

 Eskom	Guideline	Technology
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Title: **FIBRE OPTIC GANTRY TO  
SUBSTATION CONTROL ROOM  
SCOPE OF WORK GUIDELINE**

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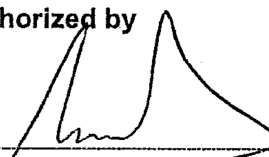
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## 1. Introduction

There is a requirement to provide a guideline to Project Planning and Application Engineers within PTM&C for the fibre optic scope of work from the gantry to the control room on Transmission and Distribution projects.

## 2. Supporting clauses

### 2.1 Scope

This document covers the contractor requirements for fibre optic work carried out during a project between the gantry and control room.

#### 2.1.1 Purpose

This document will provide the PTM&C planner with the tools to write a high level scope of work and the PTM&C applications engineer the tools to write the detailed scope of work.

#### 2.1.2 Applicability

This document is applicable to the PTM&C Planner and Applications engineer.

### 2.2 Normative/informative references

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

#### 2.2.1 Normative

- [1] ISO 9001, Quality Management Systems.
- [2] 240-70732888, Fibre Optic System Acceptance Testing Standard
- [3] 240-70733995, Optical Distribution Frame / Patch Panel
- [4] 240-46264031, Fibre Optic Design Standard – Part 2: Substations
- [5] 240-46263618, Labelling of Fibre Optic Cables

#### 2.2.2 Informative

None

### 2.3 Definitions

#### 2.3.1 General

None

#### 2.3.2 Disclosure classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

### 2.4 Abbreviations

Abbreviation	Description
ADLash <sup>TM</sup>	All Dielectric Lashed cable
ADSS	All Dielectric Self Supporting

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Abbreviation	Description
Dx	Distribution
HDD	Heavy Duty Duct
HDPE	High Density Polyethylene
HV	High Voltage
OPGW	Overhead ground wire with optical fibre
TNC	Traffic Node Cabinet
Tx	Transmission

## **2.5 Roles and responsibilities**

It is the responsibility of PTM&C to follow the guidelines outlined in this document.

## **2.6 Process for monitoring**

The document will be monitored for relevance during the project lifecycle.

## **2.7 Related/supporting documents**

Not applicable.

## **3. Document content**

The generic scope of work for gantry to control room fibre optic cabling and accessory installation should follow the guidelines below.

**Note:** The generic scope of work should apply to approximately 80% of the projects. If there are other project requirements not fully covered by this scope of work, then PTM&C Technology Design shall be consulted to assist with the additional scope of work.

### **3.1 Introduction**

A new XXXkV line will be built between Station A and Station B and a XX core OPGW will be strung between the two stations.

#### **3.1.1 Description of Work**

- An OPGW will be installed on the new XXX kV Line which is built at XXX kV line between Station A and Station B
- The contractor will be required to terminate the fibre in the control rooms at both ends of the line.
- At Station A, new single mode HDD cable will be installed between the Station B feeder gantry and the existing Traffic Node Cabinet, No. XX located in the control room.
- At Station B, new single mode HDD cable will be installed between the new Stations A feeder gantry and the existing Traffic Node Cabinet, No. XX located in the control room.

All work must be done in accordance with the standards and specifications listed in this document.

#### **3.1.2 Drawings and Diagrams**

The contractor must ensure that they are in possession of the latest drawings which the project manager will source from the PTM&C Applications Engineer.

**Table 1: Drawings and Diagrams required**

Fibre Optic Cable Trenches
Station A Control Room Panel Layout.
Station B Control Room Panel Layout.
Single mode Fibre Optic Layout in Station A Yard
Single mode Fibre Optic Layout in Station B Yard
Station A Traffic Node Cabinet Layout, No. XX
Station B Traffic Node Cabinet Layout, No. XX
Detail of the Yard Trench
Station A Yard Foundation, Trench and Earthmat Layout XXXX
Station B Yard Foundation, Trench and Earthmat Layout XXXX

### 3.2 Materials Required

- The 48 core HDD fibre optic cables required between the gantry and the TNC cabinets at Station A and Station B will comply with the NRS Specification 066-2002.
- The contractor installing the OPGW on the Station A – Station B XXX kV line shall provide the stainless steel joint boxes and the down lead clamps for the OPGW to be fastened to the gantry columns at both stations.
- The 40mm diameter, outside diameter, stainless steel pipe. (2m)
- The 48 way Optical Distribution Frame, (Patch Panel) is part of the OPGW contract and shall conform to the specification for ODFs, 240-70733995.
- The 32mm, outside diameter, HDPE pipe shall be class 6 or similar. The HDPE pipe is required to protect the duct cable in the HV Yard.
- See Table in Annex B for Bill of Material.

### 3.3 Scope of Work

The Contractor shall supply, install, terminate and test the fibre optic cables mentioned in this document and will conform to the Standards and Specifications mentioned in this document.

- At Station A, the single mode HDD cable shall be installed between the control room, and the Station B, XXXkV gantry. The most common case is if there is no loop-in on the line, then the single mode cable shall be 48 cores. If there is a loop-in on the line, then there shall be 2 single mode 24 core cables with two 24 way patch panels. However when there are loop ins or other requirements, then Technology need to be informed to ensure the most practical design is used. The estimated length of the HDD cable is 200m and the length shall be confirmed by the contractor.
- At Station B, the single mode HDD cable shall be installed between the control room, and the new Station A, XXX kV gantry. The most common case is if there is no loop-in on the line, then the single mode cable shall be 48 cores. If there is a loop-in on the line, then there shall be 2 single mode 24 core cables with two 24 way patch panels. However when there are loop ins or other requirements, then Technology need to be informed to ensure the most practical design is used. The estimated length of the HDD cable is 200m and the length shall be confirmed by the contractor.

- c) The 40mm, outside diameter, stainless steel pipes shall be installed as shown in figure 1, of the Fibre Optic Design Standard, 240-46264031. The clamps fastening the pipes must be stainless steel as well.
- d) On the gantry, the OPGW and Duct cable joint box shall be installed approximately 1.5m above ground. The loop created by the OPGW and duct cable shall be as per figure 2 in Annex A.
- e) At Station A, the existing Fibre Optic Cabinet is installed in position XX as shown on drawing no.XXX/XXXX. The ODF, (patch panel) will be installed in the TNC in the position shown in Diagram X.
- f) At Station B, the existing Fibre Optic Cabinet is installed in position X as shown on drawing no. XXX/XXXX. The ODF, (patch panel) will be installed in the TNC in the position shown in Diagram X.
- g) The contractor shall contact the project manager for instructions on where the ODFs (patch panels) will be installed.
- h) The contractor must note that trenching shall be required between the gantry and the nearest trenches for the cables and HDPE pipes from their respective gantries to the nearest trench. Marked up drawings shall be requested from the Project Manager.
- i) The Gantry point fibre connections and terminations shall be done in accordance with paragraph 4.3.2 of the Fibre Optic design standard, 240-46264031.
- j) All single HDD cables shall be installed in individual HDPE pipes.
- k) Single length cables shall be installed for its full length in accordance with the standard, 240-46264031.
- l) At the entry of the control rooms at Station A and Station B, the HDPE pipes must extend into the building.
- m) Two metres of the HDD cable shall be left in the TNC, after the cables have been terminated, two metres of fibre optic duct cable must be left within the Traffic Node Cabinets in each control room, in accordance with specification 240-46264031.
- n) Colour coding shall be completed in accordance with Eskom's standard, 240-46264031.
- o) The labelling and numbering of the cables shall be in accordance with Eskom's Labelling of Fibre Optic Cable standard 240-46263618.

### **3.4 Testing**

- a) All splices must be tested in accordance with the latest revision of Eskom Fibre Acceptance Testing Standard, 240-70732888.
- b) The contractor must submit a list of test gear available together with their current calibration test certificates.

**Note:** That all testing must be witnessed by Eskom. The contractor must arrange with the Project Manager when testing is to be done.

### **3.5 Documentation**

The final documentation must be approved by an Eskom representative and handed over to the Eskom Project manager on completion of this work:

- a) Test results as per the Fibre Optic cable System Acceptance Testing Procedure 240-70732888.
- b) Updated drawings showing the cable routing through the yard and to the Station, with as built cable lengths and the layout in the control room
- c) Full technical specification of all cables installed.

- d) A dated and signed hardcopy of results and specifications must be provided to the Project Manager.
- e) The sign off sheet (Annex C) shall be completed by an Eskom Fibre Technician and submitted to the Project Manager.
- f) A PDF dated and signed soft copy of results and specifications must be provided to the Project Manager. This should read: A signed hard copy as well as a soft copy in PDF format of all test results as well as supplied cable and material specifications shall be provided to the Eskom Project Manager.

### **3.6 General**

- a) All lengths of the HDD fibre optic cables are estimated and it is the responsibility of the successful contractor to confirm all measurements.
- b) All splicing shall be done by the contractor.
- c) The minimum bending radius of each cable as specified by the manufacturer shall be maintained as mentioned in the Installation standard 240-46264031.
- d) The names and proof of course certification of persons doing splicing must be supplied.
- e) The successful contractor must ensure that he is in possession of all documents mentioned in this Scope of Work and understands the contents thereof.

## **4. Authorization**

This document has been seen and accepted by:

<b>Name and surname</b>	<b>Designation</b>
Danie du Plessis	Senior Manager – Grids
Sikelela Mkhabela	Senior Manager - DX
Prudence Madiba	Senior Manager – GX
Alison Maseko	Senior Manager - Eskom Telecommunications (Acting)
Paul Grobler	Chief Engineer - TX
Sean Martiz	Senior Manager - GIT

## **5. Revisions**

<b>Date</b>	<b>Rev</b>	<b>Compiler</b>	<b>Remarks</b>
March 2016	1	V Naidu	New Document

## **6. Development team**

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

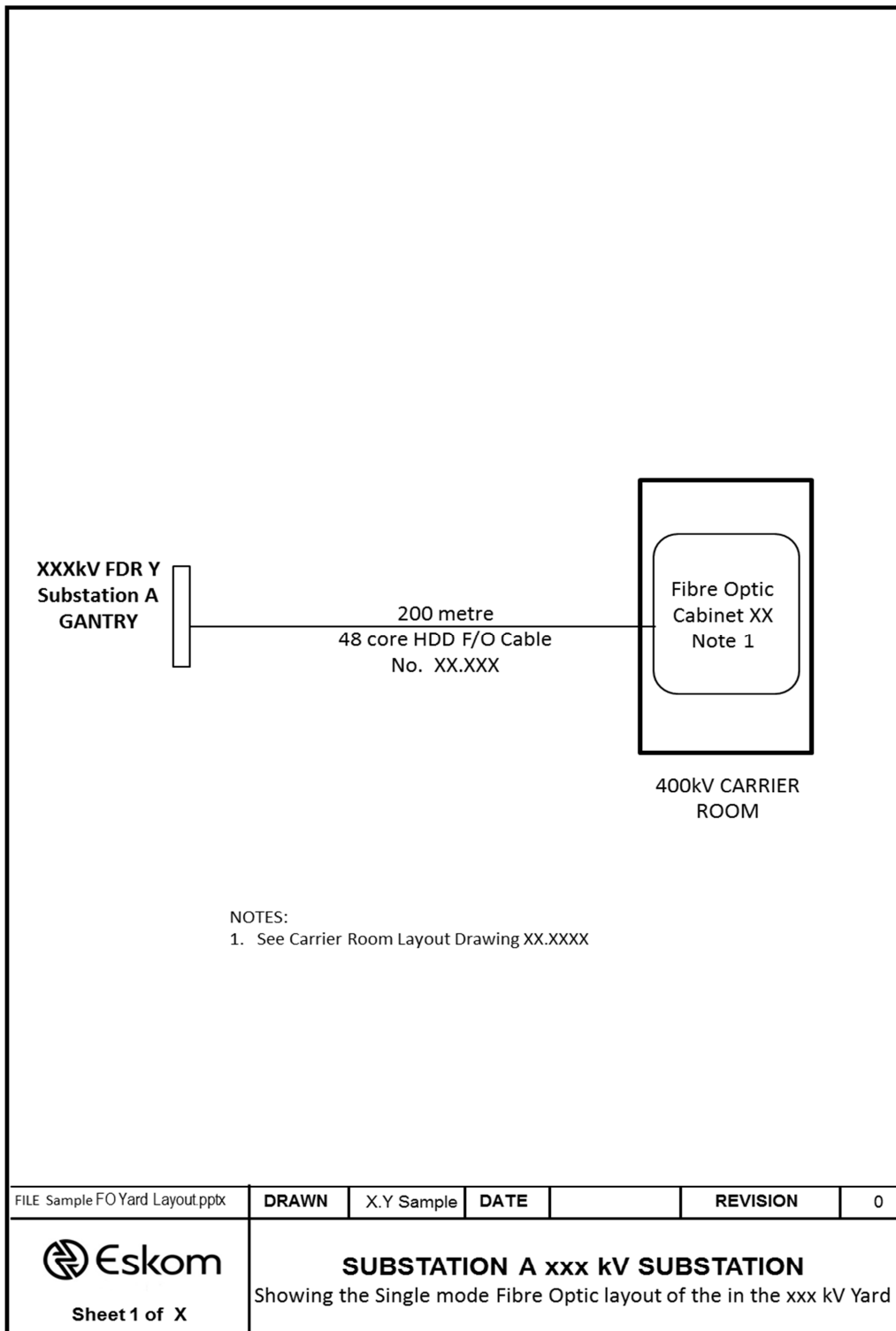
- Tejin Gosai
- Antonio Pereira
- Paddy Griffith

## **7. Acknowledgements**

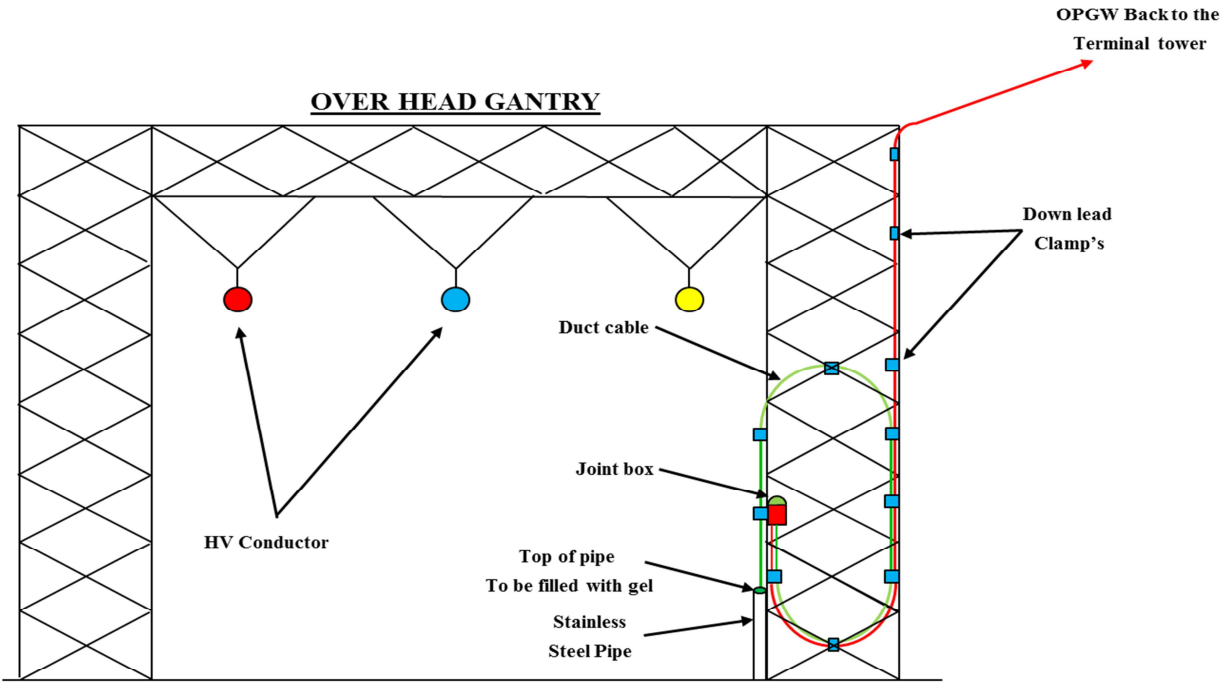
Paddy Griffith is acknowledged for the initial scope of work document created which is what this document is based on.



## Annex A – Sample Drawings Required



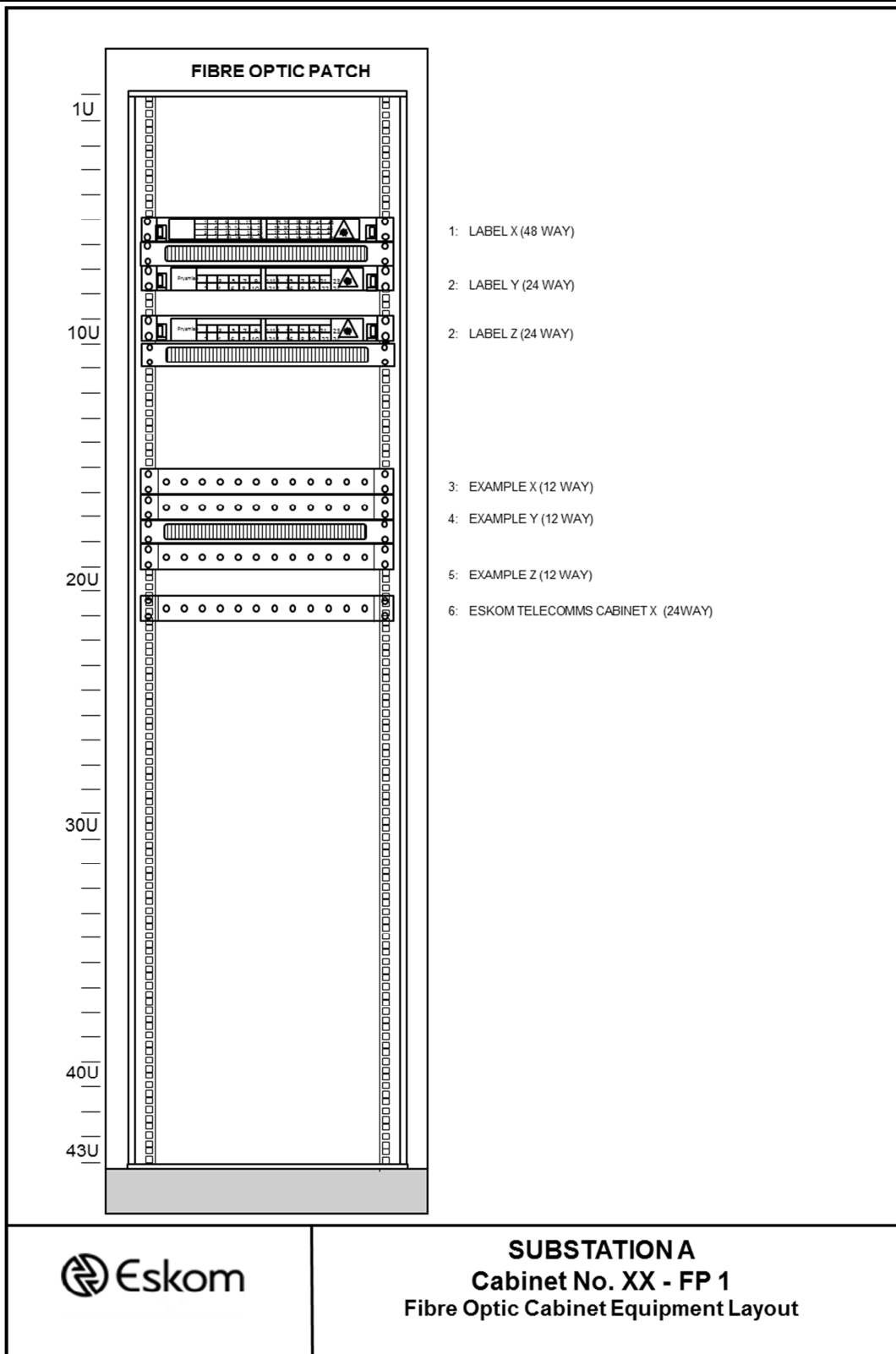
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GRID TECHNOLOGY Figure 2	Sketch showing the Fibre Optic (OPGW) Cable coming from the line onto Gantry Then down the gantry and into the stainless steel pipe	
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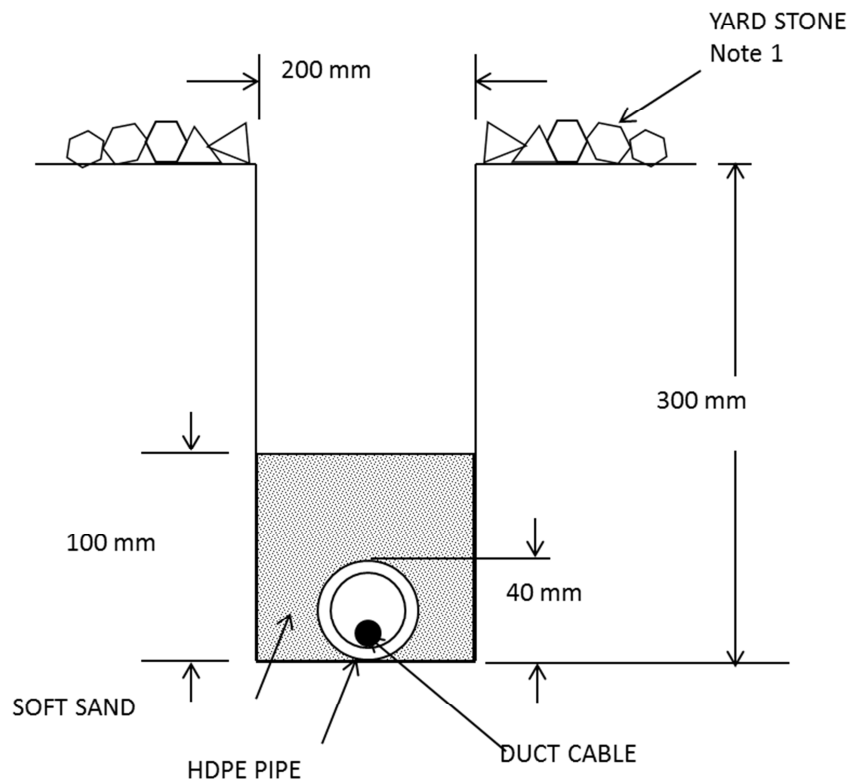
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Note 1. The yard stone must be restored to normal when the trench is closed

FILE Sample FO Yard Layout.pptx	DRAWN	X Y Sample	DATE		REVISION	0
		<b>Substation A</b> <b>Showing the detail of the Yard trench</b> <b>Sheet X of Y</b>				

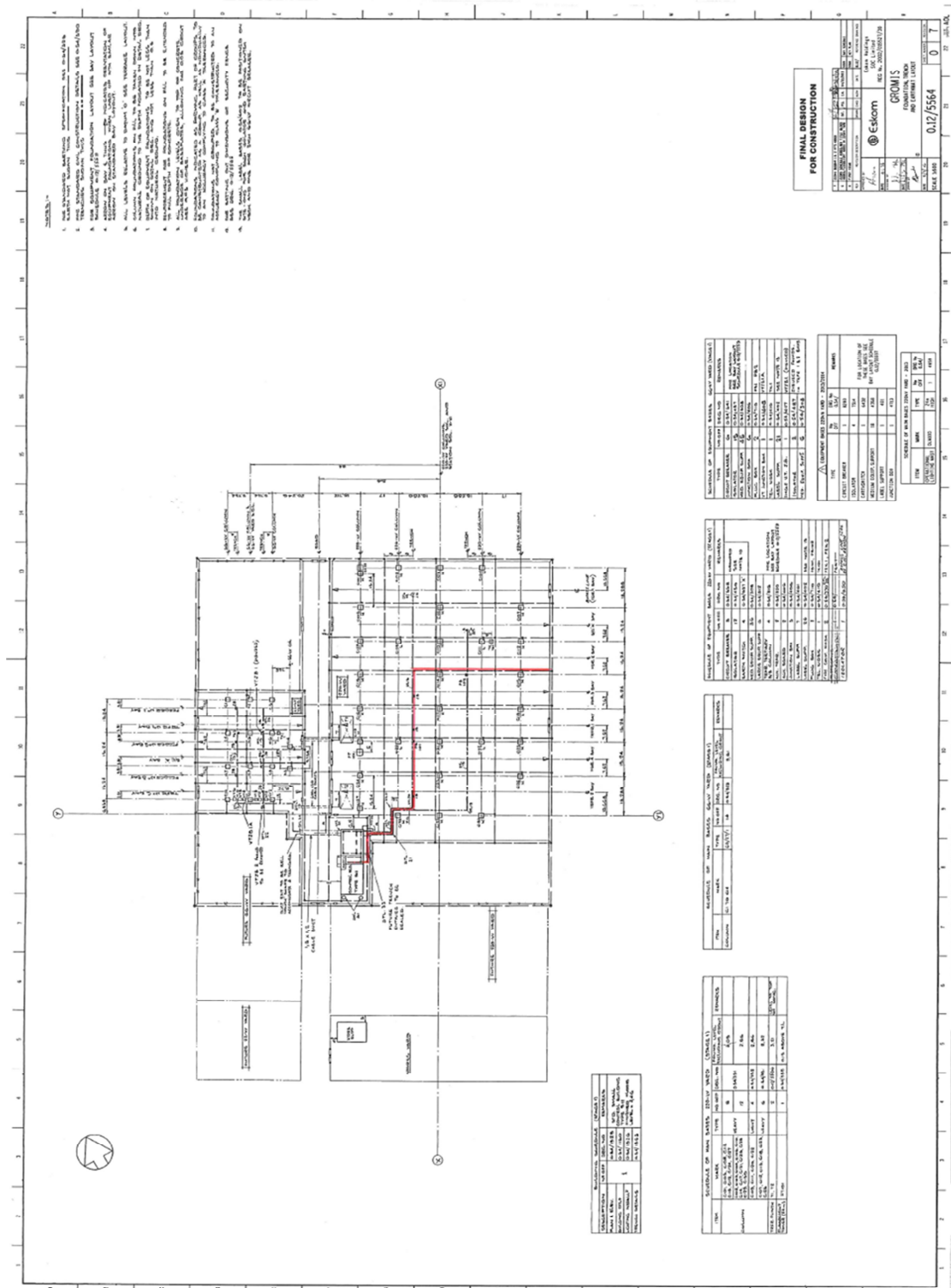
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FIBRE OPTIC GANTRY TO SUBSTATION CONTROL ROOM SCOPE OF WORK GUIDELINE

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### Annex B – Sample Bill of Materials

Item	Description	Measurement	Qty	Unit Price	Total Price
1.1	Preliminary and General (including site establishment at Station A, access, etc.)	sum	1		
1.2	Preliminary and General (including site establishment at Station B, access, etc.)	sum	1		
2.1	Survey, Station A (on site verifications of the Scope of Work, and finalising of cabinets, cable, materials, etc)	sum	1		
2.2	Survey, Station B (on site verifications of the Scope of Work, and finalising of cabinets, cable, materials, etc.)	sum	1		
3.1	Supply, install, terminate and test 48 core single mode (9/125µm) metal free Heavy Duty Duct (HDD) cable, between the Fibre Optic Cabinet at Station A and the Station B Feeder Bay and terminate both ends (All lengths mentioned must be confirmed by the contractor)	100m	1		
3.2	Supply, install, terminate and test 48 core single mode (9/125µm) metal free Heavy Duty Duct (HDD) cable, between the Fibre Optic Cabinet at Station B and the Station A Feeder Bay and terminate both ends (All lengths mentioned must be confirmed by the tendering contractor)	100m	1		
4	Trenching required for the cables and HDPE Pipes from the gantries to trench. (Trenching to be confirmed by the tendering contractor)	±15 m			
5.1	Class 6 HDPE, 32 mm, outside diameter, pipes at Station A. Contractor to confirm lengths	100 m			
5.2	Class 6 HDPE, 32 mm, outside diameter, pipes at Station B. Contractor to confirm lengths	100 m			
6	19" rack-mount 48-way single mode fibre patch panel complete with SC-APC mid-couplers & pigtails- supply and install	each	2		
7	Splice protectors Single mode	each	96		
10	No 0 compression glands	each	2		
13	Splicing of OPGW single mode fibre cores to Duct fibre cores at substation gantries	ea	96		
14	Splicing of Single mode Duct fibre cores onto pigtails and insertion of pigtails into mid-couplers	ea	96		
15	Final OTDR testing for all single mode fibre cores from end to end as per specification	ea	48		
16	Final end to end power budget measurements of OPGW fibre cores as per specification	ea	48		
17	As-built documentation including of test results as per specification - soft and hard copies	lot	2		
18	Marking of all cables, patch panels, mid-couplers and pig tails as per specification	lot	1		
19	40 mm stainless steel pipe required for the HDD cable at the gantry	ea	2		
20	Other - please specify				

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**Annex C – - Quality Acceptance Sign Off Sheet**

PROJECT	
SUBSTATION NAME	
PATCH PANEL LABEL	

ITEM	DESCRIPTION	NO	YES
1	Large gland to accommodate full cable diameter into cabinet		
2	2m plus slack in cabinet.		
3	Entry to patch panel correctly terminated.		
4	Transportation tube correctly installed		
5	Correct splicing organiser for the patch panel		
6	No insulation tape used In the organiser		
7	No macro bending on fibre or pig tails		
8	Compatible grooves for splicing protectors		
9	Neat pig tales		
10	Numbered pig tales		
11	Mid couplers grooves facing down		
12	Mid couplers tight		
13	Mid couplers protected with dust cover		
14	Patch panel mounted correctly with cage bolt and nut inside		
15	Patch panel mounted an adjustable bracket		
16	Patch panel re-cessed in such away that when the patch cords are inserted in the mid couplers the patch cords, are not t in the way of other equipment and closing door.		
17	Patch panel and cable labelled correctly with fibre distance and distant station.		
18	Patch panel and site clean		
19	Cabinet mounting – must be bolted down		
20	Cabinet Earthing – according to Standard		

Accepted by Eskom:

Technician Name: \_\_\_\_\_

Date: \_\_\_\_\_

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