Eskom	Standard	Transmission

Title: **TRANSMISSION: SUBSTATION ENGINEERING: PROCURE AND CONSTRUCT PARAMETERS**

Unique Identifier:	**240-171000172**
Alternative Reference Number:	**n/a**
Area of Applicability:	**Engineering**
Documentation Type:	**Standard**
Revision:	**1**
Total Pages:	**16**
Next Review Date:	**December 2028**
Disclosure Classification:	**Controlled Disclosure**

Compiled by	Approved by	Authorized by
Mark Peffer	**Benny Tladi**	**Subhas Maharaj**
Engineer **Substation Engineering**	**Middle Manager: (Electrical)** **Substation Engineering**	**Senior Manager** **Substation Engineering**
Date: 12/12/2023	Date: 12/12/2023	Date: 12/12/2023

Co-Compiled by	Supported by	Supported by SCOT/SC
Bilal Hajee	**Andile Maneli**	**Subhas Maharaj**
Engineer **Substation Engineering**	**Middle Manager: (Civil)** **Substation Engineering**	**SCOT/SC Chairperson**
Date: 12/12/2023	Date: 12/12/2023	Date: 12/12/2023

PCM Reference: **Substation Design**
SCOT Study Committee Number/Name: **Substation**

Content

ESKOM COPYRIGHT PROTECTED

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

Executive Summary

This document serves as a functional technical specification for any Substation: primary/power plant (Electrical and Civil Engineering) works that are to be procured and constructed by an Eskom Transmission: Substation Engineering appointed external consultant. This functional specification describes the principles and basic requirements of constructing a Major Transmission Substation. Any successfully appointed consultant shall apply these principles for assets that will be owned operated and maintained by Eskom Transmission.

This document covers the standards and specifications that should be followed to produce the design requirements of substation projects as defined by Eskom's project specific design drawings. The document summarizes these major technical requirements pertaining to procurement and construction aspects that needs to be adhered to in implementing these projects.

ESKOM COPYRIGHT PROTECTED

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

1. Introduction

This specification aims to highlight and group all specifications and standards required for the procurement, construction, stringing, earthing erection and commissioning of Eskom designed projects. It aims to promote standardized Transmission materials and practices, thereby reducing construction periods, equipment stock levels and costs generally. This specification highlights important factors that must be considered during the procuring and construction process and is applicable to new substations as well as substation strengthening and refurbishment projects.

2. Supporting clauses

2.1 Scope

This specification does not cover in detail each of the topics discussed, but rather highlights important factors that must be considered. Further details of each topic are documented in the referenced specifications.

2.1.1 Purpose

The purpose of this document is to assist the consultant appointed to do Transmission substation procurement and construction by documenting important factors that must be considered during these processes. The document is by no means exhaustive but highlights the requirements that Eskom deems important to consider as a minimum.

2.1.2 Applicability

This document shall apply throughout the Eskom Transmission Division.

2.2 Normative/informative references

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

2.2.1 Normative

[1] South African Grid Code

[2] Occupational Health and Safety Act (OHS Act) 85 of 1993

[3] Occupational Health and Safety Act No. 85, 1993 – Construction Regulations 2014

[4] 240-43008621, Eskom Generation and Wires Operating policy

[5] 240-114967625, Operating Regulations for High Voltage Systems

[6] IEEE STD 80, IEEE Guide for Safety in AC Substation Grounding

[7] 240-96393507, Soil Resistivity Testing for Substation Applications

[8] 240-101940513, Earth Electrode Resistance Measurement standard

[9] 240-95773230, The Transmission Substation Earth Fault Application Guide

[10] 240-139282493, Copper Conductors Used for Earthing in Substations (standard)

[11] 240-170000349, Copper -Clad Steel Conductor used for Earthing

[12] 240-68973110, Specification for power transformers rated for 1.25MVA and above

[13] 240-57648800, New Oil Filled Auxiliary Transformers Rated 1 MVA and Below and 33kV And Below

[14] 240-68970990, Standard for Auxiliary Transformers for Main Transmission Substations

[15] 240-65063756, Specification for outdoor circuit breakers for systems with nominal voltages from 6.6kV up-to and including 765kV standard

ESKOM COPYRIGHT PROTECTED

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

[16] 240-56063815, Specification for high voltage outdoor disconnectors and earthing switches standard

[17] 240-56062864, Current transformers Eskom specific requirements for voltages up to 132kV in accordance with NRS 029 standard

[18] 240-170000559, Eskom Standard for Top Core Current Transformers rated from 132kV up to 765kV.

[19] 240-56062765, Inductive Voltage transformers Eskom specific requirements up to 132kV in accordance with NRS 030 standard

[20] 240-56030645, Eskom Standard for Capacitive Voltage Transformers.

[21] 240-75540566, Specification for station class metal oxide surge arresters

[22] 240-56030435, Specification for outdoor ceramic post insulators for systems with nominal voltages up to 765kV standard

[23] 240-75883174, Outdoor post and long rod insulators for new and refurbished powerline up-to and including 33kV

[24] 240-77125772, Specification for Polymeric Longrod Insulators for AC Transmission Voltages of 220kV and Above

[25] 240-75883896, Outdoor Post and Long Rod Insulators for New and refurbished Powerlines for 66kV and 132kV Standard

[26] 240-77125760, Glass cap and pin insulator for Eskom transmission HVAC

[27] 240-60777474, Specification for Suspension and Strain Assemblies and for Hardware for Transmission Lines

[28] 240-56063792, Specification for Medium Voltage XLPE And Impregnated Paper Insulated Cables Standard

[29] 240-56063710, Medium Voltage Cabling in Substations

[30] 240-56063805, LV Power and Control Cable with Rated Voltage Standard 600/1000V

[31] 240-56030637, General Information and Requirements for Low-Voltage Cable Systems Standard

[32] 240-56030640, General Information and Requirements standard for AC High-Voltage, AC Extra High-Voltage and DC Cable systems

[33] 240-56030625, Specification for XLPE Insulated Power cables and Accessories for systems with Nominal Voltages of 44kV TO 132kV

[34] 240-53113923, Specification for Substation Clamps for Tube Aluminium Conductors

[35] 240-53113927, Specification for Substation Clamps for Stranded Aluminium Conductors

[36] 240-83534936, Specification for Substation Clamps – Additional for Tubular and Stranded Conductor Clamps

[37] 240-152844641, Phase Conductor Standard for Eskom Overhead Line

[38] 240-120804300, Standard for the Labelling of Electrical Equipment within Eskom Wires Networks

[39] 240-75660336, The Standard for Design, Manufacturing, and Installation of Eskom Wires Business Equipment Labels

[40] 240-132747382, Safety Signs in Transmission Substation Buildings

[41] SANS 1200, Standardized Specification for Civil Engineering Construction

[42] SANS 10400, The application of the National Building Regulations

[43] SANS 204, Energy efficiency in buildings

[44] SANS10400-XA-2021, Energy Usage in Buildings

[45] 240-83382076, Standard for operational floodlighting in substations

ESKOM COPYRIGHT PROTECTED

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

[46] 240-82172806, Standard for Air Conditioning in Tx Substation Buildings and Telecom Sites

[47] 240-100183119, Standard for the Substation HV Yard Fences

[48] 240-76368574, High Security Mesh Fencing

[49] 240-101811486, Standard for Crusher Plant

[50] 240-94743192, Standard for Fabrication Steelwork used in Eskom Transmission Substations

[51] 240-108982466, Standard for HV Yard Stones in Eskom Substations

[52] 240-56177186, Battery room standard

[53] 240-56364535, Architectural Design and Green Building Compliance Manual

[54] 240-83382122, Emergency Lighting in Substations (Standard)

[55] 240-170000153, Security Lighting for Eskom Applications

[56] 240-57127953, Execution of Site Preparation and Earthworks Standard

[57] TCP 41-141, Inspection Sheets for Substation Equipment to be taken over by the Asset Owner

[58] 240-122922610, Specification for Substation Tubular Conductors (Standard)

[59] 240-50807380, Specification for Gas Insulated Switchgear (GIS) and associated auxiliary Equipment

[60] 240-60725684, Specification for oil immersed HV and EHV Power Reactors

[61] 240-42587021, Specification for Air Core Reactors

[62] 240-64688878, Generic Capacitor Bank Specification

[63] SANS 1936, Development of dolomite land

[64] 240-103414344, Eskom Corporate Identity

[65] 240-94743194, Specification for the Erection of Steelwork used in Eskom Tx and Dx

[66] 240-98161024, Standard for Rock Blasting In Substations

[67] 240-84854974, Continuity Measurement of Substation Earth Grid Systems

[68] 240-89926574, Specification for Installation of Tubular Aluminium Conductors

[69] 240-82736997, Stringing, Earthing, and Erection Specification for Transmission Substations

[70] 240-171000164, Technical Tender Evaluation Criteria for Substation Civil works

[71] 240-171000165, Technical Evaluation Standard For Stringing , Earthing and Erection at Transmission Substations

[72] 240-171000172, Technical Evaluation Standard for the Installation of Tubular Aluminium Conductors

[73] 240-171000161, Technical Evaluation Standard for Substation Stranded Conductor Clamps - EPC Contracting

[74] 240-171000162, Technical Evaluation Standard for Substation Tubular Clamps - EPC Contracting

[75] 240-171000172, Technical Evaluation Standard for Substation Tubular Conductors -EPC Contracting

[76] SANS 2001 Series, Construction Standards

[77] BS 8215:2013, Design and Installation of Damp-Proof Courses in Masonry Construction

[78] 240-180000668, Guideline on how Contractors can select material to use to build the Substations or Infrastructure on the Self-build or Turnkey

ESKOM COPYRIGHT PROTECTED

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

2.2.2 Informative

[79] 32-1205, Eskom Maintenance Management Policy

[80] 32-727, Eskom Safety, Health, Environment and Quality policy

[81] 240-56063877, RTV Silicone Rubber Insulator Coating and Shed Extender Applications Standard

[82] 240-56062705, RTV Silicone Rubber Insulator Coating and Shed Extender Supplier Specification

[83] Stringing Conductor and Clamp Installation Quality Inspection Plan - Guideline

[84] Earthing Quality Inspection and Test Plan – Guideline

[85] Tubular Busbar Installation Quality Inspection Plan - Guideline

[86] Scoring - Stringing earthing and erection Technical Evaluation criteria – Scoring

[87] Scoring – Substation Civil Works at Substations

[88] 240-128559117, Method Statements for Eskom Transmission substations – Stringing, Erection and earthing.

2.3 Definitions

2.3.1 General

Definition	Description
Busbar	Low impedance conductor to which several electric circuits can be connected separately.
Corona	Luminous, audible discharge because of electrical overstressing in an insulating material, usually air that occurs when there is an excessive localized electric field gradient upon an object or conductor that causes the ionization and possible electrical breakdown of the air adjacent to this point.
Extra High Voltage	The set of nominal voltage levels that are used in power systems for bulk transmission of electricity in the range 220kV < Un ≤ 765kV
High Voltage	The set of nominal voltage levels that are used in power systems for bulk transmission of electricity in the range 44kV < Un ≤ 220kV.
Medium Voltage	The set of nominal voltage levels that lie above low voltage and below high voltage in the range 1kV < Un ≤ 44kV.
Minimum bay separation distance	The minimum distance between the centre lines of two bays next to each other exiting in the same direction.
Specific Creepage Distance (SCD)	The total creepage distance divided by the phase-to-phase system highest voltage.
Tube	A hollow cylindrical aluminium conductor of specified diameter and wall thickness designed to carry current
Unified Specific Creepage Distance (USCD)	The total creepage distance divided by the phase-to-earth system highest voltage.

2.3.2 Disclosure classification

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

ESKOM COPYRIGHT PROTECTED

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

2.4 Abbreviations

Abbreviation	Description
AC/DC	Alternating Current/Direct Current
AIS	Air Insulated System
CVT	Capacitive Voltage Transformer
DRT	Design Review Team
EHV	Extra High Voltage
EMVT	Electromagnetic Voltage Transformer
EPCM	Engineer, Procure, Construct and Maintain
FPI	Footprint Investigations
GIS	Gas Insulated System
HV	High Voltage
HVAC	Heating Ventilation and Air Conditioning
kV	kilo Volt
LIL	Lightning Impulse level
MV	Medium Voltage
MVA	mega Volt Amperes
NECRT	Neutral Electromagnetic Coupler with Neutral Earthing Resistor and Auxiliary Transformer
QITP	Quality Inspection test plan
RAM	Reliability, Availability, and Maintainability
RTV	Room Temperature Vulcanized
SCD	Specific Creepage Distance

2.5 Roles and responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

ESKOM COPYRIGHT PROTECTED

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

3. Procurement

3.1 Technical Procurement Specifications

3.1.1 General Requirements

The supplied equipment and material for the project shall meet or exceed, in regard to quality, ratings, reliability, functionality, integration to electricity network, future expandability, serviceability, maintainability, health, safety and environmental, the requirements given in the technical specification and applicable international and national standards, Eskom's standards and guidelines, prevailing legislation and best engineering practices. Personal safety and all required precautions and provisions necessary to make the works safe, shall be considered a paramount requirement of the design. The design and construction of the substation shall comply with the requirements of national and local legislations and by-laws.

Nothing will be supplied as free issue from Eskom and all components need to be sourced by the contractor as per the specifications stated in relevant sections and quantities as per individual project proformas.

Major equipment / Primary plant equipment should be procured as per [78], with quantities as per project specific proformas. The Eskom designs per project are based on detailed (NOT FOR CONSTRUCTION) designs and are thus not final, but subject to change post procurement of major equipment. Final scope documents will be made available once all Major equipment is procured and outlines supplied to Eskom.

3.1.2 Major Equipment Specifications

Major equipment for project specifics can include, but may not be limited to, the following:

- Power transformers
- Auxiliary transformers
- Circuit breakers
- Disconnectors
- Earth switches
- Current transformers
- Voltage transformers
- Surge arresters
- Power cables
- Insulators
- Shunt reactors
- Fault Limiting reactors
- Shunt Capacitor Banks
- Power Electronics devices

The technical requirements of substation primary plant including power transformers, circuit breakers, disconnectors, earth switches, current transformers, voltage transformers, surge arresters, insulators, insulated HV cables, Fault limiting reactors and Shunt capacitor banks are specified in the relevant Eskom standards and document [78].

All plant & equipment supplied shall be new, unused, proven and of the most recent or current models as specified in [78]. All porcelain surfaced HV Equipment shall be RTV coated prior to commissioning as per [81] & [82].

ESKOM COPYRIGHT PROTECTED

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

3.1.2.1 Power Transformers

The design, manufacture and supply of the main power transformers shall comply with the requirements of [12].

3.1.2.2 Auxiliary Transformers

The design, manufacture and supply of auxiliary transformers shall comply with the requirements of [13].

3.1.2.3 Circuit Breakers

The design, manufacture and supply of the circuit breakers shall comply with the requirements of [15].

3.1.2.4 Disconnectors and earth switches

The design, manufacture and supply of the disconnectors and earth switches shall comply with the requirements of [16].

3.1.2.5 Current Transformers

The design, manufacture and supply of the current transformers shall comply with the requirements of [17] for 132kV and below and [18] for 220kV and above applications.

3.1.2.6 Voltage Transformers

The design, manufacture and supply of Inductive Voltage transformers are applied for voltages below 220kV and need to comply to [19]. For 220kV and above, capacitive voltage transformers are applied, and the design, manufacture and supply need to comply to [20].

3.1.2.7 Surge Arresters

The design, manufacture and supply of the surge arresters shall comply with the requirements of [21].

3.1.2.8 Power Cables

The design, manufacture and supply of HV and EHV Power Cables shall comply with the requirements and specifications as per [28], [29], [30], [31], [32], and [33].

3.1.2.9 Station Post Insulators

The design, manufacture and supply of the station post insulators shall comply with the requirements of [22]. Only station post insulators made of porcelain material shall be accepted.

3.1.2.10 Oil Immersed Reactors

The design, manufacture and supply of all oil immersed reactors shall comply with [60].

3.1.2.11 Air Core Reactors

The design, manufacture and supply of all Air Core Reactors shall comply with [61].

3.1.2.12 Capacitor banks

The design, manufacture and supply of the Shunt capacitor banks shall comply with [62]

3.1.2.13 Power Electronic devices

For any project specific power electronics devices communicate with the Eskom custodian for specification guidance and Eskom acceptance.

ESKOM COPYRIGHT PROTECTED

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

3.1.3 Substation Conductors, Hardware and Accessories Specifications

Nothing will be supplied as free issue from Eskom and all components need to be sourced by the contractor as per the specifications stated in relevant sections and quantities as per individual project proformas.

The Eskom designs per project are based on detailed (NOT FOR CONSTRUCTION) designs and are thus not final, but subject to change post procurement of major equipment. Final scope documents will be made available once all major equipment is procured and outlines supplied to Eskom. Where equipment variations occur from initial detailed design assumptions, minor proforma quantities and types will be re-submitted.

3.1.3.1 Conductors

The design, manufacture and supply of various conductor is as stipulated in Table 1 below.

Table 1: Standardized conductors

Item	Description
Tubular conductor	• The design, manufacture and supply of all tubular conductor shall be in accordance with [58] and suppliers will be evaluated as per [75].
Flexible conductor	• The design, manufacture and supply of all strung flexible conductors shall be in accordance with [37].
Shieldwire	• The design, manufacture, and supply of all shieldwire shall be in accordance with [37] • Maximum tension for shieldwire applications should be 2kN.
Earthing	• The design, manufacture and supply of earthing conductors shall be in accordance with [10] and [11]. Eskom has standardized on 10mm round copper for the main earthmat and earth tails within the substation in general and bare flat copper 50x3.15mm for buildings/plinths, along walls or at appropriate locations. See 0.54/393 series for earthing details.

3.1.3.2 Clamps

Eskom has standardized on the range of standard clamps as covered in the corresponding clamp specifications (Tubular and Stranded conductor clamps),[34] , [35] & [36]. Clamps shall be designed in accordance with the above specifications. Local Suppliers Vexila (Pfisterer), McWade and Preformed Line Products South Africa (PLP) have been evaluated previously and are deemed technically acceptable for application within Eskom Transmission. At tender stage commitment letters to procure from these suppliers will be deemed acceptable. Any other suppliers would need to be evaluated as per [73] and [74].

3.1.3.3 Hardware

Hardware components refer to those non-current carrying items needed to physically support the conductors associated with the electrical system. Hardware design, manufacture, testing and supply and delivery shall be according to [27].

3.1.3.4 String Insulators

a) Long Rod Insulators

The design, manufacture and supply of Long rods insulators shall comply with the requirements of [24] for installations 220kV and above, [25] for 66kV and 132kV, and [23] for installations below 33kV.

b) Glass Cap and Pin Insulator

The design, manufacture and supply of the glass insulators shall comply with the requirements of [26].

ESKOM COPYRIGHT PROTECTED

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

3.1.3.5 Labelling

3.1.3.5.1 Plant and Equipment

The Design, Manufacturing and Installation of Eskom Wires Business Equipment Labels shall be in accordance with [39]. Labels are generally attached to lattice structures via J-brackets or L-brackets, see 0.54/403 and 0.54/1794.

3.1.3.5.2 Safety Signs

Labelling throughout the substation shall be applied as per [40].

3.1.3.5.3 Substation External Signage

Labelling at the entrance of the actual substation will comply to Eskom's corporate Identity Policy [64].

Figure 1: External Freestanding Sign

3.1.3.5.4 Key Ring Labels

The labelling of locks, for all hand operated, switchable plant is required and shall be manufactured from 1,6 mm brass plate and drilled to the dimensions detailed in the drawing below in accordance with the label requirements of the station. Plain block lettering shall be used, and the inscriptions shall be exactly as the associated plant label.

Label requirements:

- Engraved black lettering,
- 1,6 mm thick brass plate,
- 3,5 mm text height,
- 2,5 mm text width,
- 1 key ring per label

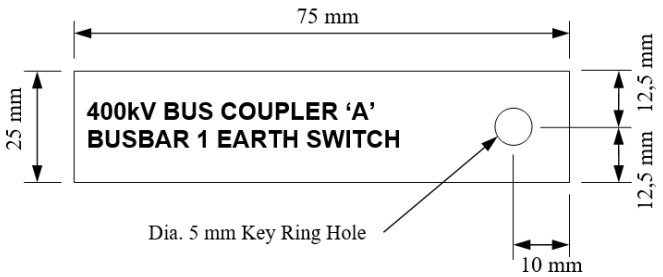

Figure 2: Brass label sample

ESKOM COPYRIGHT PROTECTED

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

3.1.4 Civil/Structural

3.1.4.1 Earthworks

Detailed earthworks shall be in accordance with SANS standard [41], [56], [66], [76] and the project specific platform design drawings where applicable.

3.1.4.2 Roads

All roads leading into and within the substation yard shall be constructed as per the project specific drawings and 0.54/390 series where applicable.

3.1.4.3 Fencing

High security perimeter fencing shall be installed at all sites as specified in [47] and [48] in accordance with the project specific drawings where applicable.

3.1.4.4 Structural Steel

The fabrication of all structural steel shall be in accordance with [50] and its erection shall be in accordance with [65]. See 0.54/8829 series for varying configurations and layouts.

3.1.4.5 Foundation and Plinths

The foundations should be procured and constructed based on the information provide per drawing. See 0.54/8829 series for varying configurations and layouts.

All transformers are to be installed with facilities to contain any oil spillage in the event of a tank failure. Bund walls shall be constructed on the concrete slab that forms part of the transformer plinths. No oil shall be allowed to spill beyond the bund wall. See the project specific drawings where applicable.

3.1.4.6 Cable trenches and cable trench covers

The installation of the trenches shall be in accordance with SANS standard [41] and [76]. See 0.54/390 series for varying trench configurations, ramps & covers etc

3.1.4.7 Retaining Walls

The building of retaining walls is critical to ensure slope stability due to the variation in terrain where the substation is constructed. The construction shall be in accordance with project specific and 0.54/390 series drawings where applicable.

3.1.4.8 Buildings

The construction of buildings shall be in accordance with standards [41][42], [43], [44], [46], [76], and [77]. The buildings shall be in accordance with the project specific and standard building drawings where applicable.

For standard control building concept layouts see 0.54/1150 sht. 110A and 110B. For standard control building finishes see 0.54/1150 sht. 100 to 112. For access control standard drawings see 0.54/7515 series. For the workshop, maintenance, and store building, see drawing 0.54/8828

3.1.4.9 Drainage

Storm water and subsoil drainage to be provided based on project specific drainage drawings and and the 0.54/390 series where applicable. The construction of the drainage system shall be in accordance SANS standard [41] and [76].

The Oil drainage shall be in accordance with the project specific drawings found in the project specific drainage drawing and the 0.54/390 series where appliable.

ESKOM COPYRIGHT PROTECTED

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

3.2 Construction Requirements

The Consultant shall comply with all the requirements stipulated in the OHS Act of 1993 - Construction Regulations, 2014, [3]. The requirement of the Operating Regulations for High Voltage Systems [5] shall apply to all construction on the high-voltage apparatus of Eskom. The purpose of the Operating Regulations for High Voltage Systems is to ensure the safety of all persons and to safeguard the apparatus and ensure continuity of supply. These regulations are an extension of and must be read in conjunction with the Occupational Health and Safety Act (Act 85 of 1993) [2] as amended and the regulations made there under.

All construction is to be carried out in accordance with Eskom's Safety, Health Environmental and Quality Specification, [80]. All the necessary safety procedures must be strictly adhered to where construction is to be required in close proximity to other energized electrical equipment.

The consultant is mandated to carry out the necessary inspections at appropriate stages to verify that the construction of the relevant work is carried out in accordance with the design. Typical Method statements [88], and typical quality inspection plans provided in [83], [84] and [85].

3.2.1 Civil Requirements

Construction should be done in accordance to [41], [42], [47], [48], [49], [50], [51], [65], and [66]. All Steel and concrete work should also be carried out, in addition to the documents mentioned above, as per the project specific and standard drawings. General civil drawings can be found in the 0.54/ 390 series drawings as well. Potential bidders should comply with technical returnable as stated in [70] and will be evaluated as per [70]. Scoring will be as per [87].

3.2.2 Electrical requirements

Construction should be done in accordance to [67], [68] and [69]. All substation earthing installations are to be carried out in accordance with the applicable sheet of Drawing 0.54/393 and the proposed project specific Earthmat Layout drawing (Where applicable), Bay Layout Earthing and Transformer Plinth Earthing drawings. Potential bidders should comply with technical returnable(s) as stated in [69] and will be evaluated as per [71] Scoring will be as per [86].

3.2.3 Working in live Substations

All personnel must always comply with the Operating Regulations for High Voltage Systems [5] as set out by Eskom when working on, or in the vicinity of electrical apparatus that is live or is capable of being made live from any source of supply.

Eskom reserves the right to evict any personnel from the site at any time should their presence on-site be considered to constitute a hazard.

3.2.4 Quality Management

3.2.4.1 Workmanship and Materials

Work must be done by appropriately qualified, competent Consultant in an entirely sound, secure, neat, efficient, and professional manner, complying with the relevant Eskom quality requirements. Where materials or work methods are included in the Eskom's specification, the materials and workmanship used must not be inferior to those in the relevant Eskom Standard. Quality Inspection plans are to be submitted to Eskom for acceptance. Baseline QITP's, [83], [84], [85] are supplied as a guide and consultants submissions should cover these as a minimum. These should typically include hold points on first off installations, crimps, cuts, etc

The verifying and hold points specified in this section are intended to provide assurance to Eskom that the prevailing Eskom Standards and specifications are adhered-to during the Procure and construct project execution. The verifying and hold points provide a mechanism for Eskom to inspect and test the works during the construction phase. This has the benefit of ensuring that any non-conformances are resolved as early as possible in the project life cycle.

ESKOM COPYRIGHT PROTECTED

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

Unless otherwise specified, all materials used must be entirely suitable for the intended application, whether stated or implied, and be free from defects. Where materials bearing the SABS (South African Bureau of Standards) mark are available, these materials must be the minimum standard for use. All manufactured materials must be used strictly in accordance with the manufacturer's instructions and recommendations.

3.3 Commissioning and Handover

The requirements for the various Quality Control and Handover process stages for a substation project from the inception of construction to commissioning and final handover are detailed in [57], Inspection Sheets must be completed for all the Substation Equipment that is to be taken over by the Asset Owner. Above and beyond the Region Grid and National Control requirements, the consultant is to inform the Eskom Project Manager a month in advance of any planned commissioning in order for Eskom to update the system database and operating diagrams.

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Subhas Maharaj	Senior Manager: Substation Engineering
Andile Maneli	Middle Manager: Substation Engineering
Nkuli Pompi	Middle Manager: Substation Engineering
Benny Tladi	Middle Manager: Substation Engineering
Sipho Zulu	Chief Engineer
Enderani Naicker	Chief Engineer
Percy Seboco	Chief Engineer
Derrick Delly	Chief Engineer
Rukesh Ramnarain	Chief Engineer
Nkululeko Mazibuko	Chief Engineer
Shivern Singh	Chief Engineer
Bilal Hajee	Chief Engineer

5. Revisions

Date	Rev	Compiler	Remarks
Dec 2023	1	M Peffer	First Issue 2.1.2 Applicability amended to Transmission division

6. Development team

- Sipho Zulu
- Thato Mathe
- Bilal Hajee
- Derrick Delly

ESKOM COPYRIGHT PROTECTED

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

7. Acknowledgements

Not applicable.

ESKOM COPYRIGHT PROTECTED

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