



Specification

Technology

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1. INTRODUCTION

This document covers the minimum Technical Specification for the engineering scope for the Extension of the Public Address System at Hendrina Power Station.

The appointed *Contractor* will be required to do the system upgrade and his work will include; complete design, installation and commissioning including interfacing to the existing PA system, as well as address defects identified. This document sets to detail the Technical Specification identified by the *Employer* for the *Contractor* to implement.

1.1 SYSTEM IDENTIFICATION

1.1.1 Public Address System

- Official name of the system: Hendrina Power Station Public Address System

1.2 PUBLIC ADDRESS SYSTEM DESCRIPTION

The Public address currently installed comprises the amplifiers that are installed in 5 amplifier cubicles. These amplifier cubicles have been placed on 5 areas/buildings. The cubicle will contain different number of amplifiers – the number depending on the areas to be serviced. The areas that have speakers are mentioned below. The amplifier cubicles are linked via fibre optic cable.

The public address system allows messages to be announced from 2 central locations thus immediately providing useful and unfiltered information. This system is based on the Bosch Praesideo 3.5 Public Address and Voice Alarm System.

1.2.1 Amplifier Cubicle – SOR Building

The amplifiers on this cubicle supply sound to the following areas:

- Unit 1-5 Turbine Floor,
- Unit 6-10 Turbine Floor,
- Unit 1-5 Operator Control Room,
- Unit 6-10 Operator Control Room,
- Coal Laboratory, OSSD & Medical Centre Buildings and
- SOR building.

1.2.2 Amplifier Cubicle – Probuy Building

The amplifiers on this cubicle supply sound to the following areas:

- Probuy Building,
- Engineering Office Building and
- Umcebo & Outage Boardroom Building.

1.2.3 Amplifier Cubicle – GWP Building

The amplifiers on this cubicle supply sound to the following areas:

- Gigawatt Building,
- North Security gate Offices,
- Maintenance Training Building and
- Safety Office Building.

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1.2.4 Amplifier Cubicle – Outages Building

The amplifiers on this cubicle supply sound to the following areas:

- Electrical Maintenance Department workshop
- Outages Building
- Canteen building

1.2.5 Amplifier Cubicle – Stores Building

The amplifiers on this cubicle supply sound to the following areas:

- MSSD workshop
- Welding & Fabrication workshop
- Stores Building
- Njabula Hall

1.3 SCOPE BOUNDARY

In 2022, the supplier of the current Public Address system declared that they will not be supporting the current range of amplifiers anymore.

The current installed technology is the Bosch Praesideo Amplifiers with supporting Bosch speakers and other Bosch technology. There has now a need to install the PA system to the areas where there were no speakers.

This project is meant to address this issue so that all station personnel can be able to hear the announcements.

The scope of this project will include the supply of more amplifiers and speakers so that all personnel on identified areas in the plant can be able to hear announcements. Also, since the current range of PA system is not supported anymore, an upgraded or a new type of amplifier system can be considered.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

The purpose of this specification is to provide the Technical Specification for the extension of the Hendrina Public address (PA) system with an upgraded PA system. It also references the technical quality and standards which should be applied.

The specification will form part of the contractual documents to the prospective *Contractors*, along with the drawings, and therefore can help minimise project risk and provide support should there be any legal disputes.

2.1.2 Applicability

This document applies to:

- Hendrina Power Station Public Address System Extension

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2.2 NORMATIVE AND INFORMATIVE REFERENCES

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

2.2.1 Normative

2.2.2 Informative

- [1] 240-49266281 Public address System Standard
- [2] 240-53113685: Design Review Procedure
- [3] 240-53113685: Design Review Procedure
- [4] 240-53114002: Engineering Change Management Procedure
- [5] 240-54937439: Fire Protection/Detection Assessment Standard
- [6] 240-56355754: Field Instrument Installation Standard
- [7] 240-56355815: Field Instrument Installation for Junction Boxes and Cable Termination Standard
- [8] 240-64550692: Label Specification and Plant Codification
- [9] 240-65459834: Project Documentation Deliverable Requirement Specification
- [10] 240-66920003: Documentation Management Review and Handover Procedure for Gx Coal Projects
- [11] 240-70164623: Design Guideline for HVAC in the Eskom Coal Fired Power Stations
- [12] 240-71432150: Plant Labelling Standard
- [13] 240-76992014: Project / Plant Specific Technical Documents and Records Management Work Instruction
- [14] 240-86973501: Engineering Drawing Standard
- [15] 240-93576498: KKS Coding Standard
- [16] R/ESK1618 Hendrina Power Station Hazardous Location Classification

2.3 DEFINITIONS

2.3.1 Disclosure Classification

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

Table 2.3 – Definition of Terms

A	
Audibility	A measure of whether sound can be heard over other sounds in a certain area.
Area of coverage	Area where PA system infrastructure is not installed and so messages broadcasts are not heard.

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O	
OEM	The Internationally registered legal entity who owns the rights for the manufacture, design and repair of the Public Address Systems.

2.4 ABBREVIATIONS

Abbreviation	Description
GWP	Gigawatt Park
HMI	Human machine Interface
PA	Public Address System
SOR	Switch Operating Room

2.5 ROLES AND RESPONSIBILITIES

- [1] *Employer* will be responsible for the overall management of the project with respect to time, cost, and quality throughout the project.
- [2] The Plant system engineer's role and responsibility will be to provide technical support.

2.6 PROCESS FOR MONITORING

This document is governed by the Design Review Procedure (240-53113685). Any changes shall be managed through the Project Engineering Change Management Procedures (240-53114026).

2.7 RELATED/SUPPORTING DOCUMENTS

2.8 HENDRINA PUBLIC ADDRESS SYSTEM DESCRIPTION

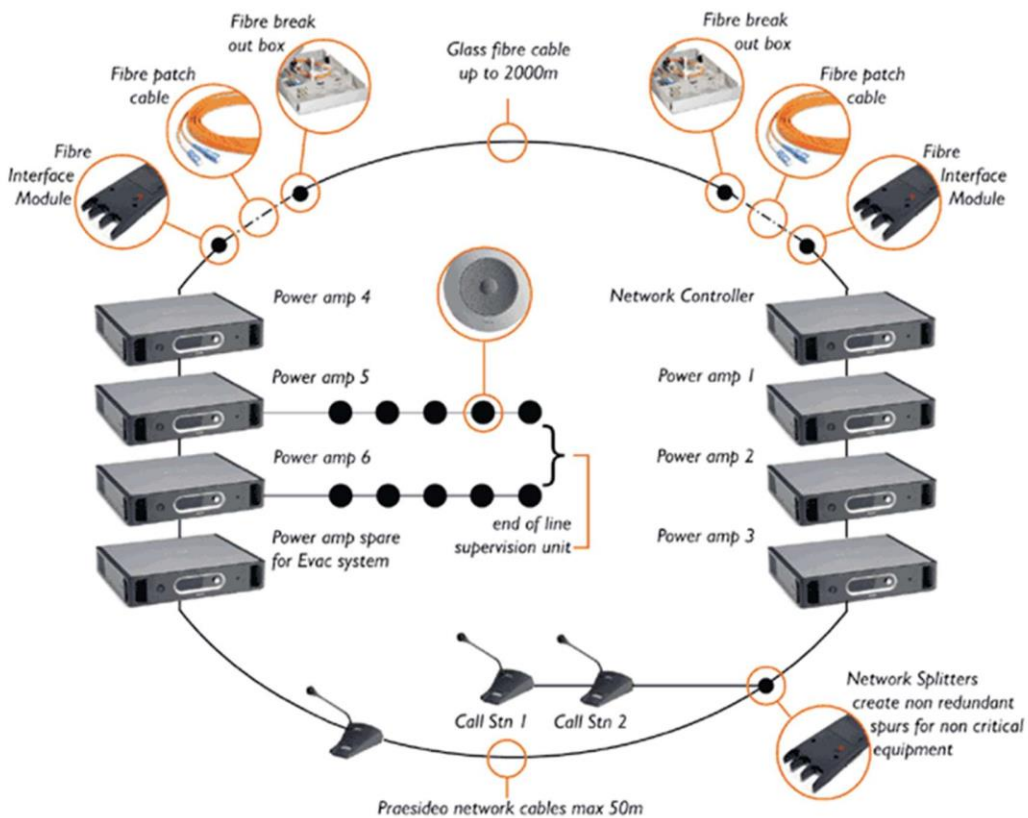
A Public Address system is currently installed at Hendrina. This system is the Bosch Praesideo 3.5 Public Address and Voice Alarm system. It covers a significant part of the station, but it does not cover all the areas within the station perimeter.

- a) The current system comprises the following:
 - 5 amplifier racks that are linked via fibre cable. These racks are in 5 buildings, viz,
 - GW Park building,
 - Probuy building,
 - Switch Operating Building,
 - Outages building and
 - Procurement building.
- b) From each of the above buildings, amplifiers are assigned to speakers that feeds the adjacent areas (buildings, workshops and plant)
- c) The announcements can be done from either the GW Park building or at the Switch Operating buildings.
- d) The additional amplifiers supplying the newly installed speakers will be installed from some of these amplifier racks mentioned above.

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- e) The connection between each Amplifier rack to the other Amplifier rack is via a fibre cable and eventually forming a ring.
- f) Although the amplifier was designed as to comply with the IEC standard, the current installation does not fully comply with the IEC and some of Eskom Standards. Before the final design for the PA extension is approved, a waiver will be considered on certain aspects of the current installation.
- g) On each building mentioned above, the amplifiers are connected as shown on the following pages:

(i) General Layout 1



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(ii) General Layout 2



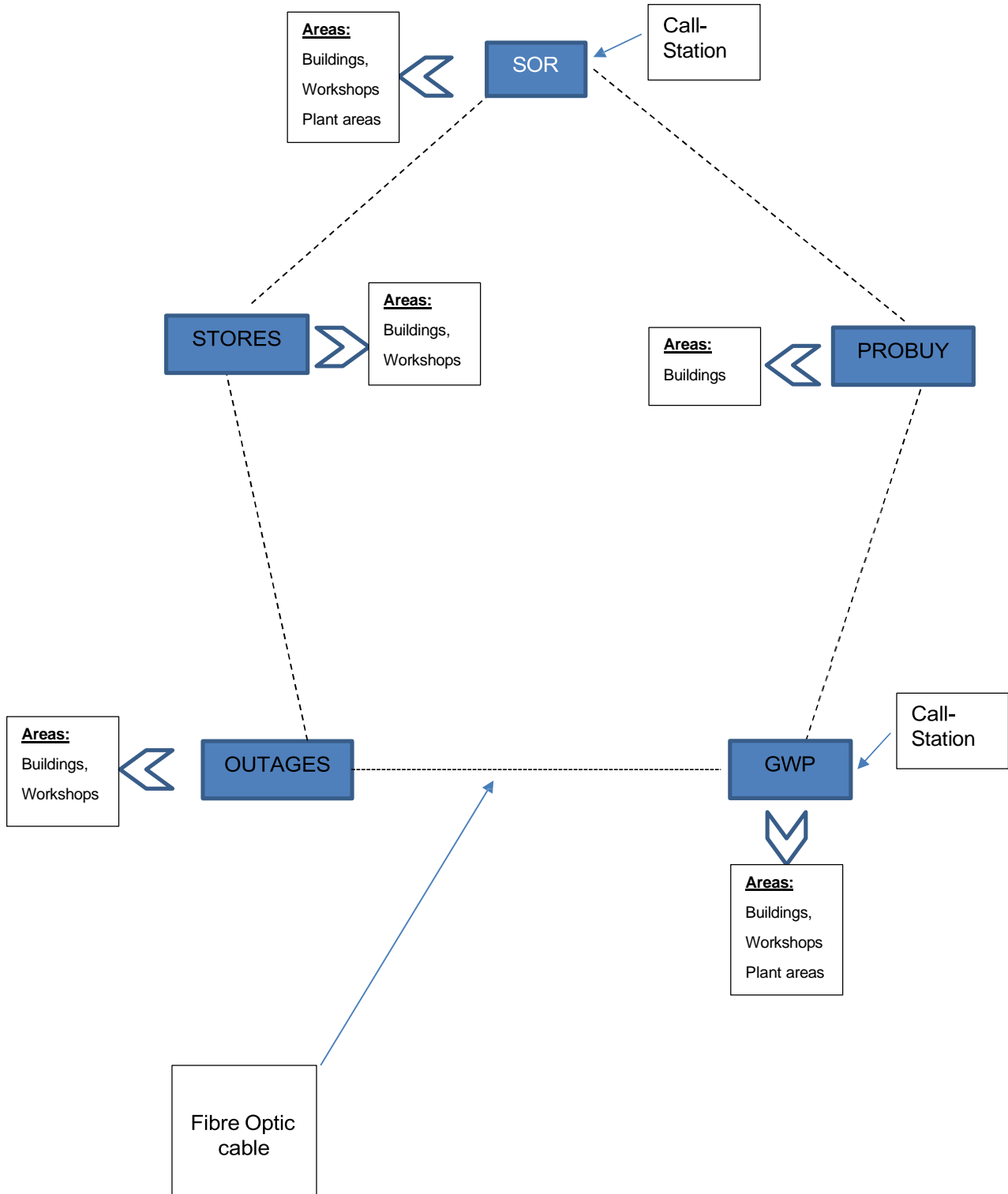
(iii) Bosch Equipment Types

Call stations	GWP	Bosch	@ GWP
	SOR	Bosch	@SOR
PA Amplifiers:	1P500	Bosch	
	2P250	Bosch	
	LBB4428	Bosch	
FIN		Fibre Interface Modules	
Speakers	Cabinet	Bosch 3013/01	
	Ceiling	Bosch LC1-WMO6E8	
	Horns 1	Bosch 3428	
	Horns 2	Bosch 3482	

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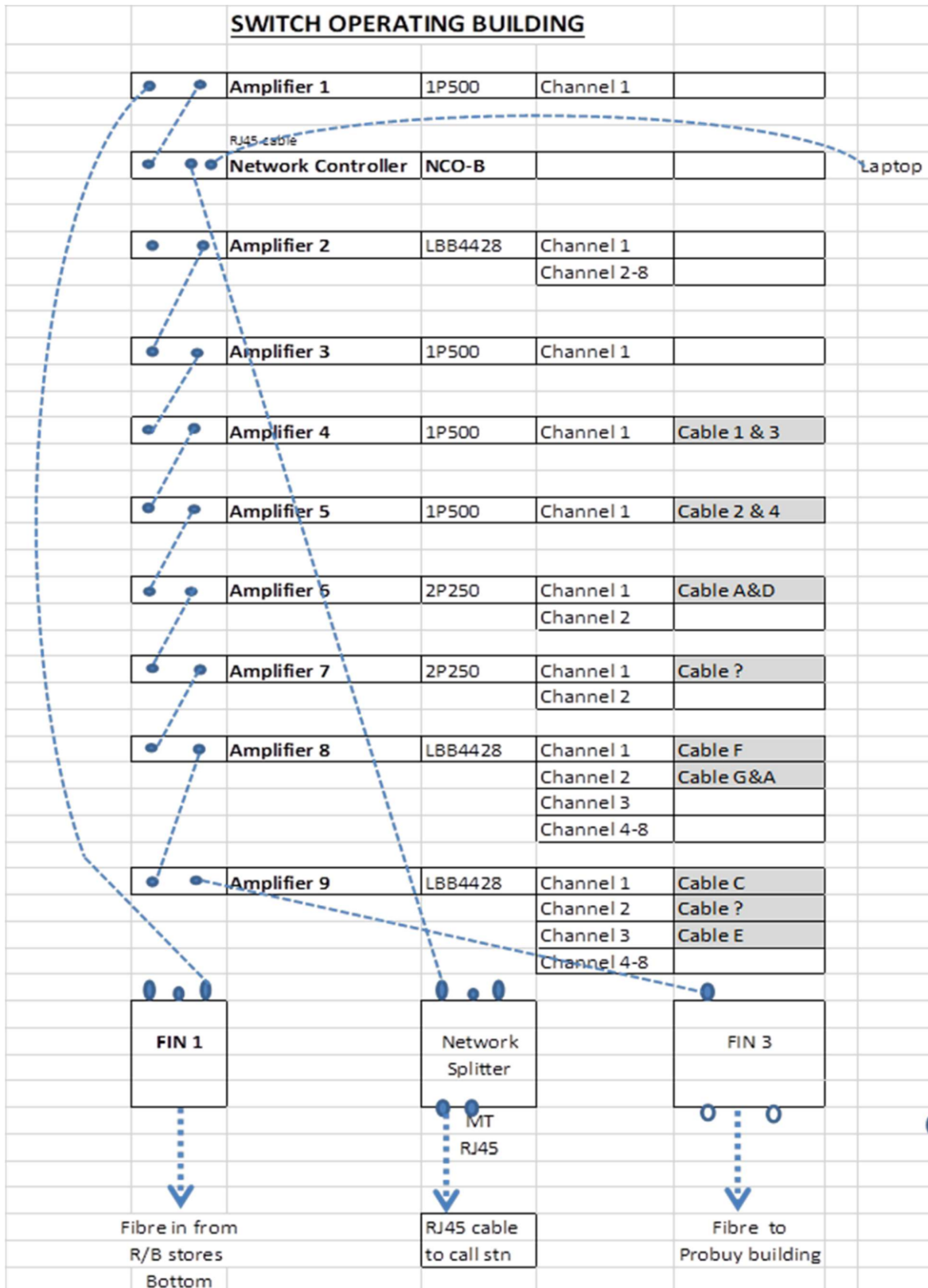
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(iii) General Layout 3



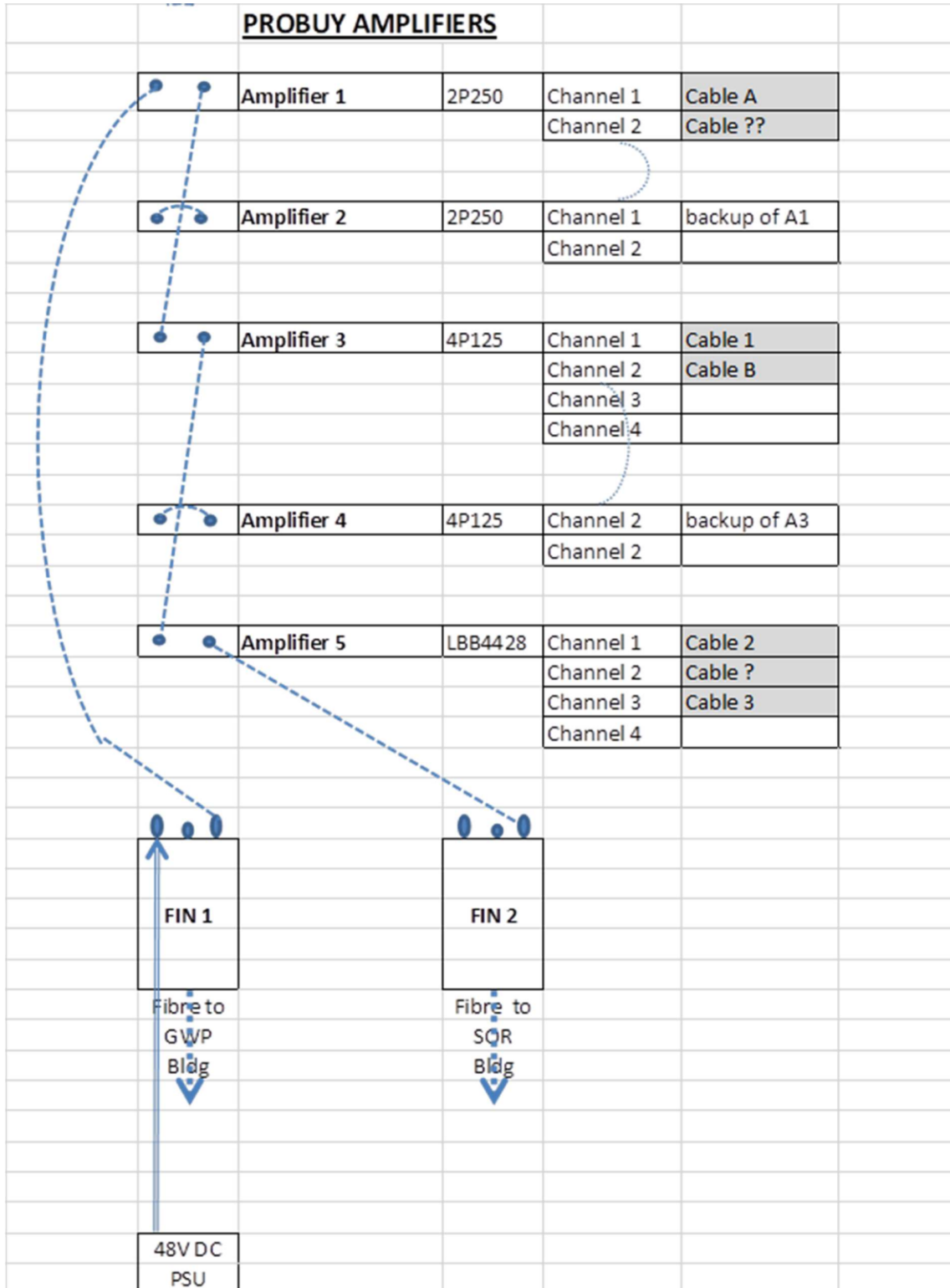
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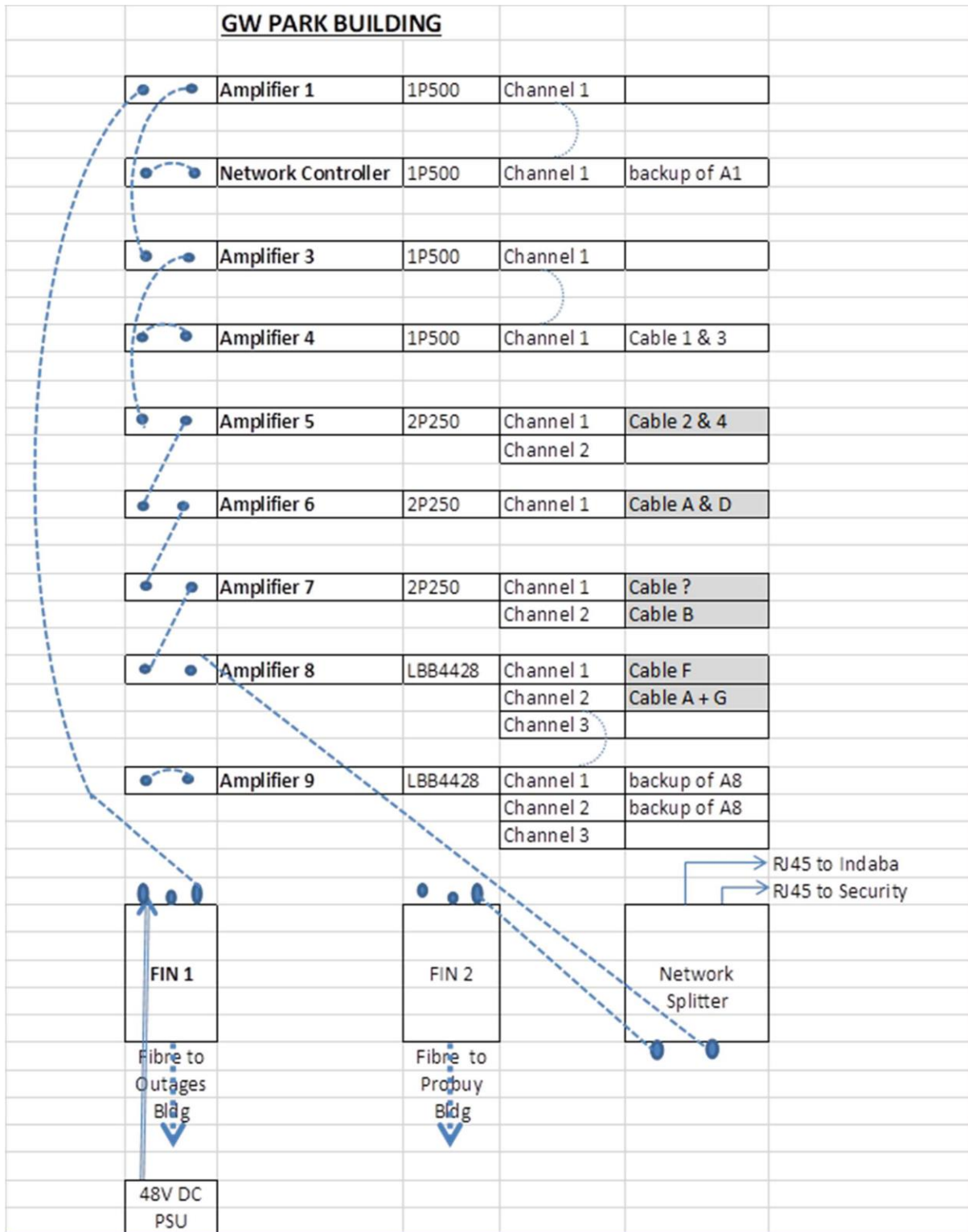
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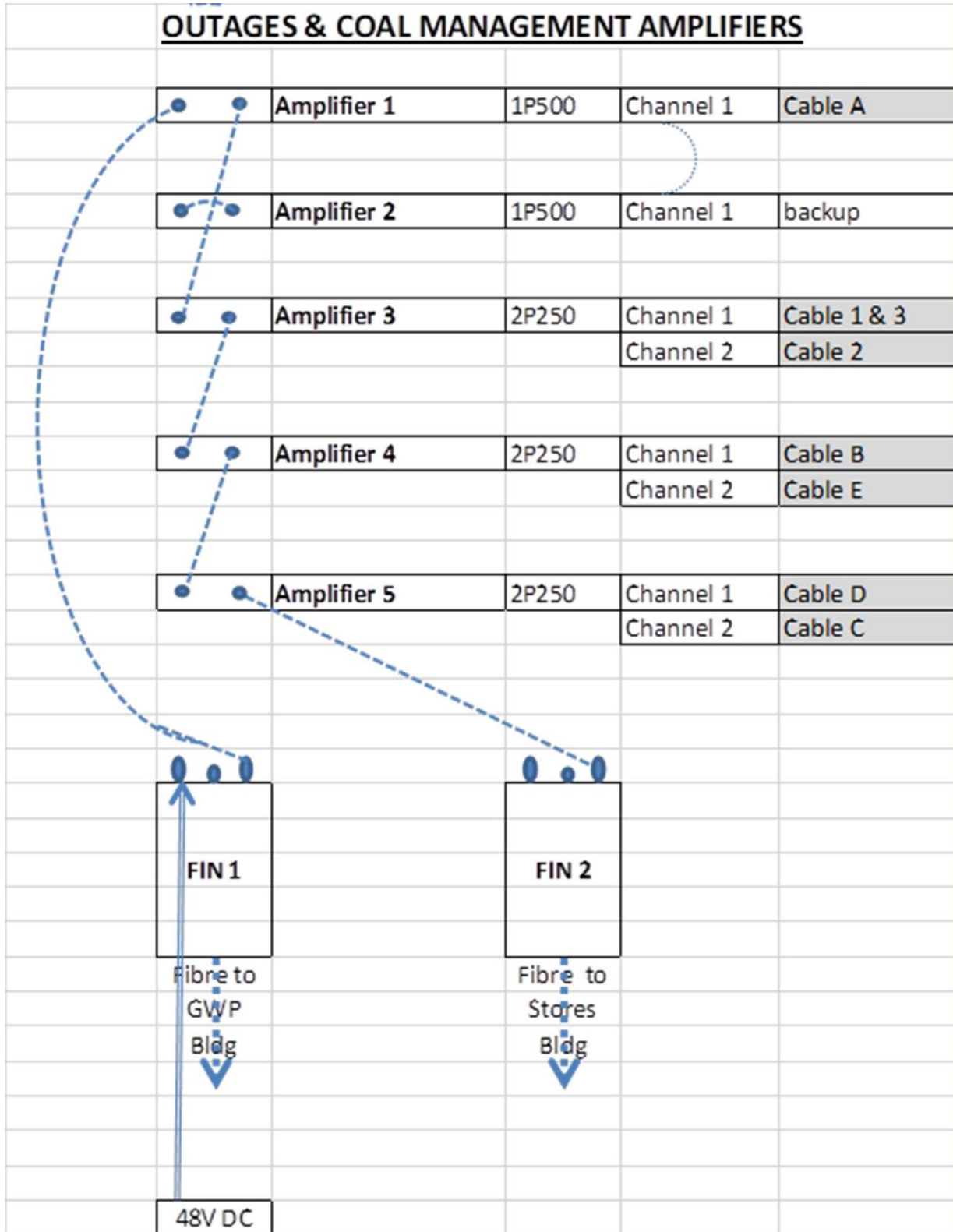
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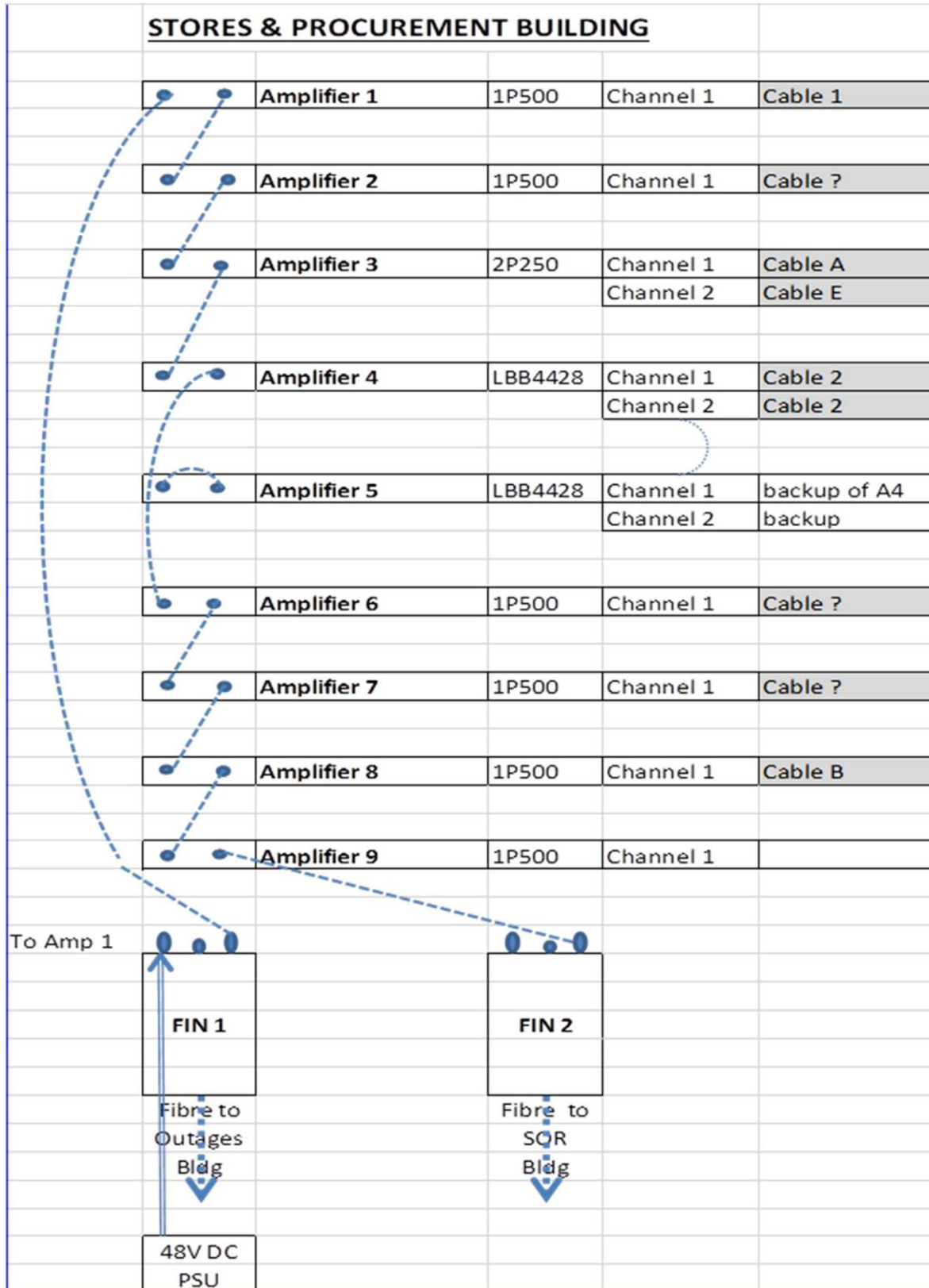
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2.8.1 Battery Limits

The *Contractor's* battery limit will include:

- i. Study the current architecture of the existing PA System,
- ii. Check the areas where new PA System is required,
- iii. Design the new system to ensure there is enough coverage and audibility,
- iv. Determine if the new PA system interfaceable with the current PA system,
- v. Supply of backup power supply in case of loss of mains power,
- vi. Providing field installation and configuration of the upgraded system that will include cabling, PA installation and commissioning to ensure the whole system operates as a whole.

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3. WORK TO BE PERFORMED AND EQUIPMENT AND PLANT TO BE PROVIDED BY THE CONTRACTOR FOR THE WORKS

- (1) The Contractor shall provide the whole of the Works as defined in section 3 of this document except where explicitly stated as otherwise.

3.1 EMPLOYER'S OBJECTIVES AND PURPOSE OF THE WORKS

- i. The purpose of the project is to provide the annunciation to areas where there was none before.
- ii. The objective of this project is to address the lack of annunciation by putting new amplifiers to ensure the entire plant is covered.

3.2 OVERALL SCOPE REQUIREMENTS FOR THE WORKS

- (1) The Contractor shall provide all equipment and services and execute all Works to fulfil all requirements specified in this Specification.
- (2) The Contractor shall supply, install and commission the amplifiers and speakers.
- (3) This shall include the engineering, design, procurement, manufacturing, factory acceptance testing, and delivery to site, off-loading at site, storage, installation, testing, commissioning, optimisation, and providing as-built documentation for the station's public address system. The areas where the new PA system is required to be installed is shown below:

- South Gate Security Building
- South Gate Storage Facilities (x3)
- South Gate Sulzer Workshop and Offices
- South Gate Contractor Site Area
- Plant Performance Offices
- White Double Storey Park Homes (Top and Bottom)
- Roshcon Ash Workshop
- Ash Booster Pump House
- Coal Staithes (x4)
- South Under-staithe Conveyors
- North Under-staithe Conveyors
- Roshcon Coal Office
- Coal Sampling Office
- Coal Plant Control Room next to conveyor 4A
- Roshcon Coal Workshop at the Coal Stockyard
- Tech and Ops workshops
- Car Wash area near South security gate
- Mill Workshop next to the Engineering Offices Building
- Compressor Plant and adjacent toilets
- Turbine Hall Basement 1-10
- Ten Turbine SPO Cabins
- Two Ash Plant Offices (Basement)

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- Toilets, Basement
- Toilets, 40 feet level, boiler side
- Oil Burner Workshop
- Workshop between Toilets 2 and 3
- Outside plant offices in front of Boiler 5
- Station Cleaners Change Room
- Tea Room building, MMD
- Unit 6-10 SPO Shell House
- Station Coal Bunker Landing
- Units 6-10 Control Room Offices
- Shift Supervisor Ash Plant Office (North)
- PO Outside Plant Cabins (North and South)
- Fuel Oil Pump Houses (North and South)
- Park Home Behind Medical Centre
- ERI Offices next to the Canteen
- South Helipad
- North Cooling towers Assembly point

The above speakers shall be fed from some of the amplifiers that will be contained in areas where the amplifier racks are in the 5 buildings mentioned below:

- o The GW Park building
- o Probuy building
- o Switch Operating Building
- o Outages building
- o Procurement building

- (4) The Contractor shall implement the controls design with the intent of safely and complete integrability of the entire PA system
- (5) The PA system shall be configured such that it responds to failures in a way that it suits the application.

3.2.1 Contractor's Design in Detail Engineering

- (1) It is the Contractor's responsibility to verify the plant system and the documentation provided by the Employer before using it.
- (2) Detail engineering is defined as being all activities to clearly identify the Contractor's scope of works for the upgrade of the plants Control logic and Protection System concerned.
- (3) As a minimum, detail engineering consists of the following activities:

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- i. High Level Engineering Philosophies & Concepts – during which the rules, philosophies and concepts followed in the various engineering and design activities, are clearly defined, clarified and accepted.
 - ii. Plant investigation work – during which the *Contractor* conducts his plant investigation work.
- (4) All detail Engineering activities are executed by the Contractor in active co-operation with the Project Manager.
 - (5) The detail Engineering activities are phased to suit the Accepted Programme.
 - (6) All equipment having long delivery times are planned and technically clarified early in the Detail engineering technical clarification stage to allow early detailed engineering to commence in parallel.
 - (7) Any discrepancies found in the design after detail design freeze is the responsibility of the Contractor to correct.

3.2.1.1 High Level Engineering Philosophies & Concepts

- (1) During the concept design activity, the Contractor develops and clarifies the documents defined in as being required for the Design of the PA system Installation Phase 2
- (2) Detailed engineering of the interfaces within the works and the interfaces to other systems, forms part of the works.

3.2.1.2 Plant Investigation Work

- (1) The *Contractor's* scope of the plant investigation work includes, but is not limited to:
 - i. Verification of the location and suitability of connection points.
 - ii. Verification of the location and suitability of all field equipment
- (2) During the plant investigation work, the *Contractor* takes responsibility for collecting all necessary data and information to enable the *Contractor's* design to be completed.

3.3 SCOPE DEFINING DOCUMENTS FOR THE WORKS

- (1) As a minimum, during the scope definition activities, the documents from Vendors that are required for basic engineering design freeze are developed and clarified by the *Contractor* to be approved by the *Project manager*.

3.4 PUBLIC ADDRESS SYSTEM

- (1) The PA Extension of the PA system will supply the areas mentioned in section 3.2.3 above. The proposed estimated distances, trenching requirements, conduit requirements, and the estimated number of speakers on each area is shown on the tables below.

The table below assumes that the Bosch range of equipment will be utilised as shown below:

- Horn1 speaker :- LBC 3482/00
- Horn2 speaker:- LBC 3428/00
- Cabinet speaker :- LBC 3018/01
- Amplifier: – PRS-1P500

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3.4.1 FED FROM SOR AMPLIFIER CUBICLES

3.4.1.1 South Gate

From	To	Distance (m)	Trenching (m)	Conduit	Speakers @ destination	Mounting Poles
SOR Amplifier A	2 Parkhomes	362	-	362	4 Cabinet 2 horn1	-
2 Parkhomes	Howden Workshops	238	50	238	4 horn1	2
Howden Workshops	South Gate	100	100	-	2 horn1	2

3.4.1.2 Units 1-5 Basement

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Amplifier B	Basement Midway	40	-	40	-	-
Basement Midway	Unit 1	260	-	260	1 Cabinet (toilet) 10 horn2	-
Unit 3&4 North transformer wall	North Ash Pump Cabin	80	-	80	1 Cabinet 1 horn2	-
North transformer wall	Condenser SPO Cabins (5 off)	45 x 5 = 225m	-	45 x 5 = 225m	(1 cabinet & 1 horn2) x 5	-

3.4.1.3 Unit 6-10 Basement

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Amplifier C	Basement Midway	40	-	40	-	-
Basement Midway	Unit 10	260	-	260	1 Cabinet (toilet) 10 horn2	-

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Unit 7&8 South transformer wall	South Ash Pump Cabin	80	80	80	1 Cabinet 1 horn2	-
South transformer wall	Condenser SPO Cabins (5 off)	45 x 5 = 225m	-	45 x 5 = 225m	(1 cabinet & 1 horn2) x 5	-

3.4.1.4 Unit 1-5 Coal Bunkers, North Incline & Turbine Floor Toilets 1-5

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Amplifier D	Coal bunkers Midway	150	-	150	-	-
Coal bunkers Midway	Unit 1	200	-	200	10 horn2	-
Turbine Floor Midway (Next to U6)	U1-5 Turbine Floor Toilets	275	-	275	6 horn2	BT6, BT3, BT2, OilBrn, Babcock
Turbine Floor Midway (Next to U6)	Shift Supervisor CW Plant Offices	100	-	100	5 Cabinets	-
South wall middle	Bottom North Incline conveyors	230	-	230	5 horn2	(Incl FO Pmphse)

3.4.1.5 Unit 6-10 Coal Bunkers, South Inclines & Turbine Floor Toilets 6-10

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Amplifier E	Coal bunker Midway	150	-	150	-	-
Coal bunker Midway	Unit 10 bunker	200	-	200	10 horn2	-
Turbine Floor Midway	Station Cleaner (Next to U6)	80	-	80	3 horn2	-

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Station Cleaner (Next to U6)	U6-10 Turbine Floor Toilets	80	-	80	2 horn2	BT8, BT12
South wall middle	Bottom South Incline conveyors	230	-	230	5 horn2	(incl FO Pmphse)

3.4.2 FED FROM STORES AMPLIFIER CUBICLES

3.4.2.1 South Contractor's Yard

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles/comment
Amplifier (Existing)	Stores Building Exit	100		100		-
Building Exit	Njabula Hall	150	100	50		-
Njabula Hall	Sandblasting Building	60	60		2 Horn1	(South Helipad)
Njabula Hall	Contractor's site	300 +100	300+100		12 Horn1	-

3.4.2.2 Compressors

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Stores Building Amp (existing)	Compressors & Toilets	60	30	30	3 Horn1	-

3.4.3 FED FROM OUTAGES AMPLIFIER CUBICLES

3.4.3.1 Coal Under-Staithes 1, 2, 3 & 4 & Rotek Ash Workshop

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles/comments
Amplifier AA	Building exit	25	-	-	-	-

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Building exit	Pipe trench	16	16	-	-	-
Pipe trench	Incline	30	30	-	-	-
Incline	Under staithe entrance	83+4		83+4	-	-
Under staithe entrance	Staithe 1 & 3	100		100	4 horn2	-
Under staithe entrance	Staithe 2 & 4	160		160	5 horn2	Incl Toilets
Staithe 3	Rotek Ash Workshop	200	100	-	4 horn2	-

3.4.3.2. Coal Over-Staithe & Coal Workshops

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Amplifier BB	Building exit	25	-	-	-	-
Building exit	Pipe trench	16	16	-	-	-
Pipe trench	Incline	30	30	-	-	-
Incline	Under staithe entrance			83+4	-	-
Under staithe entrance	Staithe 2 & 4	80+100		180	4 horn2	-
Under staithe entrance	Staithe 1 & 3	80+150		230	4 horn2	-
Staithe 3 (eo3)	Rotek – Coal Workshop	200	100	100	4 horn1	-
Roshcon Workshops	Coal truck gate	300	300	-	2 horn1	1

3.4.4. FED FROM Gigawatt Park AMPLIFIER CUBICLES

From	To	Distance (m)	Trenching (m)	Conduit	Speakers @ destination	Mounting Poles
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Building exit West (existing)	Car Wash	110	110	-	2 horn1	1
Building exit North	Tech & Ops	310	310	-	4 horn1	-

3.4.5 FED FROM PROBUY AMPLIFIER CUBICLES

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Engineering Offices Bldg (existing)	Mill Maintenance Workshop	20	3	10	2 horn1	-

3.4.6 FED FROM OUTAGES AMPLIFIER CUBICLES

From	To	Distance (m)	Trenching (m)	Conduit	Speakers @ destination	Mounting Poles
Canteen (existing)	ERI offices	50	50	-	2 horn1	1

Welding & Fabrication W/S (existing)	MMD Tea room	20	20	-	1 cabinet 1 horn1	-
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4. FED FROM GWP AMPLIFIER CUBICLES

From	To	Distance (m)	Trenching (m)	Conduit (m)	Speakers @ destination	Mounting Poles
Safety Island Building (existing)	North Assembly Point	110	83	11	4 horn1	-

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4.1.1 Bill of Quantities

The summary of the Bill of materials as mentioned above has been summarised as shown below:

	Item	Specification	Quantity
1	Poles (number)	3m high x 25mm OD hollow, Stainless Steel Pipe	4
2	Amplifiers (number)	Bosch, PRS 1P500	7
3	Horn1 speakers (number)	Bosch, LBC 3482/00	36
4	Horn2 speakers (number)	Bosch, LBC 3428/01	104
5	Cabinet speakers (number)	Bosch, 3018/01	19
6	Speaker Cable (m)	FR120, 1.5mm ²	6 681
7	Conduit (m)	Galvanised Steel conduit, 20mm diameter	4 764
8	Amplifier cubicle (number)	As in section 3.2.4 (ii)	1
9	Trenching (m)	500mm deep trench	1 935
10	Piping (m)	Black Poly-ethylene, 20mm, (outer 24mm, inner 21mm)	1 935

4.1.2 Public Address System Specification

i. Power Supplies

The following amplifier cubicles do not have amplifier back-up power supplies.

- Probuy
- SOR
- Boiler Eng
- Stores
- GWP

Hence, the Contractor must supply and install the UPS and standby batteries to meet the following criteria:

- (a) The amplifier cubicles shall be equipped with a UPS to supply power to the cubicle amplifiers to cater for a standby period of 24 hours and for a continuous broadcast of 30 minutes at full power.
- (b) The UPS type shall be rack mounted and preferably be made by Tescom.
- (c) An additional battery bank, preferably by Tescom to be connected to the UPS to ensure that the standby time is archived as mentioned in (a) above.

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- (d) The minimum life-span of the batteries shall be 5-10 years.
- (e) The system must be capable of keeping the standby batteries in an optimal condition.

ii. Cabling

- (a) All fire-rated speaker equipment must comply with EN54-54 specifications.
- (b) Speakers should have ceramic terminal blocks, thermal fuses, and metal fire-dome where applicable.
- (c) Speaker cabling shall be a minimum PH120 class as per EN50200/SANS10139.
- (d) Cabling may be of the indoor and outdoor use application and must have a minimum cross-sectional core of 1.5mm.

iii. General Cabling Requirements

As a minimum, both indoor and outdoor, PH120 speaker cables shall be used.

- a) All cabling is required to be protected against mechanical damage, chemicals, dust build-up and heat as per Eskom Standard Document: 240-56227443 Requirements for Control and Power Cables for Power Stations Standard. This cable standard will also apply to Eskom Facilities other than Power Stations.
- b) Cables are required to only be terminated in instruments, junction boxes or other approved equipment.
- c) No intermediate cable joints are permitted.
- d) For the coal staithes and coal bunker areas, there will be suspended coal dust in environment. Proper sealing of speakers and junction boxes (must be IP65) shall be observed as not to cause fires from the exposed circuits.
- e) Cables are required to be routed separately from electrical power cables and crossovers that bring signal and power cables into close proximity shall be made at right angles.
- f) Where possible, existing cable racking and routes shall be re-used else new racking and conduits are provided for by the *Contractor*.
- g) On Eskom premises where specific cable numbering conventions are in force, the *Contractor* follows these conventions otherwise the *Contractor* proposes a coding system/structure for the approval of the *Employer*

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4.2 PERFORMING THE WORKS

In performing the works the *Contractor* performs the following:

- Assesses the condition of the existing system, consults with the *Employer* regarding the faults and performs repairs as agreed upon with the *Employer*.
- Assesses the degree of conformance of the existing PA system to the Eskom Public Address System standard 240-64720986. All deviations are listed and an action plan for correction is drawn up. The *Contractor* then consults with the *Employer* regarding the critical deviations to correct and implements the modified plan.
- Acoustical analysis of the areas where the extension system will be installed. A national or international standard, approved by the *Employer*, shall be followed for this activity. The *Contractor* submits proposals for the acoustical analysis standard to the *Employer* for acceptance.
- Determination of the speaker specifications, layout (installation point of each speaker) and densities for the extension system. This activity is informed by the result of the acoustical analysis and aims at guaranteeing the intelligibility of voice messages at all points of the extension system over the normal range of environmental conditions experienced in these areas. The limits for speech intelligibility are stated as part of the design output.
- Proposal of installation points for PA system plant or materials (i.e racks, amplifiers, network equipment etc). *Employer* approves the installation points of this equipment. This does not include the installation points of the speakers.
- Cable selections and route determination. The speaker cabling used in the existing system is preferred for use in the extension system but where the *Contractor* can prove value in using cabling of a different specification, the *Employer* reviews and approves the new specification. The *Contractor* thoroughly familiarises themselves with each installation area prior to devising the cable routes.
- Design of the system extension system to comply with the Eskom PA system standard. Concessions can be discussed with the *Employer* where compliance is not achieved. The *Employer* decides whether concessions are to be approved or not.
- Selection or design of all equipment as per *Employer's* specification, where applicable. This equipment includes junction boxes, equipment racks & cables. The *Contractor* procures and supplies this equipment for the purpose of the project.
- The acquisition, delivery and installation of all equipment and materials.
- All trenching, digging, cable laying, cable installation, cable joining, cable joint markings.
- All civil work required to complete the works.

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- All mechanical work required to complete the works.
- All electrical work required to complete the works. All electrical work is tested and COCs are issued before handover.
- All Praesideo system programming, engineering and administration during the course of the project.
- Provide software licensing and firmware update schedule for all the components. This makes it possible for the *Employer* to plan for system maintenance.
- Provision of design and as built drawings.
- Update relevant *Employer* drawings

4.3 ELECTRICAL ENGINEERING

- (1) The power supplies for the public address system shall be the current 220V AC supplies. If, for the PA extension more power is required, the contractor to specify.

4.4 HUMAN FACTORS ENGINEERING REQUIREMENTS

The current microphone annunciating system will be used. One will be at the SOR and the other at the GWPark building.

4.5 DOCUMENTATION

4.5.1 Procedure for submission and acceptance of *Contractor's* design

- (1) The basis for the completion of all engineering activities is documentation as defined in:
 - i. Works Information.
- (2) Technical clarification is where the *Contractor* clarifies with the *Project Manager* all the technical issues.
- (3) The *Contractor* is responsible for maintaining the minutes of the meetings, a deviation schedule and list of open points (LOP) for all engineering activities and records of changes to scope during the engineering phases.
- (4) Immediately after the technical clarification meetings, the *Contractor* provides two soft copies of the updated documentation .
- (5) The *Project Manager* reviews the updated performance, functional, and equipment specifying documentation.
- (6) The *Contractor* prepares the formal documentation for the engineering design freeze.

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When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

4.5.2 As-built drawings, operating manuals and maintenance schedules

4.5.2.1 General Requirements

- (1) The documentation requirements cover the various stages of the works, from the engineering stages; through installation and commissioning; and operating, maintenance and training stages of the project.
- (2) All technical documentation is numbered and classified as specified in the C&I Documentation Requirements from Vendors.
- (3) All documentation is accessible in paper form and addressable in databases.
- (4) All documentation is in English

4.5.2.2 As-Built Documentation Package

- (1) The documents are reviewed by the Project Manager for correctness and conformance to the accepted design.
- (2) The OEM signs off on the completeness of the As Built documentation package

4.5.2.3 Documentation Modification

- (1) The Contractor provides additional and amended pages, sufficient for all copies of manuals or document sets to ensure that they are complete, inclusive of detail such as final settings and modifications.
- (2) The Contractor updates the soft copies of all documentation on the engineering system to ensure that they are complete, inclusive of detail such as final settings and modifications
- (3) Amendment information is forwarded to the Project Manager, within the period for reply, following receipt of agreement to equipment or system design modifications

4.5.2.4 Vendor Document Submittal Schedule

- (1) All documentation submitted by the Contractor conforms to all the requirements of the technical documentation index and are in an adequate state of completeness

4.5.2.5 Operating, Maintenance and Training Manuals

- (1) The Operating, Maintenance and Training manuals provided as part of the *works* complies with the requirements of the following standards :
 - i. IEC 62079.
 - ii. VGB R171 e.
- (2) The standard (IEC 62079) prescribes the type of information that is supplied by originators of user information, catalogues and schedules and other product support documentation required by the Employer. It also prescribes the quality of documentation that is provided by the Contractor.
- (3) The manuals are produced based on the agreed manual synopsis which forms part of the technical documentation index.
- (4) The manual synopsis is a separate document from the documentation synopsis & hierarchy.
- (5) All manuals provided are in English.
- (6) The quantity of manuals provided per unit shall be as follows:

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Manuals	Hardcopy	Soft Copy
Manual Synopsis	1	1
First Draft	1	1
Final Draft/Pre Print Proof	1	1
Final Manual	3	1

- (7) The manuals are submitted to the Project manager in the electronic format.
- (8) A training skills profile report details the required skill profile needed by operating/maintenance staff in order to adequately/safely operate/maintain Public address System is be provided.

4.5.2.6 Functional Specifications and Functional Design Philosophies

- (1) The *Contractor* produces Functional Specifications and Functional Design Philosophies for the aspects/sub-systems of the PA system from Vendors.
- (2) A Functional Specification or Functional Design Philosophy is a written narrative that describes the design and specific configuration of the concerned system(s). The functional specification(s) is created during the basic engineering phase and is updated as necessary during the project implementation.
- (3) The functional specification or functional design philosophy fulfils the following objectives:
 - i. Define how the contractual requirements related to the system are met.
 - ii. Clearly define the specific system configuration provided.
 - iii. Clearly describe the design principles followed and design choices made.
 - iv. Clearly define the system limitations.
 - v. Provide basic technical information on the system’s various software and hardware components.
 - vi. Provide references and links to detailed technical information of each system components.
 - vii. Define the characteristics of the system under normal conditions.
- (4) The principles defined in the functional specification and design philosophy documents are applied throughout the execution of the works.
- (5) The functional specifications are aligned with the OEM internal specifications, best practices and guidelines.

4.5.2.7 Scope, Interface and Construction Definition Documents

- (1) The *Contractor* produces and supplies the scope, interface and construction definition documents.
- (2) The *Contractor* consolidates all of the relevant process input information for scope, interface and construction definition documents and incorporates the *Contractor’s* own design information where applicable in a consistent manner.
- (3) It is expected that the scope, interface and construction documents are updated and refined throughout the execution of the works.

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4.5.2.8 Operating and Maintenance Manuals

- (1) The *Contractor* provides 5 hard copies and 5 electronic cd copies of operating and maintenance manuals prepared by suitably experienced personnel indicating all the maintenance and operational requirements.
- (2) Manuals contain, as a minimum, the following:
 - i. Design data including descriptions of control philosophy with alarms, set-points, interlocks and logics clearly explained
 - ii. Process and instrumentation diagrams
 - iii. Range, calibration factors, calibration certificates, data sheets, etc. for the public address equipment
 - iv. General arrangement and installation drawings and instructions
 - v. Operating procedures and instructions for normal and emergency conditions
 - vi. Commissioning and maintenance procedures and instructions for specific plant and equipment
 - vii. All drawings required for component location, dismantling and re-assembly for maintenance
 - viii. Equipment details such as make, model, type, specifications, etc.
 - ix. Detailed parts lists and ordering instructions pertaining to storage of spare parts or to their shelf life
 - x. Exploded view type drawings clearly detailing the part and uniquely identifying it, technical descriptions of the equipment and component parts
 - xi. Catalogues, schedules and other product support documents
 - xii. Troubleshooting and fault finding guide
 - xiii. Safety procedures and instructions
 - xiv. All special tools and equipment required for maintaining and operating the works
- (3) The maintenance instruction manuals are required to give a full technical description of the equipment concerned and to cover all aspects of erection, commissioning, operation and maintenance.

4.5.3 Packaging, Handling and Transporting Requirements

4.5.3.1 Packaging

- i. All the identified equipment that will be re-used must be packaged such that it can be easily transported without being damaged.
- ii. The equipment that needs to be packaged is clearly marked by the *Contractor* before decommissioning starts.
- iii. The packaging material and specifications are supplied by the *Employer*.
- iv. Equipment not marked for re-use is removed and transported to the dedicated disposal areas.

4.5.3.2 Storing of equipment

- i. Dedicated equipment storage areas are provided by the *Employer* either as temporary or permanent storage areas.
- ii. The temporary storage area is an area where the equipment may be gathered and packaged before it is transported to the permanent storage area.
- iii. All storage areas are located within the boundaries of Hendrina Power Station.

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- iv. The *Contractor* maintains a detailed inventory of all equipment that has been removed from the plant and stored in the temporary or permanent storage areas.
- v. For the duration of the *works*, the *Contractor* updates the inventory as and when equipment is removed or added to the storage areas.

4.5.3.3 Transporting

- i. The *Contractor* is required to transport all the equipment to the temporary storage or to the disposal area.
- ii. The *Contractor* is also required upon completion of packaging to transport the equipment to the permanent storage area.

4.6 SYSTEM FUNCTION AND PERFORMANCE REQUIREMENTS

4.6.1 Functional Specifications and Functional Design Philosophies

- (1) The *Contractor* produces Functional Specifications and Functional Design Philosophies for the aspects/sub-systems of the Public Address System
- (2) The functional specification or functional design philosophy fulfils the following objectives:
 - i. Define how the contractual requirements related to the system are met.
 - ii. Clearly define the specific system configuration provided.
 - iii. Clearly describe the design principles followed and design choices made.
 - iv. Clearly define the system limitations.
 - v. Provide basic technical information on the system's various software and hardware components.
 - vi. Provide references and links to detailed technical information of each system components.
 - vii. Define the characteristics of the system under normal conditions.

4.6.2 Cabling Functional Specification

- (1) The Contractor shall provide new field cabling from the Public Address amplifiers to the field equipment (speakers)
- (2) The Contractor shall provide the cabling functional specification document that describes the following as a minimum:
 - i. Methodology followed for cabling designs.
 - ii. Installation of cabling within cabinets.
 - iii. Installation of cabling on racking.
 - iv. Use of redundant process and network cable routes.
 - v. Copper and fibre cable specifications.
 - vi. Testing of cabling.

4.6.3 Field Equipment Functional Specification

- (1) The *Contractor* shall provide the field equipment functional specification describes the following points as a minimum:
 - i. General description of equipment, materials and installation requirements or standards for all field equipment including:

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- Speakers
- Speaker stands
- Cable piping supports
- Material specification
- Junction boxes
- Fire Cables
- Cable glands
- Cable supports
- Terminal blocks
- Field equipment labels

4.7 SYSTEM EXTERNAL INTERFACE REQUIREMENTS

4.7.1 Installation of the new Technology

If the PA system extension is done using a different Amplifier manufacturer other than Bosch, the following must be noted:

- A different amplifier (non-Bosch) must be interfaceable to the existing Bosch amplifier system. That means that all the messages from the Bosch system must be relay-able the other system.
- All requirements (power supplies, etc) must be specified of the new Amplifier manufacturer
- Specify all specifications that the new amplifier comply to,
- All other relevant information about a different amplifier must be submitted with the tender like how old is it in the market, how many installations are currently using it, serviceability, etc
- The Contractor to submit the methodology showing how this different amplifier will be interfaced and indicate on how the new zones will be addressed.

4.8 EXTERNAL ENVIRONMENTAL REQUIREMENTS

The *Employer's* standard 240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard should be referenced.

- i. The *Contractor* ensures that all equipment used in the designs/ solution offered conforms to all applicable environmental legislation.
- ii. The *Contractor* adheres to Hendrina Power Station Environmental Management System that must meet the requirements for the Code of Practice for EMS, ISO 14001:2004.
- iii. The EMS requirements are detailed in the latest revision of the following documents, which are available from the *Project Manager* on request, and include:
 - a. The Hendrina Power Station Environmental Policy (HSPPIN005).
 - b. The Hendrina Power Station Identify & Update Environmental Aspects Procedure (HSPPIN024).
 - c. The Objectives & Targets Procedure (HSPPIN026].
 - d. The Environmental Emergency Preparedness Procedure (HSPPIN032).
 - e. The Training, Awareness & Competence Procedure (HSPPIN029).
 - f. The Prevention & Cleaning of Oil Spills Procedure (HSPPON003).
 - g. The Waste Management Procedure (HSPPIN003).
 - h. The Roles and Responsibilities Procedure (HSPPIN028).
 - i. The EMS Non-Conformance, Corrective and Preventative Action (HSPPIN034)

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- j. The relevant Environmental Management Programmes (EMP's) and Aspects on the EMS database - this is continually changing and is available from the Employers Representative.
- k. Compliance to all relevant environmental legislation, as detailed in the latest version of the Hendrina Power Station Legal Register available from the Employers Representative.
- l. All operational procedures that include environmental requirements, relevant to the Works Information or Scope of this contract.
- iv. The *Contractor* is responsible to comply with any new environmental requirements, relevant to the Works Information or Scope that may come into effect as part of Hendrina Power Station's EMS during the duration of this contract.
- v. The *Contractor* is responsible to ensure representation at Environmental meetings that may require input for the updating of the EMS as well as training on an ad-hoc basis.
- vi. If there is uncertainty around any environmental issues, the Environmental Department at Hendrina Power Station may be contacted on (013) 296 3011 or (013) 296 3910 or (013) 296 3013

4.9 SAFETY

- i. The *Contractor* shall comply with the latest revision of Eskom Hendrina Power Station's Health, Safety and Environmental Specifications for Principal *Contractor's* requirements as mentioned in HSPHO 058 "*Safety, health and environmental specifications for principal contractors*".
- ii. The *Contractor* shall comply with any other SHE requirements not stated in HSPHO 058, but required by the *Employer*.

4.9.1 General

- i. The *Contractor* complies with the Occupational Health and Safety Act no 85 of 1993 and its regulations, Eskom SHE Policy, Standards, Procedures, Guidelines, Specifications and Regulations.
- ii. The *Contractor* ensures safety awareness at all time through continuous training
- iii. The *Contractor* is at all times responsible for the supervision of his employees, agents and Sub-Contractors and takes full responsibility and accountability for ensuring that they are competent, compliant and aware of the legal requirements and other requirements and execute the *works* accordingly.
- iv. The *Contractor* ensures that all statutory appointments and appointments required by any Eskom Regulations are made in writing and that all appointees fully understand their responsibilities and are trained and competent to execute their duties.
- v. The *Employer*, or any person appointed by the *Employer*, may, at any stage during the term of the contract:
 - a. Conduct health and safety audits by a competent person regarding all aspects of compliance with the SHEQ Requirements, at any off-site place of work, or the site establishment of the *Contractor*
 - b. Refuse any employee, Sub-Contractor or agent of the *Contractor* access to the premises if such a person has been found to commit an unsafe act or any unsafe working practice or is found not to be competent or authorised
 - c. Issue the *Contractor* with a stop order, should the *Employer* become aware of any unsafe working procedure or condition or any non-compliance.
- vi. The *Contractor* immediately reports any incidents, disabling injury, near miss, first aid incident as well as any threat to health and safety of which it becomes aware at the *works* or on the Site to the Project Manager.
- vii. The *Contractor* agrees that the *Employer* is relieved of any and all of its responsibilities and liabilities in terms of the Occupational Health and Safety Act no 85 of 1993 in respect of any acts or omissions of the *Contractor*, and the *Contractor's* employees, agents or Sub-Contractors, to the extent permitted by the Occupational Health and Safety Act no 85 of 1993.
- viii. The *Contractor* ensures that all his personnel attend a Health and Safety Induction Course presented by ETD, Monday to Friday – 09:00 to 11:00, free of charge prior to commencement of

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any works. This is a two (2) hour course and is valid for the duration of one (1) year at Hendrina Power Station.

- ix. The *Contractor* works strictly to regularly updated risk assessment.
- x. The *Contractor* ensures supervised and authorised entry into the plant.
- xi. The *Contractor* barricades the entire perimeter of the site.
- xii. The *Contractor* ensures at all times compliance with the safety regulations imposed by any act of parliament, or any regulation or by law of any statutory authority.
- xiii. The *Contractor* complies with the Occupational Health and Safety Act and Regulations, 1993 and all regulations made there under as well as the Employer's safety and operating procedures.
- xiv. The *Contractor* acknowledges that he is fully aware of the requirements of all the above and undertakes to employ people who have received sufficient training that they can comply therewith. The *Contractor* undertakes not to do, or not to allow anything to be done which will contravene any provisions of the act, regulations or operating procedures.
- xv. All employees of the *Contractor* must attend a safety induction course before they are allowed to work on site.
- xvi. It is the responsibility of the *Contractor* to ensure that all employees have attended the safety induction.
- xvii. The *Contractor* holds a Toolbox Talk and inspects all PPE before any work commences and keep written proof of such actions.
- xviii. The *Contractor* complies with all of the applicable procedures as required by the *Employer*; Procedures are available from the *Employer's* Documentation Centre on request.
- xix. The *Contractor* familiarizes himself with all permit requirements for work to be done on all plant systems and ensures that permits are applied for accordingly.
- xx. The following risks are identified by the *Employer*, and the *Contractor* includes these in his risk assessment:
 - a. Injury caused by hand tools.
 - b. High noise level.
 - c. Falling when working at heights.
 - d. Welding which may result in burning.
 - e. Movement of stairs while walking.
 - f. Falling objects.
 - g. Dust
- xxi. Any tampering with the *Employer's* fire equipment is strictly forbidden.
- xxii. All work done by the *Contractor* shall comply with the latest revision of *Employer's* SHEQ requirement as stated in the Safety, Health and Environmental Specifications for Principal Contractors Ref. No.: HSPHO/058 and all other *Employer* safety requirements.
- xxiii. *Employer* compiles a baseline safety risk assessment to identify all the possible risks during the implementation of the project.
- xxiv. The risk assessment includes all the mitigating strategies in order to minimise all the possible risks.
- xxv. *Employer* provides the *Contractor* with the baseline risk assessment to use it as a minimum requirement to compile a risk assessment identifying all the risks before the implementation commences, the risk assessment compiled by the *Contractor* will clearly show all the mitigating strategies in order to minimise all the possible risks.
- xxvi. No work shall be carried out without the risk assessment identifying all the risks and the mitigating strategies in place in order to address the identified risks.

4.9.2 Safety of workers

- i. The *Contractor* ensures the safety of all persons working in the Site. Any hot work, including welding, will be applied for in accordance with the permit to work system. No welding will be allowed on site unless permission is granted in writing by the Project Manager.
- ii. All welding, flame cutting and grinding work is properly screened to protect persons from arc flash or eye injuries. Fire blankets are fitted over the scaffolding planks and platforms. Precautions are taken to prevent any objects, welding or grinding splatter from falling.

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4.9.3 Fire protection

- i. The *Contractor* ensures that adequate firefighting apparatus is provided at all his work sites, and that his employees are trained in the use of the apparatus.
- ii. The *Contractor* takes precautions to prevent any occurrence of fires or explosions while carrying out any work near flammable gas and liquid systems. Any tampering with the *Employer's* fire equipment is strictly forbidden.
- iii. All exit doors, fire escape routes, walkways, stairways, stair landings and access to electrical distribution boards must be kept free of obstruction and not be used for work or storage at any time. Firefighting equipment must remain accessible at all times.
- iv. In case of a fire, report the location and extent of the fire to the Electrical Operating Desk at 086 123 7566, 082 677 5295 or extension 5555 if phoning from an internal landline.
- v. Take action to safeguard the area to prevent injury and spreading of the fire.

4.9.4 First aid

- i. The *Contractor* provides a first aid service to his employees and Sub-Contractors. In the case where these prove to be inadequate, like in the event of a serious injury, the *Employer's* Medical Centre and facilities will be available.
- ii. Outside the *Employer's* office hours, the *Employer's* First Aid services are only available for serious injuries and life threatening situations.
- iii. The *Employer* recovers the costs incurred, in the use of the above *Employer's* facilities, from the *Contractor*.

4.9.5 Hazardous substances

- i. The *Contractor* manages hazardous substances in accordance with the requirements of the Occupational Health and Safety Act no 85 of 1993 and the NEMWA Act. The *Contractor* declares all hazardous chemical substances brought to Site.

4.9.6 Plant safety regulations

- i. The *Employer*, on request from the *Contractor*, isolates required plant from all sources of danger as described in the Plant Safety Regulations.
- ii. The Project Manager, on request, makes available a copy of the latest revision of the Plant Safety Regulations to the *Contractor*.
- iii. The *Contractor* complies with all rules and regulations applicable to plant safety and completes the Workman's Register prior to working on the plant.
- iv. The *Contractor* declares any grinding and welding to be carried out on the workers register.
- v. At every permit change, the *Contractor* withdraws himself/herself/his staff for that period of permit suspension/revocation and thereafter only proceeds with the *works* after signing onto the new permit.
- vi. The *Contractor* ensures that he/she/all Sub-Contractors/personnel/staff/his visitors are medically, physically and psychologically fit to enter Hendrina Power Station and especially any confined space.
- vii. The *Contractor* is prohibited from entering Restricted Areas.
- viii. The responsibility is on the *Contractor* to ensure that the correct confined/hazardous space requirements and tests have been met and done by the *Employer* prior to entry into any confined space or hazardous plant areas.
- ix. The *Contractor* ensures that all personnel are competent to carry out the *works*.

The *Contractor* provides proof of competency for technical and safety aspects and must be available as and when required on site.

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4.10 SYSTEM LIFE-EXPECTANCY

The Public Address Technology should be supported by the market for at least ten years.

4.11 SECURITY

Any new PA cubicle to be lockable to prevent unauthorised access.

4.12 OTHER REQUIREMENTS OF THE *CONTRACTOR'S* DESIGN

4.13 ADDITIONAL REQUIREMENTS AND PREQUISITES

4.13.1 APPLICABLE NATIONAL STANDARDS

The *Contractor* is required to adhere to the latest editions of, and the normative references and national standards.

4.13.2 Additional Requirements and Prerequisites

4.13.3 General

- (1) The *Contractor* is required to submit a comprehensive method statement of the works to the Project Manager for acceptance prior to the start of the works
- (2) The *Contractor* is responsible for the design, erection, maintenance and removal of all temporary bracing or propping required for the execution of the works.
- (3) The *Contractor* takes full professional accountability and liability for all temporary items required for the execution of the works.

4.14 PLANT CODING AND LABELLING

- (1) During the design review stage(s) and cross referenced to all arrangement drawings, schematics, wiring diagrams, instructions and manuals and where practical to spare parts list/ ability of Contractor to manufacture and install KKS coded equipment's labels in the plant. Labels are manufactured and installed according to Plant Labelling Standard (240-71432150). Contractor will label all KKS coded equipment. The Coding Technician shall facilitate base-lining of all provider as a reference for the creation of equipment lists.
- (2) Labelling of components inside electrical and C&I panels shall be done by the Contractor.

4.14.1 Plant Identification Labelling

- (1) The *Contractor* supplies and installs codification as per the *Employer's* procedure, KKS CODING AND LABELLING, in accordance with Hendrina Power Station Labelling Specification and Plant Coding Procedure.
- (2) The *Contractor* requests numbering from the *Employer*.
- (3) The *Contractor* updates the *Employer's* P&ID's accordingly.

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5. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
	C&I Engineering Manager
	Acting Engineering Group Manager

6. REVISIONS

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March 2024	0		First version

7. DEVELOPMENT TEAM

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

8. ACKNOWLEDGEMENTS

N/A

9. APPENDICES

N/A

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