Eskom	Proposed Scope of Work for Weskusfleur 400/132kV Gas Insulated Substation	Technology

Title:	**Weskusfleur 400/132kV Gas Insulated Substation – Proposed Scope of Work**	Unique Identifier:	**WKoe11P01-SE-D89**
		Alternative Reference Number:	**N/A**
		Area of Applicability:	**Engineering**
		Documentation Type:	**Proposed Scope of Work**
		Revision:	**2**
		Total Pages:	**31**
		Next Review Date:	**N/A**
		Disclosure Classification:	**CONTROLLED DISCLOSURE**

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1. INTRODUCTION

The existing Koeberg 400kV GIS equipment together with associated AIS equipment has been in operation for almost 40 years and the substation is now due for major refurbishment to improve the reliability of the system.

The high-level scope of work for this project is to perform preliminary design, detailed design, for a new GIS building and equipping it with a 400/132kV GIS Breaker and Half busbar system. This will include conducting preliminary investigations such as geotechnical studies and procurement of all equipment in compliance to Eskom standards.

The Contractor will construct the GIS building including installation, testing, commissioning, and handover of the new equipment and decommissioning of the old substation. The Contractor to provide 'insulating gas' storage facilities.

The Contractor to submit a detailed training program and provide training that will include the installation, maintenance, operation of all the equipment and provide any special tools that could be required for maintenance.

The Contractor shall be responsible for all maintenance and repair work during the guarantee period as specified in the General Conditions of Contract NEC family of contracts. The Contractor shall supply all maintenance personnel, tools, equipment, and material (including any insulating gas required) at his own expense necessary to complete any maintenance or repair work during the guarantee period.

The purpose of this document is to provide a narrative of the high-level scope of work. The scope of work has also been demarcated in the Key Plan/Plot plan (WKoe11P01S-SE-D7 sheets 1 and 2) as well as the Station Electric Diagram (WKoe11P01S-SE-D6). Some of the work such as a preliminary scan of the area as well as the preliminary Geotech was conducted by Eskom and the results/reports are provided for information only. The tenderer / contractor should conduct a detailed study / Geotech investigation / survey and scanning to ensure that construction will be executed properly. Any investigation, exploratory study as well as surveys of the area indicated in the drawing (Key plan) are included in the scope of work. Any study required, which is essential for the completion and validation of the design must also form part of the scope. Any activity,

study as well as demolition, reconstruction, facilities/ services required to complete the commissioning and hand over must be considered as part of this scope.

Environmental, safety, communication protocols, geographical location, cultural information, heath, environmental information, accommodation, and seasonal information is beyond the scope of this document and has been provided elsewhere.

This document ultimately serves as the proposed Scope of Work that is required to be completed for the establishment of Weskusfleur 400/132kV Gas Insulated Station.

2. PROPOSED SCOPE OF WORK

All construction is to be carried out in accordance with Eskom's Safety, Health and Environmental Specification. The Scope of Work for this project basically divided into the areas of GIS and Civil work as well as temporary and permanent connection between existing Koeberg Power Station and proposed Weskusfleur Substation.

The proposed high-level scope is broken down as follows and not limited to:

- The construction of new 400/132kV substation building including earthworks.
- The design, manufacture, supply, and installation of a new 400kV and 132kV GIS system.
- The supply and installation of new 2 x 400/132/22kV 250 MVA Transformers
- The supply and installation of new 2 x 22kV/400V 315kVA Auxiliary Transformers
- The supply and installation of new 2 x 6.6kV/380V 315kVA Auxiliary Transformers
- The re-routing, design and installation of Generator Transformers in-feed 1 and 2 to the proposed new 400kV busbar.
- The supply and installation of protection schemes
- The design, manufacture, supply, and installation of a new 400 kV, 132 kV and 22kV cable systems
- The de-energization and isolation of the existing 400/132kV GIS substation.
- Stringing, earthing and erection for 8 x 400kV Feeder bays
- Stringing, earthing and erection for 5 x 132kV Feeder bays
- Commissioning and handover of the above.
- Provide a storage facility for the degassing of the 'insulating gas' for reuse.

The Contractor must follow the following ***battery limits***. Any additional items between the battery limits, required for the successful operation of the project deemed to be the responsibility of the Contractor and must be considered included in the Scope of Work.

- 400kV Gen Transformers 1 and 2: 400kV bushings.
- 400kV Feeder bays: 400kV GIS bushings plus the dropper from the closing span to the gantry.
- 400kV Interconnectors from existing Koeberg Substation (Feeder 1 and Feeder 2) to the new proposed GIS Weskesfleur Substation (Feeder 7 and Feeder 8): Link and both side terminations included.
- Main Auxiliary Transformers: fed at 6.6kV, connected to Koeberg Station Transformers 1 and 2 busbar (Breaker existing)
- 132kV Feeder bays: AIS gantries plus the dropper from the closing span to the gantry.
- 132kV Duinefontein feeder (132kV cable fed): Cable joint to the existing cable as indicated on the Keyplan, WKoe11P01S-SE-D7 Sheet 1.
- Refer to WKoe11P01-SE-D6.

Note 1: The above is a proposed Scope, a detailed scope to be compiled by the Contractor.
Note 2: All engineering outputs and associated intellectual property shall become the property of Eskom
Note 3: The list contained in this document may not be deemed complete. The contractor is encouraged to consult all the technical documents supplied in the tender pack and may request for additional documents for clarification if required.

2.1 PTM&C SCOPE

The PTM&C scope includes protection systems, tele-control, remote engineering / monitoring, measurements, metering, DC, telecommunications, and security solution for the proposed Weskusfleur Substation. Standard previously tested and Eskom approved solutions are to be utilised. Where specific schemes / solutions do not exist, development is required based on existing platforms. The deviation if required, from the existing platforms must be kept at minimum. The PTM&C Scope of Work includes but not limited to the followings (see PTM&C scope/specification 240-170000104). The list also includes the guidelines that may apply.

- Engineering, to be accepted by Eskom.
- sourcing of standard solutions
- where standard solutions do not exist, scheme design and manufacture, testing at works (FAT), in-situ testing (SAT), development of user documentation and training

- supply of all material,
- delivery, off-loading, erection, installation, cabling, application of configurations and settings, commissioning
- project systems and documentation handover
- provision of documentation, as-built drawings, configurations, protection settings
- anything else deemed necessary by the Contractor for the provision of a working solution
- all the above must be in Eskom standard format, to be reviewed and accepted by Eskom

2.1.1 Telecommunication Scope

The Telecommunications scope of work considered are as below, refer to the document PRJ11230.

The high-level scope for the design will be to provide communication infrastructure at Weskusfleur Substation, based on the SLA level and circuit requirements stipulated in the service application form (dated 2020.06.04). The design will focus on the following:

- Provision of legacy circuits on multiplexors (ABB's Fox 615), based on specification 240-70732272.
- Transport network (Huawei's OTN) over the OPGW, based on specification 240-150755516. Replicate the full design of the current Koeberg transport systems, to ensure seamless migration of OTN links from old control room to the Weskusfleur control room.
- Provision of IP/MPLS services (CISCO's CGR routers), based on specification 240-94136376, 240-170000419, 240-170000031, 240-170000032, 240-170000290.
- Provision of adequate DC standby required in line with TX substation requirements, based on specification 240-118870219.
- Design, procure and install fibre optic duct cables (Single Mode), and terminate the cables in patch panels (ODF – ODF) based on specifications 240-140642648, 240-70733995, 240-46263618.
    - Linking the two control rooms (existing Koeberg 400Kv and the Weskusfleur SS),
    - Linking Weskusfleur SS and Koeberg RS and
    - Linking Weskusfleur SS and Koeberg Admin building.
- Develop the cutover plans of the fibre optic links to the various stations (Aurora, Muldersvlei, Acacia, Ankerlig, Sterrekus) in synch with the sequencing plans to terminate OPGW into Weskusfleur SS.
- Prepare full detailed design for governance (BOQ compilation, scope of works, as-build documentation and related drawings, project execution plans, CAPEX planning and

presentations); Regional (Western Cape) TDRT workgroup presentation in preparation for TDRT and TDRT presentations for ERA.

- Procure, install and commission the telecommunications equipment.

2.2 GIS SCOPE

The scope of work for this project serves to construct a new 400kV and 132kV GIS Breaker and Half busbar system (WKoe11P01-SE-D6) which include:

- Establishment of a new 2 x 250MVA, 400/132/22kV substation to integrate 3000MW at 400kV,
- Construction of new 400kV and 132kV busbars with space capability of 2 x 250MVA, 400/132kV transformation, and one additional spare transformer for a future transformer,
- Re-routing, design and installation of the Generator Transformers in-feeds 1 & 2 to the proposed new 400kV busbar (diameter GC and diameter GD),
- Rerouting the outgoing 400kV feeders from the existing GIS busbar to the proposed new 400kV GIS busbar (line construction deviation scope not included),
- Re-routing the outgoing 132kV feeders from the existing GIS busbar to the proposed new 132kV GIS busbar (line construction deviation scope not included),
- The old and the new GIS will be connected for a certain length of time until all the feeders are transferred from the old GIS substation to the new GIS (proposed),
- The de-energization and isolation of the existing GIS both 400 and 132kV must be done. The auxiliaries of the existing GIS will remain operational (as they are).

2.2.1 Generator Transformer Room 1 (GT Room-1*) to Koeberg Gen-Transformer 1.

- From the gen-transformer to the GT Room-1, all GIS ducting including associated supports and auxiliaries (if any) to be replaced.
- The GT Room-1 switchgear to be replaced with new GIS switchgear Including all equipment associated with the GIL.
- The GIL from the GT room to the new GIS must cross the road. The contractor need to propose solutions of crossing (GIL or any other suitable solution will be considered), refer to WKoe11P01-SE-D6 and WKoe11P01-SE-D58.

2.2.2 GT Room-1 to the New GIS Substation

Note: *A combination of a GIL and 400kV Cable link is assumed as an initial solution for the link between GT rooms and the proposed GIS substation. Other optimal solutions must be proposed by the Contractor and will be evaluated.*

- Supply and installed 400kV cable system. The cable system shall include the following in accordance with 240-171000310:
  - 400 kV outdoor cable termination,
  - 400 kV XLPE cable,
  - 400 kV GIS cable termination, and
  - Bonding leads and ancillary equipment for earthing and bonding
  - DTS fibre duct, fibre cable, protection fibre duct & cable
- Install cable fixing arrangement at the suitable location
- Install the new GIL duct to and new cable termination. For information and options see drawings WKoe11P01-SE-D7 sheet 1 and sheet 2, and WKoe11P01-SE-D57 sheet 1 and sheet 2.
- From the cable termination to the new GIS, contractor to install 400kV underground cable. (Suitable method for the cable installation - underground or above ground).
- To find the optimum route, the contractor is required to survey/scan the route in order to mark existing services. The contractor may need to do manual removal of soil (cross trenching) to confirm existing underground services. The same may be necessary for the above-ground solution (above ground option should also be considered).
- If an above-ground option is considered, the maintenance means should be provided in such a way that the maintenance duration should be a minimum since Koeberg is a nuclear generating station and high availability is needed. The system (offered) should be designed as a low maintenance system, keeping in mind that maintenance duration must be minimum due to the nature of the continuity of supply.
- The underground cable will cross Koeberg Power Station fences along the route and may require tunnelling or similar while crossing the ACP2 fence.
- The termination of the 400kV cable is to be done at a suitable location (240-171000310**)**.
- The proposed cable to GIS/GIL termination of the 400kV cable is to be terminated at the upper floor or at another suitable position of the substation building (GIS building).
- The 400kV cable route might have multiple turns/bends (see drawing WKoe11P01-SE-D7 sheets 1 and 2). It should be noted that there might be space limitations; thus, the bending radius of the cable needs to be taken into consideration.
- No cable joints shall be allowed in the link from the 400kV GT house to the proposed 400kV new GIS building.
- The 400kV cable installation system must be designed and installed as per the specification 240-129143701 for the underground option.

- Strategic spares shall be offered for maintenance purposes in accordance with 240-171000310.
- Other design options shall be considered and presented to the client for review and acceptance.
- Protection, Telecom, Metering and Controls (PTM&C) system to be provided (see PTM&C scope/specification 240-170000104).
- Above ground option must comply with the national key point and Koeberg requirements to avoid compromising the security of Koeberg Power Station.
- Cable supplier to propose other optimal cable protection techniques for the acceptance of the client.
- The options to be used to protect the cable, to be designed and installed by the contractor shall also be presented to the client for review and acceptance (240-170000104; High Level Scope of work PTM&C Equipment for Weskusfleur Substation)

2.2.3 GT Room-1 Options

- Contractor to confirm if existing GT Room-1 can be reused or and new GT Room-1 is to be constructed.
- Construction of the New GT Room-1 as an option is based on the assessment and acceptance of the client.
- Detailed report for both options to be submitted to the client for review and acceptance.
- If a new GT room has to be constructed, the connection and the commissioning of the GT room must be done during the generator outage. Follow Koeberg's outage plan, no additional outage will be provided.

2.2.4 Generator Transformer Room-2 (GT Room-2) to Gen-Transformer 2.

- From the Gen-Transformer-2 to the GT Room-2, all ducting including associated supports must be replaced.
- All equipment including switchgear and related equipment in the GT Room-2 must be replaced with the new GIS switchgear and related equipment.
- The link (GIL) from the GT Room-2 to the new GIS building may cross the road. The contractor will need to propose solutions for the road crossing (GIL or any other suitable solution will be considered), refer to WKoe11P01-SE-D6 and WKoe11P01-SE-D58.

2.2.5 GT Room-2 to the New GIS substation

- Design, supply and install 400 kV cable system. The cable system shall include the following in accordance with 240-171000310:
  - 400 kV outdoor cable termination,
  - 400 kV XLPE cable,
  - 400 kV GIS cable termination, and
  - bonding leads and other ancillary equipment associated with the earthing and bonding system.
  - DTS fibre duct and cable, protection fibre duct cable.
- Install cable fixing arrangement at the suitable location
- Install new GIS ducting to the proposed cable termination. See attached proposed Key Plan WKoe11P01-SE-D7.
- From the cable termination to the new GIS building, contractor to install 400kV XLPE underground cable.
- Survey the route, scan and mark existing services.
- Cross trenching by hand to confirm existing services.
- The underground cable will cross Koeberg Power Station fences along the route and may require tunnelling or any other suitable arrangement, to cross the ACP2 fence.
- The proposed cable to GIS termination of the 400kV cable to the new proposed GIS building is to be made on the upper floor of the substation building (GIS Building) or another suitable place.
- The 400kV cable route might have multiple turns (see drawing WKoe11P01-SE-D7). It should be noted that there might be space limitations; thus, the bending radius of the cable needs to be taken into consideration.
- No cable joints shall be allowed in the link from the 400kV GT Rooms to the proposed 400kV new GIS building.
- The 400kV cable and installation arrangement must be designed and installed as per the specification 240-129143701 for the underground option.

2.2.6 GT Room-2

- Contractor to confirm the existing GT Room can be reused or a new GT Room-2 is required to be constructed.
- Detailed report of both options to be submitted to the client for review and acceptance.

2.2.7 400/132/22kV 250MVA, 22/0.4kV 315kVA (Back up Aux.) and 6.6/0.4kV 315kVA (Main Aux.) Transformers

- Install coupling transformer between 400kV and 132kV GIS busbars (Contractor to propose the optimum arrangement) as per approved transformer installation and commissioning PQP document.
- Install the 22/0.4kV 315kVA Auxiliary Transformers to the 22kV terminals of the Coupling Transformer. This Backup Auxiliary 400V supply to feed the appropriate AC board inside the GIS building as per PTM&C document 240-170000104.
- Install the 6.6/0.4kV 315kVA Auxiliary Transformer at a new proposed position (to be finalized after the building design). To be fed from a 6.6kV cable from station Aux board inside Koeberg Power Station building. This Main Auxiliary Transformer will feed the 400V AC board in the GIS building as per PTM&C document 240-170000104.

2.2.8 250MVA Coupling Transformer-1 to 132kV GIS (Options GIL and Cable system)

GIL Option

- Designs, manufacture, supply and install the GIL system between the 250MVA 132kV of the transformer side to the 132kV GIS.

Cable system option

- Supply and install 132 kV cable system. The cable installation system shall include the following in accordance with 240-171000282:
    - 132 kV outdoor cable termination,
    - 132 kV XLPE cable,
    - 132 kV GIS cable termination, and
    - Bonding leads and other ancillary equipment associated with the earthing and bonding system.
    - DTS fibre duct and fibre cable, protection fibre duct and fibre
    - HV cables to be protected using fibre and suitable protection systems (route dependent), must be reviewed and accepted by the employer.

2.2.9 250MVA Coupling Transformer-2 to 132kV GIS (Options GIL or Cable system)

GIL Option

- Designs, manufacture, supply and install the GIL system between the 250MVA 132kV of the transformer side to the 132kV GIS.

Cable system option

- Supply and install 132 kV cable system. The cable system shall include the following in accordance with 240-171000282:
    - 132 kV outdoor cable termination,
    - 132 kV XLPE cable,
    - 132 kV GIS cable termination, and
    - Bonding leads and other ancillary equipment associated with the earthing and bonding system.
    - DTS fibre duct and fibre cable, protection fibre duct and fibre cable.

2.2.10 400kV Inter-connection link (between new Weskusfleur and existing Koeberg GIS) (interconnecting link to be GIL or cable connection) which is a temporary link

Note: *These links are required to connect the old GIS busbar to the new (proposed) GIS busbar during the shifting of the lines from the old substation to the new substation. The interconnectors will ensure continuity of supply to the GRID while the construction and commissioning of Weskusfleur. These two 400 kV interconnectors will be decommissioned after the Weskusfleur is commissioned.*

- Interconnect Weskusfleur Feeder 7 and existing Koeberg Feeder 1.
- Interconnect Weskusfleur Feeder 8 (spare Transformer 13 future) and existing Koeberg Feeder 2.

Using Cable or GIL options / or any other suitable option.

- Install 2 x 400 kV interconnectors by using 400 kV XLPE cable systems to connect proposed Weskusfleur GIS Substation to existing Koeberg Substation. The cable system shall include the following in accordance with 240-171000310 (the other option if chosen must follow the same principle):
    - 400 kV outdoor cable termination,
    - 400 kV XLPE cable,
    - 400 kV GIS cable termination, and
    - bonding leads and other ancillary equipment associated with the earthing and bonding system.
    - Fibre optic duct and fibre cable for protection.
- 400kV and other HV cables to be protected using fibre and suitable protection systems (route dependent), must be reviewed and accepted by the employer.
- Crossing ACP2 by means of above-ground or under-ground option should comply with the national key point and Koeberg Power Station requirements to avoid compromising the security of Koeberg Power Station.

2.2.11 132kV lines from terminal towers to GIS building

- 6 x 132 kV cable feeders must be installed as per Key Plan, WKoe11P01S-SE-D7 Sheet 2. The overhead lines will be terminated from the 132 kV overhead terminal towers. The equipment must be installed as per the proposed Station Electric Diagram, WKoe11P01S-SE-D6.
- All of the 6 x 132kV feeders have to be installed and connected onto the new GIS using 132 kV cable systems. The cable system shall include the following in accordance with 240-171000282:
    - 132 kV outdoor cable termination,
    - 132 kV XLPE cable,
    - 132 kV GIS cable termination, and
    - Bonding leads and other ancillary equipment associated with the earthing and bonding system.
    - DTS fibre duct (if applicable) and fibre cable, protection fibre duct and fiber cable.
- The following are the 5 x 132 kV cable feeders to be connected to 132 kV overhead terminal towers.
    - 132kV Ankerlig 1 shall be relocated (emergency supply, relocated first),
    - 132kV Acacia 2 (relocated from existing Koeberg substation),
    - 132kV Blaauberg 1 (relocated from existing Koeberg substation),
    - 132kV Dassenberg 1 (relocated from existing Koeberg substation-currently under construction),
    - 132kV Dassenberg 2 (relocated from existing Koeberg substation-currently under construction).
- Connect from existing 132kV feeder Duinefontein underground cable to the new GIS at the suitable position using cable joint to connect from the existing cable to reroute to the new GIS building as indicated on the Key Plan, WKoe11P01S-SE-D7 Sheet 1.
- Install VT and Surge Arrestors in all 132kV feeders but Ankerlig 1 feeder will be equipped with a CVT and Surge Arrestor as per the Station Electric Diagram (SED), WKoe11P01S-SE-D6.
- All the AIS equipment shown in the SED to be sourced from Eskom approved suppliers.
- The Contractor to construct all gantries where the line closing span can be connected by the line contractor. This will include the construction and stringing to the substation gantry. The line contractor will string from the substation gantry to the terminal tower.

- The Contractor will be responsible to connect the droppers from the line closing span to both the 400kV and 132kV AIS equipment. The droppers will be connected when the feeder is ready to be commissioned.

250MVA 400/132/22kV Transformers (x2)

- Connect 2 x 250MVA Transformers using GIL from the 400kV GIS.
- Connect 2 x 250MVA Transformers using GIL from the 132kV GIS.

2.2.12 132kV GIS

The 132kV GIS to be constructed using the Breaker and a Half philosophy and equip each diameter as per the Station Electric Diagram.

The 132kV side of the GIS must be constructed as follows as per the Station Electric Diagram, WKoe11P01S-SE-D6:

- future diameter CA
- equip diameter CB (Feeder 3 and Transformer 11)
- equip diameter CC (Feeder 4 and Feeder 5)
- equip diameter CD (Station Transformer 2)
- equip diameter CE (Feeder 6 and Station Transformer 1)
- equip diameter CF (Feeder 7 and Transformer 12)
- future diameter CG

The whole GIS system to be designed, manufactured, tested, constructed and commissioned as per the GIS system specification, 240-50807380.

Note: The latest revision of the Station Electric Diagram to be used for the above diameters (Latest Station Electric Diagram to take precedence).

2.2.13 400kV GIS

The 400kV GIS to be constructed using the Breaker and a Half philosophy and equip each diameter as per the Station Electric Diagram.

The 400kV side of the GIS must be constructed as follows as per the Station Electric Diagram WKoe11P01S-SE-D6:

- equip diameter GA (Transformer 11 and Feeder 1)
- equip diameter GB (Feeder 2 and Feeder 3)
- equip diameter GC (Gen Transformer 2)
- equip diameter GD (Gen Transformer 1)

- equip diameter GE (Feeder 4 and Feeder 5)
- equip diameter GF (Transformer 12 and Feeder 6)
- equip diameter GG (Feeder 7 and Feeder 8)
  Note: Feeder 7 and Feeder 8 will be used as interconnectors

The whole GIS system to be designed, manufactured, tested, constructed and commissioned as per the GIS system specification, 240-50807380.
Note: The latest revision of the Station Electric Diagram to be used for the above diameters (Latest Station Electric Diagram to take precedence).

2.2.14 6.6kV Cable connection from Station Transformers to the Main Auxiliary 6.6/0.4kV 315kVA Transformer

The main Auxiliary Transformer must be connected to the 6.6kV Station Transformer Busbar with a suitable voltage and current rated cable. The 400V side of the Transformer must be connected to the AC board inside new GIS building.
The total cable route length to be confirmed by the contractor, no cable joints are allowed in the full length of the cable.
Refer to cable specifications:

- 240-171000180 (Specification for Medium Voltage XLPE Cables),
- 240-56030619 (Accessories for Medium-Voltage Power Cables for Systems with Nominal Voltages of 11kV to 33kV) and
- 240-171000181 (Technical Evaluation Criteria for MV XLPE Cable Systems for Koeberg-Weskusfleur Project).

2.2.15 22kV Cable connection from Coupling Transformers (250MVA) to the Backup Auxiliary 22/0.4kV 315kVA Transformer

A 22 kV cable system must be installed from the 2 x Backup Auxiliary Transformers (315kVA, 22kV/400V) to the 2 x Coupling Transformers (250MVA) tertiary terminals.
The total cable route length to be confirmed by the contractor, no cable joints are allowed in the full length of the cable.
Refer to cable specifications 240-171000180, 240-56030619 and 240-171000181.

2.2.16 Earthing and Bonding of the GIS and AIS equipment

- Earthing design for the GIS building as well as AIS yard to be conducted by the Contractor and must be reviewed and accepted by the Employer.

Refer to the following specifications for the Earthing and Bonding:

- 240-134369472 (Substation Earth Grid Design Standard),
- 240-96393507 (Soil Resistivity Testing for Substation Applications Standard),
- 240-101940513 (Substation Earth Electrode Resistance Measurement Standard)
- 240-84854974 (Continuity Measurement of Substation Earth Grid Systems Standard)
- 240-95773230 (Transmission Substation Earth Fault Application Guide)
- 240-170000153 (Copper Conductors Used for Earthing in Substations Standard)
- 240-50807380 (Specification for GIS & Associated Auxiliary Equipment)
- 0.54/393 series (Earthing Standard – various sheets)

2.3 DIRECT LIGHTNING PROTECTION

- Direct Lightning Stroke Protection design to be conducted by the Contractor,
- The Employer must review and accept

Refer to the following drawings and specifications for the Direct Lightning Protection:

- Wkoe11P01-SE-D7 sheet 1
- Wkoe11P01-SE-D7 sheet 2
- 240-109589380 (Direct Lightning Stroke Protection of Substations Guideline)

For building design please apply the following South African National Standards, adopted from the IEC:

- SANS 62305-1:2007 (Protection against lightning, Part 1: General principals)
- SANS 62305-2:2007 (Protection against lightning, Part 2: Risk management)
- SANS 62305-3:2007 (Protection against lightning, Part 3: Physical damage to structures and life hazard)
- SANS 62305-4:2007 (Protection against lightning, Part 4: Electrical and electronic systems within structures)

2.4 LIGHTING

Floodlighting installation shall provide a minimum average illumination level of 10 lux within the high voltage yard and 20 lux at the Transformer bays, with a uniformity ratio of 1:5 within the high voltage yard.

Refer to the following drawings and specifications for Lighting:

- 240-83382122 (Emergency Lighting in Substations Standard)
- 240-83382076 (Standard for Operational Floodlighting in Substations)
- Wkoe11P01-SE-D7 sheet 1
- Wkoe11P01-SE-D7 sheet 2

Interior lighting shall be designed according to SANS 10114 part-1 and 2.

2.5 VENTILATION

Ventilation shall be provided by means of air conditioning in the control room and offices as per the specification below. Suitable ventilation in the GIS switchgear area inside the building must also be considered and accepted by the Employer.

- 240-82172806 (Standard for air conditioning in Transmission substation buildings)

2.6 LABELLING AND OPERATING DIAGRAM

Operating Diagrams are used as a guide by National (Power) Control and Substation for operation. Operating Personnel to operate High Voltage (HV) equipment within the Substation and use the Operating Diagram as a guide.
Labelling of all bays and equipment shown on an Operating Diagram shall be in accordance with 240-120804300.
Safety labels on the site shall be in accordance with 240-132747382.

Refer to the following specifications for Labelling and Operating Diagram:

- 240-120804300 (Standard for the Labelling of Electrical equipment within Eskom Wires Networks)
- 240-132747382 (Safety Signs in Transmission Substations and Buildings)
- 240-77297024 (Standard for Operating Diagrams for Eskom Transmission Substations)

2.7 CIVIL WORKS SCOPE

2.7.1 Buildings

The Contractor is responsible for the building design of all the buildings including the GIS building according to the document Wkoe11P01-SE-D53.

The contractor shall render professional services by providing functional, cost effective and architecturally acceptable design solutions in accordance with the scope of work and technical requirements. The contractor is responsible for the entire design, documentation, execution, and handover of the buildings.

The envelope will be an economical but durable building of concrete, steel and masonry materials and must consist of the following for the successful operation of the plant.

- **GIS Building** to a suitable length, width and height to suit the equipment and provision of general requirements such as access to all parts of the building by suitable means must be provided for both normal and emergency conditions.
- **Control room** to be constructed to install secondary plant panel in accordance with the PTM&C specification.
- **Battery room** must be constructed to host the batteries with sufficient ventilation, acid resistant finishes and floor drainage.
- **Ablution** facilities for male, female and disabled persons to be constructed in accordance with building specification, Wkoe11P01-SE-D53.
- **Open plan office** with equipped kitchen, furniture, window blinds and telecoms equipment must be provided where required.
- **Store building** must have the facility for 'insulating gas' storage and strategic spares with access control, suitable overhead crane, racking, electrical supply and suitable access for the material loading and unloading as specified.
- **MEWP** (Machine Elevated Working Platform) building for the spray wash trailer must be provided.
  Note: Advise where must MEWP be installed, must be agreed by the Employer.
- GIS Equipment maintenance and repairs building with suitable access control, workbenches, racking and cupboards as specified.
- **GT room building** is to be designed and built by the contractor according to the specification Wkoe11P01-SE-D58.
- The **Storage Yard** shall be built according to WKoe11P01-SE-D38.
  Refer to the following typical building drawings:
  - 0.54/5588 (Cladded Store Building)
  - WKoe11P01-SE-D50 (Workshop Building)
  - WKoe11P01-SE-D59 (Consumable Store Building)
- Security building / Guard house (0.54/7515 sheet 1B)

- **Office boardroom** for 20 people

All the buildings, shall have the following:

- Water supply
- Electrical supply
- Air conditioning
- Sewer system
- Paving
- General building drainage
- Covered parking - 2 standard carports for 8 motor vehicles (refer to 0.54/10119)

2.7.2 Construction power

The Contractor to design and install the construction supply and must be removed and rehabilitated in accordance with the EMP on completion.

2.7.3 Fence and Yard Stone

Fences compromise of all fences required at the Substation. These are Outer Fence, Inner Fence, Non-lethal and a safety fence. All fences shall comply with all Eskom drawings and specifications below:

- 240-76368574 (High Security Mesh fencing),
- 240-78980848 (Standard for NLEPDS Electrical Components),
- 240-100183119 (Standard for Fences in Eskom Transmission Substations),
- 240-170000066 (Scope of work for Integrated Security System – Weskusfleur Substation),
- Wkoe11P01-SE-D14

At the beginning of the project (to allow for sufficient time to analyse and choose suitable subcontractor) the contractor is to identify three (3) yard stone quarries near the proposed development. Samples are to be obtained from these quarries and subjected to tests outlined in the document 240-108982466 to determine suitability of aggregates.
Prior to acceptance of any crushed stone the aggregate report shall be submitted to the Employer for review and acceptance. No crusher-run, i.e., road construction material or stone from mining activities (contaminated with chemicals) will be accepted as yard stone.

Yard stone shall comply with all Eskom drawings and specifications below:

- 240-108982466 (Standard for HV Yard Stones in Eskom Substations)
- 240-101811486 (Standard for Crusher Plant)
- Wkoe11P01-SE-D14

2.7.4 Terrace, Access and the Construction Road

Terrace and Access Roads including permanent access and construction roads shall be designed by the Contractor according to the site requirements thus a Geotech study shall be undertaken by the Contractor.

- Contractor must remove the construction road on completion of the project. Rehabilitation of the area must be done in accordance with the EMP.
- Contractor must use only approved construction roads/passages and must not drive on any other area *due the environmental sensitivity.*

Refer to the following typical drawings:

- Wkoe11P01-SE-D41
- Wkoe11P01-SE-D42 sheet 1, sheet 2 and sheet 3

2.7.5 Stormwater and Fire Protection

The Contractor must undertake an independent hydrological study and create a drainage system that always allows safe operations.

Fire protection system must be provided inside the GIS and Control room areas and shall be designed in accordance with International and Eskom/SANS standards.

Fire protection for Transformers in the form of a passive fire protection system including an oil holding dam shall be designed and constructed must be reviewed and accepted by the Employer.

Refer to the following specifications, standards and drawing and compliance must be assured:

- Wkoe11P01-SE-D43
- 240-80139043 (TST41-224) (Passive Fire Protection for Oil Filled Equipment)
- SANS10400 (for buildings)

2.7.6 Transformer and Foundations

A Transformer plinth and associated infrastructure such as bundwall etc. shall be designed based on the size of the Transformer and as per Eskom specifications. All equipment foundations shall be based on Eskom best practices and shall be determined based on the outline of equipment.

Refer to the following specifications, standards and drawing and compliance must be assured:

- Wkoe11P01-SE-D44
- 240-68973110 (Specification for Power Transformers Rated for 1.25MVA and Above and with Highest Voltage of 2.2kV or Above)
- 240-57648800 (New Oil Filled Auxiliary Transformers Rated 1MVA and Below and 33kV and Below)
- 240-68970990 (Standard for Auxiliary Transformers for Main Transmission Substations)

2.7.7 GT House & GIL Ducts

The GT House and GIL Ducts shall be designed and built based on the need as evaluated by the Contractor. If required, the GT house shall be based on the specifications as provided by Eskom.
Refer to the specification Wkoe11P01-SE-D58.

2.7.8 Cable Ducts/tunnel/culverts

The cable ducts/tunnel/culverts if required, shall run on an optimum route. Preliminary information is given in the drawings, and this should be evaluated by the Contractor. Eskom has conducted a preliminary ground scan which shall be provided to the Contractors. The Contractor must perform a detailed ground scanning for services and base their designs on the outcome of the scan results.

The preliminary Ground Scan Report titled, *Underground Detection Survey Project: Eskom Koeberg Investigation report – 14/10/2019*, is included in the document pack.
Typical concept culvert drawings Wkoe11P01-SE-D56 and Wkoe11P01-SE-D57 also form part of the document pack.

2.8 FENCING, MONITORING AND ELECTRONIC WARNING SYSTEM

Eskom's requirements for this project must be to design, supply, installation and commissioning of an Integrated Security System at Weskusfleur Substation. The Integrated Security System shall be an integration of the CCTV system with intruder detection, access control system, non-lethal electrified fence/Non-Lethal Energized Perimeter Detection System and public address system. Refer to the specification 240-170000066.

Refer to the following specification and compliance must be assured:

- 240-170000066 (Scope of work for Integrated Security System – Weskusfleur Substation)

3. LIST OF ESKOM DRAWINGS AND DOCUMENTS

Documents / Drawings		
Drawing Number	**Drawing Title**	**Rev No.**
WKoe11P01-SE-D6	Weskusfleur Station Electric Diagram (Detail design)	**3**
WKoe11P01-SE-D7 sheet 1	Weskusfleur Key Plan (Detail design)	3
WKoe11P01-SE-D7 sheet 2	Weskusfleur Key Plan (Detail design)	3
Wkoe11P01-SE-D14	Weskusfleur Fence and Yard stone layout	2
Wkoe11P01-SE-D15	Weskusfleur GIS, Control Building, Generation Transformer Building and Connection Structure to the Cable Chamber - Technical Tender Evaluation Strategy.	**2**
Wkoe11P01-SE-D38	Weskusfleur Storage Yard General Arrangement and Setting out	0
Wkoe11P01-SE-D41	Weskusfleur 400/132kV GIS Station Terrace Layout and Details	1
Wkoe11P01-SE-D42 sheet 1	Weskusfleur 400/132kV GIS Station Access Road Layout and Details	1
Wkoe11P01-SE-D42 sheet 2	Weskusfleur 400/132kV GIS Station Longitudinal Section and Details	0
Wkoe11P01-SE-D42 sheet 3	Weskusfleur 400/132kV GIS Station Temporary Construction Road Details	0
Wkoe11P01-SE-D43	Weskusfleur Storm water Drainage and Fire Protection	1
Wkoe11P01-SE-D44 sheet 1	Weskusfleur 400/132/22kV 250MVA Transformer 11 Plinth Details	1
Wkoe11P01-SE-D44 sheet 2	Weskusfleur 400/132/22kV 250MVA Transformer 12 Plinth Details	1
Wkoe11P01-SE-D46 sheet 1	Weskusfleur Security Lighting Layout	0
Wkoe11P01-SE-D46 sheet 2	Weskusfleur Security Lighting SLDB1 & SLDB2 400/230V AC Schematic and Cable Block Diagram	0
Wkoe11P01-SE-D46 sheet 3	Weskusfleur Access Control Building Electrical Installation and Schematic Diagram	0
Wkoe11P01-SE-D50	Weskusfleur Workshop Building Plan, Elevation, Section and Details	0
Wkoe11P01-SE-D52	Weskusfleur Maintenance Workshop Lighting and Electrical Installation Layout	0
Wkoe11P01-SE-D53	Functional Specification for the Design and Construction of the 400/132kV GIS and Control Building for Weskusfleur Substation	**4**
Wkoe11P01-SE-D54 sheet 1	Weskusfleur Gen 1 GIL to Cable Connection Layout and Details Option-1B	0

Wkoe11P01-SE-D54 sheet 2	Weskusfleur Gen 1 GIL to Cable Connection Layout and Details Option-1C	0
Wkoe11P01-SE-D55 sheet 1	Weskusfleur Gen 1 GIL to Cable Connection Layout and Details Option-1A	0
Wkoe11P01-SE-D56 sheet 1	Weskusfleur Gen 1 and Gen 2 to Cable Connection Layout and Details Option-2A	0
Wkoe11P01-SE-D56 sheet 2	Weskusfleur Gen 1 and Gen 2 to Cable Connection Layout and Details Option-2B	0
Wkoe11P01-SE-D56 sheet 3	Weskusfleur Gen 1 and Gen 2 to Cable Connection Layout and Details Option-3	0
Wkoe11P01-SE-D57 sheet 1	Weskusfleur General Layout of Culverts Option 1	0
WKoe11P01-SE-D57 sheet 2	Weskusfleur General Layout of Culverts Option 2	0
WKoe11P01-SE-D57 sheet 3	**Weskusfleur General Layout of Culverts Option 3**	0
Wkoe11P01-SE-D59	Weskusfleur Consumable Store Building Plan, Elevation, Section and Details	0
Wkoe11P01-SE-D60	Weskusfleur Oil Dam Submersible Pump Electrical installation	0
Wkoe11P01-SE-D61	Weskusfleur Workshop Electrical installation and Schematic Diagram	0
Wkoe11P01-SE-D62	Weskusfleur IBR Cladded Store Electrical Installation Layout	0
Wkoe11P01-SE-D63	Weskusfleur Consumable Store Electrical installation Layout	0
WKoe11P01-SE-D65	Weskusfleur Scan Area	0
WKoe11P01-SE-D66	Koeberg 400kV Busbar Reconfiguration and Tranformer Replacement Project – Technical tender Evaluation Strategy for Civil Works at Weskusfleur substation	2
WKoe11P01-SE-D86	Koeberg 400kV Busbar Reconfiguration and Transformer Replacement Project – Technical tender Evaluation Strategy for the Stringing, Earthing and Erection at Weskusfleur substation	**3**
WKoe11P01-SE-D89	Weskusfleur 400/132kV Gas Insulated Substation – Proposed Scope of Work **(This Document)**	**2**
0.54/390	HV Yard Civil Work Standard Details	various
0.54/393 series	Earthing Standard	various
0.54/3754	Transformer Oil Holding Dam Details	9
0.54/4963 sheet 1	HV Yard Safety Fence with Steel Posts Arrangement Foundation Details	3
0.54/4963 sheet 2	HV Yard Safety Fence with Steel Posts Arrangement Gate Details	1

0.54/4963 sheet 3	HV Yard Safety Fence with Steel Posts Arrangement Posts Details	1
0.54/4963 sheet 4	HV Yard Safety Fence with Steel Posts Arrangement Gate Hinges Details	2
0.54/4963 sheet 5	HV Yard Safety Fence Earthing Clamp for Substation Gates	1
0.54/5578	Standard Stair and Handrail Details	0
0.54/5588 sheet 1	Workshop and Stores General Arrangement	7
0.54/5588 sheet 2	Workshop and Stores Details of Steel	4
0.54/5588 sheet 3	Workshop and Stores Details of Steelwork	8
0.54/5588 sheet 4	IBR Cladded Store Building Plan, Elevation, Section and Details	7
0.54/5633 sheet 1	2,4m High Security Fence with Overhang Access Gate Plan, Elevations and Details	3
0.54/5633 sheet 2	2,4m High Security Fence with Overhang Access Gate Posts Plan, Elevations and Details	1
0.54/5633 sheet 3	2,4m High Security Fence with Overhang Posts and Struts Detail	6
0.54/5633 sheet 4	2,4m High Security Fence with Overhang Posts Concrete Bases and Gate Keep Detail	1
0.54/5633 sheet 7	2,4m High Security Fence with Overhang Brackets Layout and Details	5
0.54/5664	Substations Transformer Fire Protection Oil Holding Dam Joints Position and Details	1
0.54/6084 sheet 3	Transformer Oil Holding Dam Compartment Wall Detail for Type 12 Dam	2
0.54/6597	Security fences Layout and Details	2
0.54/7515 sheet 1B	Transmission Substation Access Control Building Plan Section, Elevation and Details	2
0.54/8282	Non-Lethal Fence Plan, Section and Details	4
0.54/8725 sheet 1	High Security Mesh Fencing 2400 High - Outer Fence with Steel Posts details	2
0.54/8725 sheet 2	High Security Mesh Fencing 2400 High - Outer Fence with Steel Posts details	0
0.54/10119	Standard Carport 4 cars 10.4m long Plan Section and Details	0
0.54/10230 sheet 1	Three Types of Security Sliding gates General Arrangement	1
0.54/10230 sheet 2	8,6m Non-Lethal Sliding Gate - Middle Steelwork Arrangements	1
0.54/10230 sheet 3	8,6m Non-Lethal Sliding Gate - Middle Steelwork Arrangements	1
0.54/10230 sheet 4	8,6m Non-Lethal Sliding Gate - Middle Steelwork Arrangements	1
0.54/10230 sheet 5	1m Security gate Steelwork Arrangements and Details	0

0.54/10230 sheet 6	Substation access Gates Single 8,6m gate with no Middle Post Layout, Sections and Details	1
D-DT-8076 sheet 1	Concrete Slab, Pre-cast Cable Cover	2
Specification/Standards/Guideline		
Unique Identifier	**Title**	**Rev No.**
ELECTRICAL		
240-50807380	Specification for Gas Insulated Switchgear (GIS) and Associated Auxiliary Equipment (standard) - plus amendment 1	6
240-53113923	Specification for Substation Clamps for Tube Aluminium Conductors (Standard)	2
240-53113927	Specification for Substation Clamps for Stranded Aluminium Conductors (Standard)	1
240-57648800	New Oil Filled Auxiliary Transformers Rated 1MVA and Below and 33kV and Below	3
240-68970990	Standard for Auxiliary Transformers for Main Transmission Substations	1
240-68971742	Standard for Corona Studies	1
240-68971854	Standard for Power Frequency Electric and Magnetic Analysis in Substations	1
240-68971972	Standard for Stranded Flexible Conductor Selection	1
240-68972068	Standard for Tubular Conductor Selection	1
240-68972408	Standard for Flexible and Tubular Conductor Heights and Phase Spacing	1
240-68973110	Specification for Power Transformers Rated for 1.25MVA and Above and with Highest Voltage of 2.2kV or Above	2
240-71062174	Generic Substation Design (Standard)	**3**
240-75305807	Application of AIS and GIS Switchgear at Eskom Main Transmission Substations	1
240-77297024	Standard for Operating Diagrams for Eskom Transmission Substations (Standard)	1
240-80139043 (TST41-224)	Passive Fire Protection for Oil Filled Equipment	1
240-82172806	Standard for Air Conditioning in Transmission Substation Buildings and Telecommunication Sites	2
240-83382076	Standard for Operational Flood Lighting in Substations (Standard)	2
240-83382122	Emergency Lighting in Substations (Standard)	2

240-84854974	Continuity Measurement of Substation Earth Grid Systems (standard)	2
240-85524376	Standard for Determining Dropper Conductor Short-Circuit Forces on Equipment in Outdoor Substations	1
240-89926574	Specification for the Installation of Tubular Aluminium Conductors (Standard)	2
240-95773230	Transmission Substation Earth Fault Application Guide (Guideline)	2
240-96393507	Soil Resistivity Testing for Substation Applications (standard)	3
240-101940513	Substation Earth Electrode Resistance Measurement (standard)	2
240-109589380	Direct Lightning Stroke Protection of Substations (Guideline)	3
240-109644476	Practice Note for Implementation of Substation layouts for Transmission Substations (Practice Note)	1
240-116206790	Standard for Tertiary Bay Requirements when Power Transformer are used to Supply Station Auxiliary Loads and Rural Supplies	1
240-120804300	Standard for the Labelling of Electrical Equipment Within Eskom Wires Networks (Standard) – UNDER REVIEW	2
240-122922610	Specification for Substation Tubular Conductors (Standard)	2
240-132747382	Safety Signs in transmission Substations and Buildings (Standard)	2
240-134369472	Substation Earth Grid Design standard	2
240-170000153	Copper Conductors Used for Earthing in Substations (standard)	1
CIVIL		
240-94743192	Standard for Fabrication Steelwork used in Eskom Transmission Substations	**2**
240-94743194	Standard for the Erection of the Steelwork and Microwave Towers in Eskom Transmission Substations	**2**
240-100183119	Standard for Fences in Eskom Transmission Substations	**2**
240-101811486	Standard for Crusher Plant	1
240-108982466	Standard for HV Yard Stones in Eskom Substations	**2**
240-153000199	Substation Drainage Specification (Standard)	1
OTHER		
PRJ11230	Project Planning for Weskusfleur substation, Input to Integrated Telecommunication Design	1
32-214	IT/OT-Third Party Access Control Procedure	4
240-17000056	Technical Evaluation Criteria for the Expedited Transmission & Distribution Sourcing of Transformers	**2**

240-46263618	Labelling of Fibre Optic Cables Standard	**3**
240-46264031	**Fibre-Optic Design and Installations-Substations**	3
240-55410927	Cyber Security Standard for Operational Technology	2
240-170001061	**Transmission Cyber Security Standard for Operational Technology**	1
240-55410927	**Cyber Security Standard for Operational Technology**	2
240-56030619	Accessories for Medium-Voltage Power cables for Systems with Nominal Voltages of 11kV to 33kV Standard	**3**
240-56063792	Specification for Medium-Voltage XLPE and Impregnated Paper Insulated Cables Standard	**3**
240-64720986	Emergency Preparedness Public Address System – For Large Area Deployment	**3**
240-70732272	MSAP Design Guideline	2
240-70733995	Optical Distribution Frame/patch Panel/Patch Box	**4**
240-76368574	High Security Mesh Fencing	**2**
240-78980848	Standard for NLEPDS Electrical Components	4
240-79669677	DMZ Designs for Operational Technology	**2**
240-83563472	Drawing Standards for Substations: Power Plant	1
240-91190304	Specification for CCTV Surveillance with Intruder Detection	**2**
240-94136376	IP Voice and Data Network Design Guide	**3**
240-102220945	Specification for IACS for Eskom Sites	1
240-118870219	Standby Power systems Topology and Autonomy for Eskom Sites	2
240-129143701	Project specific Technical requirements for the Cable Trench Concrete Culvert or Wall Required on the Koeberg 400kV Busbar and Transformer Replacement project	1
240-140642648	Fibre Optic Design Standard – Part 1 Lines and Cables	1
240-170000031	Migration of Disturbance Recorder Devices (SIMEAS R) to IP	1
240-170000032	Migration of TWS Fault Locator Devices (MKV, MKVI, and FL8) to IP	1
240-170000066	Scope of work for Integrated Security System – Weskusfleur Substation	1
240-170000104	High Level Scope of Work – PTM&C Equipment for Weskusfleur Substation	1
240-170000290	Migration of Transmission Schneider ION 8800 Meters to IP	1
240-170000419	OT Voice Design Guide	1
240-171000180	Specification for MV XLPE Cables	1
240-171000181	Technical Evaluation Criteria for MV XLPE Cables	1

240-171000279	Technical Evaluation Criteria for Weskusfleur 132kV Cable System	1
240-171000282	Specification for 132kV Cable System	1
240-171000310	Weskusfleur 400kV Cable System and GIL project Requirements	1
240-171000311	Technical Evaluation Criteria for Weskusfleur 400kV Cables Project	1
240-777155912	Technical Tender Evaluation Criteria for Auxiliary Transformers and NECRTs	4

4. AUTHORISATION

This document has been seen and accepted by:

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5. REVISIONS

Date	Rev.	Compiler/s	Remarks
July 2022	1	C Thomas	First Issue
Jan 2024	2	C Thomas	Item 3: document / drawing added / updated, added latest revision number (in bold letter).

6. DEVELOPMENTAL TEAM

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

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7. ACKNOWLEDGEMENTS

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