Eskom	Scope of Work	Eskom Real Estate

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1. INTRODUCTION

Main Power incomer reticulation at MWP is done via the 4 X 11kV Incomer underground feeder cables from the Dx substation called Fourways. There is no historical data as to whether the cables ever undergone any replacement since the initial installation in the 1980s. The reticulation is such that there are two incomer receiving busbars separated by a bus-section arrangement. Each incoming 2X11kV cables is terminated onto the one Main North MV Busbar and the other 2X11kV cables are terminated onto the other Main South MV Busbar as depicted in the figure below.

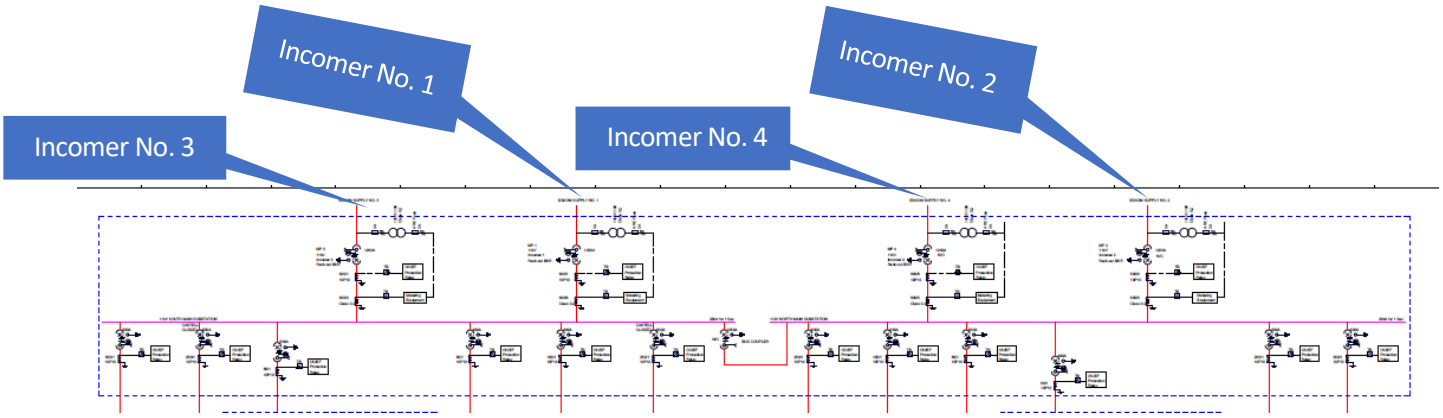


Figure 1: SLD MV Incomer Cable Feeders

In October 2025, F and A Cables (Pty) Ltd conducted tests on one of the feeder cables entitled feeder no. 4. The tests results revealed as follows:

- Cable testing with a meggerd did not indicate a zero-ohm fault.
- Cable was tested with the Adrit 22kV thumper and scope.
- The milliamp meter on the Adrid 22kV indicated that there is water in the cable.
- Faults were indicated with the scope at 123m and 289m from fourways substation.
- Using a ground microphone, fault was pinpointed at the 2 different locations.
- Fault on 123m is in parking area under paving.

As indicated by above tests, faults were indicated and more than one location on a single feed. Seeing that these incomer cables are the only source of electrical power supply to MWP entire facilities and as a result, it became essentially critical that the head office cannot be compromised from a point of reliability and availability of electrical energy. It is, therefore, imperative that the entire MV cable feeder supply be replaced to ensure that the supply system restores reliability and availability efforts.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

The purpose of the document is for the removal of the existing 11kV MV Incomer cables between the Eskom Dx Fourways Substation and MWP. It further involves the manufacture, supply, delivery, offloading, installation, terminating, testing and handing over of 1000m of 8 X 2X300mm² Al 3-Core XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1339.

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2.1.2 Load Demand at MWP

Current MD (Maximum Demand) at MWP measured at over 24 months period is indicated as 5311kVA as of February 2026. There is a plan in the near future (less than 5 years) to include additional two blocks F and G whereby they are estimated to be the size of the current blocks C and D. For the purposes of load estimation, blocks C and D are sized at 53408m^2 and therefore using the VA m^2 ratio of 60VA/m^2, this translates to 3204kVA (Worst Case) for future blocks F & G. This will increase the MD to 8516kVA and with an allowable growth factor of 10%, then required load at MWP will increase to 9367kVA within the next 5 to 10 years. See calculation in figure 2 below.

MWP LOAD CALCULATION FOR MV CABLE REPLACEMENT

Project Name:			Compiled By		Bernard Mokase, PrEng								
Expected kV from Dx			11	Growth Factor	10%	Measured Combined MD - kVA	5311	Derating Factor	0,80				
FROM	TO		DESIRED CAPACITY kVA	FUTURE LOAD GROWTH (BLOCKS F & G	GROWTH FACTOR (kVA)	DESIRED FULL LOAD (A)	DERATING FACTOR (A)	SELECTED MV CABLE	MAXIMUM LOAD CABLE CAN CARRY (A)	MAXIMUM LOAD CABLE CAN CARRY (kVA)	IMPEDENCE (Ω/KM)	DISTANCE (M)	VOLT DROP (%)
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 1 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE Insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1339	840	16 004	0,07675	1000	0,34%
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 2 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE Insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1340	840	16 004	0,07675	1000	0,34%
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 3 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE Insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1341	840	16 004	0,07675	1000	0,34%
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 4 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE Insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1342	840	16 004	0,07675	1000	0,34%
MAXIMUM DEMAND MEASURED OVER 24 MONTHS (kVA)								5 311					
CURRENT NOTIFIED MAXIMUM DEMAND - kVA								8 000					
TOTAL DESIRED LOAD + LOADS OF BLOCKS F & G - kVA								8 616					

Figure 2: Load calculations for MWP

2.1.3 Applicability

This document is applicable to MWP only.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document are to apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] SANS Code of Practice 97/1339 Medium Voltage Cables.

[2] Occupational Health and Safety Act No. 95 of 1993

[3] ISO 9001 Quality Management Systems

[4] Construction Regulations, 2014

[5] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy

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2.2.2 Informative

[1] 240-53665024: Engineering Quality Manual

[2] 240-53114026: Project Engineering Change Management Procedure

[3] 240-53113685: Design Review Procedure

2.3 DEFINITIONS

Definition	Description
Acceptance	The *Employer* accept the condition or design but does not take responsibility from the Contractor
Approval	Written agreement or authorization by *Employer*. All requests for approval must be submitted in writing and any proposed deviation from specified requirements must be fully justified and agreed by *Employer*.
Contractor	Refers to the corporation appointed to perform the engineering, procurement, and construction Works required for the project.
Employer	Refers to Eskom Holdings State Owned Company
Eskom Plant Engineering	Refers to the Eskom Engineering team who will perform the reviews and provide technical assistance for the work performed by the appointed *Contractor.*
Interface	Interface in these document means either to hard wired or software interaction between the *Contractor*s and/or other Works
Specification	The document/s forming part of the contract in which the methods of executing the various items of work to be done is described, as well as the nature and quality of the materials to be supplied and it includes technical schedules and drawings attached thereto as well as all samples and patterns
The Client	The end user will be Eskom who will be represented by Eskom Real Estate throughout the duration of the Project.

2.3.1 Classification

Public domain: published in any public forum without constraints (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
ERE	Eskom Real Estate
kW	Kilovolt-ampere
kVA	Kilovolt-ampere
kVAR	Kilovolt-Ampere Reactive
ISO	International Organisation for Standardisation
O&M	Operating and Maintenance
OEM	Original Equipment Manufacture
OH&S	Occupational Health and Safety
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Procedure

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Abbreviation	Description
SANS	South African National Standards
MWP	Megawatt Park

2.5 PROCESS FOR MONITORING

The primary process for monitoring will be governed by the Design Review Procedure (240-53113685), this entails assuring that the design achieves the requirements set out in this document. Any changes to this document will be performed as per Project Engineering Change Management Procedure (240-53114026).

2.6 RELATED/SUPPORTING DOCUMENTS

N/A

3. DESCRIPTION OF THE *WORKS*

3.1 GENERAL

The installation of cables in buildings, and in the ground for system voltages up to 11000 volts, 50Hz, shall conform to the SABS Code of Practice 10142-2; SANS 1507, and SANS 97 all as amended.

3.2 CABLE TYPES

The following cable types shall be used, unless otherwise specified in the detailed technical specification:

High voltage supplies (6600/11000 Volts):

- Paper insulated, lead covered, steel armoured, screened and drained (general use), manufactured to SABS 97 (table N) or cross-linked polyethylene (XLPE) with Aluminium conductors and screened with a brass sheath.

3.3 JOINTS

Jointing shall be carried out strictly in accordance with the manufacturer's instruction and by personnel competent in jointing the types of cables involved. No joints in cable runs will be allowed unless a cable run exceeds the maximum length available on a cable drum. (Normally 300m)

The joint shall not impair the anti-electrolysis characteristics of the cable. Joints shall be fully water and airtight and shall be free of voids and air pockets. The crossing of cores in joints will not be permitted under any circumstances.

The Contractor shall notify the Engineer timeously of the day on which jointing is to be carried out in order that an inspection may be arranged if so required. Any cable joint not inspected by the Engineer because of insufficient notice being given, shall be opened for inspection and redone at the discretion of the Engineer and at the cost of the Contractor.

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Outdoor termination must be able to withstand air pollution and bad weather without any signs of surface current tracking. Termination for high voltage XLPE cables must have a satisfactory stress relief in order to keep the partial discharges extinguished. Taped or prefabrication terminations may be used, in accordance with the manufacturer's recommendation.

3.4 CONNECTION OF CABLE CORES

When cutting away insulation from cable cores to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be nicked or cut away to fit into lugs.

Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug. Suitable lugs shall be crimped to cable core ends using mechanical or pneumatic tools designed for this purpose.

Cables that are connected to clamp type terminals where the clamping screws are not in direct contact with the conductor need not be lugged but the correct terminal size shall be used. Ferrules shall be used where cable cores are connected directly to equipment with screws against the conductor strands.

3.5 TRENCHING

The new cables will be installed in the existing cable duct. The following shall be applicable:

- Laying of underground cables in trenches shall be done in compliance with SANS 10198-8 (Cable Laying and Installation).
- Cables laid at the bottom of the trench will lay on a 150mm sand layer. Contractor shall only be allowed to reduce the 150mm sand layer requirement under prior approval from the Employer and under proper technical justification based on the Thermal Resistivity (TR) of the backfill material.
- MV cables (if applicable) will lay at the bottom of the trench, at a minimum depth of 1000mm.
- LV (DC and AC) cables to be a minimum of 300mm above the MV cable layer and laid at a minimum depth of 600mm.
- The depth of signal tape must be at least 200mm above cables and 300 mm below the surface to warn contractors of the presence of cables. Trenches greater than 1 m wide should have two or more equally spaced warning tapes above the cables.
- If applicable, distance between DC and AC cables will be a minimum of 200mm (from nearest duct or cable edge).
- Fibre optic cables must be separated 125 mm from low voltage cables and medium voltage cables if applicable.
- Where power cables had to cross the roads, cables shall be laid in cased ducts concreted along their entire length. The depth from the top of the protection tube to the surface shall be not less than 0.80m.
- If applicable, conductive (copper) signal cables will lie at least 200mm apart from LV cables.

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- Minimum separation from the cables (LV or MV) to the excavation walls, shall be not less than 50 mm.
- If applicable, the contractor shall displace cables horizontally through the different layers (MV cables should be accessible for repair without causing damage to the cables above).
- All cables to be surrounded by soft sand backfill (a fine-fill material to be used for MV and LV cables). The thickness of the sand backfill above the cables shall align with the requirements of the trench design study and the TR of the sand backfill shall be as per the requirements of the trench design study. Under no circumstances will river-sand or any soil with unsuitable TR shall be allowed.
- Earthing, where applicable, will be laid at the lowest layer of the trenches.
- Trenches shall be backfilled with clean fill material free from aggregate, debris, organic material, and stones. Trenches shall be backfilled in layers of no more than 150 mm each and mechanically compacted to 93% of maximum density at optimum moisture content, to avoid cavities that may cause collapse of trench top due to settling of the soil.

3.6 CABLE SLEEVES

Cable sleeves required at the start of the existing cable trench.

Pulling socks or other suitable means approved by the Engineer shall be used for the installation of cables in sleeves. Care shall be taken to ensure that the maximum allowed mechanical forces on the cables are not exceeded and that the sheaths are not damaged during installation. Furthermore, the Contractor shall ensure that the cables are not kinked or excessively bent while maintaining the minimum bending radius as specified by the manufacturer.

The Contractor shall use necessary precautions to ensure that all cables are not damaged at the mouth of cable sleeves.

The Contractor shall inspect the sleeves before installation of the cables to ensure and confirm that there are no sharp edges present that could cause damage to the sheaths.

Cables found with scratch marks or other forms of damage will be rejected and shall be replaced at the Contractor's cost.

Should long runs of cables in sleeves be encountered, it may be required to grease the cable with petroleum jelly or other non-aggressive compound to facilitate the installation. This will however be discussed with the Engineer prior to installation.

3.7 CABLE MARKERS

Cable markers shall consist of concrete blocks dimensioned as follows:

300mm high, 150mm x 150mm at the top and 250mm x 250mm at the bottom.

A brass plate for labelling shall be cast into the tops of the blocks in such a manner that they cannot be prised loose. The wording as follows as well as arrows indicating cable direction shall be clearly stamped on the brass plates.

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a) For HV cable route - "HIGH VOLTAGE CABLES".

b) For MV and LV cable routes - "ELECTRICAL CABLES"

c) For joint positions - "ELECTRIC CABLE JOINT".

Cable markers shall be installed on the surface along all the underground routes and shall project 50 mm above finished or natural ground level. If the projected markers could be a hazard to pedestrians or other traffic, they shall be installed flush with the surface.

Cable markers shall be installed at all changes of direction, at the beginning and end of cable runs (i.e. where a cable enters a substation or building), above all joints above cable pipe entries and exits and at intervals not exceeding 50m along the cable route. The position of cable markers shall be indicated on the "as built" drawings.

3.8 PROVINCIAL ADMINISTRATION, NATIONAL ROAD AND S.A.R. CROSSINGS

Not applicable

3.9 INSTALLATION OF CABLES

3.9.1 Installation Depths in Ground

Use existing cable duct

3.9.2 Cable Laying

Cable rollers shall be used at all times to run out cables. Rollers shall be spaced so that the length of cable will be totally suspended during the laying operation.

Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used, and care shall be exercised to avoid abrasion, elongation or distortion of any kind.

Where cables have to be drawn around corners, well lubricated securely fixed skid plates shall be used.

3.9.3 Spacing of Cables

Cables installed in a common trench shall be laid parallel to each other spaced as follows: (LV: up to 1000V; HV: 1000V to 11000V):

LV/LV : 2 cable diameters

LV/HV : 300 mm minimum

Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200 mm.

3.9.1 Termination

Termination for high voltage XLPE cables must have a satisfactory stress relief in order to keep the partial discharges extinguished.

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Taped or prefabrication terminations may be used, in accordance with the manufacturer's recommendation.

3.10 TESTING

Each cable shall be tested after installation in accordance with SANS 97 (up to 11kV) as well as the requirements of the Local and Supply Authorities.

Cable Rating (kV)	**TEST VOLTAGE (Applied for 15 Minutes)**				
	Paper-insulated cables				XLPE-insulated cables
	Between conductors		Conductors to sheath		Conductors to screen
	AC (r.m.s.) (kV)	DC (kV)	AC (r.m.s.) (kV)	DC (kV)	DC (kV)
6,6	12	18	12	18	11
11	20	30	20	30	18

HV cables shall be pressure tested in accordance with the above table and the exact leakage current shall be tabulated and certified. The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price. The Contractor shall notify the Engineer and if applicable the Supply Authority timeously so that their representatives may witness the tests.

On Completion of the tests on any cable, the Contractor shall without delay, submit three copies of the certified Test Reports to the Engineer. The contractor shall provide all the testing equipment as required for the respective tests.

4. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- Bernard Mokase
- Tiisetso Nkalai
- David Kunene
- Andrew Koenana

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5. ACKNOWLEDGEMENTS

We would like acknowledge Eskom Real Estate Facility Management team as well as MWP's maintenance departments for their support during data gathering and plant walk downs.

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ANNEXURE A – CABLE AND LOAD CALCULATION SHEET

MWP LOAD CALCULATION FOR MV CABLE REPLACEMENT

Project Name:			Compiled By		Bernard Mokase, PrEng							
Expexted kV from Dx			11	Growth Factor	10%	Measured Combined MD - kVA	5311	Derating Factor	0,80			
FROM	TO		DESIRED CAPACITY kVA	FUTURE LOAD GROWTH (BLOCKS F & G	GROWTH FACTOR (kVA)	DESIRED FULL LOAD (A)	DERATING FACTOR (A)	SELECTED MV CABLE	MAXIMUM LOAD CABLE CAN CARRY (A)	MAXIMUM LOAD CABLE CAN CARRY (kVA)	IMPEDENCE (Ω/KM)	DISTANCE (M)	VOLT DROP (%)
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 1 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1339	840	16 004	**0,07675**	**1000**	**0,34%**
ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 2 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1340	840	16 004	**0,07675**	**1000**	**0,34%**
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ESKOM DX FOURWAYS SUBSTATION	ESKOM SUPPLY NO. 4 – MAIN SUBSTATION AT MWP		5 311	3 204	9 367	492	615	2X300mm² Al 3-Core XLPE insulated PVC bedded, steel wire armoured, PVC sheathed 6.35/11kV cables to SANS 1342	840	16 004	**0,07675**	**1000**	**0,34%**
MAXIMUM DEMAND MEASURED OVER 24 MONTHS (kVA)								**5 311**					
CURRENT NOTIFIED MAXIMUM DEMAND - kVA								**6 000**					
TOTAL DESIRED LOAD + LOADS OF BLOCKS F & G - kVA								**8 516**					

Figure 3: Load Calculation Sheets

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