



Scope of Work – Substation Engineering

Technology

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Civils Scope of Work

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1. INTRODUCTION

The purpose of the document is to outline high level scope of work required to be executed in both greenfield and brownfield projects by contractors appointed within the civil works panel for construction of Transmission substations. Substation Engineering will conduct the tender evaluations for the civil works panels and will require extensive detailed method statements for the execution of all civil works as per the approved design, specifications, and industry standard. These prerequisite method statement will in general include the following:

- Structural Concrete and Foundations,
- Cable Trenches,
- Earthworks/Terrace,
- Roads,
- Drainage,
- Yard Stone,
- Buildings,
- Fences,
- Structural Steelwork,
- Security Lighting,
- Earthmat & Earthtails,
- Floodlighting,
- Lighting and HVAC in Buildings

2. SCOPE OF WORK

This document is to be used in conjunction with the referenced civil engineering specifications developed within Substation Engineering (see section 3 for design specifications). Contractors will be bound by these standard Eskom specifications and any deviations without consultation will result to the product or items being rejected. Deviations may occur due to market constraints and other unforeseen variables.

The construction method statements should demonstrate compliance with the civil specifications, industry standards, safety regulations and ensuring quality of works within project timeline. The tendering contractors are expected to provide detailed method statements outlining how they will execute the civil works outlined below:

2.1 STRUCTURAL CONCRETE AND FOUNDATIONS

The scope includes the construction of various foundation types required for the substation, including but not limited to:

- Main column foundations
- Equipment foundations
- Transformer plinths
- Reactor plinths

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- Building foundations

The contractor shall comply to the following foundation specification:

- concrete strengths at 28 days/ stone size: Foundation 25/19
- min. concrete cover to reinforcement = 50mm
- these foundations have been designed to founded on competent founding material having a min. ground bearing capacity of 150kpa,
- in all cases, competency of founding material must be established by a qualified geotechnical engineer,
- steel template to be used for setting out H.D. bolts,
- H.D. bolts supplied by civil contractor complete with nuts and washers and to be galvanised to SANS 763 (hot dipped) and must be clearly marked with diameter, grade and base type. Thread of nuts to be over-cut to SANS 763 to allow for the thickness of galvanising. Any damage to the galvanised surfaces shall be repaired with an approved zinc-metal spray or inorganic zinc-rich paint complying with SANS 926. Application to suppliers' specifications.
- All top edges of concrete above ground to have 20 x 20 chamfers.
- All work to be in accordance with SANS 1200 series specifications.

The Contractor shall design trial mixes in accordance with SANS 0100, Part II, 1980, appendix B. The target strength of the trial mix shall be determined using K equal to 1,7 and a standard deviation of 5 MPa for a "good" degree of site control. Target Strength = Specified Strength + ($K \times$ standard deviation). The Contractor shall submit the trial mixes together with 7- and 28-day test results to Eskom for approval. The average 28-day test result shall equal or exceed the target strength. No concreting shall proceed until the trial mixes have been approved. Mix designs must account for durability issues by accommodating proactive measures that will guard against chemical and physical attacks on the concrete.

The contractor will be responsible for excavation, formwork, reinforcement, concrete testing, concrete placement, curing and backfilling.

2.2 CABLE TRENCHES

Protect cables against mechanical and environmental damage and provides level surface for personal to safely walk over. Cable trenches consist of standard precast concrete kerbs, fig. 5 to SABS 927, with haunching at joints on both sides. It also consists of 30mm riversand at the bottom and the concrete cover.

2.3 EARTHWORKS/TERRACE

The scope includes all earthworks required for site preparation, grading, excavation, backfilling, and compaction to establish a stable and level platform. These will be carried out in accordance with geotechnical recommendations.

The contractor scope to include:

- Site clearing and removal of unsuitable materials
- Cutting, filling and levelling to achieve the required platform elevation

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- Proper backfilling and compaction to specified densities
- Erosion control and site stabilization measures.

2.4 ROADS

The scope includes the construction of an access road for personnel and equipment into the substation for construction, maintenance and operational activities. This includes heavy duty trucks which are used to transport transformers and reactors. There are 3 types of roads used in a substation:

- Concrete/terrace road
- Gravel road, or
- Tar road

2.5 DRAINAGE

There are two separate drainage systems in a substation, stormwater drainage system and oil drainage system.

The storm water drainage is based on the principle of storm water flowing through the yard stone on terrace level. The storm water is caught into a system of subsoil drains with perforated pipes, sloping towards concrete pipes that discharge into the veld or natural water course through headwalls and stilling basins.

The oil drainage system is separate from the storm water drainage system To prevent oil from oil filled equipment to polluting the environment. The oi drainage system from the oil catchment area is also drained through concrete pipes to the oil holding dam.

The contractor will be responsible for the supply and installation of these concrete pipes and including the construction of oil holding dam.

2.6 YARD STONE

Every substation HV yard terrace should have a high resistive covering to increase the resistance of the current path through the body for personnel safety, reduce weed growth and the help ground to retain moisture.

The scope includes the supply, placement and compaction of the yard stone across the substation area.

Crushed stone shall be clean, hard, durable and sound crushed (granite) stone of aggregate size between 26.5mm and 37.5mm nominal size as stipulated in SANS 1083: 2014, Aggregates crushing from natural sources and should have a wet resistivity value of at least 3000 Ohms. Prior to acceptance of any crushed stone the aggregates report shall be submitted to the substation design engineer for approval. The aggregate report shall include the grading result from the sieve analysis, wet resistivity values and an XRD analysis of the stone.

2.7 BUILDINGS

The buildings house secondary plant equipment (protection, metering, DC, tele-protection, switch gear, control panel, etc.), store spares and materials, and serves as offices for personnel deployed in substations, security and workshops.

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The following are various types of buildings that the contractors will be required to constructed new or to refurbish as listed below:

- Control Building,
- Maintenance and Workshop building,
- Cladded stores
- and access control buildings.

The contractor will be responsible for all aspects of building construction, including the preparation, foundations, structural works (brickwork or concrete), roofing, doors and windows, finishes, ventilation, drainage, and any required insulation.

2.8 FENCES

The fences in substations ssecure Eskom properties and ensures the safety of personnel, public and stray animals.

In the substation environment, the following fencing types are available:

- Boundary fence (animal fence)
- Security fence
- High security mesh fence
- Safety fence
- Concrete wall.

The contractor will be responsible for all fencing works, including excavation for fence posts, anti-tunnelling, installation of fence panels, gates, overhangs, etc.

2.9 STRUCTURAL STEELWORK

The steelwork in a substation is to provide support to electrical equipment. The scope will include supply and installation of structural steelwork. This includes, but is not limited to steel gantries, equipment supports structures and fencing components.

The contractor shall submit full details of erection procedure and methods of erection such as accurate fabrication, surface treatment (such as galvanization or protective coatings), transportation, assembly, and installation on-site. Proper alignment, bolting, welding (if applicable), and securing of structures must be ensured.

Install equipment steel supports and caps as per bay layouts

The component parts shall be so assembled that:

- The whole and all parts of the finished structure are within the tolerances specified,
- No member is bent, twisted or otherwise damaged, and
- The specified cambers are obtained.

2.10 SECURITY LIGHTING

The security lighting is the lighting around the double security fence of the Substation.

It is operated and switched via a trigger from the non-lethal fence.

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The contractor will be responsible for the installation of the security lighting poles, luminaires, cabling, trenching, distribution boards control cables, connections to the power supply.

2.11 EARTHMAT & EARTHTAILS

The scope includes the supply, installation and testing of the substation earth connections to main earthmat to ensure electrical safety. Effective earthing is of the utmost importance for the protection of the equipment and for safety purposes.

2.12 FLOODLIGHTING

The purpose of Floodlighting is for personnel to observe obstructions & other hazards while moving within the high voltage yards at night-time, and to read high voltage apparatus identification labels, mounted at heights not exceeding 2m above the ground level.

The contractor will be responsible for the installation of floodlighting masts, mounting of luminaires, cabling, trenching, and connections to the power supply and ensuring proper alignment and illumination levels as per project.

2.13 LIGHTING AND HVAC IN BUILDINGS

Sufficient lighting and power points shall be provided for in the buildings to comply to the standards.

Forced ventilation shall be supplied for positive pressure in the Control room and extraction fans for the battery room.

The Battery room shall be zoned, and the installation shall comply with the specific zone.

Air conditioning shall be installed in the control room and offices.

3. DESIGN SPECIFICATION LIST

The table shown below provides the specifications titles and unique numbers for substation infrastructure. These specifications have already been referenced in this document in the sections above for the contractor to consult in the tendering phase as well as at execution phase:

SPEC TITLE	SPEC NUMBER
High security mesh fencing	240-76368574
Standard for hv yard stones	240-108982466
Functional specification for design construction of control building	WKOE11P01-SE-D53
Standard for air Conditioning in Transmission substation Buildings and Telecommunication sites	240-82172806
Standard for operational Floodlighting in Transmission substations	240-83382076
Standard for fabrication steelwork	240-94743192
Standard for the erection of steelwork and microwave towers in eskom transmission substations	240-94743194
Standard for fences in Eskom transmission Substations	240-100183119

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Main civil and building	N/A
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4. GENERAL

The contractor shall, at his own expense, supply and provide all the Constructional Plant, Temporary Works, materials for both temporary and permanent works, labour and supervision, transport to or from the site and in and about the Works and everything required for the construction, completion and maintenance of the Works. The Contractor shall ensure that all the foregoing constituent parts of the Works are to the standard and quality specified in this document or where not specified to the highest available and shall also ensure they are suitable for the purpose intended by Eskom. The Contractor shall be responsible for the strength and quality of all materials used and workmanship employed and for the stability of the permanent works and the temporary works and the fact that the Employer has not objected during the construction period to any materials and/or workmanship employed by the Contractor and even though such materials and/or workmanship have been inspected by the Supervisor shall not relieve the Contractor of such responsibility.

5. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
Andile Maneli	Middle Manager – Civil
Subhas Maharaj	Senior Manager – Substation Engineering
Thato Mathe	Chief Technologist – Civil

6. REVISIONS

Date	Rev.	Compiler/s	Remarks
December 2021	0	S Duma	First Issue
February 2025	1	S Duma	Scope of work modified for the 2026 civil panel

7. DEVELOPMENTAL TEAM

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

- Senzo Duma
- Thato Mathe

8. ACKNOWLEDGEMENTS

- None

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