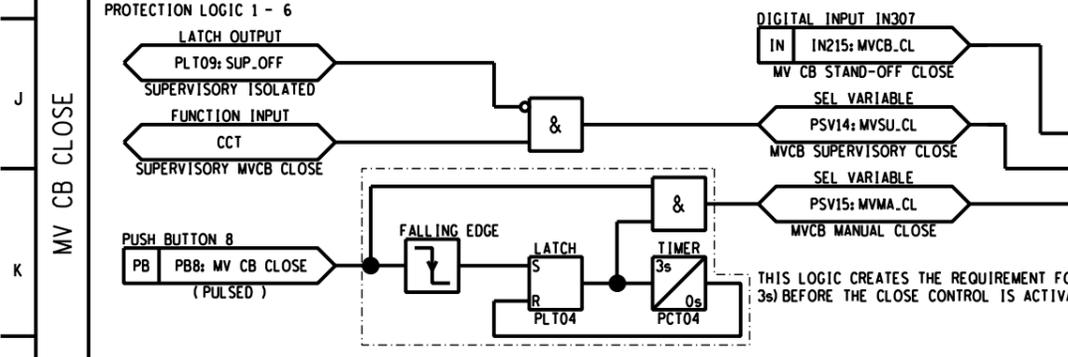
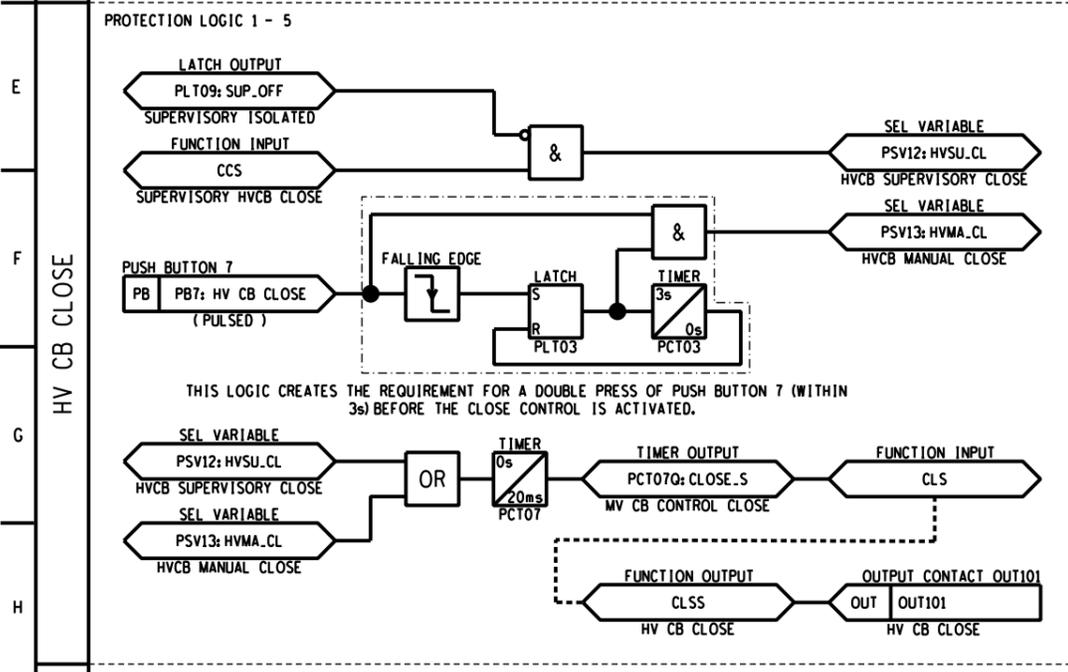
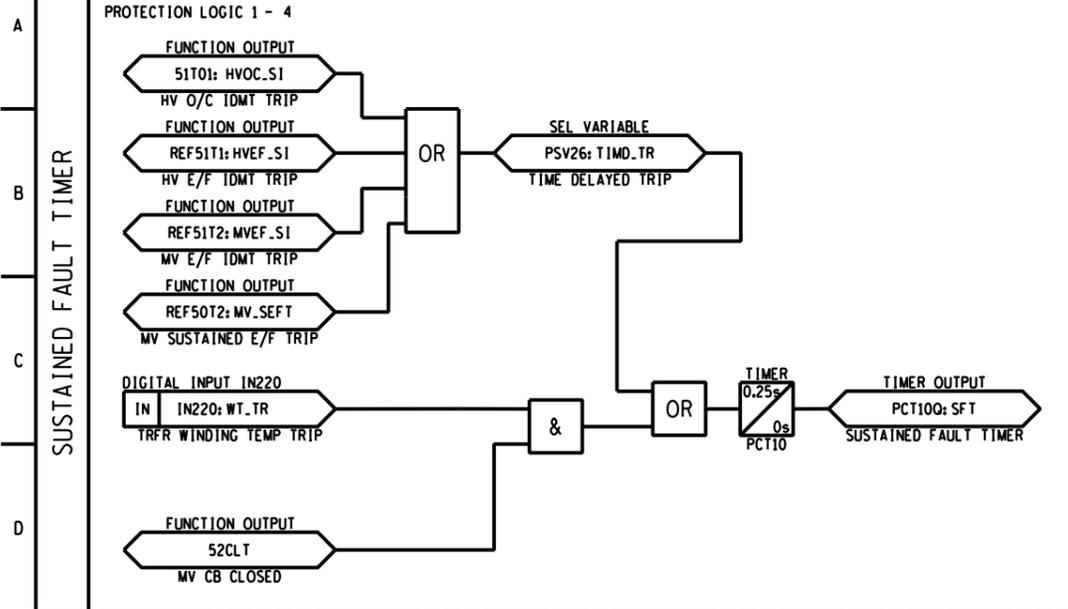


CAPE TOWN OFFICE WATERSIDE PLACE, SOUTH GATE TYGER WATERFRONT CARL CRONJE DRIVE TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. NO. 1966/00628/07		SHEET 8 AC KEY DIAGRAM		SHEET 17 SPR REV DC AC KEY DIAGRAM		SHEET 25 RED670 REFERENCE DIAGRAM																	
SHEET 7 RELAY LOGIC DIAGRAM		SHEET 16 BACK-UP DC KEY DIAGRAM		SHEET 24 RED670 AC/DC & SUP. KEY DIAGRAM		SHEET 23 HV CT JB CABLING DIAGRAM																	
SHEET 6 RELAY LOGIC DIAGRAM		SHEET 15 BACK-UP DC KEY DIAGRAM		SHEET 22 PANEL CABLING DIAGRAM		SHEET 21 PANEL CABLING DIAGRAM																	
SHEET 5 RELAY LOGIC DIAGRAM		SHEET 14 BACK-UP DC KEY DIAGRAM		SHEET 20 PANEL CABLING DIAGRAM		SHEET 19 REFERENCE DIAGRAM																	
SHEET 4 RELAY LOGIC DIAGRAM		SHEET 13 MAIN DC KEY DIAGRAM		SHEET 18 SUPERVISORY/COMMS KEY DIAGRAM		SHEET 17 SUPERVISORY/COMMS KEY DIAGRAM																	
SHEET 3 SCHEME LOGIC DIAGRAM		SHEET 12 MAIN DC KEY DIAGRAM		SHEET 16 REFERENCE DRAWINGS		SHEET 15 REFERENCE DRAWINGS																	
SHEET 2 FRONT PANEL LABELS		SHEET 11 VT SUPPLY KEY DIAGRAM		SHEET 14 REFERENCE DRAWINGS		SHEET 13 REFERENCE DRAWINGS																	
SHEET 1 PANEL EQUIPMENT LAYOUT		SHEET 10 AC KEY DIAGRAM		SHEET 9 AC KEY DIAGRAM		SHEET 8 AC KEY DIAGRAM																	
SHEET 0 COVER SHEET		SHEET 9 AC KEY DIAGRAM		SHEET 8 AC KEY DIAGRAM		SHEET 7 AC KEY DIAGRAM																	
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REV	DATE	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER																
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				ISCOR SUBSTATION 66/11 kV TRANSFORMER 1 RELAY LOGIC DIAGRAM																			
PROJECT APPROVED C. KING		DESIGN APPROVED S.J. van ZYL		DATE 08/01/2012		DATE 11/06/10																	
PROJECT CHECKED J. MOSTERT		DESIGN CHECKED P.A. GERBER		DATE 10/01/2012		DATE 11/06/10																	
DRAWN BY A v S		CHECKED BY S.J. van ZYL		SCALE		SET NUMBER 81																	
REV 1 Svz 15/11/2010		CHANGES AS PER SHEET 0 - COVER SHEET.		REV 2 PAG 25/11/2011		DATE 17/09/09																	
REVISION TO MASTER		BY		CHKD		SCALE																	

D-WC-7104 81 04 00

MASTER TRACING FILED UNDER D-DT-15202 SHEET 4 OF 26 REVISION 1

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 00071E ALL



A SUSTAINED FAULT TIMER

B HV CB CLOSE

C MV CB CLOSE

D CB ANTI-PUMP

A HV CB CLOSE BLOCK/CANCEL

B MV CB CLOSE BLOCK/CANCEL

C MISCELLANEOUS TRIPS

D MT RELAY WITHDRAWN

A CUSTOMER MTR WITHDRAWN

COMBINED PROTECTION LOGICS

MT RELAY WITHDRAWN

CUSTOMER MTR WITHDRAWN

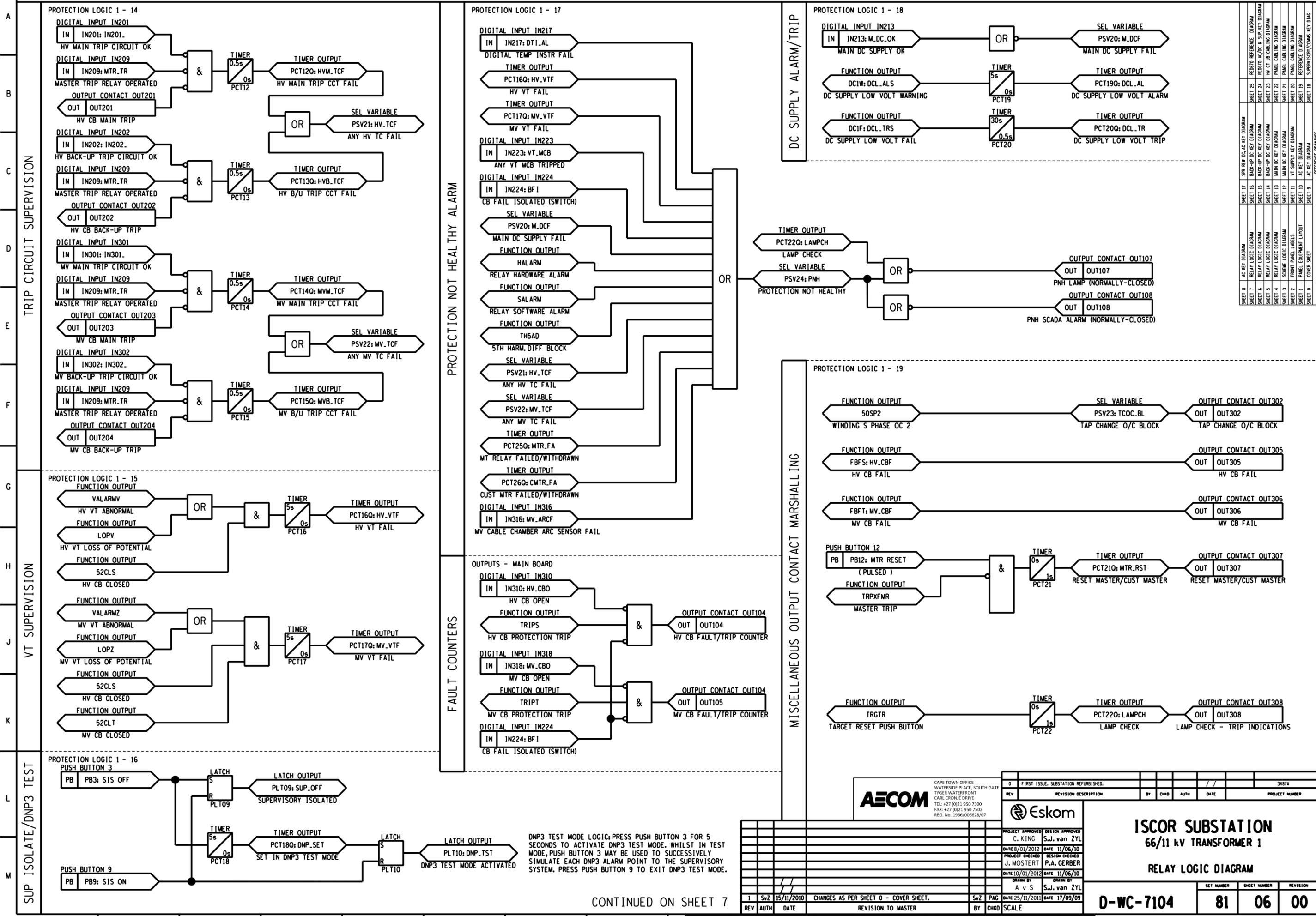
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SHEET 8	AC KEY DIAGRAM	SHEET 17	SPR REW DC AC KEY DIAGRAM	SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM	SHEET 16	BACK-UP DC KEY DIAGRAM	SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM	SHEET 15	BACK-UP DC KEY DIAGRAM	SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM	SHEET 14	BACK-UP DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM	SHEET 13	MAIN DC KEY DIAGRAM	SHEET 21	PANEL CABLING DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM	SHEET 12	MAIN DC KEY DIAGRAM	SHEET 20	PANEL CABLING DIAGRAM
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SHEET 0	COVER SHEET	SHEET 9	AC KEY DIAGRAM		

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. 1966/00628/07	
REV	DATE	BY	CHG
1	15/11/2010	Svz	PAG
CHANGES AS PER SHEET 0 - COVER SHEET.		DATE 25/11/2011	
REVISION TO MASTER		SCALE	

Eskom		PROJECT APPROVED C. KING		DESIGN APPROVED S.J. van ZYL	
DATE 01/01/2012		DATE 11/06/10		PROJECT CHECKED J. MOSTERT	
DATE 10/01/2012		DATE 11/06/10		DESIGN CHECKED P.A. GERBER	
DRAWN BY A v S		DATE 25/11/2011		DATE 17/09/09	
PROJECT NUMBER 3487A		SET NUMBER 81		SHEET NUMBER 05	
PROJECT TITLE ISCOR SUBSTATION 66/11 kV TRANSFORMER 1		REVISION 00		PANEL TYPE DESIGNATION 4TM7100MOD.FZD	
RELAY LOGIC DIAGRAM		D-WC-7104		SIZE DROUITE A1L	

MASTER TRACING FILED UNDER D-DT-15202 SHEET 5 OF 26 REVISION 1



SHEET 17	SPR REF DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAGRAM
SHEET 25	RECORD REFERENCE DIAGRAM
SHEET 24	RECORD AC/DC & SUP KEY DIAGRAM
SHEET 23	HW CT CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	REFERENCE DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	REFERENCE DIAGRAM

DNP3 TEST MODE LOGIC: PRESS PUSH BUTTON 3 FOR 5 SECONDS TO ACTIVATE DNP3 TEST MODE. WHILST IN TEST MODE, PUSH BUTTON 3 MAY BE USED TO SUCCESSIVELY SIMULATE EACH DNP3 ALARM POINT TO THE SUPERVISORY SYSTEM. PRESS PUSH BUTTON 9 TO EXIT DNP3 TEST MODE.



0 FIRST ISSUE. SUBSTATION REFURBISHED.			
REV	REVISION DESCRIPTION	BY	CHKD
1	SvZ 15/11/2010 CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG
2	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
3	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
4	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
5	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
6	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
7	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
8	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
9	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
10	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
11	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
12	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
13	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
14	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
15	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
16	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
17	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
18	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
19	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
20	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
21	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
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23	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
24	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
25	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
26	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
27	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
28	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
29	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09
30	DATE 25/11/2010	DATE 17/09/09	DATE 17/09/09

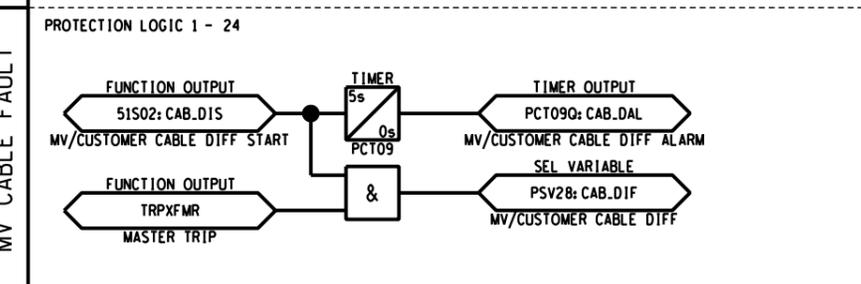
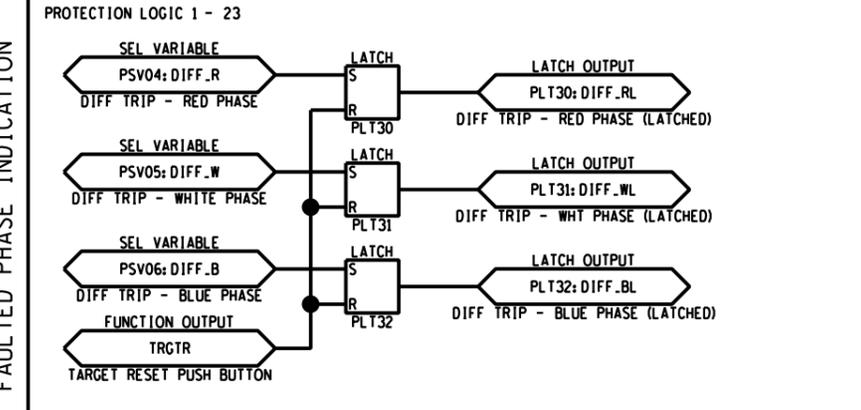
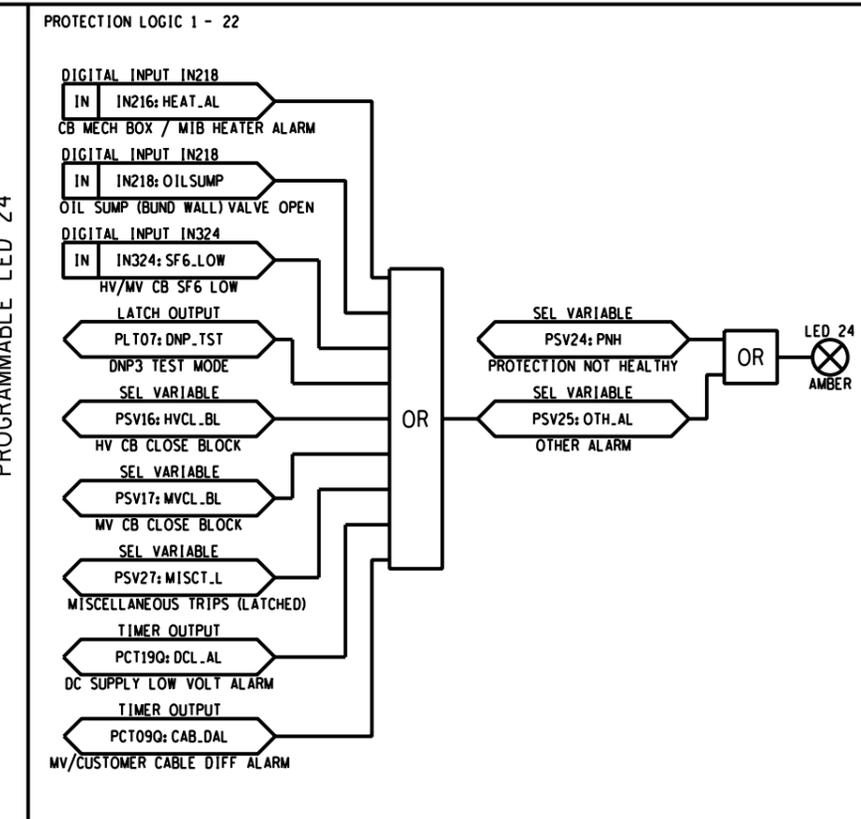
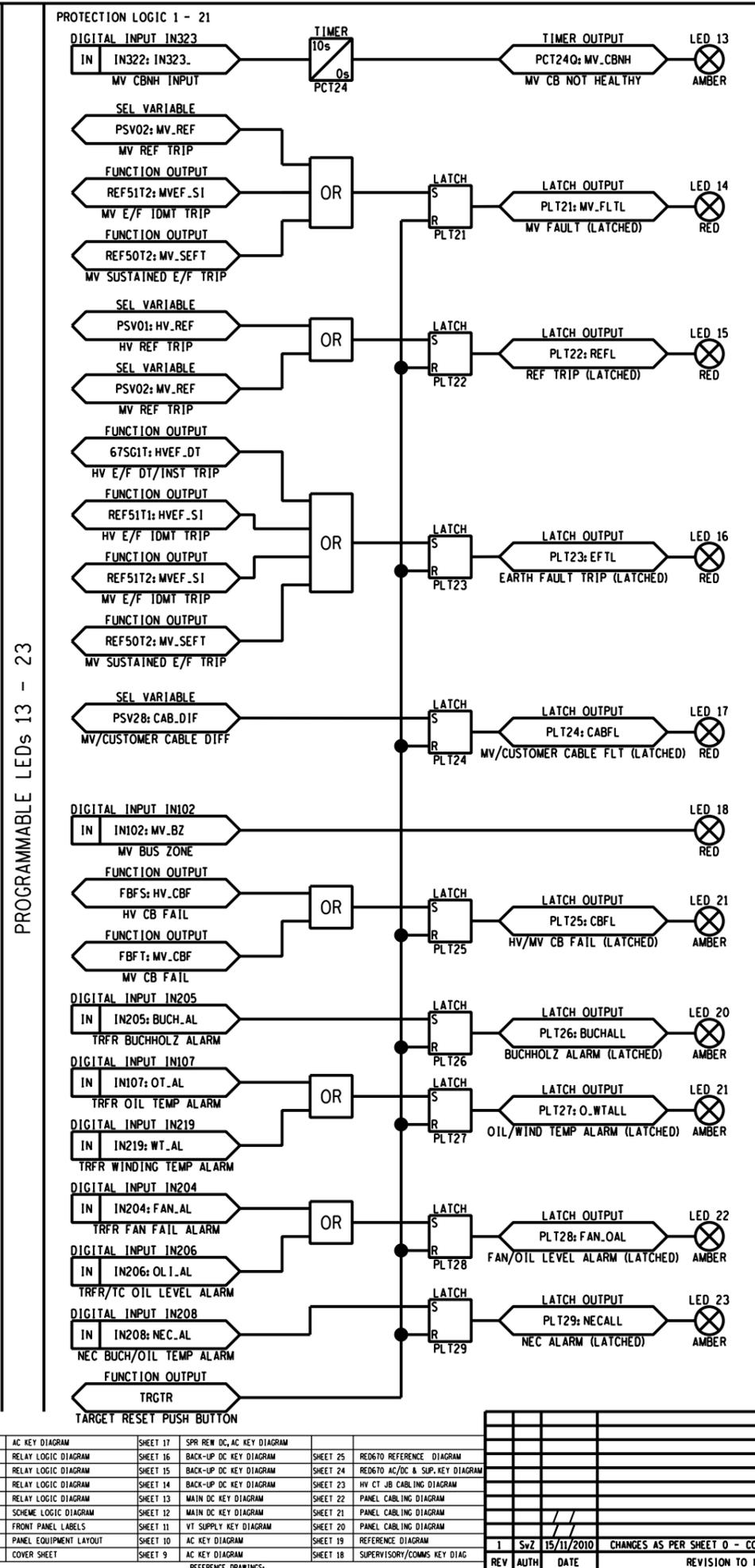
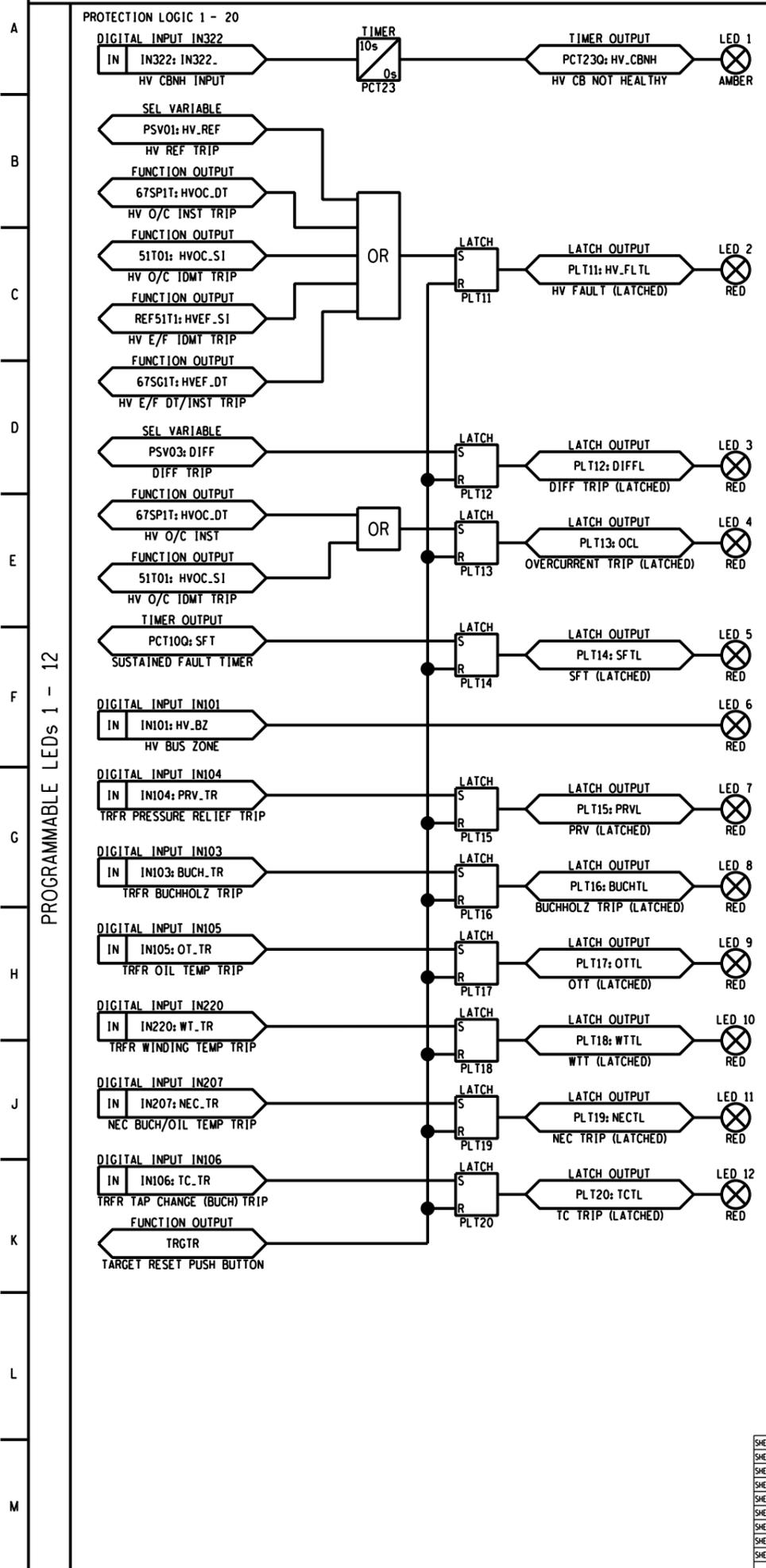
ISCOR SUBSTATION
66/11 kV TRANSFORMER 1

RELAY LOGIC DIAGRAM

D-WC-7104	81	06	00
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CONTINUED ON SHEET 7

MASTER TRACING FILED UNDER D-DT-15202 SHEET 6 OF 26 REVISION 1



SHEET 8	AC KEY DIAGRAM	SHEET 17	SPR REV DC AC KEY DIAGRAM	SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM	SHEET 16	BACK-UP DC KEY DIAGRAM	SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM	SHEET 15	BACK-UP DC KEY DIAGRAM	SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM	SHEET 14	BACK-UP DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM	SHEET 13	MAIN DC KEY DIAGRAM	SHEET 21	PANEL CABLING DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM	SHEET 12	MAIN DC KEY DIAGRAM	SHEET 20	PANEL CABLING DIAGRAM
SHEET 2	FRONT PANEL LABELS	SHEET 11	VT SUPPLY KEY DIAGRAM	SHEET 19	PANEL CABLING DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 10	AC KEY DIAGRAM	SHEET 18	REFERENCE DIAGRAM
SHEET 0	COVER SHEET	SHEET 9	AC KEY DIAGRAM	SHEET 17	SUPERVISORY/COMMS KEY DIAGRAM

1	Svz	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	Svz	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	

AECOM

CARE TOWN OFFICE
WATERSIDE PLACE, SOUTH GATE
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REG. No. 1966/006628/07

0	FIRST ISSUE, SUBSTATION REFURBISHED.				3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE

Eskom

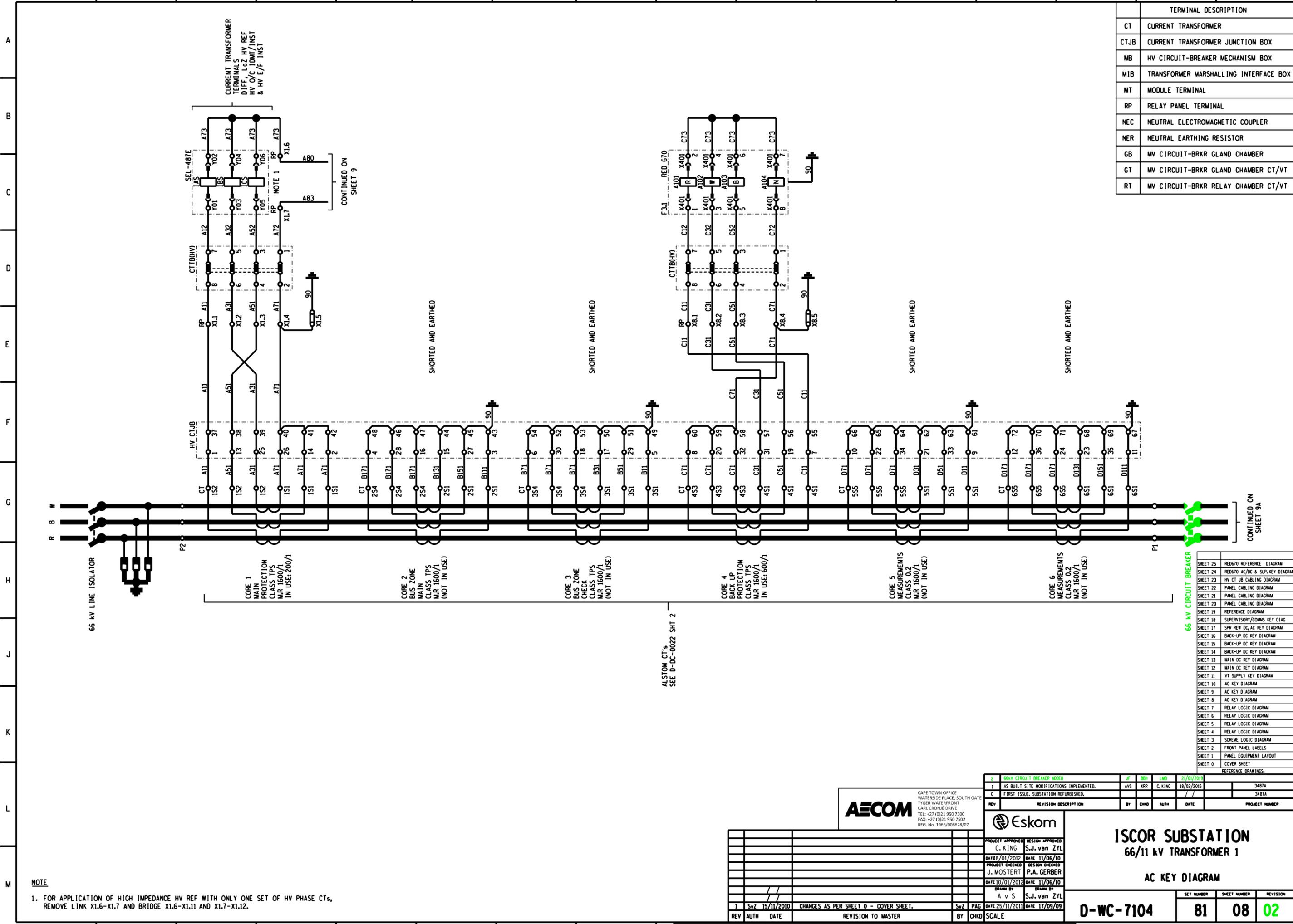
PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL
DATE 08/01/2012
DATE 11/06/10
PROJECT CHECKED: J. MOSTERT
DESIGN CHECKED: P.A. GERBER
DATE 10/01/2012
DATE 11/06/10
DRAWN BY: A v S
DRAWN BY: S.J. van ZYL

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1
RELAY LOGIC DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	07 00

PANEL TYPE DESIGNATION 4TM7100MOD.FZD

MASTER TRACING FILED UNDER D-DT-15202 SHEET 7 OF 26 REVISION 1



TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
MB	HV CIRCUIT-BREAKER MECHANISM BOX
MIB	TRANSFORMER MARSHALLING INTERFACE BOX
MT	MODULE TERMINAL
RP	RELAY PANEL TERMINAL
NEC	NEUTRAL ELECTROMAGNETIC COUPLER
NER	NEUTRAL EARTHING RESISTOR
GB	MV CIRCUIT-BRKR GLAND CHAMBER
GT	MV CIRCUIT-BRKR GLAND CHAMBER CT/VT
RT	MV CIRCUIT-BRKR RELAY CHAMBER CT/VT

CONTINUED ON SHEET 9A

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REM DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

NOTE
 1. FOR APPLICATION OF HIGH IMPEDANCE HV REF WITH ONLY ONE SET OF HV PHASE CT's, REMOVE LINK X1.6-X1.7 AND BRIDGE X1.6-X1.11 AND X1.7-X1.12.

ALSTOM CT's
 SEE D-DC-0022 SHT 2



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66KV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A



ISCOR SUBSTATION
66/11 kV TRANSFORMER 1

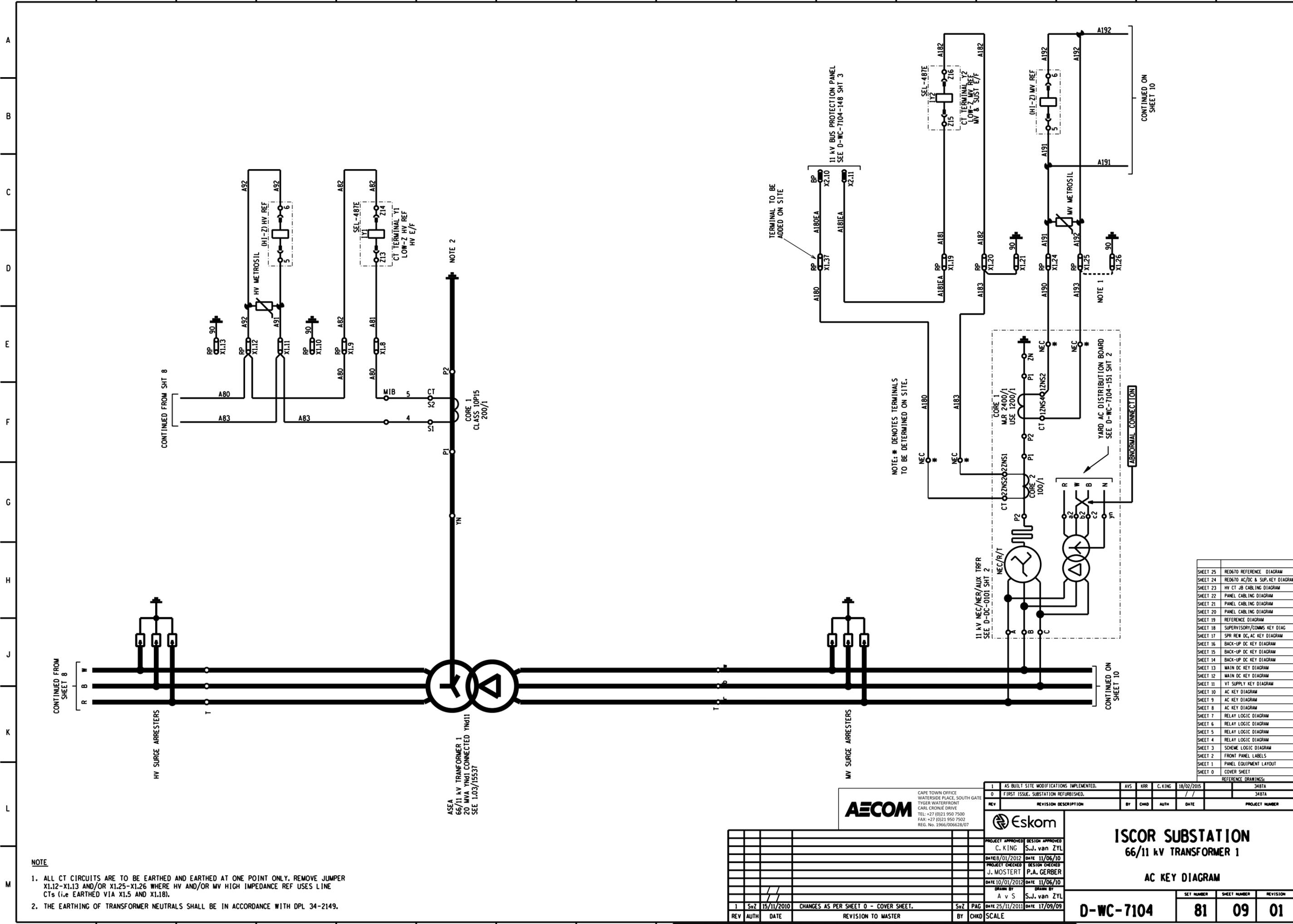
AC KEY DIAGRAM

PROJECT APPROVED C. KING	DESIGN APPROVED S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY A v S	DATE 25/11/2011
DATE 15/11/2010	DATE 17/09/09

D-WC-7104 **81** **08** **02**

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007TE A1L

MASTER TRACING FILED UNDER D-DT-15202 SHEET 8 OF 26 REVISION 1



- NOTE**
- ALL CT CIRCUITS ARE TO BE EARTHED AND EARTHED AT ONE POINT ONLY. REMOVE JUMPER X1.12-X1.13 AND/OR X1.25-X1.26 WHERE HV AND/OR MV HIGH IMPEDANCE REF USES LINE CTs (i.e. EARTHED VIA X1.5 AND X1.18).
 - THE EARTHING OF TRANSFORMER NEUTRALS SHALL BE IN ACCORDANCE WITH DPL 34-2149.

ASEA
66/11 kV TRANSFORMER 1
20 MVA YND1 CONNECTED YN011
SEE 1.03/15537

AECOM
CAPE TOWN OFFICE
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REG. No. 1966/00628/07

REV	DATE	DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	Svz	PAG	A v S	17/09/09	
0		FIRST ISSUE. SUBSTATION REFURBISHED.					347A
1		AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRP	C. KING	18/02/2015	347A

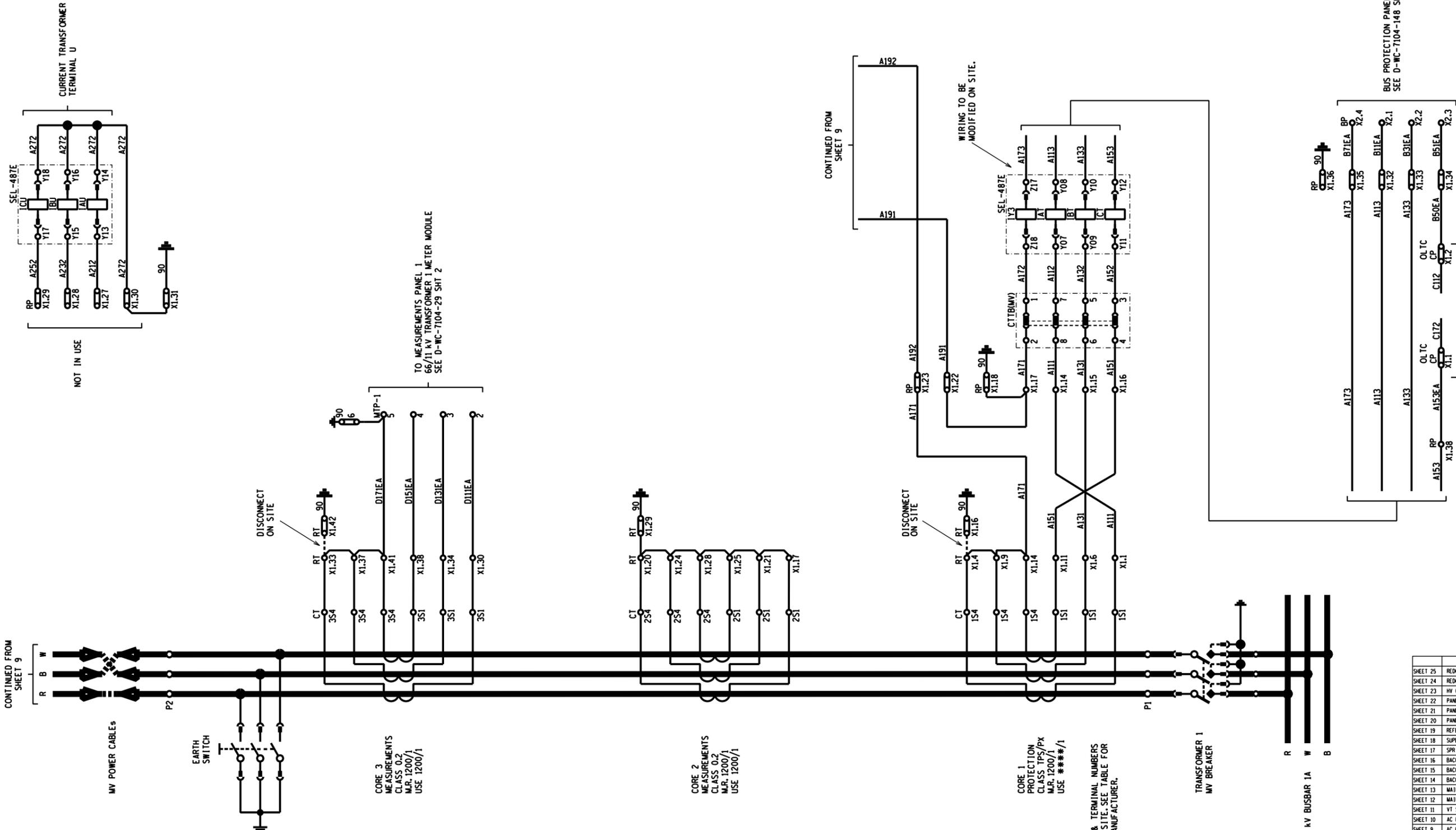
PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 01/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	DRAWN BY
A v S	S.J. van ZYL

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	09 01

LEVELS	1	3	8	10	11	17	24	25	26	27	30
PANEL TYPE DESIGNATION	4TM7100MOD.FZD										

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REV DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

MASTER TRACKING FILED UNDER D-DT-15202 SHEET 9A OF 26 REVISION 1



ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 3)

RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.30	RT X1.34	RT X1.38	RT X1.39	RT X1.31, X1.35 & X1.39
400/1A (S3-S4)	RT X1.32	RT X1.36	RT X1.40	RT X1.41	RT X1.33, X1.37 & X1.41
600/1A (S2-S3)	RT X1.31	RT X1.35	RT X1.39	RT X1.40	RT X1.32, X1.36 & X1.40
800/1A (S1-S3)	RT X1.30	RT X1.34	RT X1.38	RT X1.40	RT X1.32, X1.36 & X1.40
1000/1A (S2-S4)	RT X1.31	RT X1.35	RT X1.39	RT X1.41	RT X1.33, X1.37 & X1.41
1200/1A (S1-S4)	RT X1.30	RT X1.34	RT X1.38	RT X1.41	RT X1.33, X1.37 & X1.41

ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 2)

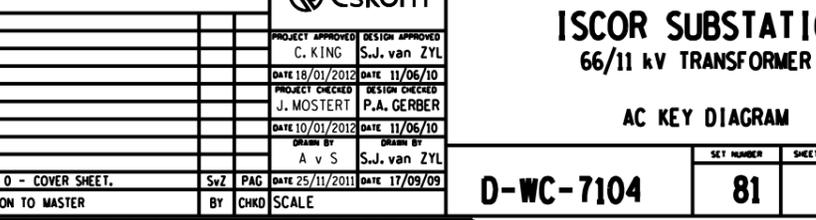
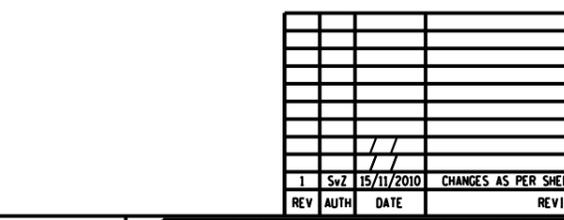
RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.17	RT X1.21	RT X1.25	RT X1.26	RT X1.18, X1.22 & X1.26
400/1A (S3-S4)	RT X1.19	RT X1.23	RT X1.27	RT X1.28	RT X1.20, X1.24 & X1.28
600/1A (S2-S3)	RT X1.18	RT X1.22	RT X1.26	RT X1.27	RT X1.19, X1.23 & X1.27
800/1A (S1-S3)	RT X1.17	RT X1.21	RT X1.25	RT X1.27	RT X1.19, X1.23 & X1.27
1000/1A (S2-S4)	RT X1.18	RT X1.22	RT X1.26	RT X1.28	RT X1.20, X1.24 & X1.28
1200/1A (S1-S4)	RT X1.17	RT X1.21	RT X1.25	RT X1.28	RT X1.20, X1.24 & X1.28

ACTOM BREAKER - PROTECTION CT RATIO SELECTION (CORE 1)

RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.1	RT X1.6	RT X1.11	RT X1.12	RT X1.2, X1.7 & X1.12
400/1A (S3-S4)	RT X1.3	RT X1.8	RT X1.13	RT X1.14	RT X1.4, X1.9 & X1.14
600/1A (S2-S3)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.3, X1.8 & X1.13
800/1A (S1-S3)	RT X1.1	RT X1.6	RT X1.11	RT X1.13	RT X1.3, X1.8 & X1.13
1000/1A (S2-S4)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.4, X1.9 & X1.14
1200/1A (S1-S4)	RT X1.1	RT X1.6	RT X1.11	RT X1.14	RT X1.4, X1.9 & X1.14

* DENOTES CT RATIO & TERMINAL NUMBERS TO BE DETERMINED ON SITE. SEE TABLE FOR APPLICABLE BREAKER MANUFACTURER.

TO MEASUREMENTS PANEL 1
66/11 kV TRANSFORMER 1 METER MODULE
SEE D-WC-7104-29 SHT 2



ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 3)

RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.30	RT X1.34	RT X1.38	RT X1.39	RT X1.31, X1.35 & X1.39
400/1A (S3-S4)	RT X1.32	RT X1.36	RT X1.40	RT X1.41	RT X1.33, X1.37 & X1.41
600/1A (S2-S3)	RT X1.31	RT X1.35	RT X1.39	RT X1.40	RT X1.32, X1.36 & X1.40
800/1A (S1-S3)	RT X1.30	RT X1.34	RT X1.38	RT X1.40	RT X1.32, X1.36 & X1.40
1000/1A (S2-S4)	RT X1.31	RT X1.35	RT X1.39	RT X1.41	RT X1.33, X1.37 & X1.41
1200/1A (S1-S4)	RT X1.30	RT X1.34	RT X1.38	RT X1.41	RT X1.33, X1.37 & X1.41

ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 2)

RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.17	RT X1.21	RT X1.25	RT X1.26	RT X1.18, X1.22 & X1.26
400/1A (S3-S4)	RT X1.19	RT X1.23	RT X1.27	RT X1.28	RT X1.20, X1.24 & X1.28
600/1A (S2-S3)	RT X1.18	RT X1.22	RT X1.26	RT X1.27	RT X1.19, X1.23 & X1.27
800/1A (S1-S3)	RT X1.17	RT X1.21	RT X1.25	RT X1.27	RT X1.19, X1.23 & X1.27
1000/1A (S2-S4)	RT X1.18	RT X1.22	RT X1.26	RT X1.28	RT X1.20, X1.24 & X1.28
1200/1A (S1-S4)	RT X1.17	RT X1.21	RT X1.25	RT X1.28	RT X1.20, X1.24 & X1.28

ACTOM BREAKER - PROTECTION CT RATIO SELECTION (CORE 1)

RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.1	RT X1.6	RT X1.11	RT X1.12	RT X1.2, X1.7 & X1.12
400/1A (S3-S4)	RT X1.3	RT X1.8	RT X1.13	RT X1.14	RT X1.4, X1.9 & X1.14
600/1A (S2-S3)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.3, X1.8 & X1.13
800/1A (S1-S3)	RT X1.1	RT X1.6	RT X1.11	RT X1.13	RT X1.3, X1.8 & X1.13
1000/1A (S2-S4)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.4, X1.9 & X1.14
1200/1A (S1-S4)	RT X1.1	RT X1.6	RT X1.11	RT X1.14	RT X1.4, X1.9 & X1.14

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REW DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
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SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



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FAX: +27 (0)21 950 7502
REG. NO. 1966/006628/07

1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015	347A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					347A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

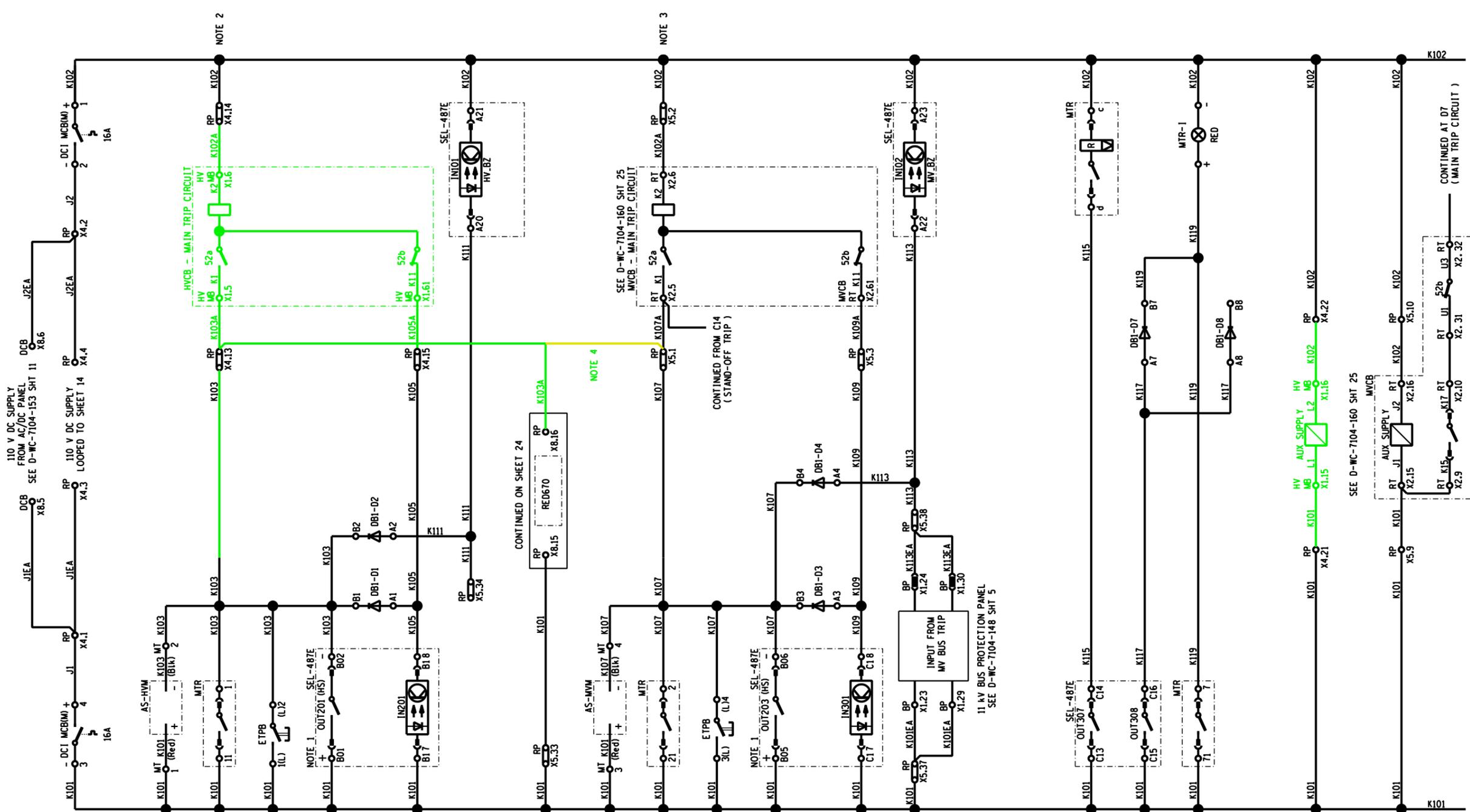
PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 18/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	
A v S	S.J. van ZYL

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1

AC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	10 01

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	



- CONTACT PROTECTOR (ARC SUPPRESSOR)
- HV CIRCUIT-BREAKER MAIN TRIP CIRCUIT
- HV CIRCUIT-BREAKER EMERGENCY TRIP
- DIFFERENTIAL, REF, HV O/C HI-SET, OVER EXCITATION, LOCAL/SUPERVISORY TRIP
- HV MAIN TRIP CIRCUIT SUPERVISION
- (NOT IN USE) HV BUS ZONE TRIP
- RED670 DIFF TRIP
- CONTACT PROTECTOR (ARC SUPPRESSOR)
- MV CIRCUIT-BREAKER MAIN TRIP CIRCUIT
- MV CIRCUIT-BREAKER EMERGENCY TRIP
- DIFFERENTIAL, REF, HV O/C HI-SET & IDMT, MV E/F, OVER EXCITATION, LOCAL/SUPERVISORY TRIP
- MV MAIN TRIP CIRCUIT SUPERVISION
- MV BUS ZONE TRIP
- (NOT IN USE) CUSTOMER MASTER OPERATE (ORDERING OPTION)
- (NOT IN USE) CUSTOMER MASTER RESET (ORDERING OPTION)
- CUSTOMER MASTER / MASTER TRIP RESET
- LAMP CHECK
- MASTER TRIP INDICATION
- (NOT IN USE) CUSTOMER MASTER TRIP INDICATION (ORDERING OPTION)
- HV CIRCUIT-BREAKER SF6 GAS MONITORING SUPPLY
- MV CIRCUIT-BREAKER SF6 GAS MONITORING SUPPLY
- MV CIRCUIT-BREAKER STAND-OFF TRIP (VIA UMBILICAL CORD)

NOTES

- SEL-487E OUTPUT CONTACTS DESIGNATED 'HS' ARE HIGH SPEED, HIGH CURRENT TYPES. WITH OPERATING TIMES LESS THAN 10ms, AND BREAKING CAPACITY 10MVA, L/R = 20ms.
- THE K11 (X1L6) TERMINAL MAY NOT BE AVAILABLE ON OLDER GENERATION CIRCUIT-BREAKERS. WIRE A CIRCUIT-BREAKER AUXILIARY (52b) CONTACT ACROSS X4.14-X4.15 IN THIS CASE.
- THE K11 (X1L6) TERMINAL MAY NOT BE AVAILABLE ON OLDER GENERATION CIRCUIT-BREAKERS. WIRE A CIRCUIT-BREAKER AUXILIARY (52b) CONTACT ACROSS X5.2-X5.3 IN THIS CASE.
- WIRING INDICATED IN YELLOW TO BE REMOVED ON SITE

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REW DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2009	
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A

Eskom
 PROJECT APPROVED: C. KING
 DESIGN APPROVED: S.J. van ZYL
 DATE 08/01/2012 DATE 11/06/10
 PROJECT CHECKED: J. MOSTERT
 DESIGN CHECKED: P.A. GERBER
 DATE 10/01/2012 DATE 11/06/10
 DRAWN BY: A v S
 CHECKED BY: S.J. van ZYL

ISCOR SUBSTATION
 66/11 kV TRANSFORMER 1
 MAIN DC KEY DIAGRAM

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

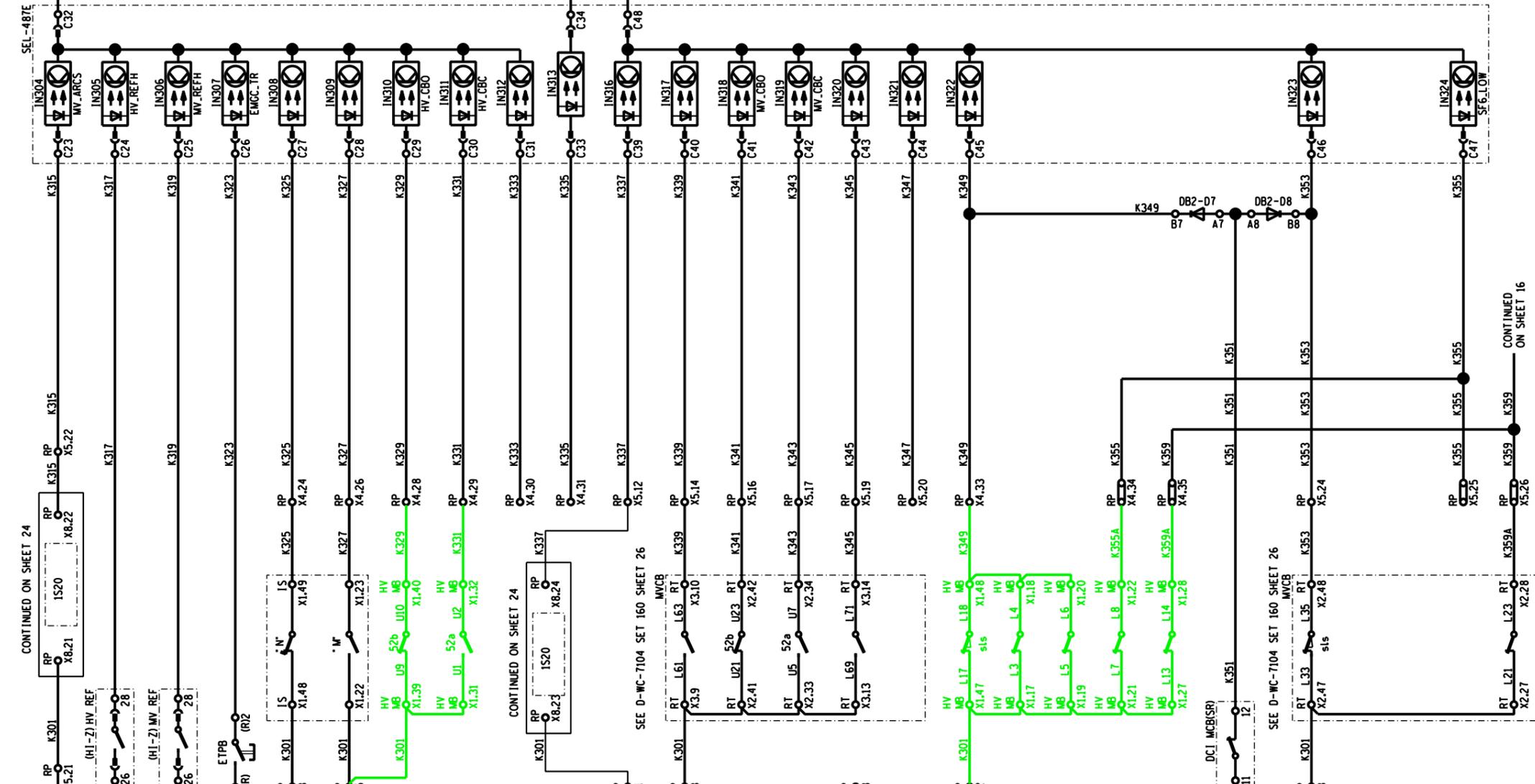
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	12 02

CONTINUED FROM SHEET 14

CONTINUED FROM SHEET 14

CONTINUED ON SHEET 16

CONTINUED ON SHEET 16



- MV INDOOR CIRCUIT-BRKR CABLE CHAMBER ARC FAULT DETECTED
- HIGH IMPEDANCE HV REF TRIP
- HIGH IMPEDANCE MV REF TRIP
- EMERGENCY TRIP
- HV LINE ISOLATOR OPEN
- HV LINE ISOLATOR CLOSED
- HV CIRCUIT-BREAKER OPEN
- HV CIRCUIT-BREAKER CLOSED
- SPARE STATUS INPUT
- SPARE STATUS INPUT
- MV CIRCUIT-BREAKER CABLE CHAMBER ARC SENSOR FAILED
- MV CIRCUIT-BREAKER RACKED OUT
- MV CIRCUIT-BREAKER OPEN
- MV CIRCUIT-BREAKER CLOSED
- MV CIRCUIT-BREAKER INTEGRAL EARTH APPLIED (NOT IN USE)
- MV BUSBAR EARTH APPLIED
- HV CIRCUIT-BREAKER (NOT INSTALLED) NOT HEALTHY
- CIRCUIT-BREAKER COMMON ALARM
- SF6 GAS LOW
- SF6 GAS LOW
- HV CIRCUIT-BREAKER MB HEATER ALARM
- SPRING REWIND MCB TRIPPED
- SPRING DISCHARGED
- CIRCUIT-BREAKER COMMON ALARM
- SF6 GAS LOW
- (NOT IN USE)
- SF6 GAS LOW
- MV CIRCUIT-BREAKER MB HEATER ALARM

NOT INSTALLED

LEVELS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

SHEET 25	REDTO REFERENCE DIAGRAM
SHEET 24	REDTO AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
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SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
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SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



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2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019		
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015		3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.				/		3487A

PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	DRAWN BY
A v S	S.J. van ZYL

Eskom

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1

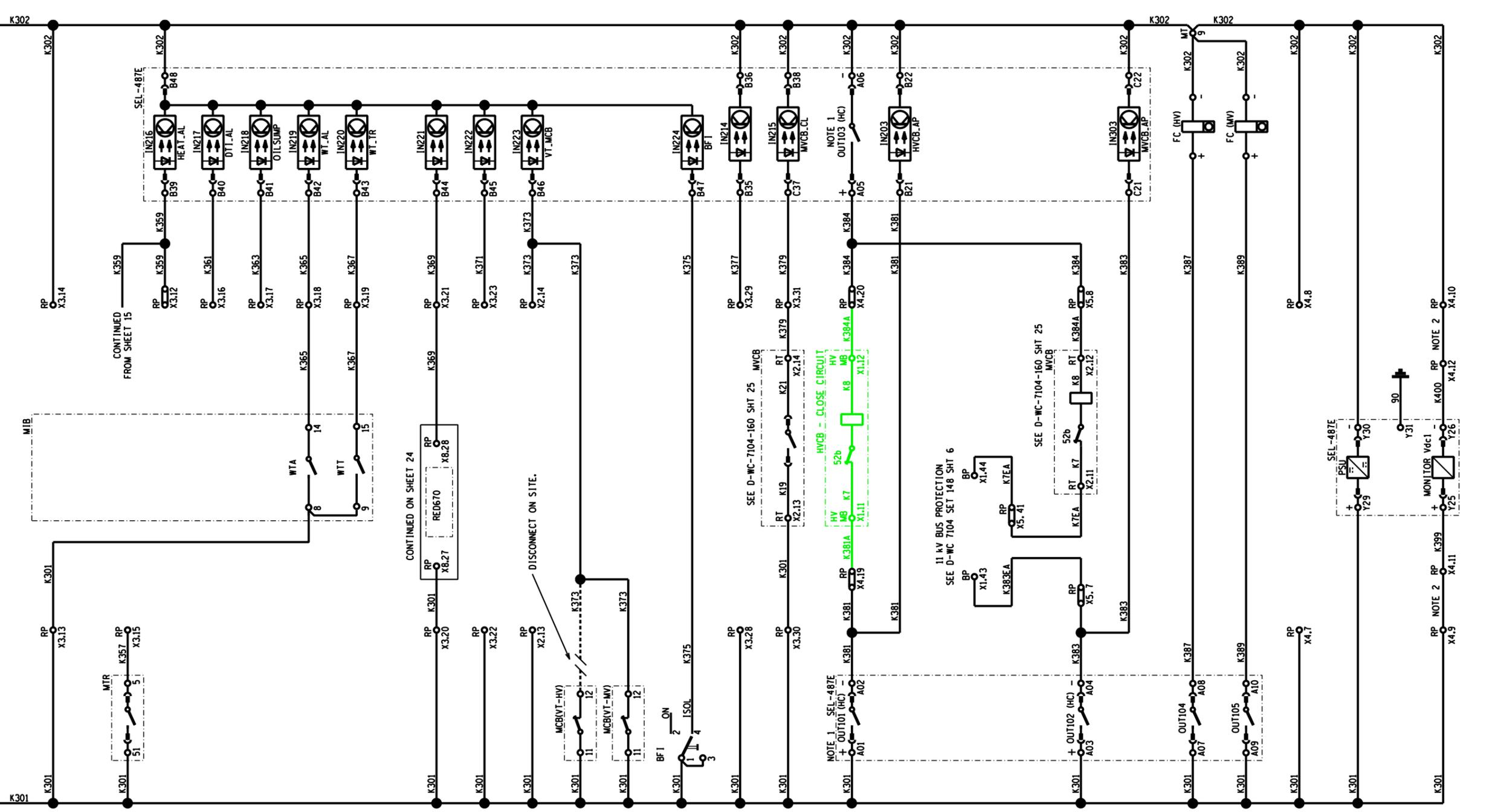
BACK-UP DC KEY DIAGRAM

D-WC-7104 SET NUMBER: **81** SHEET NUMBER: **15** REVISION: **02**

MASTER TRACING FILED UNDER D-DT-15202 SHEET 15 OF 26 REVISION 1

CONTINUED FROM SHEET 15

CONTINUED FROM SHEET 15



NOT INSTALLED
DIGITAL TEMPERATURE
INSTRUMENT POWER SUPPLY

NOT INSTALLED MIB DC SUPPLY
(COOLER CONTROL)

NOT IN USE COOLER FAN TRIP

NOT IN USE MIB HEATER ALARM

NOT IN USE DIGITAL TEMPERATURE
INSTRUMENT FAIL

NOT IN USE OIL SUMP (BUND WALLS)
DRAIN VALVE OPEN

TRANSFORMER WINDING
TEMPERATURE ALARM

TRANSFORMER WINDING
TEMPERATURE TRIP

RED670
DIFF TRIP

SPARE INPUT

VT MCB TRIPPED

NOT IN USE HV VOLTAGE TRANSFORMER
MCB TRIPPED

NOT IN USE MV VOLTAGE TRANSFORMER
MCB TRIPPED

CIRCUIT-BREAKER FAIL
ISOLATED

SPARE INPUT

MV CIRCUIT-BREAKER
STAND-OFF CLOSE
(VIA UMBILICAL CORD)

HV CIRCUIT-BREAKER
CLOSE & ANTI-PUMP

HV CIRCUIT-BREAKER
ANTI-PUMP INPUT

MV CIRCUIT-BREAKER
CLOSE

MV CIRCUIT-BREAKER
ANTI-PUMP INPUT

HV CIRCUIT-BREAKER
FAULT/TRIP COUNTER

MV CIRCUIT-BREAKER
FAULT/TRIP COUNTER

SPARE SUPPLY

SEL-487E
POWER SUPPLY

BACK-UP / CUSTOMER
DC SUPPLY MONITORING

CONTINUED FROM SHEET 15

CONTINUED ON SHEET 24

DISCONNECT ON SITE.

NOTE 1
OUT101 (HC)
+
OUT102 (HC)
+
OUT103 (HC)
+

11 kV BUS PROTECTION
SEE D-WC 7104 SET 148 SHT 6

SEE D-WC-7104-160 SHT 25

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
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SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

NOTES

- SEL-487E OUTPUT CONTACTS DESIGNATED 'HC' ARE HIGH CURRENT (NORMAL SPEED) TYPES, WITH BREAKING CAPACITY 100ac, L/R = 20ms.
- REMOVE LINKS IN THE EVENT THAT THE SEL-487E IS TO BE USED TO MONITOR THE CUSTOMER'S DC SUPPLY. IN THIS CASE, WIRE THE CUSTOMER'S POSITIVE SUPPLY TO X4.11 AND THE NEGATIVE TO X4.12 (MAX 350VDC).
- REFERENCE CONDITIONS: DIGITAL TEMPERATURE INSTRUMENT SHOWN IN THE OPEN POSITION, DE-ENERGISED (FAILED) STATE, OIL SUMP DRAIN VALVE SHOWN IN THE OPEN POSITION.

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REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	3487A
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0	FIRST ISSUE, SUBSTATION REFURBISHED.					3487A

PROJECT APPROVED C. KING	DESIGN APPROVED S.J. van ZYL
DATE 18/01/2012	DATE 11/06/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY A v S	DRAWN BY S.J. van ZYL

Eskom

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1

BACK-UP DC KEY DIAGRAM

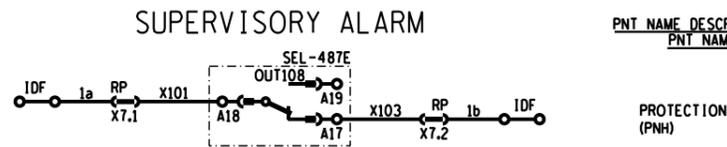
D-WC-7104 **81** **16** **02**

SET NUMBER SHEET NUMBER REVISION

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

ALARM WORDING

PROTECTION NOT HEALTHY



SUPERVISORY ALARM

PNT NAME DESCRIPTION/
PNT NAME

PROTECTION (PNH)

SEL-487E MAIN PRINTED CIRCUIT (PC) BOARD JUMPER SETTINGS

THE FOLLOWING MAIN PC BOARD JUMPER SELECTIONS SHALL BE MADE BY CONCO PRIOR TO DELIVERY OF SCHEMES TO ESKOM.

JUMPER NAME	SETTING	FUNCTION
J21-A	N/A	RESERVED FOR USE BY SEL
J21-PASSWORD	OFF	DISABLE PASSWORD PROTECTION
J21-BREAKER	ON	ALLOW ASCII SERIAL COMMANDS "OPEN", "CLOSE" AND "PULSE"
J21-D	N/A	RESERVED FOR USE BY SEL
JMP1	OFF	IRIG-B TERMINATING Z (OFF = 2550 Ohms, ON = 50 Ohms)
JMP2	ON	PORT 3 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)
JMP3	ON	PORT 2 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)
JMP4	OFF	PORT 1 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)

COMMS INTERFACE AND TIME SYNCHRONISATION

SEL-2886 DIP SWITCH SETTINGS

THE FOLLOWING DIP SWITCH SELECTIONS SHALL BE MADE BY CONCO PRIOR TO DELIVERY OF SCHEMES TO ESKOM.

NO.	1	2	3	4	5	6	7	8
ON-1								
OFF-0								

THE SEL-2886 IS SET IN SEND DATA CONTROL (SDC) MODE (DIP SWITCH 4 OFF), CONFIGURED FOR COMPATIBILITY WITH 9600 BAUD (DIP SWITCHES 1-3) AND WITH ECHO OFF (DIP SWITCH 6).

ALTERNATIVE BAUD RATE SETTINGS ARE AS FOLLOWS:

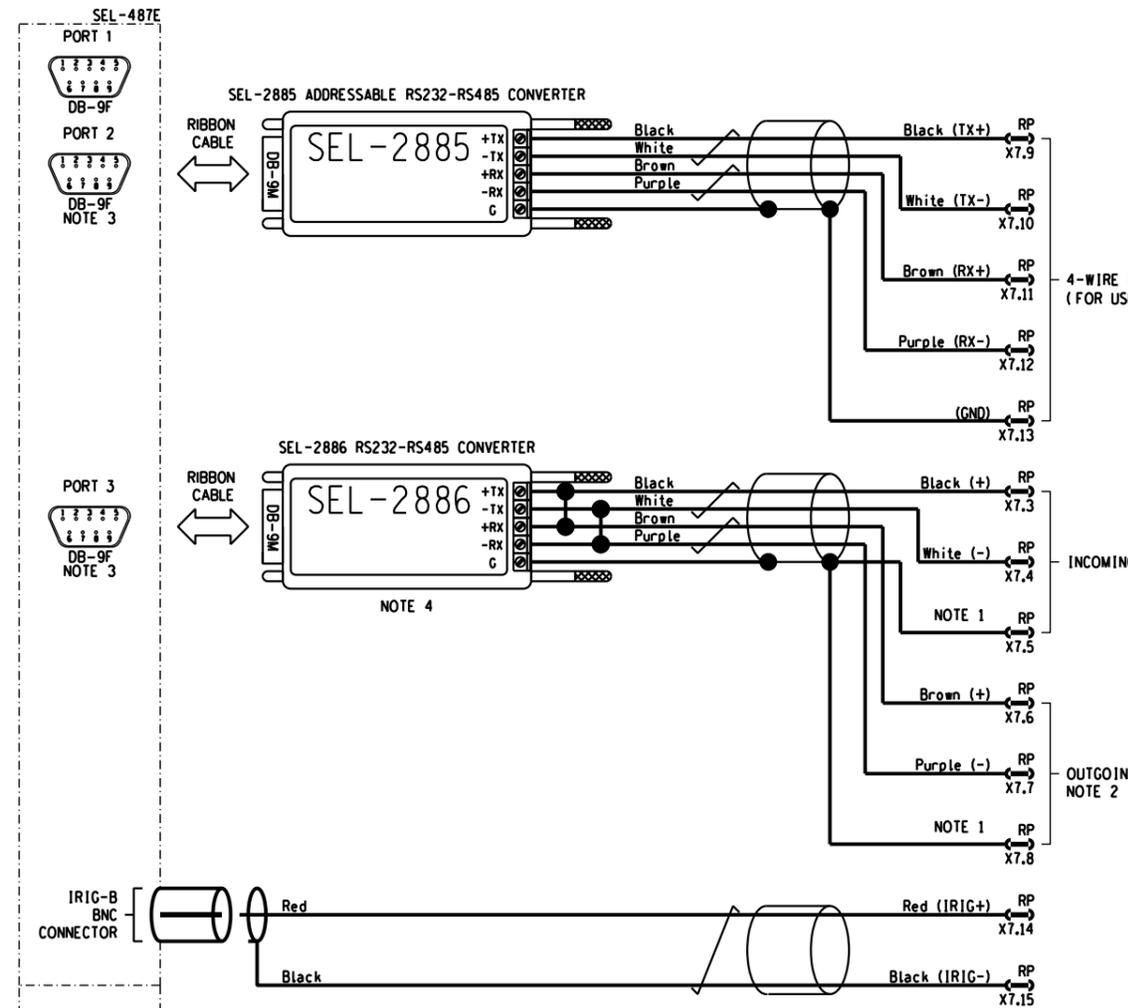
BAUD	1	2	3
1200	1	1	1
2400	0	1	1
4800	1	0	1
9600	0	0	1
19200	1	1	0
38400	0	1	0
57600	1	0	0
115200	0	0	0

SPARE RS232 PORT
(e.g. FOR MIRROR-BIT COMMUNICATION)

REMOTE ENGINEERING ACCESS
RS232 REAR PORT SUPPORTING SEL OR LMD PROTOCOL

SERIAL SCADA COMMUNICATION
RS232 REAR PORT SUPPORTING DNP3 PROTOCOL

TIME SYNCHRONISATION
IRIG-B

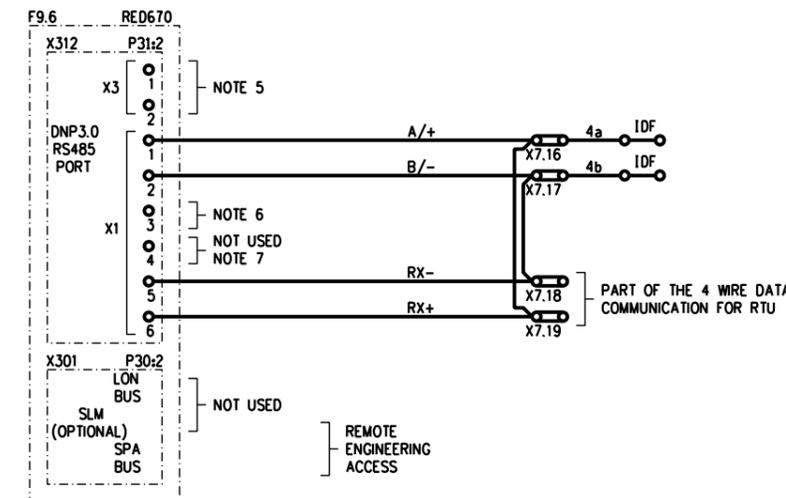


4-WIRE RS-485
(FOR USE WITH LIMITED MULTI DROP (LMD) PROTOCOL)

INCOMING

OUTGOING

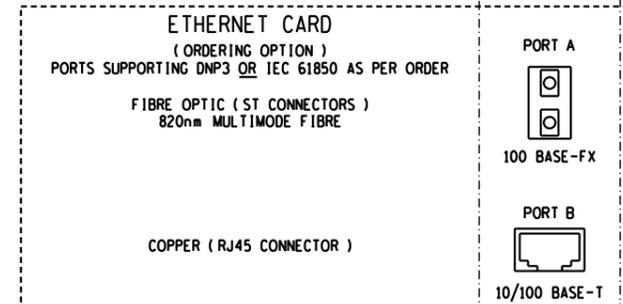
NOTE 2



NOTE:

- 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.
- TERMINATION RESISTOR FOR TRANSMITTER AND RECEIVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
- TERMINATION RESISTOR FOR RECEIVER IN THE 4 WIRE CASE (CONNECT TO RX+).

SHEET NO.	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
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SHEET 14	BACK-UP DC KEY DIAGRAM
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SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
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SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



- NOTES
- RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
 - THE SEL-2886 PRODUCT MANUAL INDICATES THAT TERMINATING RESISTORS SHOULD SELDOM BE REQUIRED ON THE RS485 CIRCUITS (E.G. COMMUNICATION AT UP TO 115200bps CAN BE ACHIEVED OVER A 230m CABLE RUN WITHOUT THE NEED FOR RESISTORS). WHERE REQUIRED, REFER TO THE PRODUCT MANUAL FOR RESISTOR SIZING AND INSTALLATION PRACTICE NOTES.
 - THE SEL-2885 AND SEL-2886 CONVERTERS REQUIRE A +5Vdc AUXILIARY SUPPLY. THIS IS PROVIDED VIA PIN 1 OF THE SEL-487E COMM PORT. SEE MAIN PC BOARD JUMPER SETTINGS, TOP RIGHT.
 - SEL-2886 CONVERTERS ARE CAPABLE OF 2- OR 4-WIRE RS485 MULTI-DROP CONNECTIONS. THE SEL-2886 IS WIRED FOR 2-WIRE CONNECTION IN THE STANDARD SCHEME APPLICATION.

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1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	10/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

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PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL
DATE: 08/01/2012
DATE: 11/06/10

PROJECT CHECKED: J. MOSTERT
DESIGN CHECKED: P.A. GERBER
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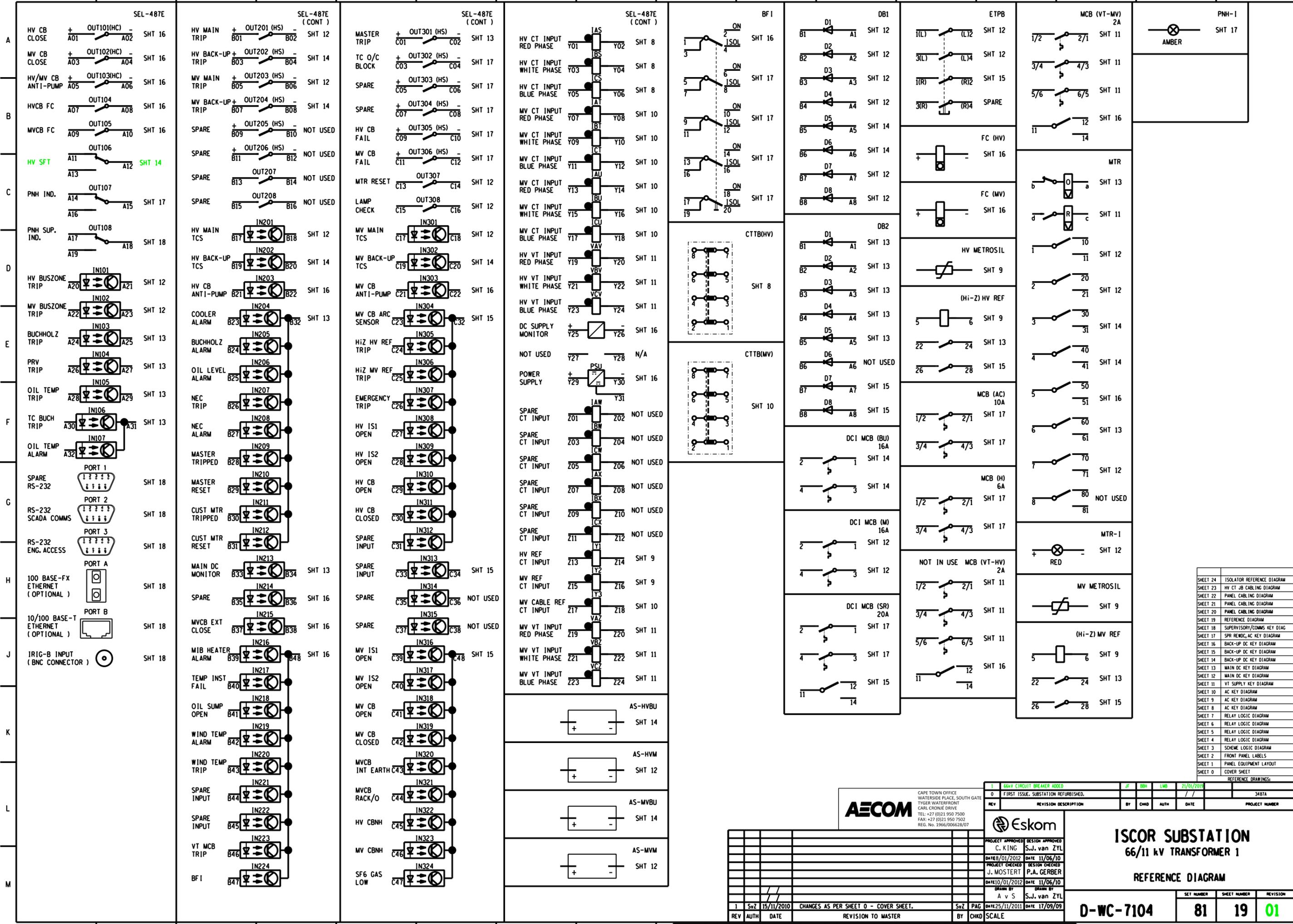
DRAWN BY: A v S
DATE: 25/11/2011
DATE: 17/09/09

ISCOR SUBSTATION
66/11 kV TRANSFORMER 1
SUPERVISORY/COMMS KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	18 01

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007TE A1L

MASTER TRACING FILED UNDER D-DT-15202 SHEET 18 OF 26 REVISION 1



SHEET 24	ISOLATOR REFERENCE DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
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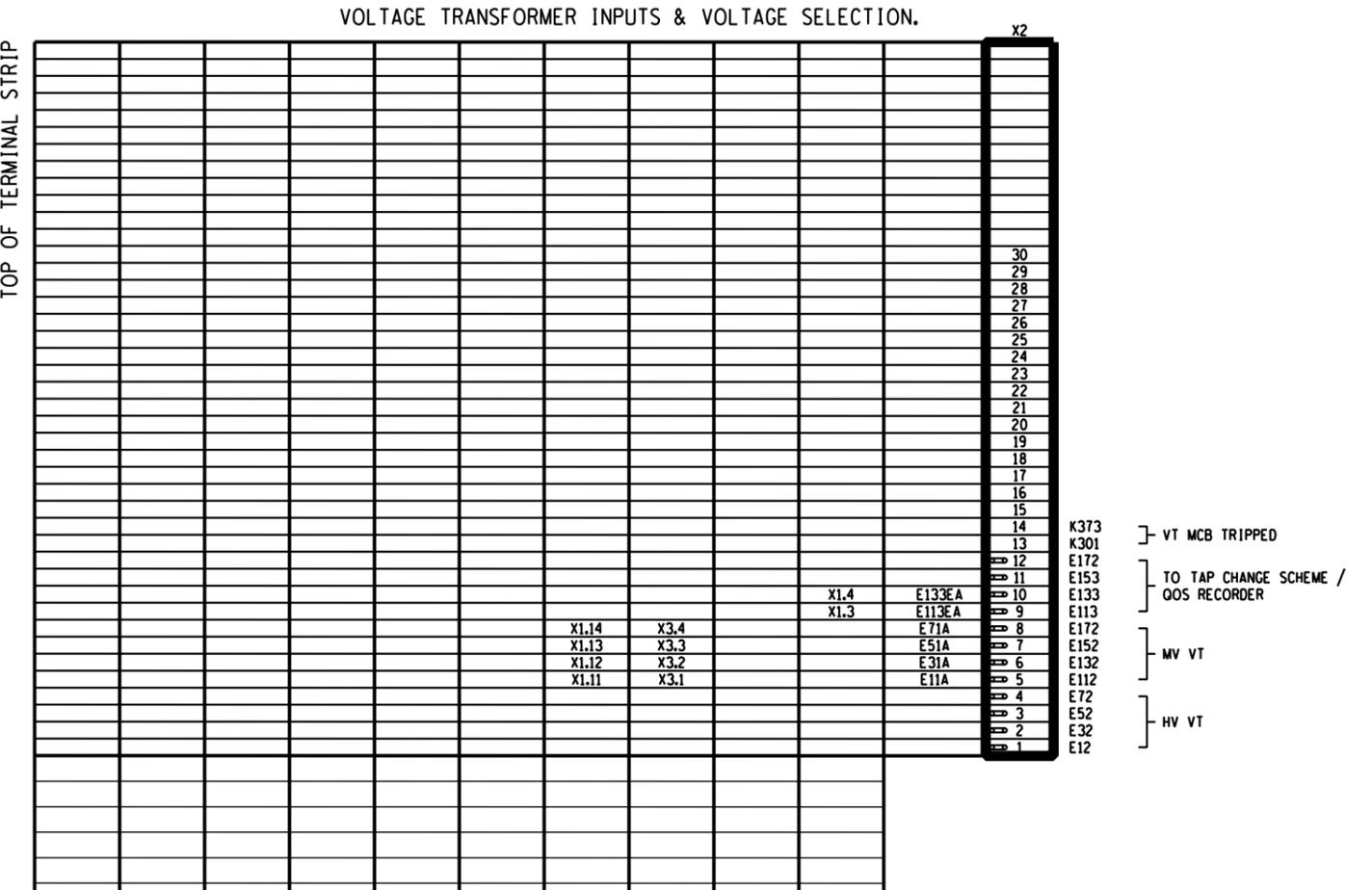
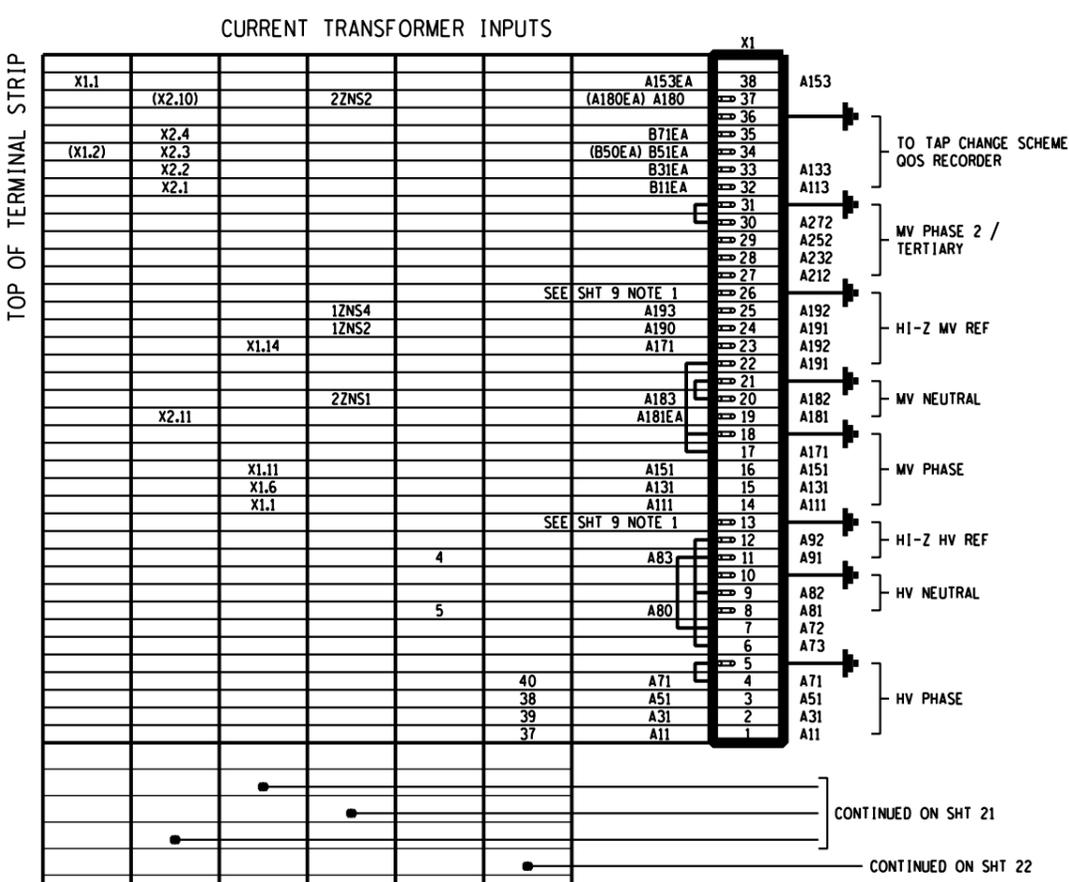
1	66kV CIRCUIT BREAKER ADDED	JF	BH	LMB	21/01/2019		
0	FIRST ISSUE, SUBSTATION REFURBISHED.						3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE		PROJECT NUMBER

PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	
A v S	S.J. van ZYL
DATE 25/11/2011	DATE 17/09/09

ISCOR SUBSTATION		
66/11 kV TRANSFORMER 1		
REFERENCE DIAGRAM		
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	81	19 01

LEVELS	1	3	8	10	11	17	24	26	27	30
1	Sv2	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	Sv2	PAG	DATE 25/11/2011	DATE 17/09/09			
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE				

MASTER TRACING FILED UNDER D-DT-15202 SHEET 19 OF 26 REVISION 1



EA522	EA508	EA506	EA514	EA512	EA504	CABLE NUMBER
12	19	19	12	12	12	CABLE SIZE
4	3	4	5	10	4	NUMBER OF SPARES
OLTIC PANEL 66/11 kV TRFR 1 OLTIC RACK	11 kV BUS PROTECTION PANEL	11 kV BREAKER MECH BOX RT TERMINALS	NECRT	TRANSFORMER MIB	66 kV CT JUNCTION BOX	DESTINATION

29	28	EA522	CABLE NUMBER
4	4	-	CABLE SIZE
0	0	-	NUMBER OF SPARES
11 kV FEEDER 10 RELAY PANEL (LOOP CABLE)	11 kV BUSBAR 1A 11 kV VT RT (LOOP CABLE)	OLTIC PANEL 66/11 kV TRFR 1 OLTIC RACK	DESTINATION

LOOPED TERMINALS

66 kV CT JB	40-41-42; 43-44-45-46-47-48-EARTH; 49-50-51-52-53-54-EARTH; 58-59-60; 61-62-62-64-65-66-EARTH; 67-68-69-70-71-72-EARTH;
MIB	1-18-7-261-6-4-5-263; 11-10; 262-264-8-9;
NECRT	K1-K3-K5-L1-L3; K2-K4-K6; L2-L4
11 kV BKR MB RT TERMINALS	X1.4-X1.9-X1.14; X1.17-X1.20-X1.21-X1.24-X1.25-X1.28-X1.29-EARTH; X1.33-X1.37-X1.41; X2.15-X2.9; X2.10-X2.31; X2.5-X2.32; X3.9-X2.41-X2.33-X3.13; X2.47-X2.27;
66 kV LINE ISOLATOR	X1.50-X1.24;

- NOTES:**
- (2) INDICATES TWO LEADS IN PARALLEL.
 - SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
 - LEAD NUMBERS SHOWN THUS
P7 INDICATES NO CHANGE IN LEAD NUMBER.
P7 P7A INDICATES CHANGE IN LEAD NUMBER.
 - SEE CABLE BLOCK DIAGRAM FOR PREFIXING.
 - SLIDING LINK TERMINALS ARE TO BE ORIENTED SUCH THAT THE LINK FALLS/REMAINS CLOSED WHEN THE SECURING SCREW IS LOOSENED.
- UNLESS INDICATED OTHERWISE, STANDARD TERMINALS: ENTRELEC M10/10.RS
 ☐ ENTRELEC D6/8-ST1-RS SLIDING LINK TEST TERMINAL

NOTE: * INDICATES TERMINAL NUMBER TO BE DETERMINED ON SITE.



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	18/02/2015	SABTA
0	FIRST ISSUE. SUBSTATION REFURBISHED.					SABTA
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

Eskom

**ISCOR SUBSTATION
66/11 kV TRANSFORMER 1**

PANEL CABLING DIAGRAM

PROJECT APPROVED C. KING	DESIGN APPROVED S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY A v S	CHECKED BY S.J. van ZYL

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	

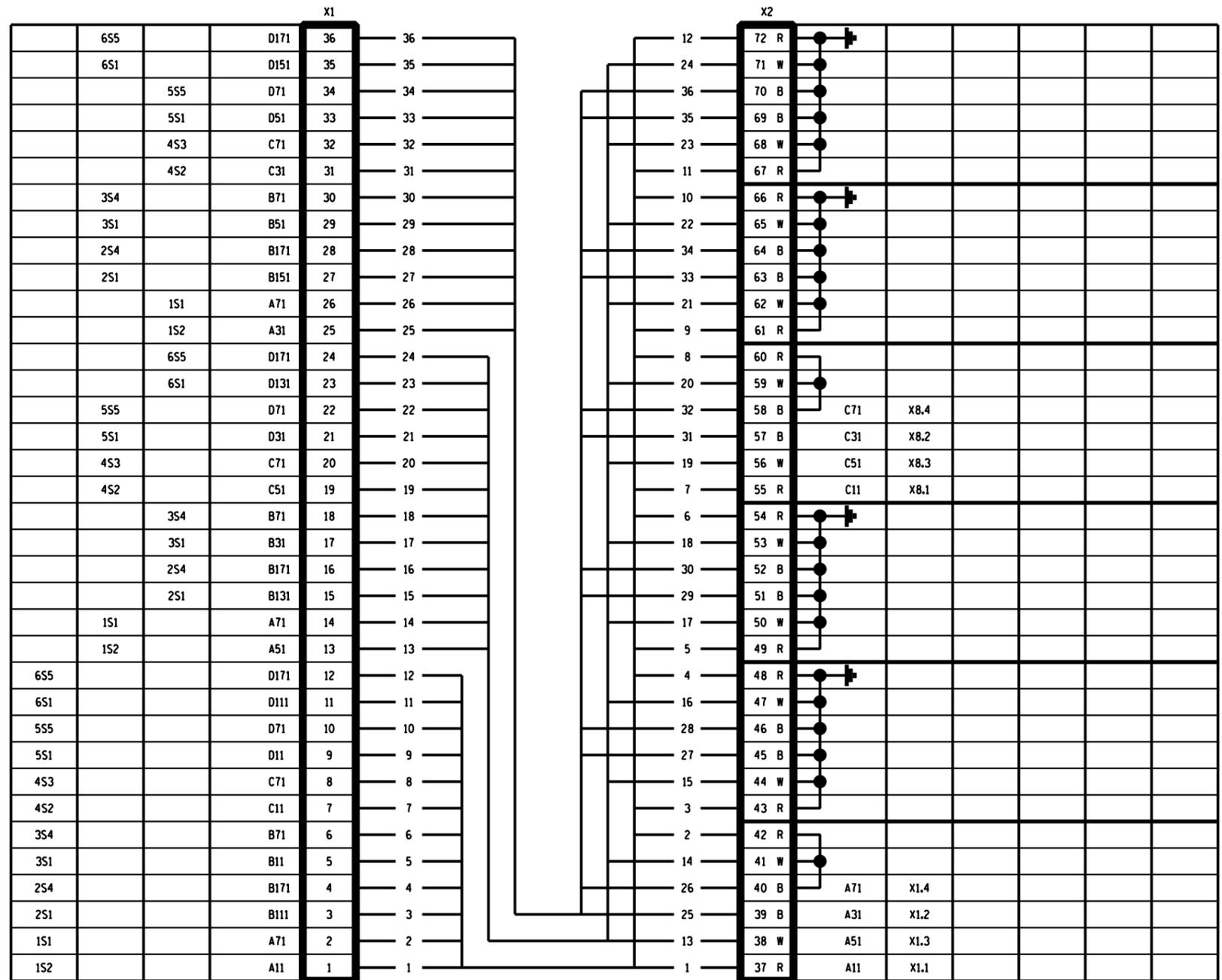
D-WC-7104

SET NUMBER	SHEET NUMBER	REVISION
81	20	01

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE DROUITE A1L

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REW DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

TOP OF TERMINAL STRIP



NOTE: ALL SPARE CABLE CORES TO BE EARTHED ON ONE END ONLY.
 NOTE: USE JUNCTION BOX
 VRW 6 CORE CT INSERT
 DRG D-DT-5404

EB501	EB502	EB503	CABLE NUMBER
12	12	12	CABLE SIZE
0	0	0	NUMBER OF SPARES
			DESTINATION

CABLE NUMBER	EA504
CABLE SIZE	12
NUMBER OF SPARES	4
	RELAY PANEL
	DESTINATION

SHEET 25	RED670 REFERENCE DIAGRAM
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SHEET 14	BACK-UP DC KEY DIAGRAM
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SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
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SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRB	C. KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A

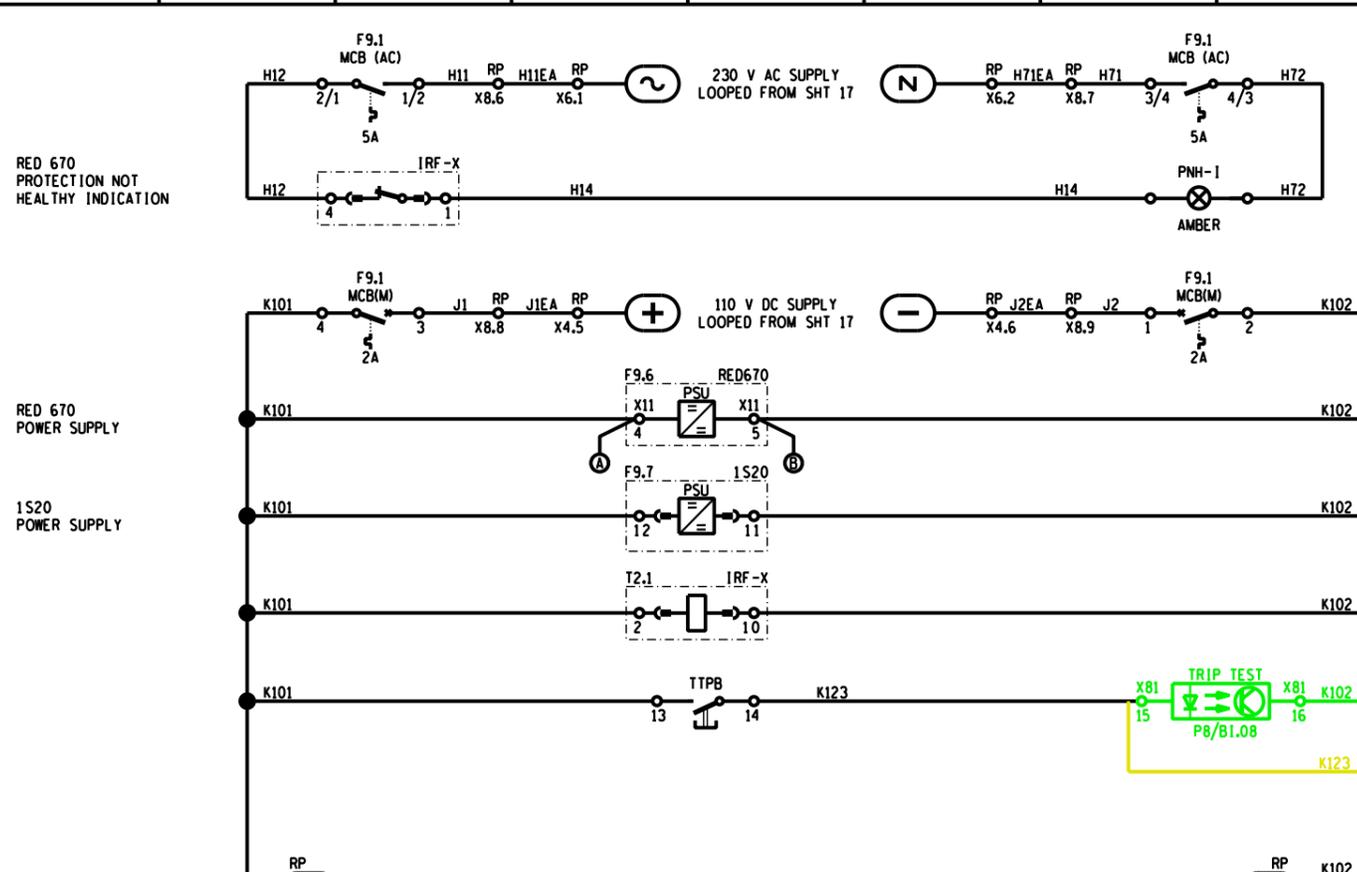
PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	DRAWN BY
A v S	S.J. van ZYL

ISCOR SUBSTATION
 66/11 kV TRANSFORMER 1
 HV CT JB CABLING DIAGRAM

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	

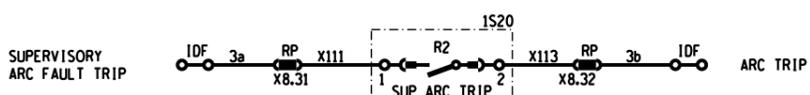
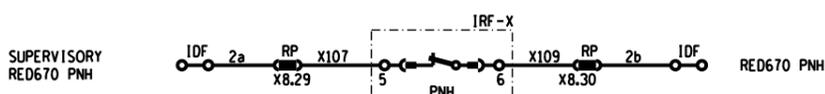
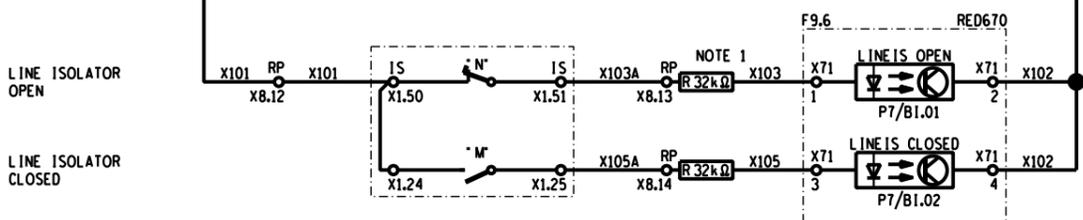
D-WC-7104	81	23	01
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MASTER TRACING FILED UNDER D-DT-15202 SHEET 23 OF 26 REVISION 1

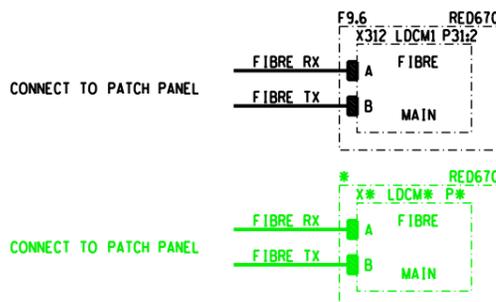


SUPERVISORY STATUS 48 V DC (DNP3 OPTIONAL & HMI DISPLAY)

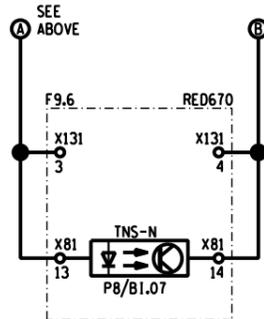
NOTE:
1. FOR 220 V DC SUPPLY, RESISTOR = 64kΩ



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



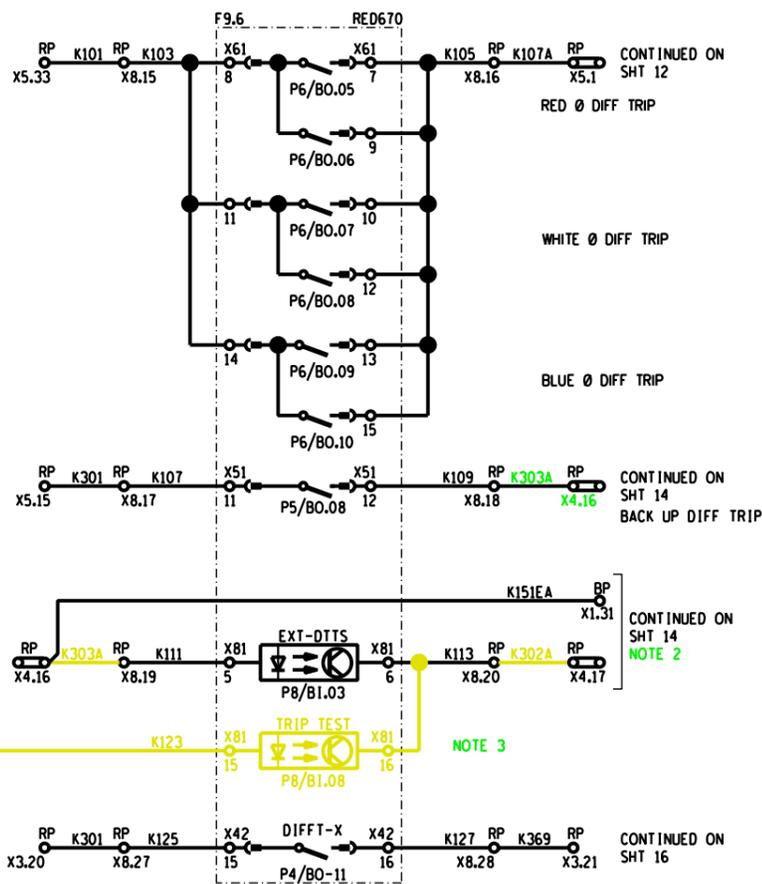
TNS NORMAL



1. 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.

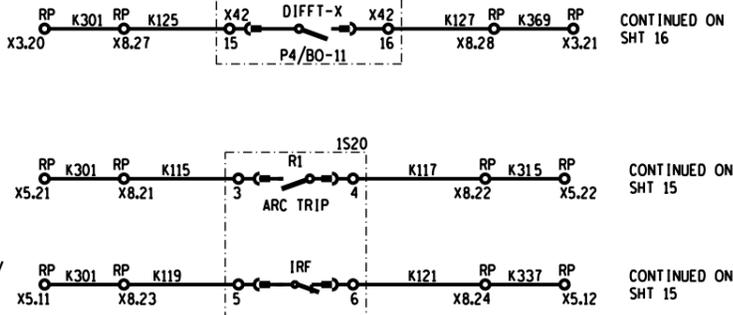
2. DISCONNECT RED670 BY REMOVING JUMPERS BETWEEN TERMINALS X4.16 AND X8.19; AND X4.17 AND X8.20. CONNECT AS INDICATED ON SHEET 14.
3. INPUT WIRED BETWEEN POS. AND NEG. OF TWO SEPARATED SUPPLIES. REMOVE JUMPER BETWEEN X8.16 AND X8.16 AND CONNECT X8.16 TO K102 NEG. SUPPLY.

DIRECT INTERTRIP
SEND TO REMOTE END
(BLOCKED VIA BFIS OR TPIS SET OFF)



ARC FAULT TRIP

ARC PROTECTION/
SENSOR FAIL



NOTE: THIS CAN BE USED UP TO DISTANCES
OF 50 METERS WITH STP CABLING



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66KV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	3487A
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A

PROJECT APPROVED	DESIGN APPROVED
C. KING	
DATE: 01/2012	DATE:
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	
DATE: 10/01/2012	DATE:
DRAWN BY	DRAWN BY
A v S	
DATE: 25/11/2011	DATE:

ISCOR SUBSTATION 66/11 kV TRANSFORMER 1	
RED670 AC, DC & SUPERVISORY KEY DIAGRAM	
SET NUMBER	SHEET NUMBER
D-WC-7104	81
	24
	02

SHEET	DESCRIPTION
25	RED670 REFERENCE DIAGRAM
24	RED670 AC/DC & SUP. KEY DIAGRAM
23	HV CT JB CABLING DIAGRAM
22	PANEL CABLING DIAGRAM
21	PANEL CABLING DIAGRAM
20	PANEL CABLING DIAGRAM
19	REFERENCE DIAGRAM
18	SUPERVISORY/COMMS KEY DIAG
17	SPR REM DC AC KEY DIAGRAM
16	BACK-UP DC KEY DIAGRAM
15	BACK-UP DC KEY DIAGRAM
14	BACK-UP DC KEY DIAGRAM
13	MAIN DC KEY DIAGRAM
12	MAIN DC KEY DIAGRAM
11	VT SUPPLY KEY DIAGRAM
10	AC KEY DIAGRAM
9	AC KEY DIAGRAM
8	AC KEY DIAGRAM
7	RELAY LOGIC DIAGRAM
6	RELAY LOGIC DIAGRAM
5	RELAY LOGIC DIAGRAM
4	RELAY LOGIC DIAGRAM
3	SCHEME LOGIC DIAGRAM
2	FRONT PANEL LABELS
1	PANEL EQUIPMENT LAYOUT
0	COVER SHEET

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	1	15/11/2010	REVISION 1 CHANGES INDICATED.
1	PANEL EQUIPMENT LAYOUT	1	15/11/2010	REAR OF MODULE R3; COMPONENT ORDER ALTERED.
2	FRONT PANEL LABELS	1	15/11/2010	SEL-487E LED 10 LABEL UPDATED; "WIND;" CHANGED TO "WINDING"; BREAKER FAIL ISOLATE SWITCH LABEL WORDING ALTERED.
3	SCHEME LOGIC DIAGRAM	1	15/11/2010	LEVEL 5: HV/MV EARTH FAULT PROTECTION APPLIED FROM PHASE CTs. LEVEL 16: APPLICATION OF MV CUST CABLE PROTECTION ALTERED.
4	RELAY LOGIC DIAGRAM	1	15/11/2010	UPDATED AS PER FINALISED SETTINGS TEMPLATE (REV 0). REPLACES PREVIOUS SHEET 4.
5	RELAY LOGIC DIAGRAM	1	15/11/2010	UPDATED AS PER FINALISED SETTINGS TEMPLATE (REV 0). REPLACES PREVIOUS SHEET 5.
6	RELAY LOGIC DIAGRAM	1	15/11/2010	UPDATED AS PER FINALISED SETTINGS TEMPLATE (REV 0). REPLACES PREVIOUS SHEET 6.
7	RELAY LOGIC DIAGRAM	1	15/11/2010	UPDATED AS PER FINALISED SETTINGS TEMPLATE (REV 0). REPLACES PREVIOUS SHEET 7.
8	AC KEY DIAGRAM	1	15/11/2010	AS PER PREVIOUS ISSUE.
9	AC KEY DIAGRAM; STAR-DELTA POWER TRANSFORMER	1	15/11/2010	VOLTAGE TRFRS PREVIOUSLY ON LEVEL 12 MOVED TO LEVEL 11.
9B	AC KEY DIAGRAM; STAR-STAR POWER TRANSFORMER (NOT USED)	1	15/11/2010	VOLTAGE TRFRS PREVIOUSLY ON LEVEL 12 MOVED TO LEVEL 11.
9C	AC KEY DIAGRAM; AUTO TRANSFORMER (NOT USED)	1	15/11/2010	VOLTAGE TRFRS PREVIOUSLY ON LEVEL 12 MOVED TO LEVEL 11.
10	AC KEY DIAGRAM; ESKOM MV CIRCUIT-BREAKER	1	15/11/2010	AS PER PREVIOUS ISSUE.
10B	AC KEY DIAGRAM; CUSTOMER MV CIRCUIT-BREAKER (NOT USED)	1	15/11/2010	PLACEMENT OF TERMINAL T AND U CT INPUTS SWAPPED. CT STAR POINTS REVERSED.
10C	AC KEY DIAGRAM; SECONDARY SIDE HV CIRCUIT-BREAKER (FOR AUTO TRANSFORMER APPLICATIONS) (NOT USED)	1	15/11/2010	AS PER PREVIOUS ISSUE.
11	VT SUPPLY KEY DIAGRAM	1	15/11/2010	AS PER PREVIOUS ISSUE.
12	MAIN DC KEY DIAGRAM	1	15/11/2010	AS PER PREVIOUS ISSUE.
13	MAIN DC KEY DIAGRAM	1	15/11/2010	AS PER PREVIOUS ISSUE.
14	BACK-UP DC KEY DIAGRAM	1	15/11/2010	LEVEL 15: FERRULE NUMBERS FOR TERMINAL X2.42 CORRECTED FROM K409 TO K407.
15	BACK-UP DC KEY DIAGRAM	1	15/11/2010	IN313 TERMINAL NO'S CORRECTED FROM A... TO C... LEVEL 16: MV LINE ISOLATOR STATUS ADDED. LEVELS 3, 4 & 5: MIB CONTACT CONFIGS CORRECTED (N/O vs N/C). NOTE 3 ADDED.
16	BACK-UP DC KEY DIAGRAM	1	15/11/2010	FERRULE NO'S OF CB CLOSE COIL -VE SUPPLIES CHANGED FROM K385 TO K384. DC SUPPLY MONITORING NO'S CHANGED FROM K398 & K399 TO K399 & K400. MODULE TERMINAL (MT) ADDED IN FAULT COUNTER CIRCUIT (K302).
17	SPR REWIND DC KEY, AC KEY DIAGRAM	1	15/11/2010	FERRULE NUMBERS ADDED TO TEST POINT WIRING.
18	SUPERVISORY/COMMS KEY DIAGRAM	1	15/11/2010	LEVEL 26: SEL-2886 DIP SWITCH SETTINGS ADDED.
19	PROTECTION REFERENCE DIAGRAM	1	15/11/2010	AS PER PREVIOUS ISSUE.
20	PANEL CABLING DIAGRAM	1	15/11/2010	LEVEL 9: FERRULE NUMBERS ADDED FOR TERMINALS X1.11 & X1.12 AS PER SHEET 10C.
21	PANEL CABLING DIAGRAM	1	15/11/2010	FERRULE NO'S FOR X3.36 & X3.37 CORRECTED FROM K511 & K513 TO K509 & K511. NO'S FOR X4.11, X4.12 & X4.20 UPDATED AS PER SHT 16.
22	PANEL CABLING DIAGRAM	1	15/11/2010	FERRULE NO'S FOR X5.8 UPDATED AS PER SHEET 16. X7.1-X7.2 DESCRIPTION CHANGED FROM 'TCNH ALARM' TO 'PNH ALARM'. LEVEL 16: MV LINE ISOLATOR STATUS ADDED.
24	MV OR SECONDARY SIDE CT JB CABLING DIAGRAM (NOT USED)	1	15/11/2010	AS PER PREVIOUS ISSUE.
25	MV OR SECONDARY SIDE VT JB CABLING DIAGRAM (NOT USED)	1	15/11/2010	AS PER PREVIOUS ISSUE.
26	CABLE BLOCK DIAGRAM (NOT USED)	1	15/11/2010	AS PER PREVIOUS ISSUE.
24	RED670 RELAY DC, AC & SUPERVISORY KEY DIAGRAM	0	25/11/2011	SHEET ADDED FOR SITE SPECIFIC APPLICATION
25	RED670 RELAY REFERENCE DIAGRAM	0	25/11/2011	SHEET ADDED FOR SITE SPECIFIC APPLICATION

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1	SCHEME RATED FOR 110 V DC SUPPLY. (AFFECTS TYPE OF CONTACT PROTECTION (SNUBBER CTs) SUPPLIED)	16	
2		17	INDOOR SWITCHGEAR AS PER D-DT-5408 SHTs 7 -14 (RT TERMINALS) WITH REMOTE PROTECTION SCHEME
3	STAR-DELTA POWER TRANSFORMER WITH 360 A NEC/R (INCLUDES COOLER FANS; DELETE IF NOT APPLICABLE)	18	
4		19	
5		20	
6		21	
7		22	
8	HIGH IMPEDANCE HV & MV REF FOR TWO-WINDING TRFR - TWO RMS 2V73 RELAYS (ORDERING OPTION)	23	
9		24	APPLICATION WITH RED670 DIFF RELAY INTEGRATION
10	STANDARD DESIGN DRAWING	25	NON-STANDARD DESIGN WITH HV POST CTs AND NO HV BREAKER
11	APPLICATION USING TRFR MV / SECONDARY-SIDE VTs (i.e. WITHOUT MV VT SELECTION OPTION)	26	STANDARD COMMS OPTIONS (RS-485/DNP3 SCADA & RS-485 REMOTE ENG. ACCESS)
12		27	IEC-61850/ETHERNET COMMS (ORDERING OPTION)
13		28	
14		29	
15		30	APPLICATION WITH 4TC-5200 TAP CHANGE CONTROL SCHEME

TRANSFORMER SECONDARY-SIDE CIRCUIT-BREAKER OPTIONS

TRANSFORMER PRIMARY-SIDE CIRCUIT-BREAKER OPTIONS

? MUTUALLY EXCLUSIVE LEVELS/SHEETS. SELECT ONE AND ONLY ONE OF EACH PAIR/SET PER APPLICATION.
 IMPORTANT: OWING TO SPACE CONSTRAINTS WITHIN THE MODULE, LEVELS 15 AND 16 CAN NOT BE APPLIED TOGETHER.

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REW DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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

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



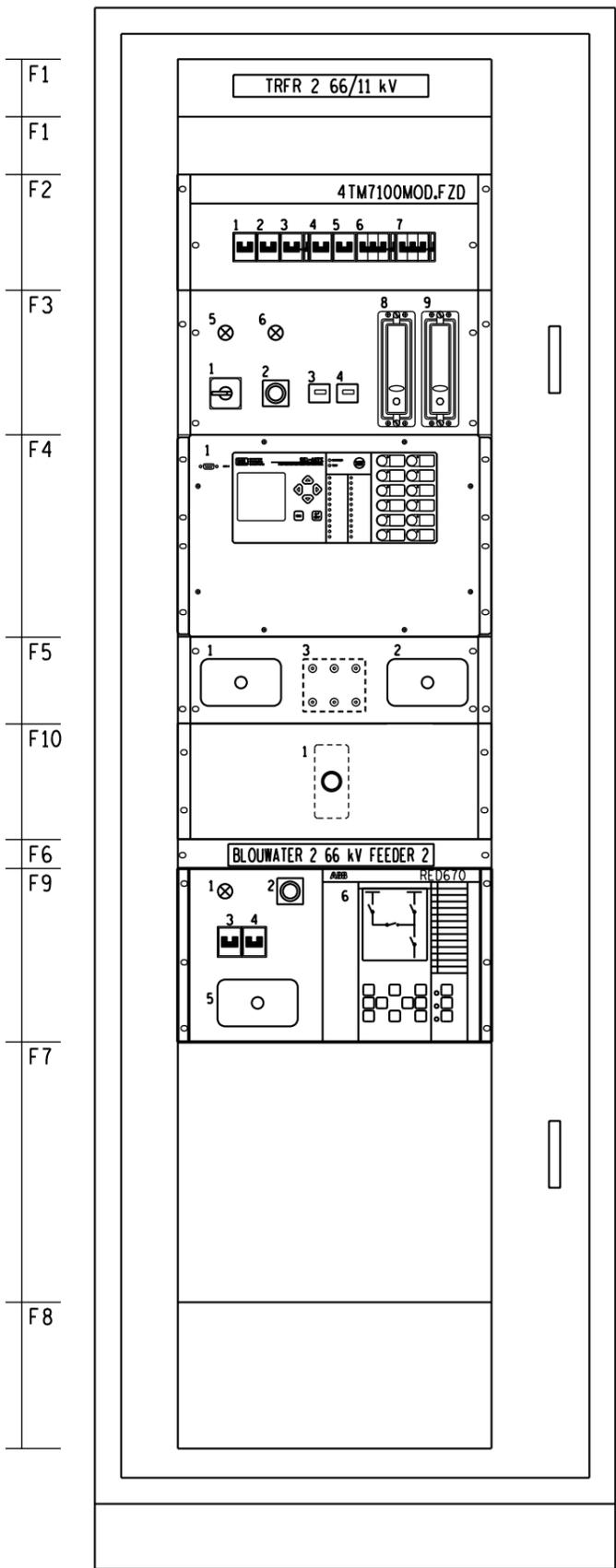
CAPE TOWN OFFICE WATERSIDE PLACE, SOUTH GATE TYGER WATERFRONT CARL CRONJE DRIVE TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. No. 1966/006628/07		0 FIRST ISSUE. SUBSTATION REFURBISHED.		3487A
AECOM		Eskom		
PROJECT APPROVED C. KING		DESIGN APPROVED S.J. van ZYL		
DATE 01/2012		DATE 11/06/10		
PROJECT CHECKED J. MOSTERT		DESIGN CHECKED P.A. GERBER		
DATE 10/01/2012		DATE 11/06/10		
DRAWN BY A v S		CHECKED BY S.J. van ZYL		
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ
REV	AUTH	DATE	REVISION TO MASTER	BY
SCALE		DATE 25/11/2011		DATE 17/09/09

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

COVER SHEET

D-WC-7104	SET NUMBER 83	SHEET NUMBER 00	REVISION 00
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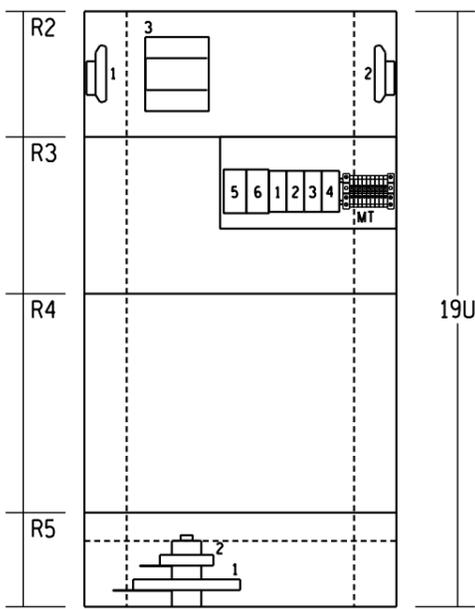
FRONT VIEW



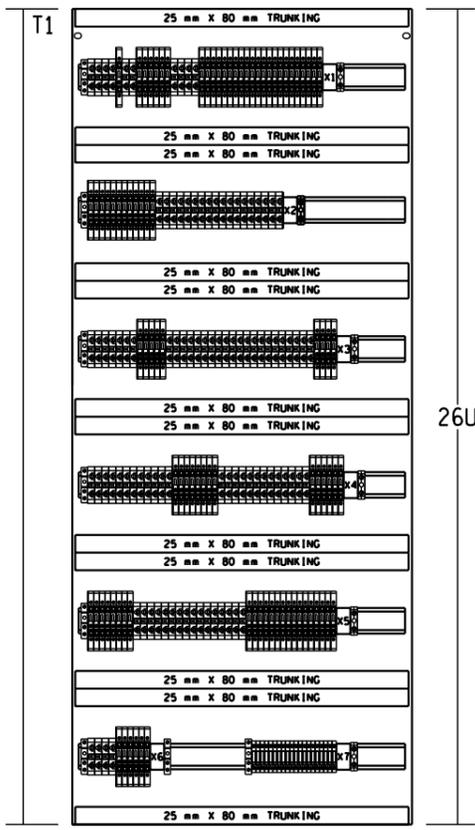
2U
2U
1U
3U
5U
7U
3U
4U
1U
6U
9U
5U

19U
4TM-7100 MODULE

REAR OF MODULE

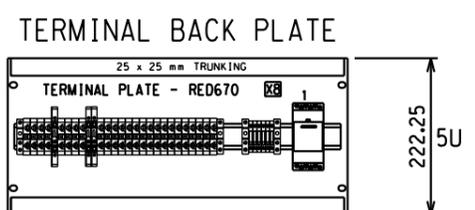


TERMINAL BACK PLATE



LOCATION	DESIGNATION	DESCRIPTION	TYPE	MANUFACTURER
FRONT VIEW				
F1		BLANKING PLATE		
F2	1	DCI MCB (M)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (MAIN CCT) (16A)	EP102UC(C16)
	2	DCI MCB (BU)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (BACK-UP CCT) (16A)	EP102UC(C16)
	3	DCI MCB (SR)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (SPRING REWIND) (20A)	EP102UC(C20)
	4	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (10A)	G62(C10) & CA H
	5	MCB (H)	HEATER SUPPLY AC MINIATURE CIRCUIT-BREAKER (6A)	G62(C06)
	6	MCB (VT-HV)	HV VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02) & CA H
	7	MCB (VT-MV)	HV VOLTAGE TRANSFORMER MINIATURE CIRCUIT-BREAKER (2A)	G63(C02) & CA H
F3	1	BF1	CIRCUIT-BREAKER FAIL ISOLATE SWITCH	CA-10
	2	ETPB	EMERGENCY TRIP PUSH BUTTON WITH COVER (RED)	MP1-10R / MCBH-20
	3	FC (HV)	HV CIRCUIT-BREAKER FAULT/TRIP COUNTER (3 DIGIT)	3099
	4	FC (MV)	MV CIRCUIT-BREAKER FAULT/TRIP COUNTER (3 DIGIT)	3099
	5	PNH-I	PROTECTION NOT HEALTHY INDICATION (AMBER)	KRE-222-UL (230Vac)
	6	MTR-I	MASTER TRIP OPERATED INDICATION (RED)	KRE-222-UN
	8	(HI-Z) HV REF	HV HIGH IMPEDANCE RESTRICTED EARTH FAULT PROTECTION RELAY	2V73-AAA
	9	(HI-Z) MV REF	MV HIGH IMPEDANCE RESTRICTED EARTH FAULT PROTECTION RELAY	2V73-AAA
F4	1	SEL-487E	TRANSFORMER PROTECTION AND CONTROL RELAY	SEL-487E
F5	1	CTTB(HV)	HV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY
	2	CTTB(MV)	MV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK	PK2 4-WAY
	3	TP1-TP6	BANANA PLUG TEST POINTS (BLACK)	RC11 BK
F6		BLANKING PLATE		
F7		BLANKING PLATE		
F8		BLANKING PLATE		
F9	1	PNH-I	PROTECTION NOT HEALTHY INDICATION (RED 670) (AMBER)	KRE-222-UL (230 Vac)
	2	TTPB	TRIP TEST PUSH BUTTON WITH COVER (RED)	CP10-10R-10/ YSF
	3	DCI MCB (M)	DC ISOLATE MINIATURE CIRCUIT-BREAKER (RED 670 CCT) (5A)	EP102UC(C5)
	4	MCB (AC)	AC ISOLATE MINIATURE CIRCUIT-BREAKER (RED 670 CCT) (2A)	G62(C2)
	5	CTTB(HV) - 2	HV DIFFERENTIAL CURRENT TRANSFORMER TEST BLOCK (RED 670)	PK2 4-WAY
	6	RED 670	LINE PROTECTION AND CONTROL RELAY	RED 670
F10	1	IS20	ARC FAULT RELAY	IS20(CAA)
REAR OF MODULE				
R2	1	DB1	DIODE BOARD 1 (8 TRIPPING DIODES)	10200
	2	DB2	DIODE BOARD 2 (8 TRIPPING DIODES)	10200
	3	MTR	MASTER TRIP RELAY	BJBT **
R3		MT	MODULE TERMINALS	M4/6
	1	AS-HVM	HV MAIN TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	2	AS-HVBU	HV BACK-UP TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	3	AS-MVM	MV MAIN TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	4	AS-MVBU	MV BACK-UP TRIPPING CIRCUIT ARC SUPPRESSOR	SEL-9501
	5	SEL-2885	ADDRESSABLE RS-232 TO RS-485 CONVERTER (REMOTE ENG. ACCESS)	SEL-2885
	6	SEL-2886	RS-232 TO RS-485 CONVERTER (SCADA COMMUNICATION)	SEL-2886
R4			REAR OF SEL-487E RELAY	
R5	1	HV METROSIL	SINGLE PHASE METROSIL FOR HI-Z HV REF RELAY (6 INCH)	600A/S1/S887
	2	MV METROSIL	SINGLE PHASE METROSIL FOR HI-Z MV REF RELAY (3 INCH)	300A/S1/S646
TERMINAL BACK PLATE				
T1	X1-X7		TERMINAL RAILS (RAISED FROM BACK PLATE BY 70 mm STAND-OFF POSTS). SCHEME WIRING TERMINATED AT BOTTOM SIDE OF TERMINAL STRIPS. REFER TO SHTs 20 - 22 FOR TERMINAL BLOCK MAKES AND TYPES	
T2	X8		TERMINAL RAILS SCHEME WIRING TERMINATED AT BOTTOM SIDE OF TERMINAL STRIPS. REFER TO SHT 22 FOR TERMINAL BLOCK MAKES AND TYPES	
1	IRF-X		RED670 PNH AUXILIARY RELAY (110=110V DC)	CR-U110DC3L

** SPECIFY 110 Vdc OR 220 Vdc



THE SCHEME IS DESIGNED FOR MOUNTING A 19 INCH RACK SYSTEM AS PER IEC 60297. THE MODULE AND BACK PLATE ARE 482.6mm WIDE. THE MODULE IS 300mm DEEP.

AECOM

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Eskom

PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL
DATE: 01/2012
PROJECT CHECKED: J. MOSTERT
DESIGN CHECKED: P.A. GERBER
DATE: 10/01/2012
DATE: 11/06/10

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

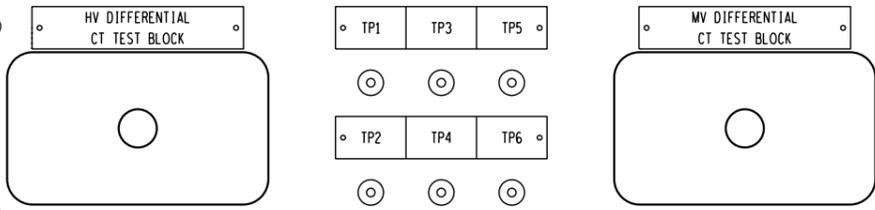
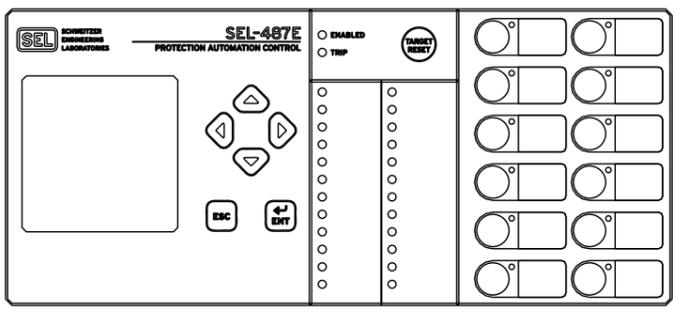
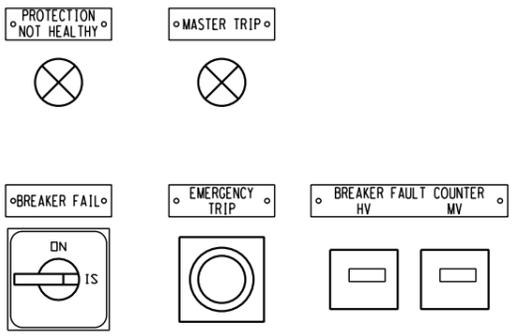
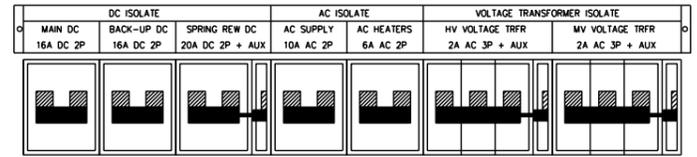
PANEL EQUIPMENT LAYOUT

D-WC-7104 83 01 00

REV	DATE	DESCRIPTION	BY	CHKD	DATE
0		FIRST ISSUE, SUBSTATION REFURBISHED.			
1	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	15/11/2010

MASTER TRACING FILED UNDER D-DT-15202 SHEET 1 OF 26 REVISION 1

66/11 kV TRFR 2

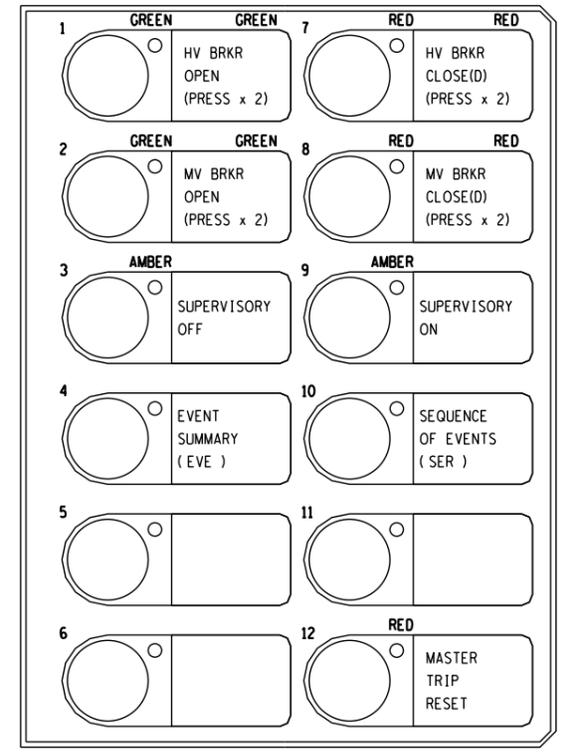


DETAIL OF SEL-487E PROGRAMMABLE LEDs AND PUSH BUTTONS

ENABLED
TRIP

TARGET RESET ← TARGET RESET & LAMP CHECK

COLOUR	NO.	DESCRIPTION
AMBER	1	HV BRKR NOT HEALTHY
RED	2	HV
RED	3	DIFF
RED	4	OVERCURRENT
RED	5	SUSTAINED FAULT TIMER
RED	6	HV BUS ZONE
RED	7	TRFR PRESSURE RELIEF TRIP
RED	8	TRFR BUCHHOLZ TRIP
RED	9	TRFR OIL TEMP TRIP
RED	10	TRFR WINDING TEMP TRIP
RED	11	NEC BUCHHOLZ/OIL TEMP TRIP
RED	12	OLTC BUCHHOLZ/PRESSURE TRIP
		MV BRKR NOT HEALTHY
		MV
		REF
		EARTH FAULT
		CUSTOMER CABLE FAULT
		MV BUS ZONE
		BRKR FAIL
		TRFR BUCHHOLZ ALARM
		TRFR OIL/WIND. TEMP ALARM
		TRFR OIL LEVEL/FAN FAIL ALARM
		NEC BUCHHOLZ/OIL TEMP ALARM
		OTHER ALARM



- NOTES**
- CIRCUIT-BREAKER CONTROLS REQUIRE THE RESPECTIVE BUTTON TO BE PRESSED TWICE WITHIN 3 SECONDS BEFORE ACTIVATION.
 - PRESS PUSH BUTTON 3 FOR 5 SECONDS TO ACTIVATE DNP3 TEST MODE. WHILST IN TEST MODE, PUSH BUTTON 3 MAY BE USED TO SUCCESSIVELY SIMULATE EACH DNP3 ALARM POINT TO THE SUPERVISORY SYSTEM. PRESS PUSH BUTTON 9 TO EXIT DNP3 TEST MODE.

NOTE 1
NOTE 1
NOTE 2

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REW DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

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AECOM

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ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

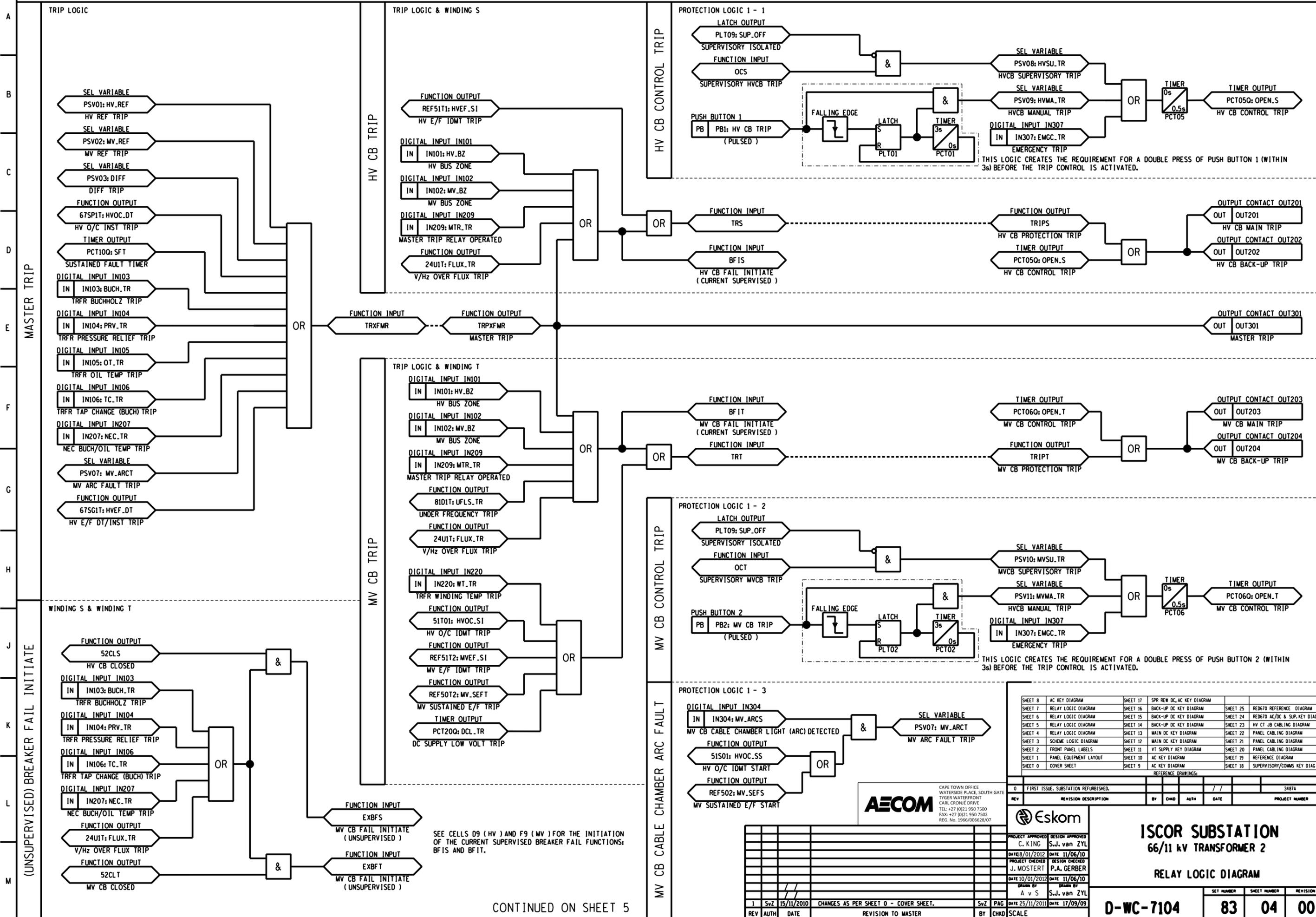
FRONT PANEL LABELS

D-WC-7104 **83** **02** **00**

SET NUMBER SHEET NUMBER REVISION

REV	AUTH	DATE	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	A v S	DATE 25/11/2011	DATE 17/09/09
			REVISION TO MASTER					

SEL-487E RELAY PROGRAMMABLE LOGIC - TRIPPING LOGIC



SEE CELLS D9 (HV) AND F9 (MV) FOR THE INITIATION OF THE CURRENT SUPERVISED BREAKER FAIL FUNCTIONS: BFIS AND BFIT.

CONTINUED ON SHEET 5

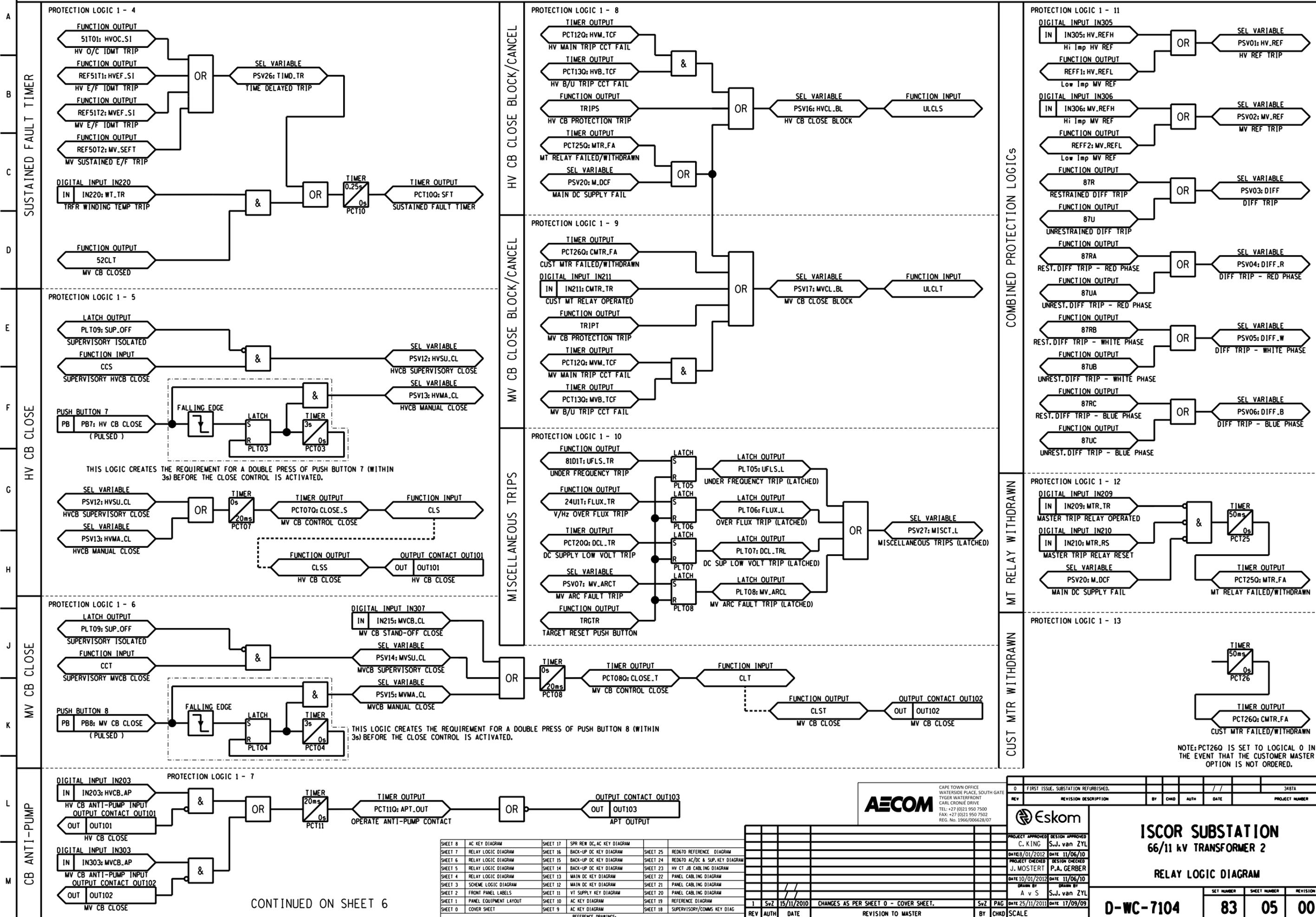


CAPE TOWN OFFICE WATERSIDE PLACE, SOUTH GATE TYGER WATERFRONT CARL CROONIE DRIVE TEL: +27 (0)21 950 7500 FAX: +27 (0)21 950 7502 REG. NO. 1966/00628/07		<table border="1"> <tr> <th>REV</th> <th>REVISION DESCRIPTION</th> <th>BY</th> <th>CHKD</th> <th>AUTH</th> <th>DATE</th> <th>PROJECT NUMBER</th> </tr> <tr> <td>0</td> <td>FIRST ISSUE. SUBSTATION REFURBISHED.</td> <td></td> <td></td> <td></td> <td></td> <td>3487A</td> </tr> </table>		REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER	0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A								
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER																			
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A																			
<table border="1"> <tr> <th>DATE</th> <th>DESIGNED BY</th> <th>DATE</th> <th>DESIGN CHECKED</th> </tr> <tr> <td>08/01/2012</td> <td>C. KING</td> <td>11/06/10</td> <td>S.J. van ZYL</td> </tr> <tr> <th>DATE</th> <th>DESIGNED BY</th> <th>DATE</th> <th>DESIGN CHECKED</th> </tr> <tr> <td>10/01/2012</td> <td>J. MOSTERT</td> <td>11/06/10</td> <td>P.A. GERBER</td> </tr> </table>		DATE	DESIGNED BY	DATE	DESIGN CHECKED	08/01/2012	C. KING	11/06/10	S.J. van ZYL	DATE	DESIGNED BY	DATE	DESIGN CHECKED	10/01/2012	J. MOSTERT	11/06/10	P.A. GERBER	<table border="1"> <tr> <th>SET NUMBER</th> <th>SHEET NUMBER</th> <th>REVISION</th> </tr> <tr> <td>D-WC-7104</td> <td>83</td> <td>04 00</td> </tr> </table>		SET NUMBER	SHEET NUMBER	REVISION	D-WC-7104	83	04 00
DATE	DESIGNED BY	DATE	DESIGN CHECKED																						
08/01/2012	C. KING	11/06/10	S.J. van ZYL																						
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10/01/2012	J. MOSTERT	11/06/10	P.A. GERBER																						
SET NUMBER	SHEET NUMBER	REVISION																							
D-WC-7104	83	04 00																							

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2
RELAY LOGIC DIAGRAM

1	Svz	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	Svz	PAG	DATE 25/11/2011	DATE 17/09/09
REVISION TO MASTER				SCALE			

MASTER TRACING FILED UNDER D-DT-15202 SHEET 4 OF 26 REVISION 1



CONTINUED ON SHEET 6

SHEET 8	AC KEY DIAGRAM	SHEET 17	SPR REW DC AC KEY DIAGRAM	SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM	SHEET 16	BACK-UP DC KEY DIAGRAM	SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM	SHEET 15	BACK-UP DC KEY DIAGRAM	SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM	SHEET 14	BACK-UP DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM	SHEET 13	MAIN DC KEY DIAGRAM	SHEET 21	PANEL CABLING DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM	SHEET 12	MAIN DC KEY DIAGRAM	SHEET 20	PANEL CABLING DIAGRAM
SHEET 2	FRONT PANEL LABELS	SHEET 11	VT SUPPLY KEY DIAGRAM	SHEET 19	REFERENCE DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 10	AC KEY DIAGRAM	SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 0	COVER SHEET	SHEET 9	AC KEY DIAGRAM REFERENCE DRAWINGS		



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REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE

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ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

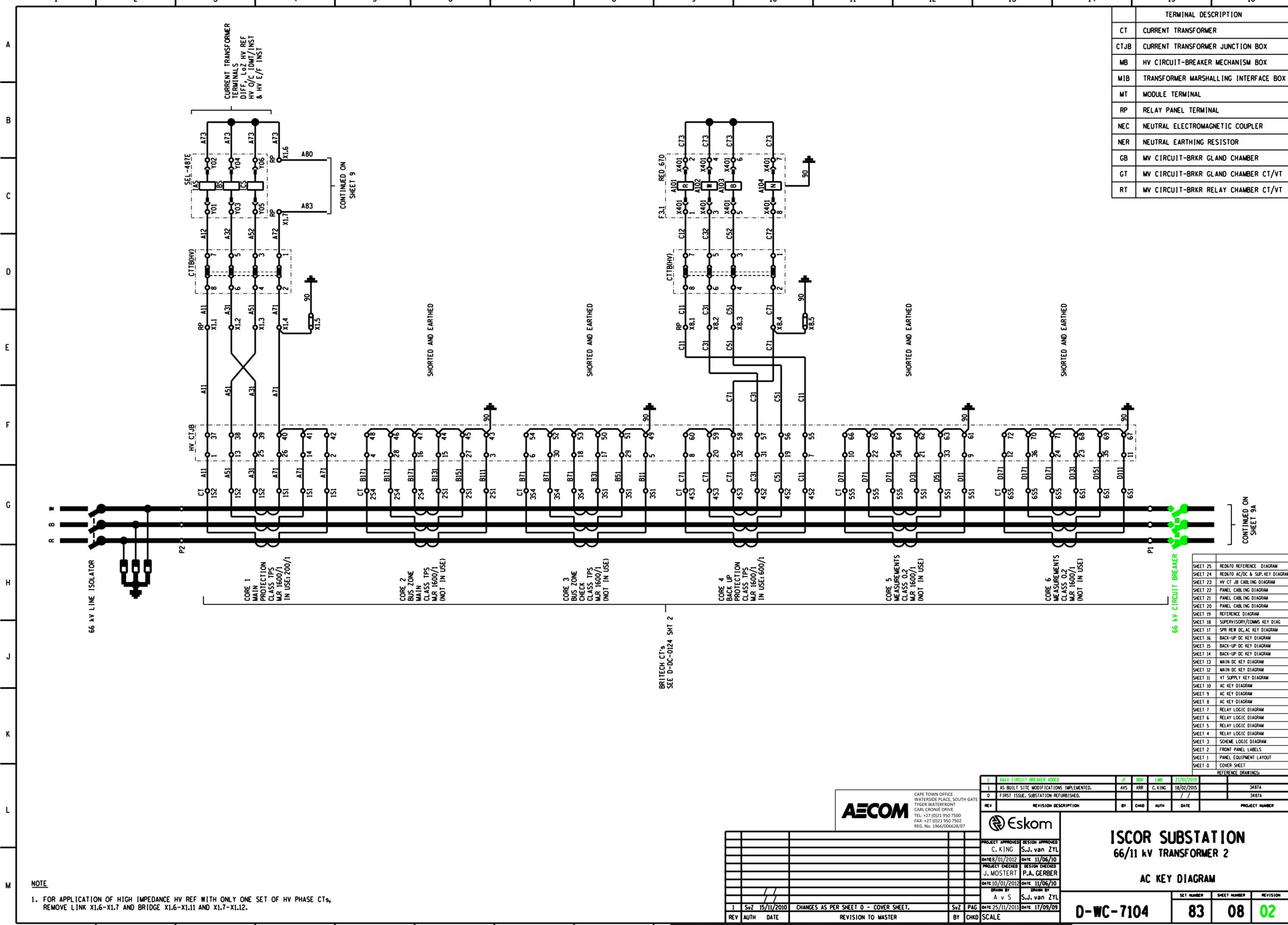
RELAY LOGIC DIAGRAM

PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL
DATE: 01/2012
DATE: 11/06/10
PROJECT CHECKED: J. MOSTERT
DESIGN CHECKED: P.A. GERBER
DATE: 10/01/2012
DATE: 11/06/10
DRAWN BY: A v S
DATE: 25/11/2010
DATE: 17/09/09

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	05 00

PANEL TYPE DESIGNATION 4TM7100MOD.FZD

MASTER TRACING FILED UNDER D-DT-15202 SHEET 5 OF 26 REVISION 1



TERMINAL DESCRIPTION	
CT	CURRENT TRANSFORMER
CTJB	CURRENT TRANSFORMER JUNCTION BOX
MB	HV CIRCUIT-BREAKER MECHANISM BOX
MIB	TRANSFORMER MARSHALLING INTERFACE BOX
MT	MODULE TERMINAL
RP	RELAY PANEL TERMINAL
NEC	NEUTRAL ELECTROMAGNETIC COUPLER
NER	NEUTRAL EARTHING RESISTOR
GB	MV CIRCUIT-BRKR GLAND CHAMBER
GT	MV CIRCUIT-BRKR GLAND CHAMBER CT/VT
RT	MV CIRCUIT-BRKR RELAY CHAMBER CT/VT

CONTINUED ON SHEET 9A

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REM DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
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SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
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SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

NOTE
 1. FOR APPLICATION OF HIGH IMPEDANCE HV REF WITH ONLY ONE SET OF HV PHASE CTs, REMOVE LINK X1.6-X1.7 AND BRIDGE X1.6-X1.11 AND X1.7-X1.12.

BRITECH CT's
 SEE D-DC-0124 SHT 2



REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66KV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A



ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

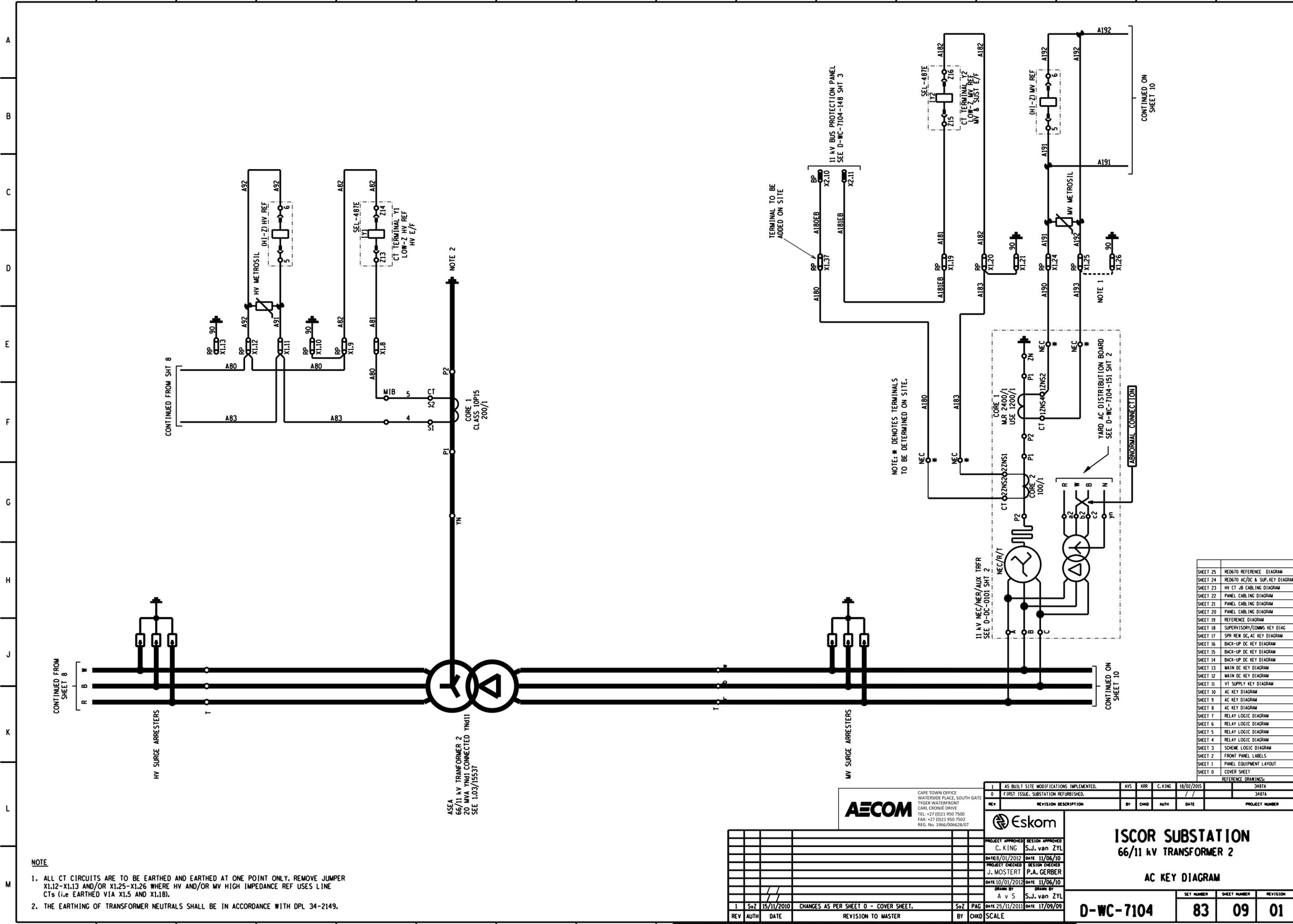
AC KEY DIAGRAM

PROJECT APPROVED C. KING	DESIGN APPROVED S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY A v S	DATE 25/11/2011
DATE 15/11/2010	DATE 17/09/09

D-WC-7104 **83** **08** **02**

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007TE A1L

MASTER TRACING FILED UNDER D-DT-15202 SHEET 8 OF 26 REVISION 1



- NOTE**
1. ALL CT CIRCUITS ARE TO BE EARTHED AND EARTHED AT ONE POINT ONLY. REMOVE JUMPER X1.12-X1.13 AND/OR X1.25-X1.26 WHERE HV AND/OR MV HIGH IMPEDANCE REF USES LINE CTs (i.e. EARTHED VIA X1.5 AND X1.18).
 2. THE EARTHING OF TRANSFORMER NEUTRALS SHALL BE IN ACCORDANCE WITH DPL 34-2149.

ASEA
66/11 kV TRANSFORMER 2
20 MVA YND1 CONNECTED YN011
SEE 1.03/15537

AECOM
CAPE TOWN OFFICE
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TEL: +27 (0)21 950 7500
FAX: +27 (0)21 950 7502
REG. No. 1966/00628/07

1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRP	C. KING	18/02/2015	347A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					347A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

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ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

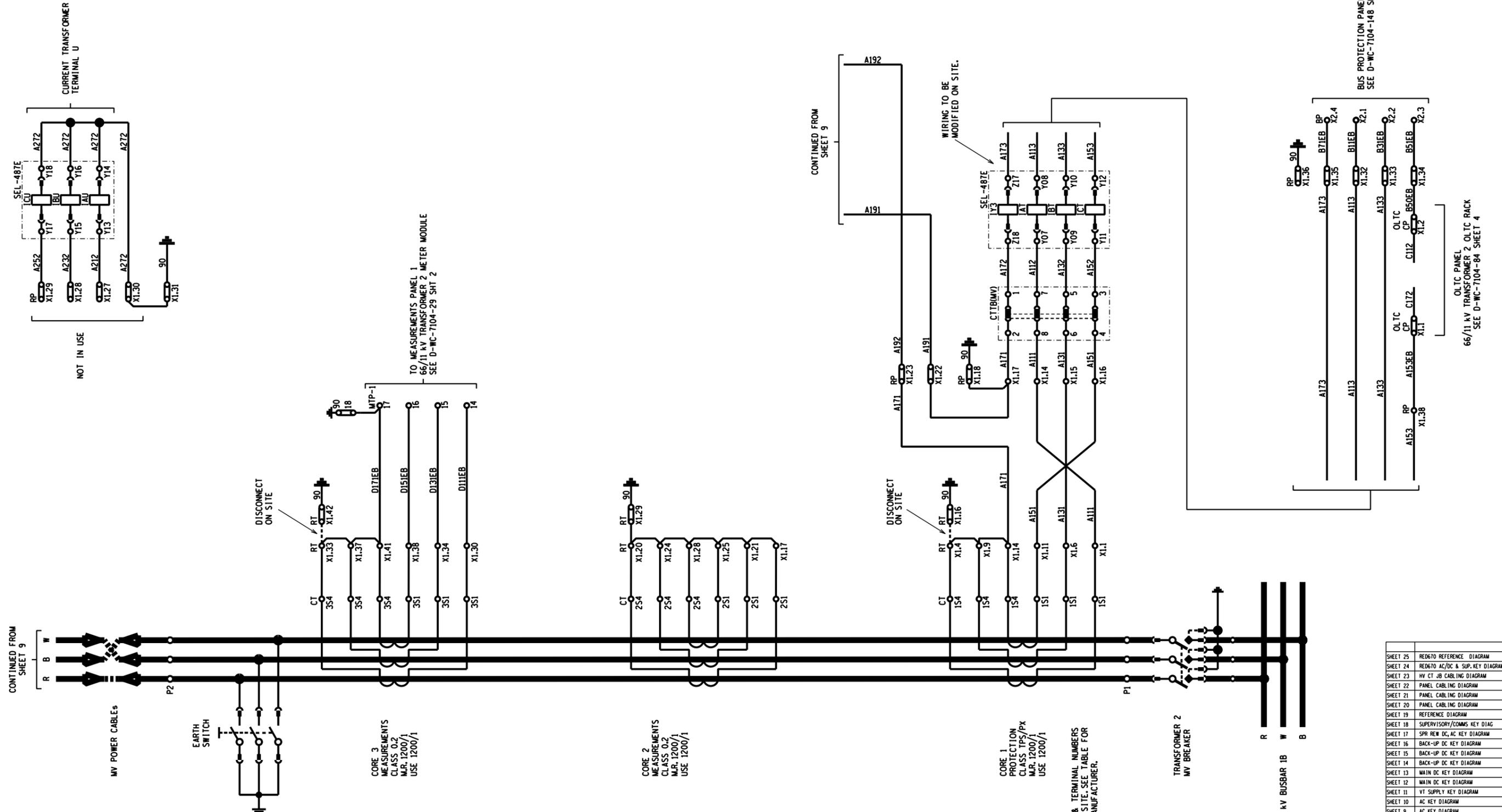
AC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	09 01

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007TE A1L

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REV DC, AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
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SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
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SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	Sv2	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	Sv2	PAG	DATE 25/11/2011 DATE 17/09/09



ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 3)					
RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.30	RT X1.34	RT X1.38	RT X1.39	RT X1.31, X1.35 & X1.39
400/1A (S3-S4)	RT X1.32	RT X1.36	RT X1.40	RT X1.41	RT X1.33, X1.37 & X1.41
600/1A (S2-S3)	RT X1.31	RT X1.35	RT X1.39	RT X1.40	RT X1.32, X1.36 & X1.40
800/1A (S1-S3)	RT X1.30	RT X1.34	RT X1.38	RT X1.40	RT X1.32, X1.36 & X1.40
1000/1A (S2-S4)	RT X1.31	RT X1.35	RT X1.39	RT X1.41	RT X1.33, X1.37 & X1.41
1200/1A (S1-S4)	RT X1.30	RT X1.34	RT X1.38	RT X1.41	RT X1.33, X1.37 & X1.41

ACTOM BREAKER - METERING CT RATIO SELECTION (CORE 2)					
RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.17	RT X1.21	RT X1.25	RT X1.26	RT X1.18, X1.22 & X1.26
400/1A (S3-S4)	RT X1.19	RT X1.23	RT X1.27	RT X1.28	RT X1.20, X1.24 & X1.28
600/1A (S2-S3)	RT X1.18	RT X1.22	RT X1.26	RT X1.27	RT X1.19, X1.23 & X1.27
800/1A (S1-S3)	RT X1.17	RT X1.21	RT X1.25	RT X1.27	RT X1.19, X1.23 & X1.27
1000/1A (S2-S4)	RT X1.18	RT X1.22	RT X1.26	RT X1.28	RT X1.20, X1.24 & X1.28
1200/1A (S1-S4)	RT X1.17	RT X1.21	RT X1.25	RT X1.28	RT X1.20, X1.24 & X1.28

ACTOM BREAKER - PROTECTION CT RATIO SELECTION (CORE 1)					
RATIO	R φ	W φ	B φ	N	BRIDGES
200/1A (S1-S2)	RT X1.1	RT X1.6	RT X1.11	RT X1.12	RT X1.2, X1.7 & X1.12
400/1A (S3-S4)	RT X1.3	RT X1.8	RT X1.13	RT X1.14	RT X1.4, X1.9 & X1.14
600/1A (S2-S3)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.3, X1.8 & X1.13
800/1A (S1-S3)	RT X1.1	RT X1.6	RT X1.11	RT X1.13	RT X1.3, X1.8 & X1.13
1000/1A (S2-S4)	RT X1.2	RT X1.7	RT X1.12	RT X1.13	RT X1.4, X1.9 & X1.14
1200/1A (S1-S4)	RT X1.1	RT X1.6	RT X1.11	RT X1.14	RT X1.4, X1.9 & X1.14

* DENOTES CT RATIO & TERMINAL NUMBERS TO BE DETERMINED ON SITE. SEE TABLE FOR APPLICABLE BREAKER MANUFACTURER.



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

PROJECT APPROVED	C.KING	DESIGN APPROVED	S.J. van ZYL
DATE 08/01/2012		DATE 11/06/10	
PROJECT CHECKED	J. MOSTERT	DESIGN CHECKED	P.A. GERBER
DATE 10/01/2012		DATE 11/06/10	
DRAWN BY	A v S		

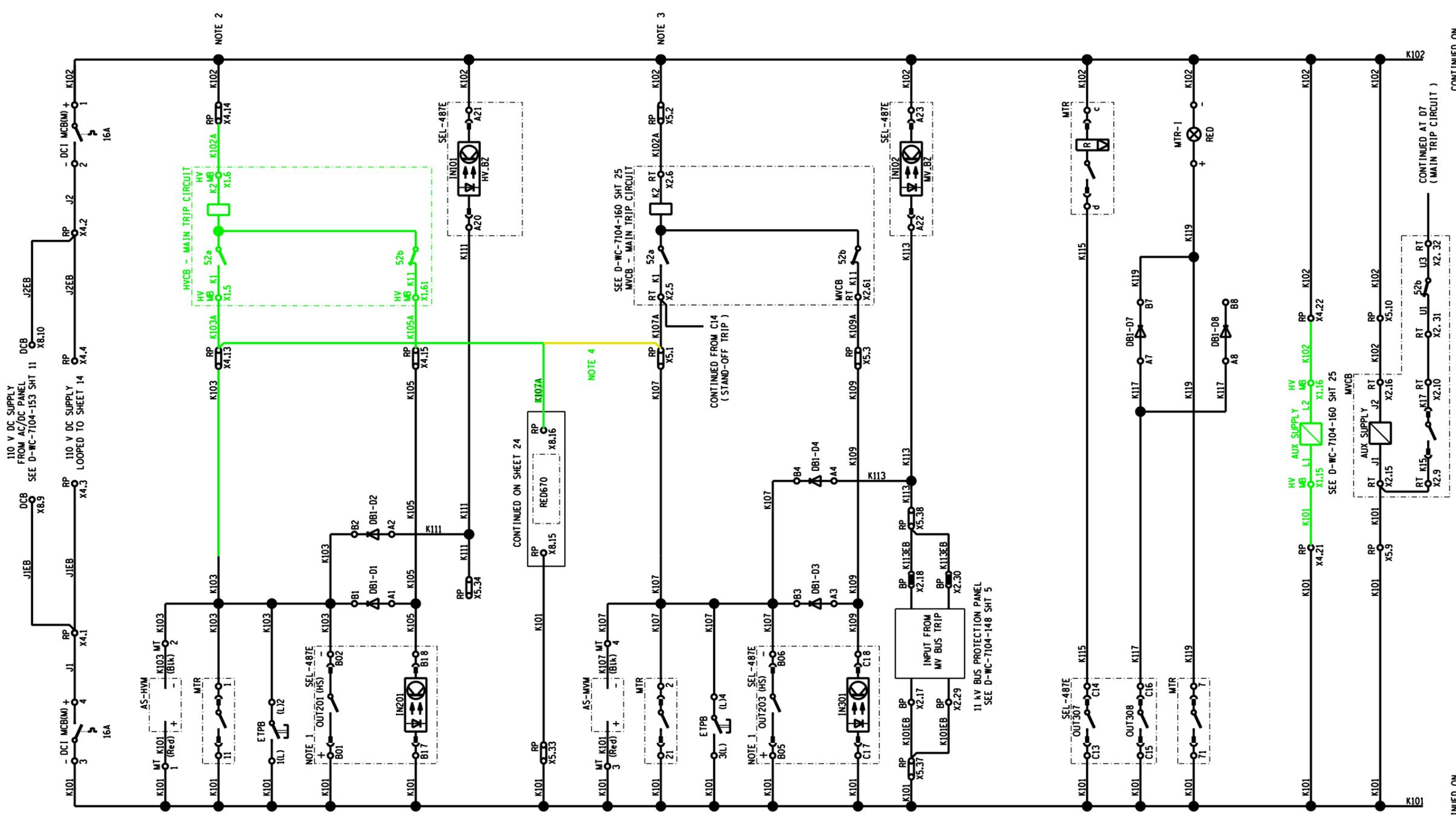
ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

AC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	10
		01

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
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REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011
						DATE 17/09/09



CONTACT PROTECTOR (ARC SUPPRESSOR)

HV CIRCUIT-BREAKER MAIN TRIP CIRCUIT

HV CIRCUIT-BREAKER EMERGENCY TRIP

(NOT IN USE) DIFFERENTIAL, REF, HV O/C HI-SET, OVER EXCITATION, LOCAL/SUPERVISORY TRIP

HV MAIN TRIP CIRCUIT SUPERVISION

(NOT IN USE) HV BUS ZONE TRIP

RED670 DIFF TRIP

CONTACT PROTECTOR (ARC SUPPRESSOR)

MV CIRCUIT-BREAKER MAIN TRIP CIRCUIT

MV CIRCUIT-BREAKER EMERGENCY TRIP

DIFFERENTIAL, REF, HV O/C HI-SET & IDMT, MV E/F, OVER EXCITATION, LOCAL/SUPERVISORY TRIP

MV MAIN TRIP CIRCUIT SUPERVISION

MV BUS ZONE TRIP

CUSTOMER MASTER OPERATE (ORDERING OPTION)

CUSTOMER MASTER RESET (ORDERING OPTION)

CUSTOMER MASTER / MASTER TRIP RESET

LAMP CHECK

MASTER TRIP INDICATION

CUSTOMER MASTER TRIP INDICATION (ORDERING OPTION)

HV CIRCUIT-BREAKER SF6 GAS MONITORING SUPPLY

MV CIRCUIT-BREAKER SF6 GAS MONITORING SUPPLY

MV CIRCUIT-BREAKER STAND-OFF TRIP (VIA UMBILICAL CORD)

NOTES

1. SEL-487E OUTPUT CONTACTS DESIGNATED 'HS' ARE HIGH SPEED, HIGH CURRENT TYPES, WITH OPERATING TIMES LESS THAN 100ms, AND BREAKING CAPACITY 100kg, L/R = 200ms.
2. THE K11 (X1L61) TERMINAL MAY NOT BE AVAILABLE ON OLDER GENERATION CIRCUIT-BREAKERS. WIRE A CIRCUIT-BREAKER AUXILIARY (52b) CONTACT ACROSS X4.14-X4.15 IN THIS CASE.
3. THE K11 (X1L61) TERMINAL MAY NOT BE AVAILABLE ON OLDER GENERATION CIRCUIT-BREAKERS. WIRE A CIRCUIT-BREAKER AUXILIARY (52b) CONTACT ACROSS X5.2-X5.3 IN THIS CASE.
4. WIRING INDICATED IN YELLOW TO BE REMOVED ON SITE

SHEET	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REW DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
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. 1966/00628/07

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER
2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A

Eskom

PROJECT APPROVED: C. KING
DESIGN APPROVED: S.J. van ZYL

DATE 18/01/2012 DATE 11/06/10
PROJECT CHECKED: J. MOSTERT DESIGN CHECKED: P.A. GERBER

DATE 10/01/2012 DATE 11/06/10
DRAWN BY: A v S
CHECKED BY: S.J. van ZYL

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

MAIN DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	12 02

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007E ALL

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

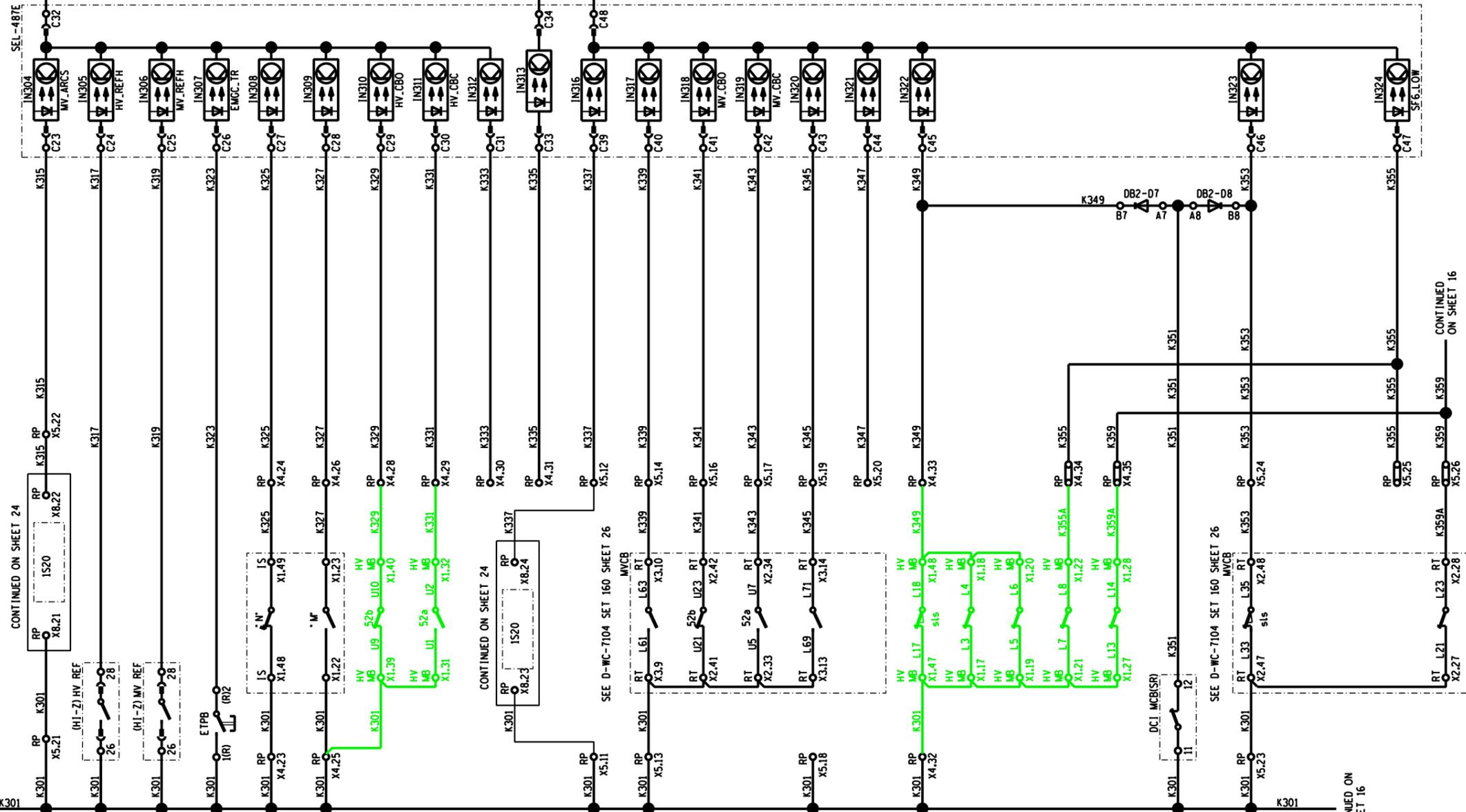
CONTINUED FROM SHEET 14

CONTINUED FROM SHEET 14

CONTINUED ON SHEET 16

CONTINUED ON SHEET 16

CONTINUED ON SHEET 16



MV INDOOR CIRCUIT-BRKR CABLE CHAMBER ARC FAULT DETECTED
 (NOT IN USE) HIGH IMPEDANCE HV REF TRIP
 HIGH IMPEDANCE MV REF TRIP
 EMERGENCY TRIP
 HV LINE ISOLATOR OPEN
 HV LINE ISOLATOR CLOSED
 HV CIRCUIT-BREAKER OPEN
 HV CIRCUIT-BREAKER CLOSED
 SPARE STATUS INPUT
 SPARE STATUS INPUT
 MV CIRCUIT-BREAKER CABLE CHAMBER ARC SENSOR FAILED
 MV CIRCUIT-BREAKER RACKED OUT
 MV CIRCUIT-BREAKER OPEN
 MV CIRCUIT-BREAKER CLOSED
 MV CIRCUIT-BREAKER INTEGRAL EARTH APPLIED
 (NOT IN USE) MV BUSBAR EARTH APPLIED
 HV CIRCUIT-BREAKER (NOT INSTALLED) NOT HEALTHY
 CIRCUIT-BREAKER COMMON ALARM
 SF6 GAS LOW
 SF6 GAS LOW
 HV CIRCUIT-BREAKER MB HEATER ALARM
 SPRING REWIND MCB TRIPPED
 SPRING DISCHARGED
 CIRCUIT-BREAKER COMMON ALARM
 SF6 GAS LOW
 (NOT IN USE) SF6 GAS LOW
 MV CIRCUIT-BREAKER MB HEATER ALARM

NOT INSTALLED

LEVELS 1 3 8 10 11 17 22 26 27 30

SHEET 25	REDTO REFERENCE DIAGRAM
SHEET 24	REDTO AC/DC & SUP. KEY DIAGRAM
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SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
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CAPE TOWN OFFICE
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 REG. No. 1966/00628/07

2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019		
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015		3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.						3487A

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

Eskom

PROJECT APPROVED: C. KING
 DESIGN APPROVED: S.J. van ZYL
 DATE: 01/2012
 PROJECT CHECKED: J. MOSTERT
 DATE: 10/01/2012

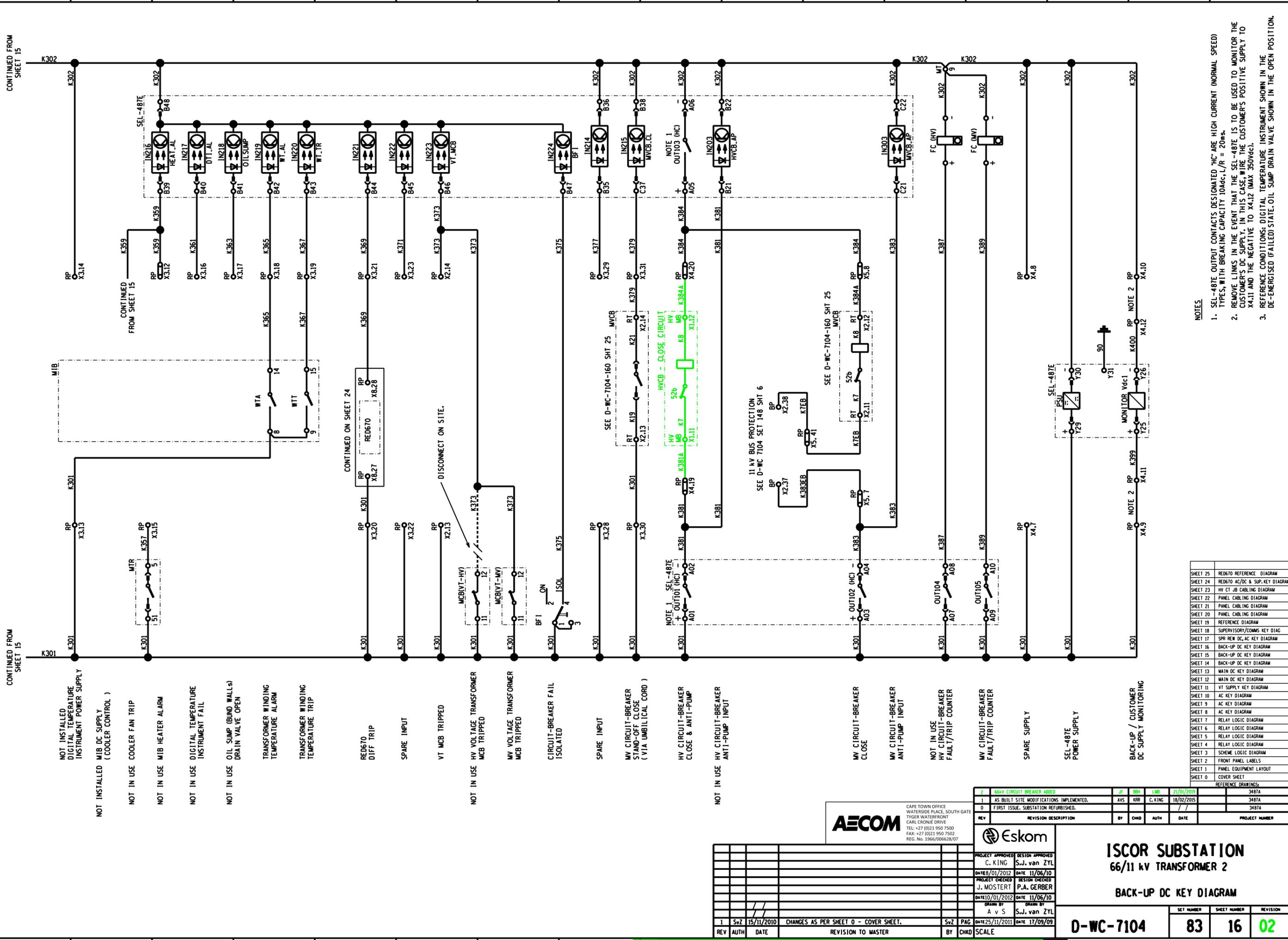
DATE: 15/11/2010
 DATE: 25/11/2011
 DATE: 17/09/09

ISCOR SUBSTATION
 66/11 kV TRANSFORMER 2
 BACK-UP DC KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	15 02

PANEL TYPE DESIGNATION 4TM7100MOD.FZD

MASTER TRACING FILED UNDER D-DT-15202 SHEET 15 OF 26 REVISION 1



CONTINUED FROM SHEET 15

CONTINUED FROM SHEET 15

- NOT INSTALLED DIGITAL TEMPERATURE INSTRUMENT POWER SUPPLY
- NOT INSTALLED MIB DC SUPPLY (COOLER CONTROL)
- NOT IN USE COOLER FAN TRIP
- NOT IN USE MIB HEATER ALARM
- NOT IN USE DIGITAL TEMPERATURE INSTRUMENT FAIL
- NOT IN USE OIL SUMP (BUND WALLS) DRAIN VALVE OPEN
- TRANSFORMER WINDING TEMPERATURE ALARM
- TRANSFORMER WINDING TEMPERATURE TRIP

- RED670 DIFF TRIP
- SPARE INPUT
- VT MCB TRIPPED
- NOT IN USE HV VOLTAGE TRANSFORMER MCB TRIPPED
- MV VOLTAGE TRANSFORMER MCB TRIPPED
- CIRCUIT-BREAKER FAIL ISOLATED
- SPARE INPUT
- MV CIRCUIT-BREAKER STAND-OFF CLOSE (VIA UMBILICAL CORD)
- HV CIRCUIT-BREAKER CLOSE & ANTI-PUMP
- NOT IN USE HV CIRCUIT-BREAKER ANTI-PUMP INPUT

AECOM
 CAPE TOWN OFFICE
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 REG. No. 1966/00628/07

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0	FIRST ISSUE, SUBSTATION REFURBISHED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

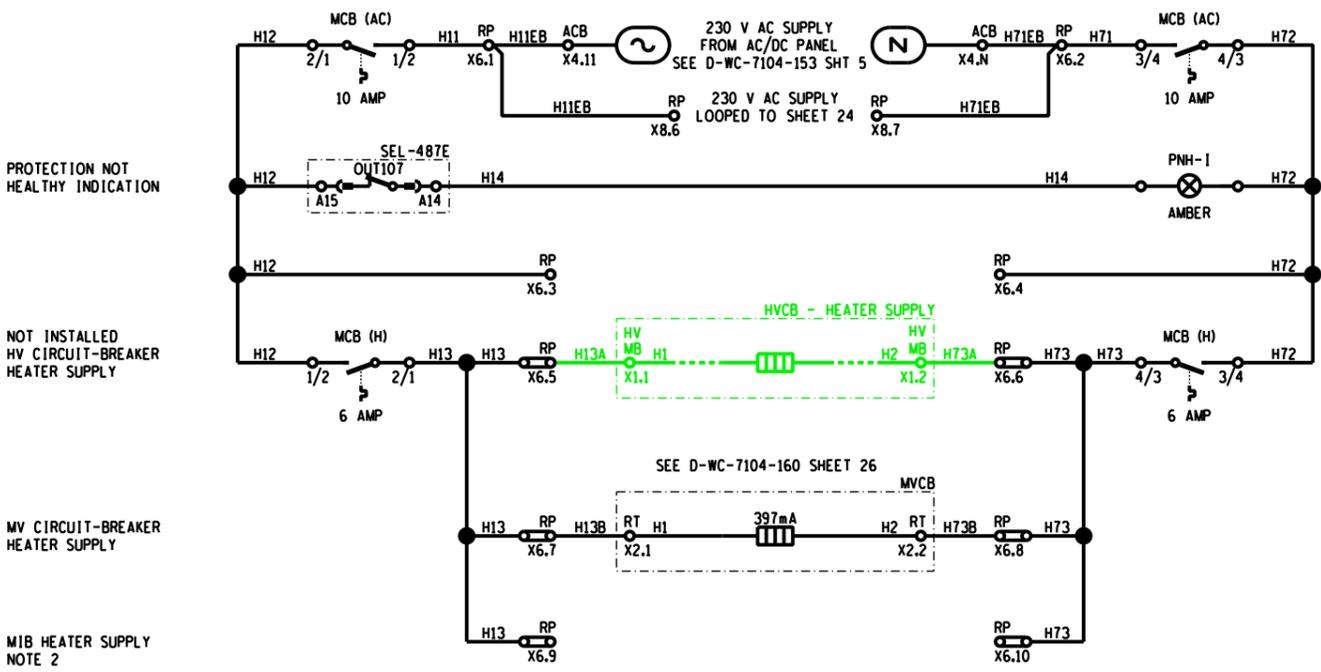
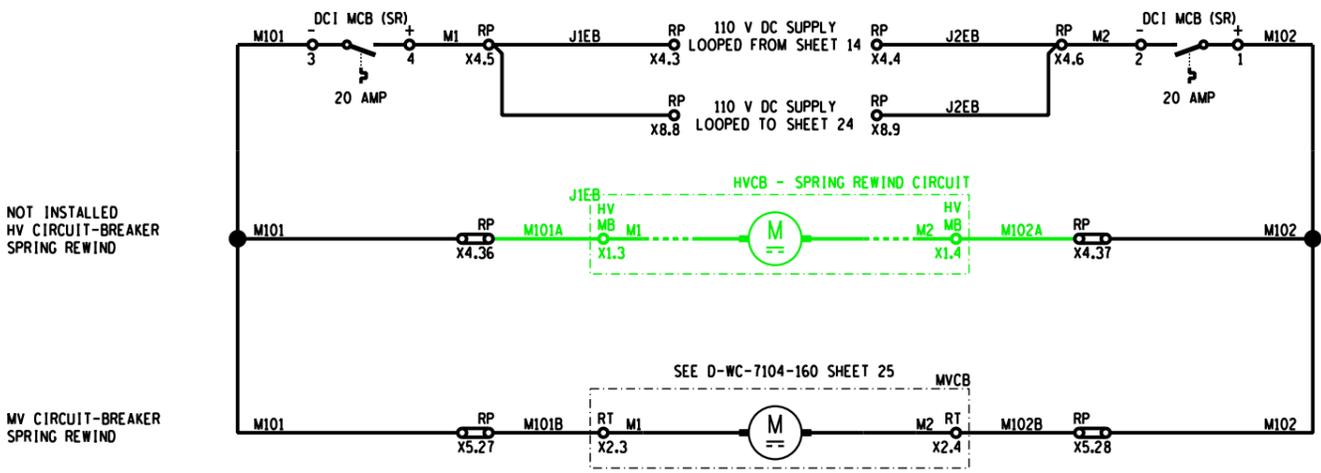
Eskom	
PROJECT APPROVED C. KING	DESIGN APPROVED S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED J. MOSTERT	DESIGN CHECKED P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY A v S	
DATE 25/11/2011	
DATE 17/09/09	

ISCOR SUBSTATION		
66/11 kV TRANSFORMER 2		
BACK-UP DC KEY DIAGRAM		
D-WC-7104	83	16
02		

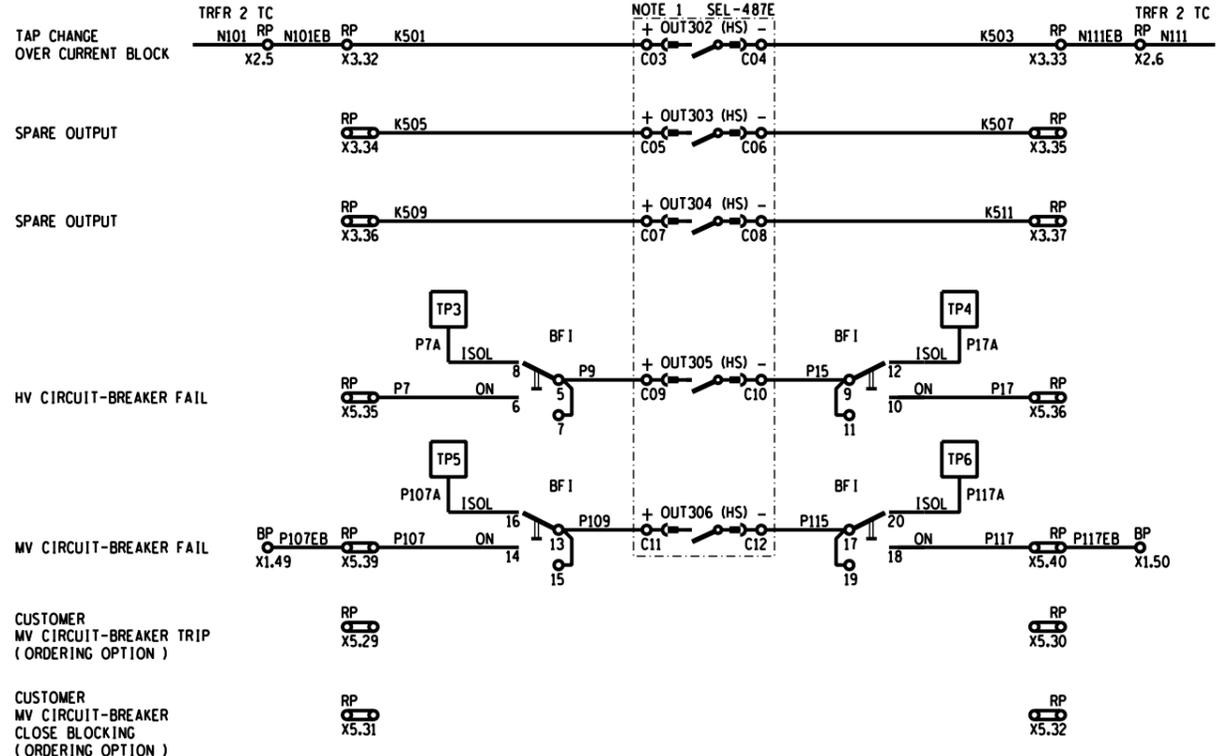
- NOTES**
- SEL-487E OUTPUT CONTACTS DESIGNATED 'HC' ARE HIGH CURRENT (NORMAL SPEED) TYPES, WITH BREAKING CAPACITY 100ac, L/R = 20ms.
 - REMOVE LINKS IN THE EVENT THAT THE SEL-487E IS TO BE USED TO MONITOR THE CUSTOMER'S DC SUPPLY. IN THIS CASE, WIRE THE CUSTOMER'S POSITIVE SUPPLY TO X4.11 AND THE NEGATIVE TO X4.12 (MAX 350VDC).
 - REFERENCE CONDITIONS: DIGITAL TEMPERATURE INSTRUMENT SHOWN IN THE OPEN POSITION. DE-ENERGISED (FAILED) STATE. OIL SUMP DRAIN VALVE SHOWN IN THE OPEN POSITION.

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SHEET 11	VT SUPPLY KEY DIAGRAM
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SHEET 8	AC KEY DIAGRAM
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SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	



- NOTES**
- SEL-487E OUTPUT CONTACTS DESIGNATED 'HS' ARE HIGH SPEED, HIGH CURRENT TYPES, WITH OPERATING TIMES LESS THAN 10ms, AND BREAKING CAPACITY 10Adc, L/R = 20ms.
 - THE TRANSFORMER HEATER SUPPLY IS USUALLY LOOPED FROM THE THREE PHASE AC SUPPLY FOR THE COOLER FANS (WHERE PROVIDED). A SEPARATE SINGLE PHASE AC SUPPLY IS NOT REQUIRED IN THIS CASE.



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SHEET 2	FRONT PANEL LABELS
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SHEET 0	COVER SHEET



2	66kV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019		
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015		3487A
0	FIRST ISSUE, SUBSTATION REFURBISHED.						3487A

Eskom

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

SPR REWIND DC, AC KEY DIAGRAM

PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	
A v S	S.J. van ZYL
DATE 25/11/2011	DATE 17/09/09

REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

D-WC-7104 **83** **17** **02**

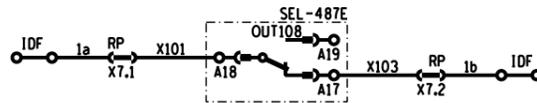
PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE DROUITE A1L

MASTER TRACING FILED UNDER D-DT-15202 SHEET 17 OF 26 REVISION 1

ALARM WORDING

PROTECTION NOT HEALTHY

SUPERVISORY ALARM



PNT NAME DESCRIPTION/
PNT NAME

PROTECTION (PNH)

SEL-487E MAIN PRINTED CIRCUIT (PC) BOARD JUMPER SETTINGS

THE FOLLOWING MAIN PC BOARD JUMPER SELECTIONS SHALL BE MADE BY CONCO PRIOR TO DELIVERY OF SCHEMES TO ESKOM.

JUMPER NAME	SETTING	FUNCTION
J21-A	N/A	RESERVED FOR USE BY SEL
J21-PASSWORD	OFF	DISABLE PASSWORD PROTECTION
J21-BREAKER	ON	ALLOW ASCII SERIAL COMMANDS "OPEN", "CLOSE" AND "PULSE"
J21-D	N/A	RESERVED FOR USE BY SEL
JMP1	OFF	IRIG-B TERMINATING Z (OFF = 2550 Ohms, ON = 50 Ohms)
JMP2	ON	PORT 3 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)
JMP3	ON	PORT 2 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)
JMP4	OFF	PORT 1 PIN 1 (ON = +5Vdc, OFF = NO FUNCTION)

COMMS INTERFACE AND TIME SYNCHRONISATION

SEL-2886 DIP SWITCH SETTINGS

THE FOLLOWING DIP SWITCH SELECTIONS SHALL BE MADE BY CONCO PRIOR TO DELIVERY OF SCHEMES TO ESKOM.

NO.	1	2	3	4	5	6	7	8
ON-1								
OFF-0								

THE SEL-2886 IS SET IN SEND DATA CONTROL (SDC) MODE (DIP SWITCH 4 OFF), CONFIGURED FOR COMPATIBILITY WITH 9600 BAUD (DIP SWITCHES 1-3) AND WITH ECHO OFF (DIP SWITCH 6).

ALTERNATIVE BAUD RATE SETTINGS ARE AS FOLLOWS:

BAUD	1	2	3
1200	1	1	1
2400	0	1	1
4800	1	0	1
9600	0	0	1
19200	1	1	0
38400	0	1	0
57600	1	0	0
115200	0	0	0

SPARE RS232 PORT
(e.g. FOR MIRROR-BIT COMMUNICATION)

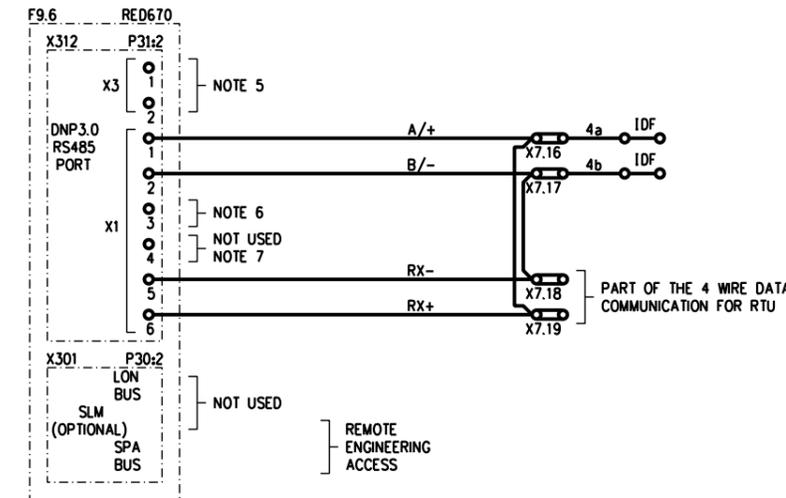
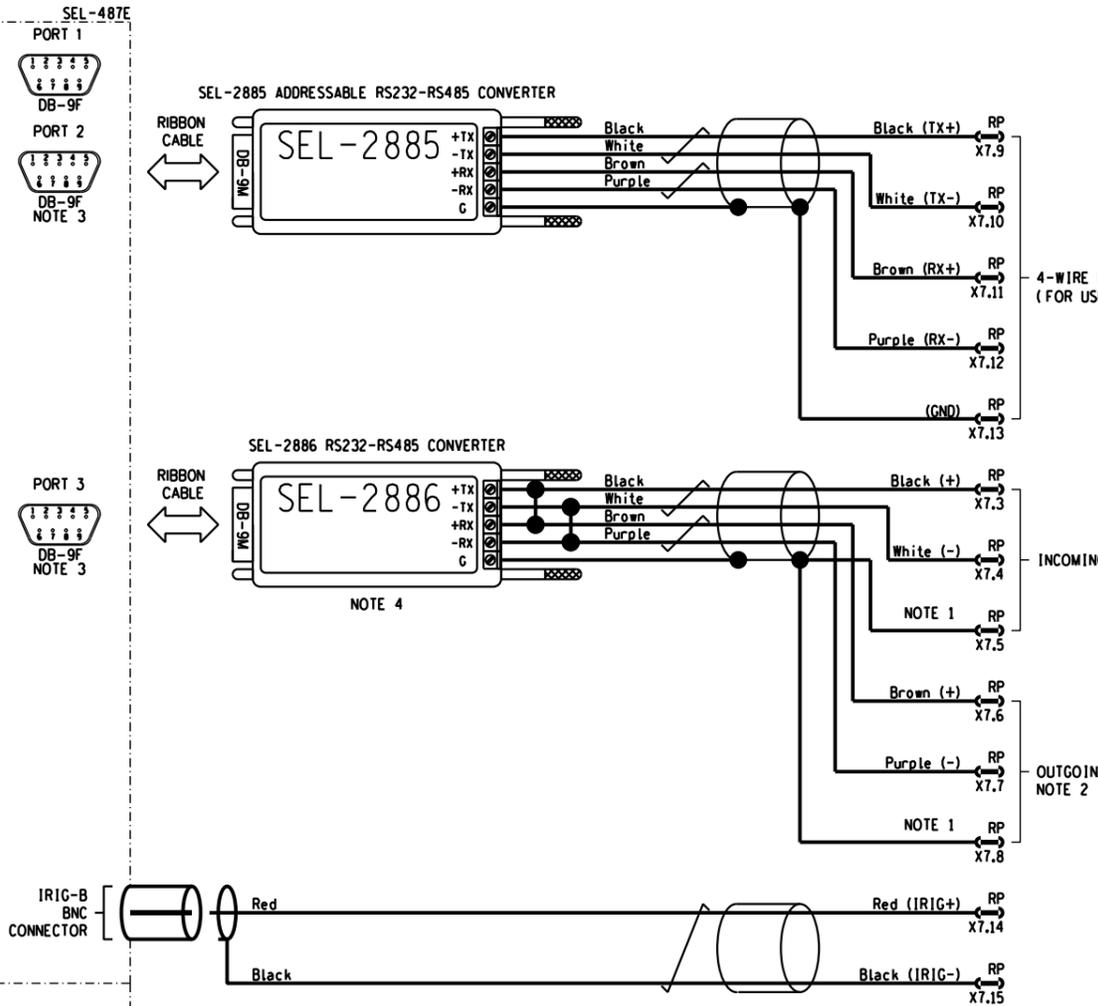
REMOTE ENGINEERING ACCESS
RS232 REAR PORT SUPPORTING SEL OR LMD PROTOCOL

SERIAL SCADA COMMUNICATION
RS232 REAR PORT SUPPORTING DNP3 PROTOCOL

TIME SYNCHRONISATION
IRIG-B

ETHERNET CARD
(ORDERING OPTION)
PORTS SUPPORTING DNP3 OR IEC 61850 AS PER ORDER

FIBRE OPTIC (ST CONNECTORS)
820nm MULTIMODE FIBRE



- NOTE:
- 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.
 - TERMINATION RESISTOR FOR TRANSMITTER AND RECEIVER. ESKOM PERSONNEL TO CONNECT TO A/+ IF USED.
 - TERMINATION RESISTOR FOR RECEIVER IN THE 4 WIRE CASE (CONNECT TO RX+).

NOTES

- RS485 COMMUNICATION CIRCUITS TO BE EARTHED AT ONE POINT ONLY.
- THE SEL-2886 PRODUCT MANUAL INDICATES THAT TERMINATING RESISTORS SHOULD SELDOM BE REQUIRED ON THE RS485 CIRCUITS (e.g. COMMUNICATION AT UP TO 115200bps CAN BE ACHIEVED OVER A 230M CABLE RUN WITHOUT THE NEED FOR RESISTORS). WHERE REQUIRED, REFER TO THE PRODUCT MANUAL FOR RESISTOR SIZING AND INSTALLATION PRACTICE NOTES.
- THE SEL-2885 AND SEL-2886 CONVERTERS REQUIRE A +5Vdc AUXILIARY SUPPLY, THIS IS PROVIDED VIA PIN 1 OF THE SEL-487E COMM PORT. SEE MAIN PC BOARD JUMPER SETTINGS, TOP RIGHT.
- SEL-2886 CONVERTERS ARE CAPABLE OF 2- OR 4-WIRE RS485 MULTI-DROP CONNECTIONS. THE SEL-2886 IS WIRED FOR 2-WIRE CONNECTION IN THE STANDARD SCHEME APPLICATION.

SHEET NO.	DESCRIPTION
SHEET 25	RED670 REFERENCE DIAGRAM
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SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C.KING	18/02/2015	3487A
0	FIRST ISSUE, SUBSTATION REFURBISHED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

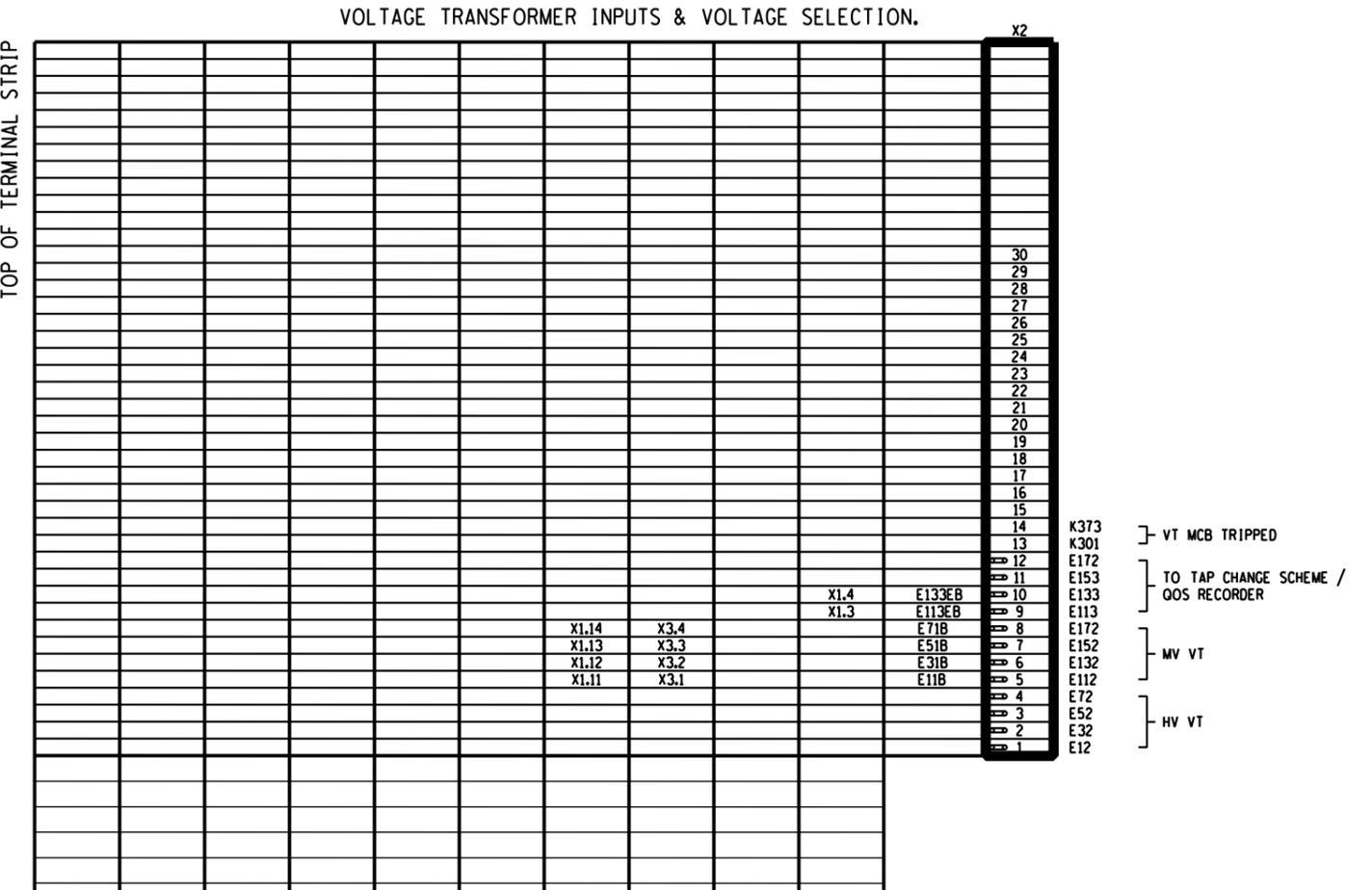
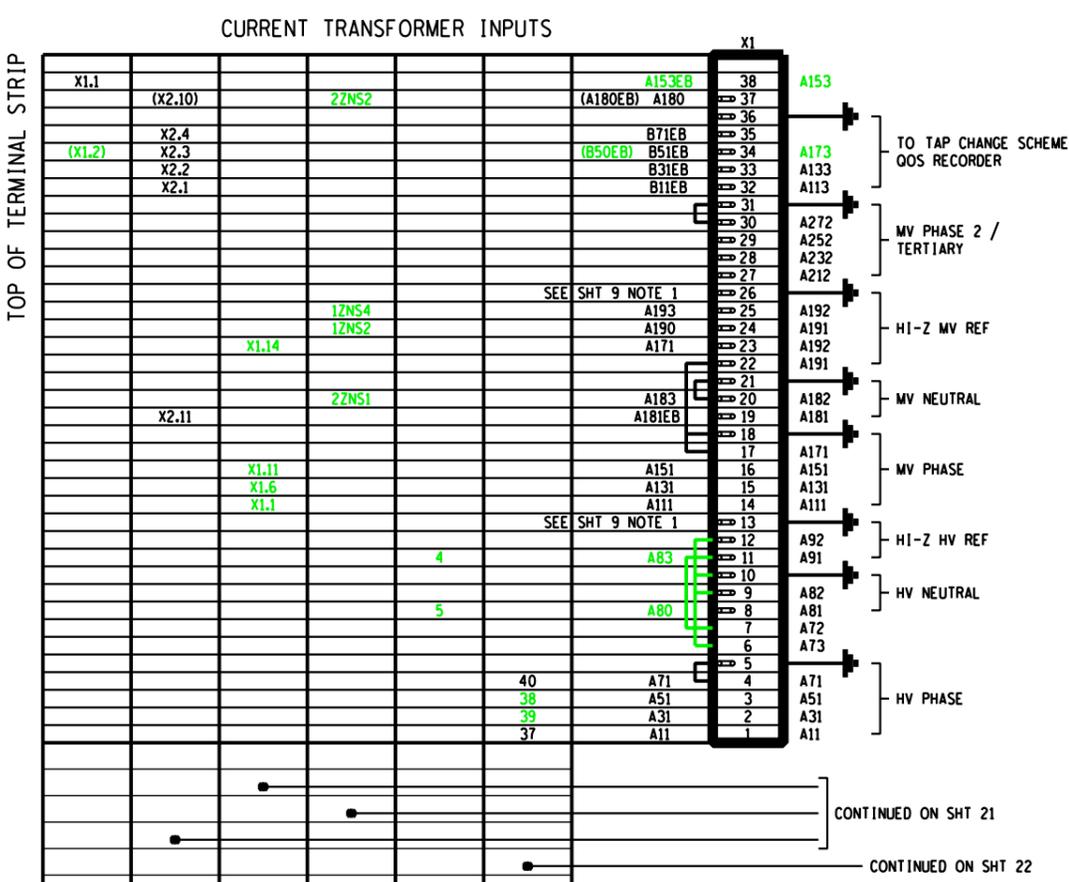
ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

SUPERVISORY/COMMS KEY DIAGRAM

SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	18 01

REV	AUTH	DATE	CHANGES	BY	CHKD	SCALE
1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011 DATE 17/09/09

MASTER TRACING FILED UNDER D-DT-15202 SHEET 18 OF 26 REVISION 1



EB522	EB508	EB506	EB514	EB512	EB504	CABLE NUMBER
12	19	19	12	12	12	CABLE SIZE
4	3	4	5	10	4	NUMBER OF SPARES
OLTC PANEL 66/11 kV TRFR 2 OLTC RACK	11 kV BUS PROTECTION PANEL	11 kV BREAKER MECH BOX RT TERMINALS	NECRT	TRANSFORMER MIB	66 kV CT JUNCTION BOX	DESTINATION

32	31	EB522	CABLE NUMBER
4	4	-	CABLE SIZE
0	0	-	NUMBER OF SPARES
11 kV FEEDER 3 RELAY PANEL (LOOP CABLE)	11 kV BUSBAR 1B 11 kV VT RT (LOOP CABLE)	OLTC PANEL 66/11 kV TRFR 2 OLTC RACK	DESTINATION

LOOPED TERMINALS

66 kV CT JB	40-41-42; 43-44-45-46-47-48-EARTH; 49-50-51-52-53-54-EARTH; 58-59-60; 61-62-63-64-65-66-EARTH; 67-68-69-70-71-72-EARTH;
MIB	1-18-7-261-6-4-5-263; 11-10; 262-264-8-9;
NECRT	K1-K3-K5-L1-L3; K2-K4-K6; L2-L4
11 kV BKR MB RT TERMINALS	X1.4-X1.9-X1.14; X1.17-X1.20-X1.21-X1.24-X1.25-X1.28-X1.29-EARTH; X1.33-X1.37-X1.41; X2.15-X2.9; X2.10-X2.31; X2.5-X2.32; X3.9-X2.41-X2.33-X3.13; X2.47-X2.27;
66 kV LINE ISOLATOR	X1.50-X1.24;

- NOTES:**
- (2) INDICATES TWO LEADS IN PARALLEL.
 - SPARE CABLE LEADS TO BE LEFT LONG ENOUGH TO REACH THE FURTHEST TERMINAL.
 - LEAD NUMBERS SHOWN THUS
P7 INDICATES NO CHANGE IN LEAD NUMBER.
P7 P7A INDICATES CHANGE IN LEAD NUMBER.
 - SEE CABLE BLOCK DIAGRAM FOR PREFIXING.
 - SLIDING LINK TERMINALS ARE TO BE ORIENTED SUCH THAT THE LINK FALLS/REMAINS CLOSED WHEN THE SECURING SCREW IS LOOSENED.
- UNLESS INDICATED OTHERWISE, STANDARD TERMINALS: ENTRELEC M10/10.RS
 ENTRELEC D6/8-ST1-RS SLIDING LINK TEST TERMINAL

NOTE: * INDICATES TERMINAL NUMBER TO BE DETERMINED ON SITE.

MASTER TRACING FILED UNDER D-DT-15202 SHEET 20 OF 26 REVISION 1

1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRB	C. KING	18/02/2015	347A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					347A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

HATCH

PROJECT APPROVED: C. KING
 DESIGN APPROVED: S.J. van ZYL
 DATE: 08/01/2012
 PROJECT CHECKED: J. MOSTERT
 DATE: 10/01/2012
 DRAWN BY: A v S

Eskom

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2
PANEL CABLING DIAGRAM

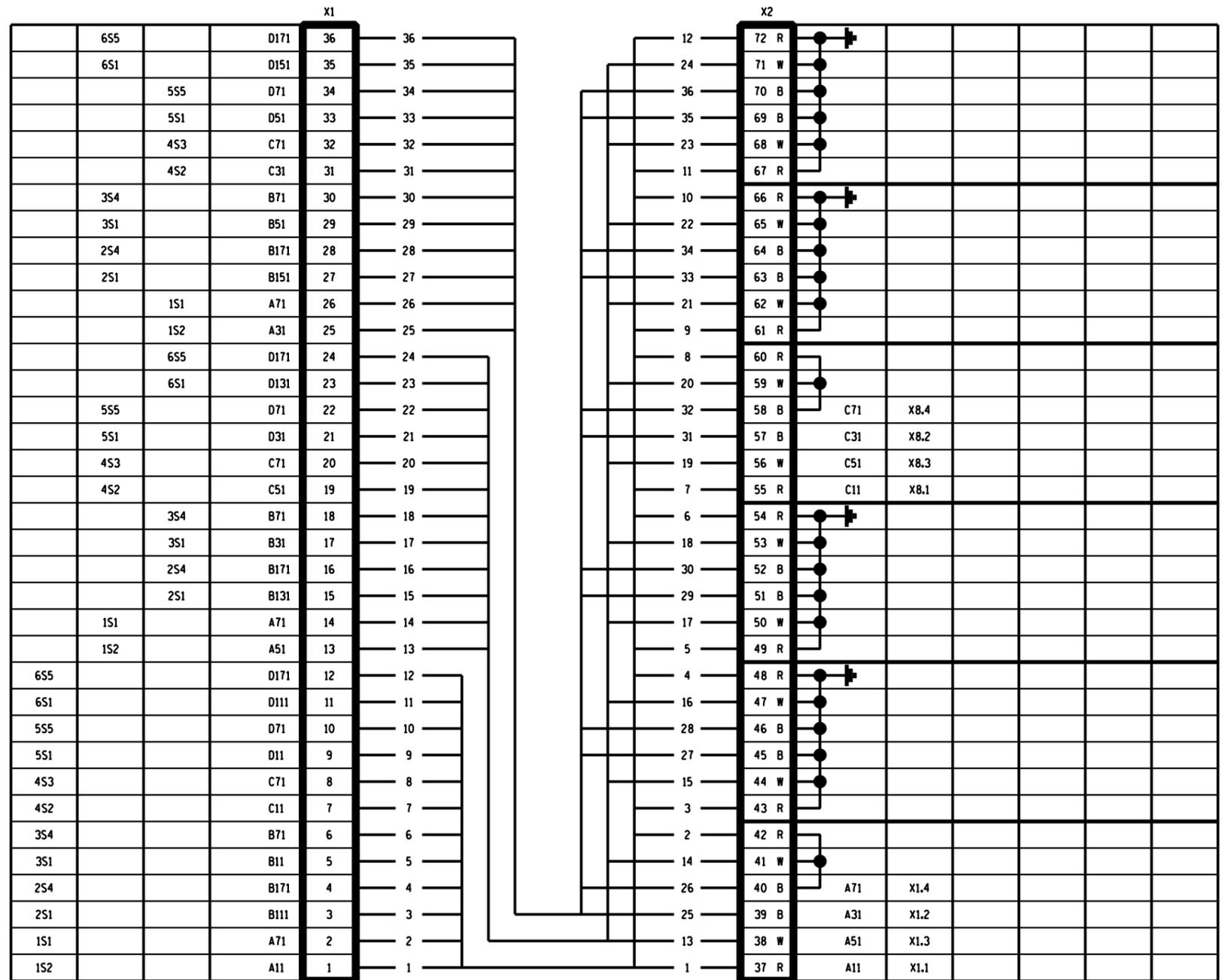
SET NUMBER	SHEET NUMBER	REVISION
D-WC-7104	83	20
		01

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 00070E A1L

SHEET	DESCRIPTION
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SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
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SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET

TOP OF TERMINAL STRIP



NOTE: ALL SPARE CABLE CORES TO BE EARTHED ON ONE END ONLY.
 NOTE: USE JUNCTION BOX
 VRW 6 CORE CT INSERT
 DRG D-DT-5404

EB501	EB502	EB503	CABLE NUMBER
12	12	12	CABLE SIZE
0	0	0	NUMBER OF SPARES
			DESTINATION

CABLE NUMBER	EB504
CABLE SIZE	12
NUMBER OF SPARES	4
	DESTINATION

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPI REV DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRB	C. KING	18/02/2015	3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.					3487A

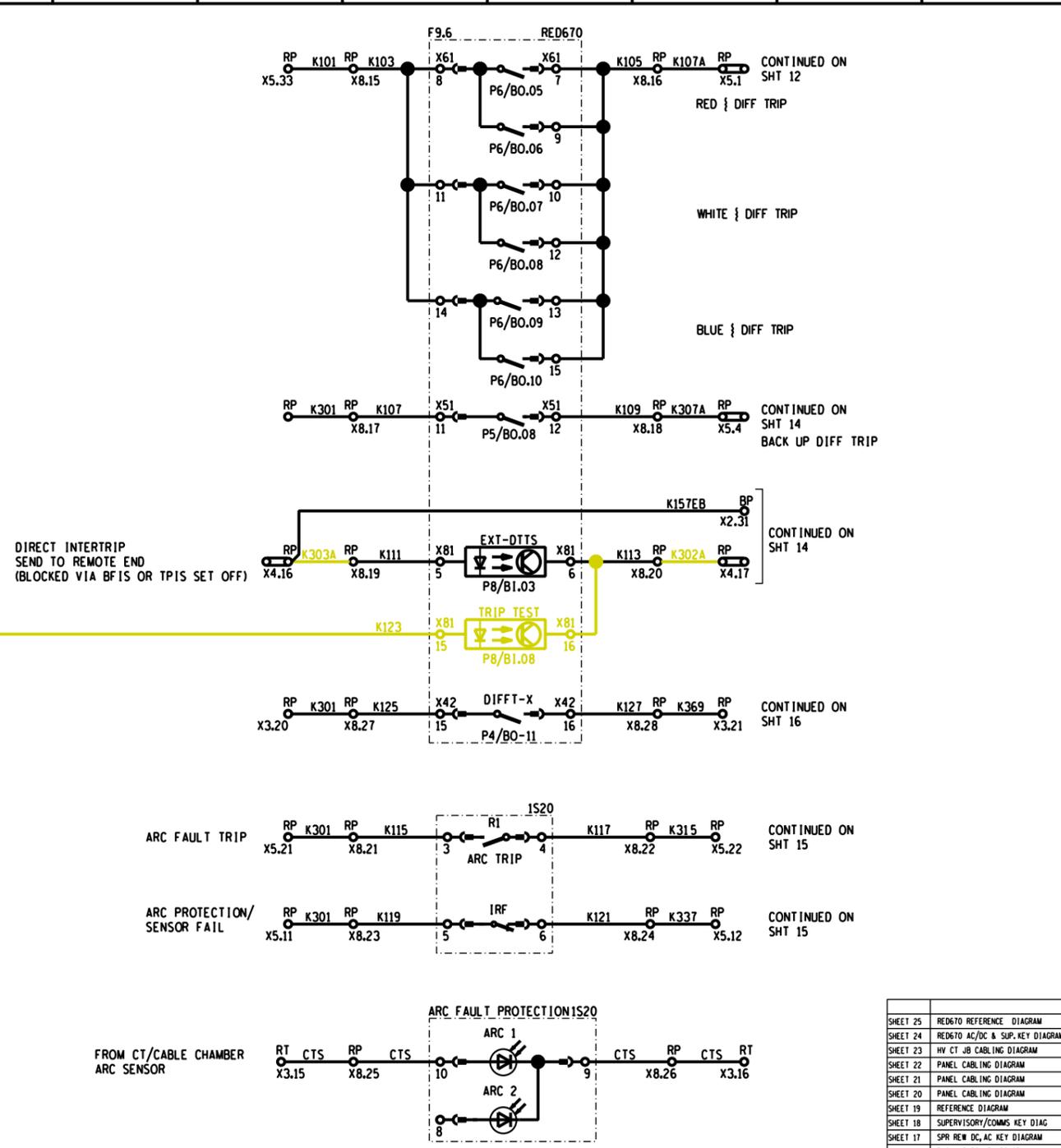
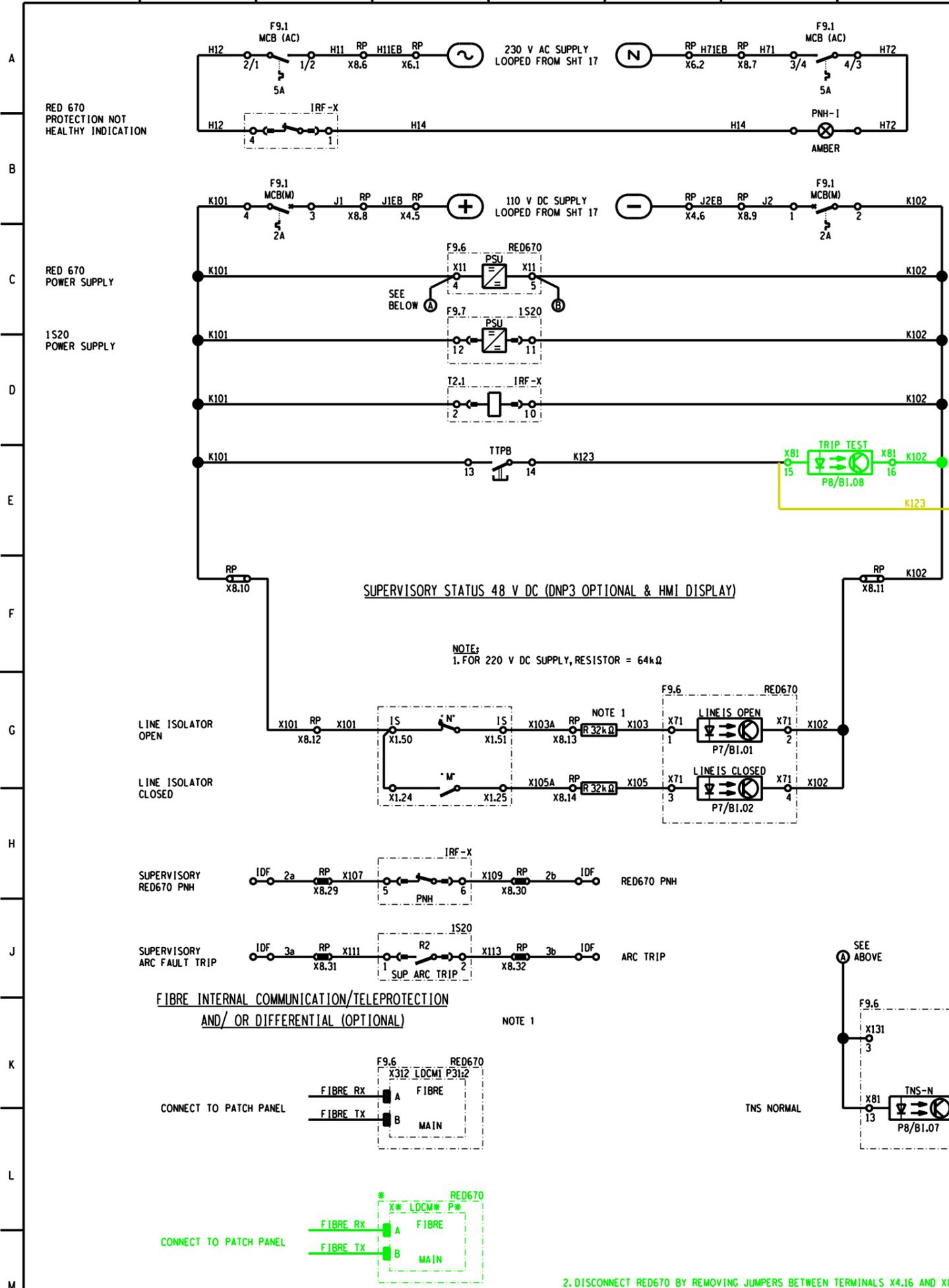
PROJECT APPROVED	DESIGN APPROVED
C. KING	S.J. van ZYL
DATE 08/01/2012	DATE 11/06/10
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	P.A. GERBER
DATE 10/01/2012	DATE 11/06/10
DRAWN BY	DRAWN BY
A v S	S.J. van ZYL

ISCOR SUBSTATION
 66/11 kV TRANSFORMER 2
 HV CT JB CABLING DIAGRAM

1	SvZ	15/11/2010	CHANGES AS PER SHEET 0 - COVER SHEET.	SvZ	PAG	DATE 25/11/2011	DATE 17/09/09
REV	AUTH	DATE	REVISION TO MASTER	BY	CHKD	SCALE	

D-WC-7104	83	23	01
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MASTER TRACING FILED UNDER D-DT-15202 SHEET 23 OF 26 REVISION 1



1. 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.
2. DISCONNECT RED670 BY REMOVING JUMPERS BETWEEN TERMINALS X4.16 AND X8.19; AND X4.17 AND X8.20. CONNECT AS INDICATED ON SHEET 14.
3. INPUT WIRED BETWEEN POS. AND NEG. OF TWO SEPARATED SUPPLIES. REMOVE JUMPER BETWEEN X8.16 AND X8.16 AND CONNECT X8.16 TO K102 NEG. SUPPLY.

SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 23	HV CT JB CABLING DIAGRAM
SHEET 22	PANEL CABLING DIAGRAM
SHEET 21	PANEL CABLING DIAGRAM
SHEET 20	PANEL CABLING DIAGRAM
SHEET 19	REFERENCE DIAGRAM
SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 17	SPR REM DC AC KEY DIAGRAM
SHEET 16	BACK-UP DC KEY DIAGRAM
SHEET 15	BACK-UP DC KEY DIAGRAM
SHEET 14	BACK-UP DC KEY DIAGRAM
SHEET 13	MAIN DC KEY DIAGRAM
SHEET 12	MAIN DC KEY DIAGRAM
SHEET 11	VT SUPPLY KEY DIAGRAM
SHEET 10	AC KEY DIAGRAM
SHEET 9	AC KEY DIAGRAM
SHEET 8	AC KEY DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM
SHEET 2	FRONT PANEL LABELS
SHEET 1	PANEL EQUIPMENT LAYOUT
SHEET 0	COVER SHEET



2	66KV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019		
1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRR	C. KING	18/02/2015		3487A
0	FIRST ISSUE. SUBSTATION REFURBISHED.						3487A

Eskom

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

RED670 AC, DC & SUPERVISORY KEY DIAGRAM

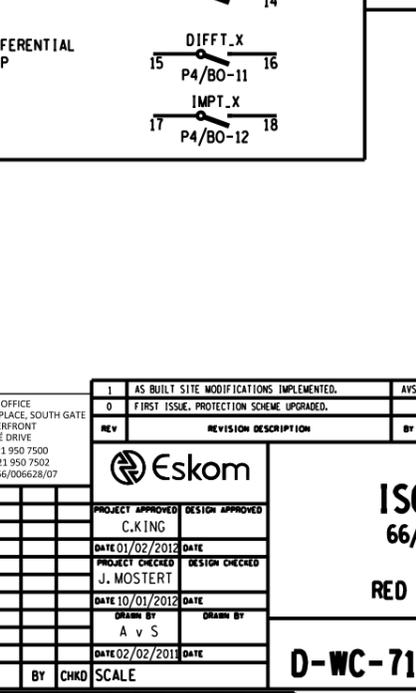
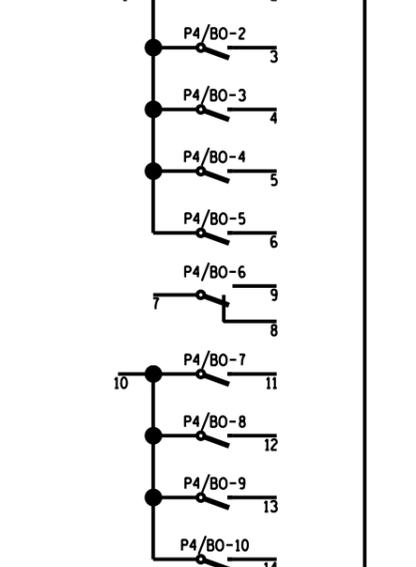
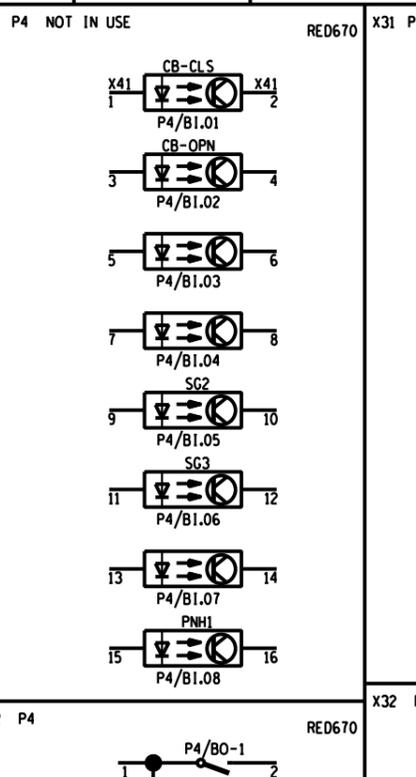
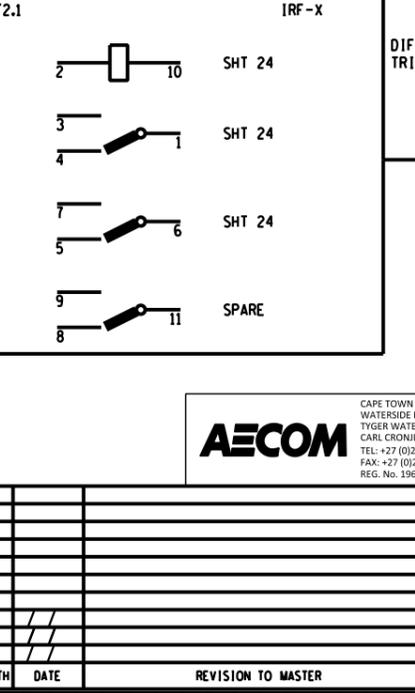
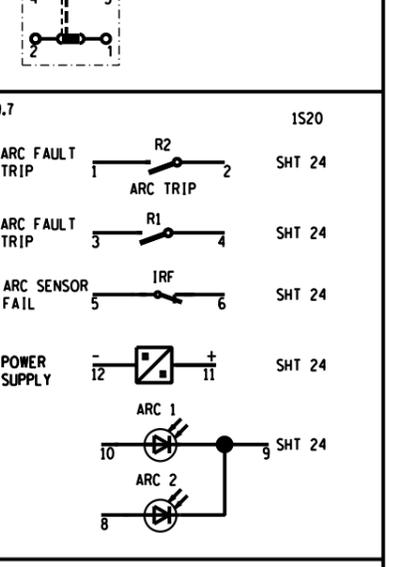
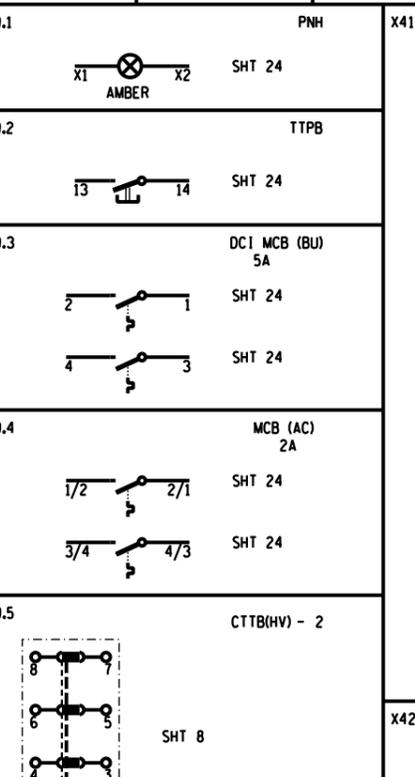
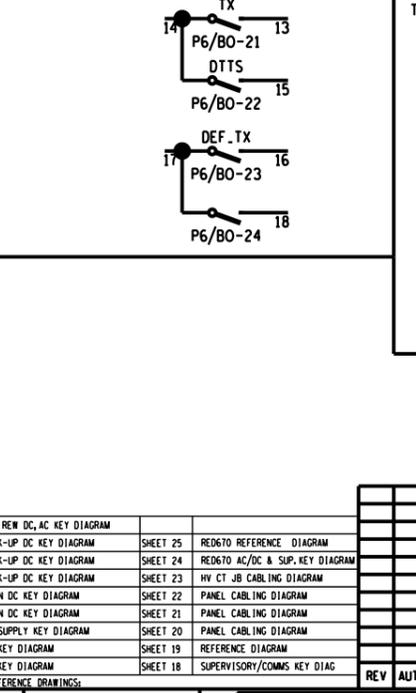
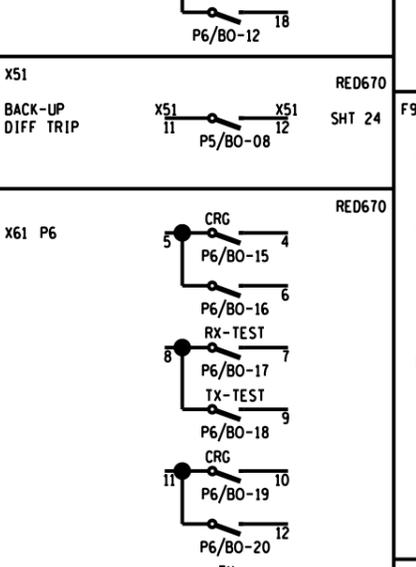
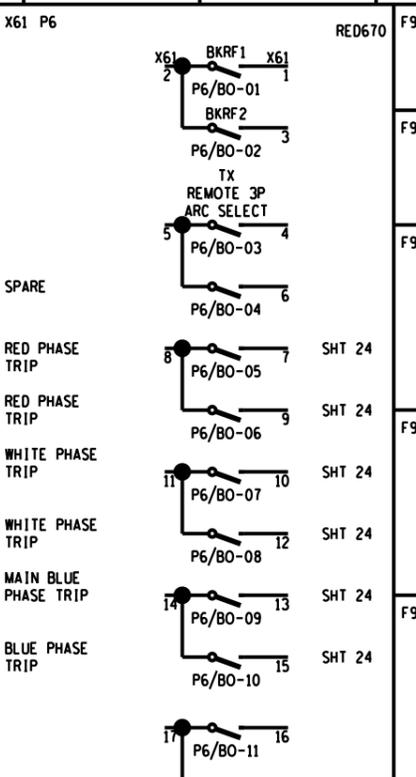
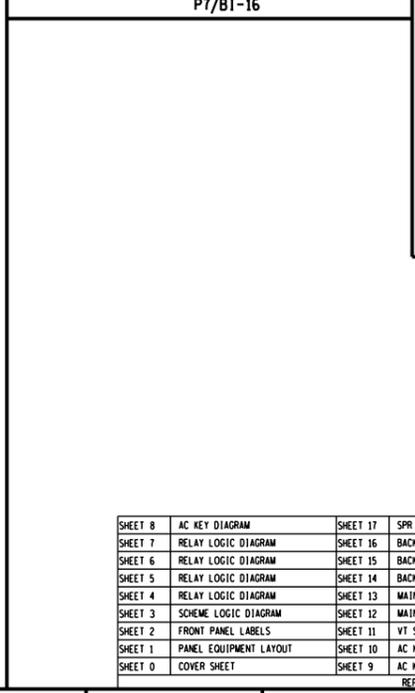
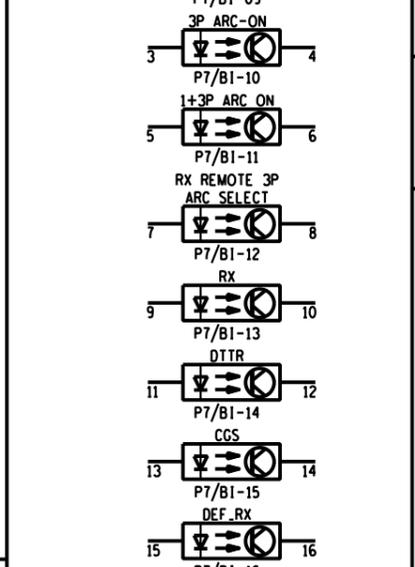
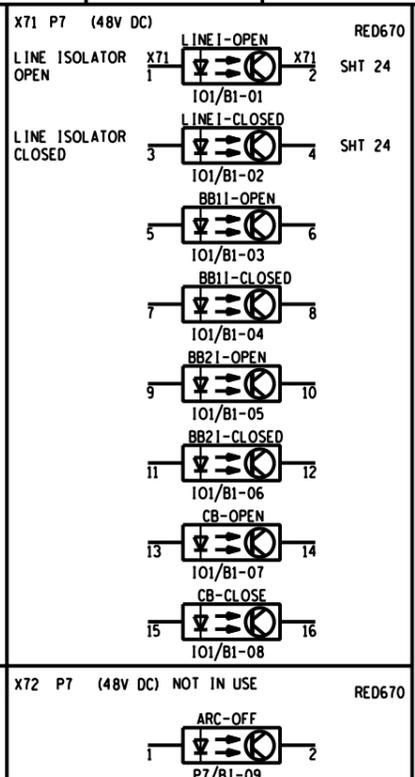
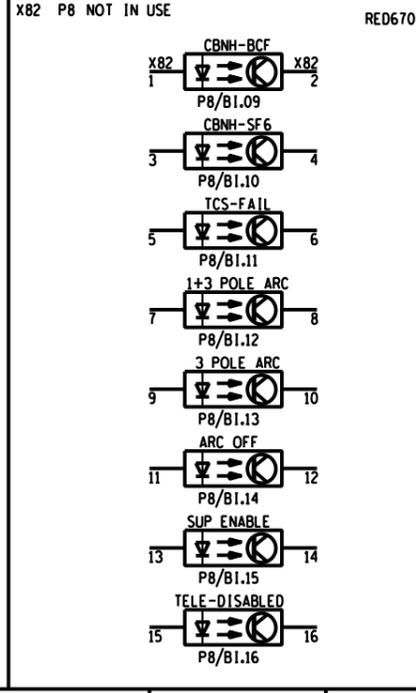
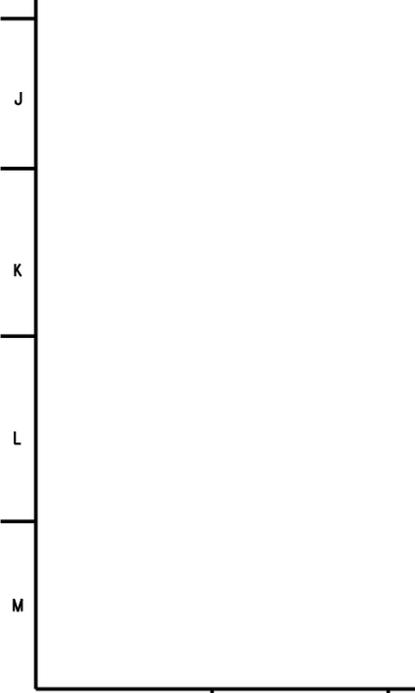
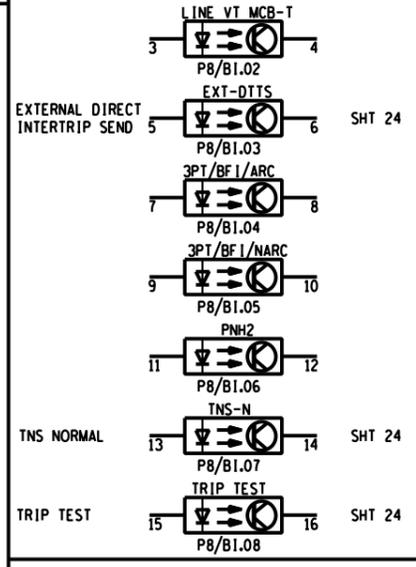
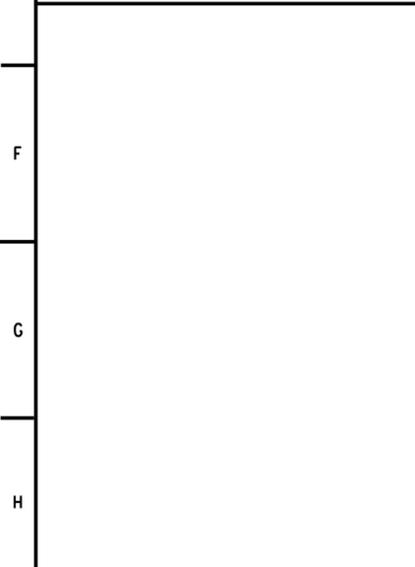
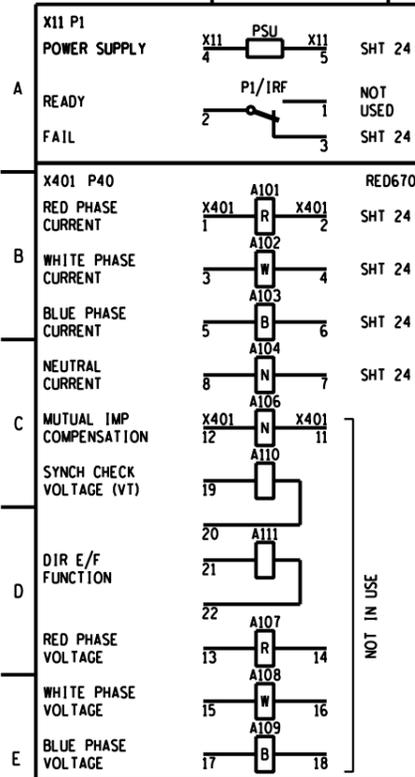
D-WC-7104 **83** **24** **02**

REVISION TO MASTER BY CHKD SCALE

PROJECT APPROVED: C. KING DESIGN APPROVED: []
 DATE: 01/2012 DATE: []
 PROJECT CHECKED: J. MOSTERT DESIGN CHECKED: []
 DATE: 10/01/2012 DATE: []
 DRAWN BY: A v S DRAWN BY: []
 DATE: 25/11/2011 DATE: []

SET NUMBER SHEET NUMBER REVISION

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE 0007TE A1L



SHEET 8	AC KEY DIAGRAM	SHEET 17	SPR REV DC, AC KEY DIAGRAM	SHEET 25	RED670 REFERENCE DIAGRAM
SHEET 7	RELAY LOGIC DIAGRAM	SHEET 16	BACK-UP DC KEY DIAGRAM	SHEET 24	RED670 AC/DC & SUP. KEY DIAGRAM
SHEET 6	RELAY LOGIC DIAGRAM	SHEET 15	BACK-UP DC KEY DIAGRAM	SHEET 23	HY CT JB CABLING DIAGRAM
SHEET 5	RELAY LOGIC DIAGRAM	SHEET 14	BACK-UP DC KEY DIAGRAM	SHEET 22	PANEL CABLING DIAGRAM
SHEET 4	RELAY LOGIC DIAGRAM	SHEET 13	MAIN DC KEY DIAGRAM	SHEET 21	PANEL CABLING DIAGRAM
SHEET 3	SCHEME LOGIC DIAGRAM	SHEET 12	MAIN DC KEY DIAGRAM	SHEET 20	PANEL CABLING DIAGRAM
SHEET 2	FRONT PANEL LABELS	SHEET 11	VT SUPPLY KEY DIAGRAM	SHEET 19	REFERENCE DIAGRAM
SHEET 1	PANEL EQUIPMENT LAYOUT	SHEET 10	AC KEY DIAGRAM	SHEET 18	SUPERVISORY/COMMS KEY DIAG
SHEET 0	COVER SHEET	SHEET 9	AC KEY DIAGRAM	SHEET 18	SUPERVISORY/COMMS KEY DIAG



1	AS BUILT SITE MODIFICATIONS IMPLEMENTED.	AVS	KRB	C.KING	18/02/2015	3487A
0	FIRST ISSUE. PROTECTION SCHEME UPGRADED.					3487A
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NUMBER

PROJECT APPROVED	DESIGN APPROVED
C.KING	J. MOSTERT
DATE 01/02/2012	DATE
PROJECT CHECKED	DESIGN CHECKED
J. MOSTERT	
DATE 10/01/2012	DATE
DRAWN BY	DRAWN BY
A v S	
DATE 02/02/2013	DATE

ISCOR SUBSTATION
66/11 kV TRANSFORMER 2

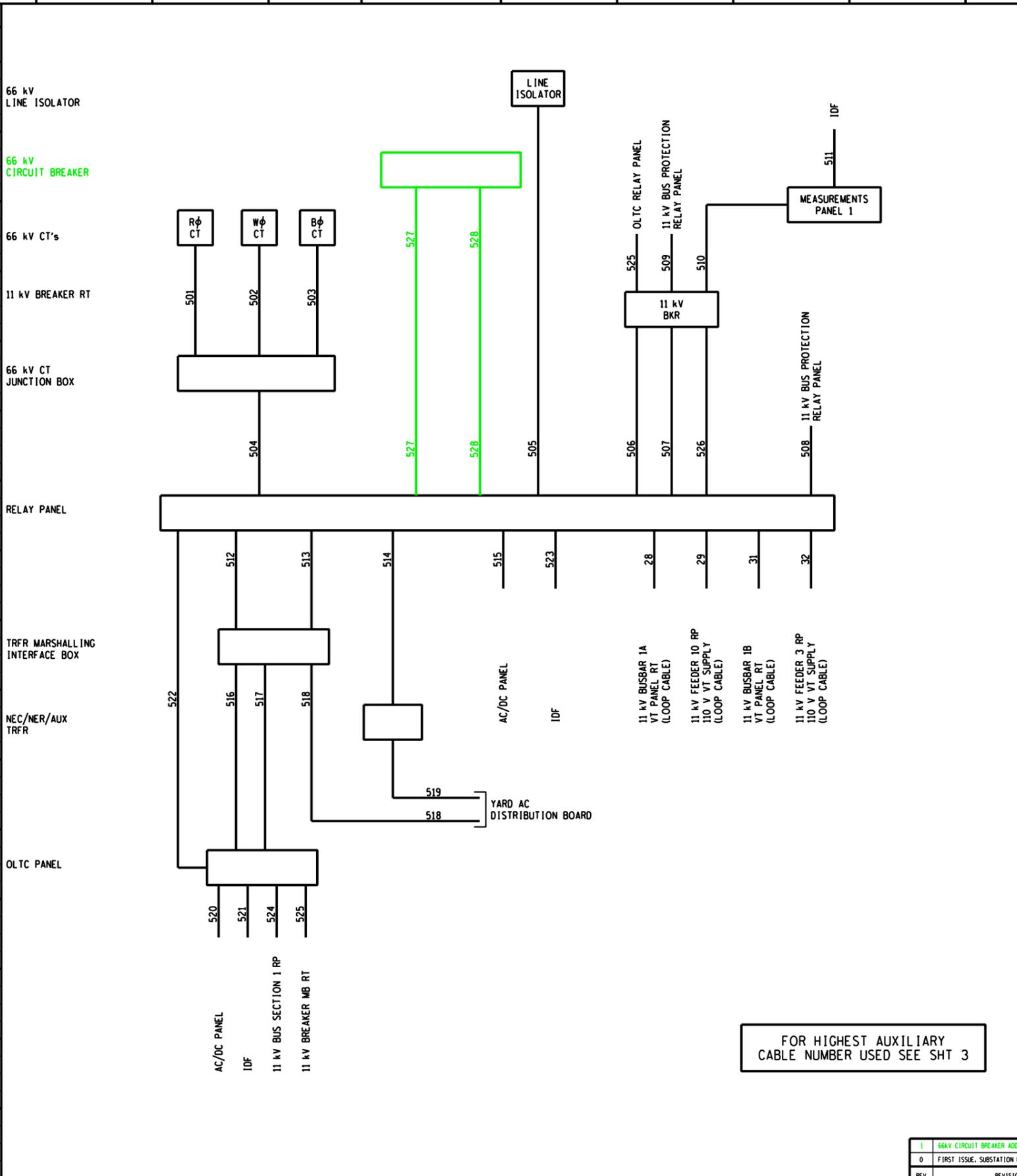
RED 670 REFERENCE DIAGRAM

D-WC-7104

SET NUMBER	SHEET NUMBER	REVISION
83	25	01

PANEL TYPE DESIGNATION 4TM7100MOD.FZD SIZE GROUPE ALL

DRAWING REFERENCE NUMBERS		
	66/11 kV TRFR 1	66/11 kV TRFR 2
A	ARRANGEMENT D-DC-0044 SHT 1	D-DC-0044 SHT 1
	WIRING	
	KEY	
B	ARRANGEMENT	
	WIRING	
	KEY	
	CABL ING	
C	ARRANGEMENT	
	WIRING D-DC-0022 SHT 2 & 3 (ALSTOM)	D-DC-0124 SHT 2 (ITT)
	KEY	
	CABL ING	
D	ARRANGEMENT	
	WIRING D-WC-7104 SET 81 SHT 23	D-WC-7104 SET 83 SHT 23
	KEY	
	CABL ING	
E	ARRANGEMENT	
	WIRING D-WC-7104 SET 81 SHT 1	D-WC-7104 SET 83 SHT 1
	KEY	
	CABL ING D-WC-7104 SET 81 SHT 8-17	D-WC-7104 SET 83 SHT 8-17
	WIRING D-WC-7104 SET 81 SHT 19-22	D-WC-7104 SET 83 SHT 19-22
F	ARRANGEMENT	
	WIRING ASEA 1.03/15537	ASEA 1.03/15537
	KEY	
	CABL ING	
G	ARRANGEMENT	
	WIRING D-DC-0102 SHT 2	D-DC-0102 SHT 2
	KEY	
	CABL ING	
H	ARRANGEMENT	
	WIRING D-WC-7104 SET 82 SHT 1	D-WC-7104 SET 84 SHT 1
	KEY	
	CABL ING D-WC-7104 SET 82 SHT 3-10	D-WC-7104 SET 84 SHT 3-10
	WIRING D-WC-7104 SET 82 SHT 12-13	D-WC-7104 SET 84 SHT 12-13
J	ARRANGEMENT	
	WIRING	
	KEY	
	CABL ING	
K	ARRANGEMENT	
	WIRING	
	KEY	
	CABL ING	
L	ARRANGEMENT	
	WIRING	
	KEY	
	CABL ING	



No.	CABLE DESIGNATION TYPE	TRFR 1		TRFR 2	
		EA	EB	EA	EB
501	BVX12DCV	*	*		
502	BVX12DCV	*	*		
503	BVX12DCV	*	*		
504	BVX12DCV	*	*		
505	BVX12DCV	*	*		
506	BVX19DCV	*	*		
507	BVX12DCV	*	*		
508	BVX19DCV	*	*		
509	TPH10AV	*	*		
510	BVX4DCV	*	*		
511	TPH10AV	*	*		
512	BVX12DCV	*	*		
513	BVX19DCV	*	*		
514	BVX12DCV	*	*		
515	BVX4ECV	*	*		
516	BVX12DCV	*	*		
517	BVX19DCV	*	*		
518	BVX4ECV	*	*		
519	BVX4KCV	*	*		
520	BVX4ECV	*	*		
521	TPH10AV	*	*		
522	BVX12DCV	*	*		
523	TPH10AV	*	*		
524	BVX4DCV	*	X		
525	BVX4DCV	*	*		
526	BVX4DCV	*	*		
527	BVX4DCV	*	*		
528	BVX12DCV	*	*		

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
1	66KV CIRCUIT BREAKER ADDED	JF	BBH	LMB	21/01/2019	
0	FIRST ISSUE, SUBSTATION REFURBISHED.				/ /	3487A

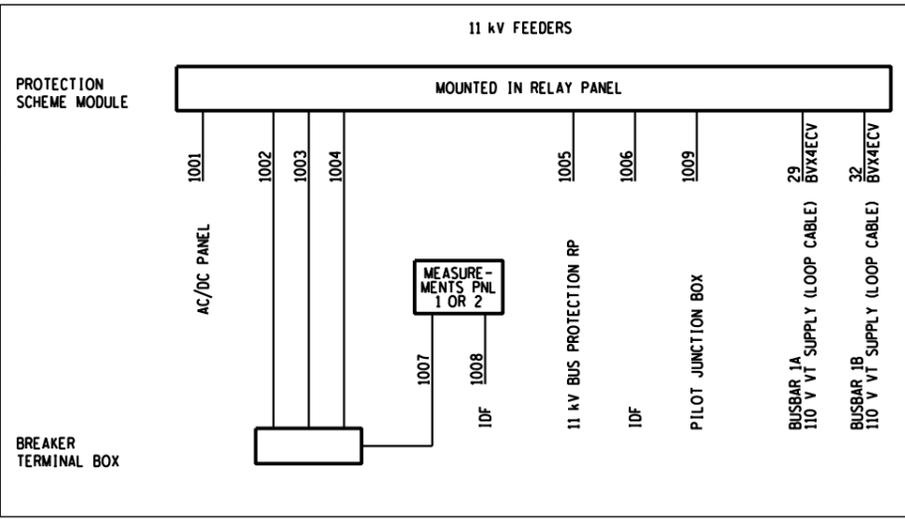
REFERENCE DRAWINGS:			
SHEET 3	AUXILIARIES CABLE BLOCK		
SHEET 2	11 kV FEEDERS & AUX. CABLE BLOCK		
SHEET 1	66/11 kV TRANSFORMERS CABLE BLOCK		

Eskom		ISCOR SUBSTATION	
AUTH: C.KING		66/11 kV TRANSFORMERS	
DATE: 19/01/2012		CABLE BLOCK DIAGRAM	
CHKD: J. MOSTERT		SET	SHEET
DATE: 10/01/2012		D-WC-7104	159 01 01
DRAWN: A v S			
DATE: 06/01/2012			

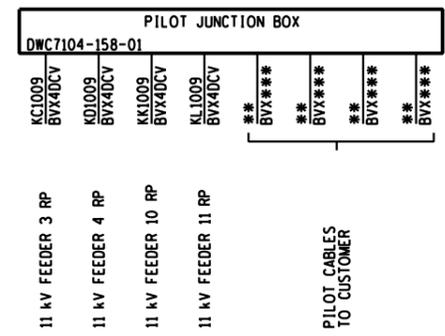
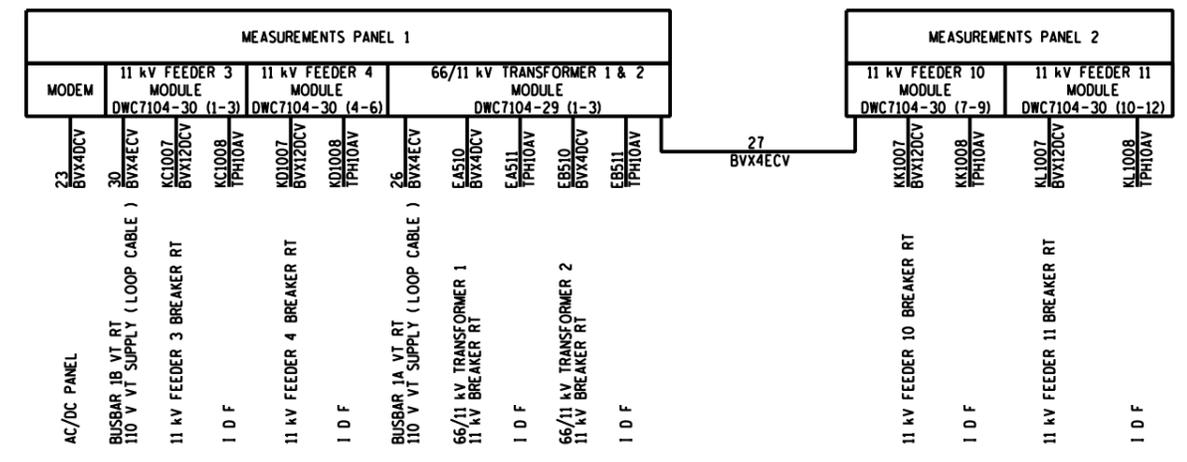
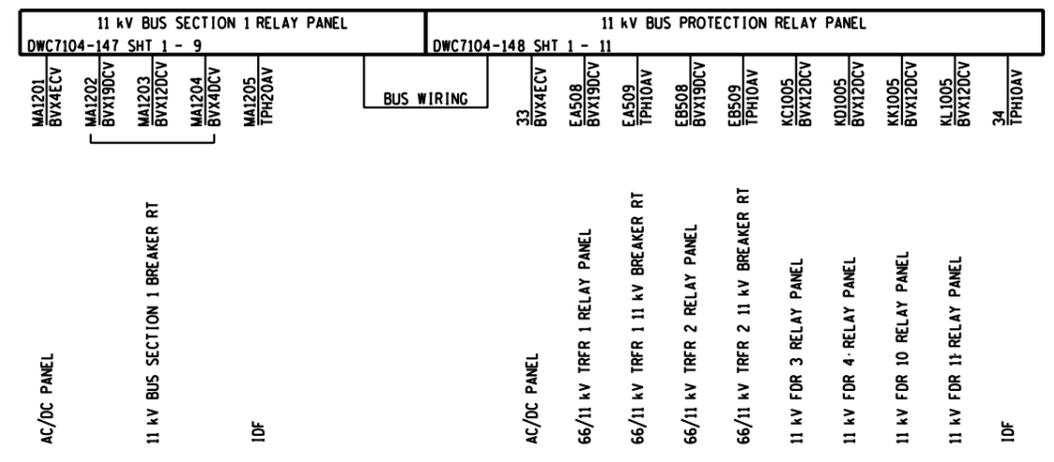


SCALE: 1
THIS DRAWING IS THE PROPERTY OF ESKOM
DATE: 06/01/2012

DRAWING REFERENCE NUMBERS				
	FDR 3	FDR 4	FDR 10	FDR 11
ARRANGEMENT	D-WC-7104 SET 133 SHT 1	D-WC-7104 SET 134 SHT 1	D-WC-7104 SET 140 SHT 1	D-WC-7104 SET 141 SHT 1
KEY	SHT 3-7	SHT 3-7	SHT 3-7	SHT 3-7
REFERENCE	SHT 8	SHT 8	SHT 8	SHT 8
CABLING	SHT 9	SHT 9	SHT 9	SHT 9
ARRANGEMENT				
KEY				
WIRING				
CABLING				
ARRANGEMENT				
KEY				
WIRING				
CABLING				
ARRANGEMENT				
KEY	D-WC-7104 SET 160	D-WC-7104 SET 160	D-WC-7104 SET 160	D-WC-7104 SET 160
CABLING				



CABLE DESIGNATION No.	PREFIX TYPE	FDR 3	FDR 4	FDR 10	FDR 11
		KC	KD	KK	KL
1001	BVX4ECV	*	*	*	*
1002	BVX19DCV	*	*	*	*
1003	BVX12DCV	*	*	*	*
1004	BVX4DCV	*	*	*	*
1005	BVX12DCV	*	*	*	*
1006	TPH10AV	*	*	*	*
1007	BVX12DCV	*	*	*	*
1008	TPH10AV	*	*	*	*
1009	BVX4DCV	*	*	*	*



FOR HIGHEST AUXILIARY CABLE NUMBER USED SEE SHT 3

NOTE: * INDICATES CABLE DETAILS TO BE DETERMINED ON SITE.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
1	CABLE No. 1007 WAS BVX4DCV.	AVS	JM	C. KING	13/03/2013	348TA
0	FIRST ISSUE, SUBSTATION REFURBISHED.				/ /	348TA

Eskom		ISCOR SUBSTATION		
AUTH: C.KING		11 kV FEEDERS & AUXILIARIES		
DATE: 19/01/2012		CABLE BLOCK DIAGRAM		
CHKD: J. MOSTERT		D-WC-7104		
DATE: 10/01/2012		SET	SHEET	REVISION
DRAWN: A v S		159	02	01
DATE: 06/01/2012		THIS DRAWING IS THE PROPERTY OF ESKOM		

AECOM

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REG. No. 1366/006628/07

SHEET NO.	REFERENCE DRAWINGS
SHEET 3	AUXILIARIES CABLE BLOCK
SHEET 2	11 kV FEEDERS & AUX. CABLE BLOCK
SHEET 1	66/11 kV TRANSFORMERS CABLE BLOCK

10.8. Non Standard Material Specifications

Not Applicable

11. Execution Plan and Temporary Arrangements

11.1. Constructability Plan

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

11.1.1. Protection

Pre - Outage Works:

- Procure new labels for 66 kV feeder protection panels.
- Procure control cabling as required.
- Procure 2 x new teleprotection cards and fibre patch leads.

Outage Works:

To be undertaken during the outage for the installation of the 66 kV breakers.

Feeder 1:

- Install, lug and loom new control cables as required for the installation of the new 66 kV breaker.
- Modify scheme wiring to include changes as required for the installation of the new 66 kV breaker.
- Re-commission transformer protection scheme to prove all functionality except teleprotection and differential protection.

Feeder 2:

- Install, lug and loom new control cables as required for the installation of the new 66 kV breaker.
- Modify scheme wiring to include changes as required for the installation of the new 66 kV breaker.
- Re-commission transformer protection scheme to prove all functionality except teleprotection and differential protection.

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. **Note: To be undertaken on the same day as Blouwater and Ystervark Substation Energisation.**

Feeder 1:

- Install new labels for 66 kV feeder protection panel.
- Upgrade RED 670 relay 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.
- Upgrade RED 670 relay 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.

Labels:

The labels for the relay panels will be changed during the outage to tie in the new Ystervark Substation.

11.1.2. Primary Plant**Pre - Outage Works:**

- Procure all new foundation materials.
- Procure new 2 x 66 kV circuit breakers.
- Procure clamps, conductors, earthing material, bolts/nuts etc.

Outage Works:

- Barricade and make safe areas where foundations are to be installed.
- Open, isolate, test dead and earth the first 66 kV transformer-feeder bay.
- Excavation for foundation and earth tail installation.
- Shoring of excavated hole for foundation.
- Cast rebar and concrete for foundations.

- Install earth tails onto earth grid/mat and foundation rebar.
- Backfill and compaction.
- Install steel support structure for 66 kV circuit breaker.
- Install the new 66 kV circuit breaker.
- Connect new conductors and clamps.
- Complete commissioning of first 66 kV transformer-feeder bay.
- Repeat the process above to install the 66 kV circuit breaker in the adjacent 66 kV transformer-feeder bay.

The disconnection and removal of the 11 kV Ore Plant feeders will be planned in conjunction with Transnet.

The final execution/constructability plan shall be agreed to on-site between the Contractor, Transnet and Eskom, once the Contractor's work programme has been received.

11.2. Temporary Arrangements

At present there are no planned temporary arrangements. Given the dynamics of this project, and its criticality on the overall Transnet Tippler 3 project, it is foreseen that possible adhoc temporary arrangements will come to fruition during the construction phase. Should this occur, Transnet will engage with Eskom accordingly.

11.3. Specification

Not Applicable

11.4. Bill of Materials

Not Applicable

11.5. Bill of Quantities

Not Applicable

11.6. Detailed Drawings

Not Applicable

11.7. Non Standard Material Specifications

Not Applicable

12. HV Lines

Not Applicable

13. MV Lines

Not Applicable

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sustain the world's
built, natural and
social environments