TRANSNET
freight rail

CAPITAL PROGRAM (ELECTRICAL PROJECTS)

USER REQUIREMENT SPECIFICATION (TECHNICAL REQUIREMENTS)

DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF A NEW 88 kV TO 11 kV INTAKE DISTRIBUTION SUBSTATION AND NETWORK CHANGES AT ERMELO.

Author:	Engineering Technician Capital Program	P Maree	.....
Supported:	Manager (Electrical) Infrastructure Maintenance	G Coetzee	.....
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Date: ..... 2010-01-29 ~~2010~~

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1.0 SCOPE

1.1 The scope for the project covers Transnet Freight Rail's (TFR) requirements for the design, supply, installation, testing and commissioning of a new 88/11 kV intake distribution substation and network changes at Ermelo.

2.0 DESCRIPTION OF WORK

The "works" shall include the following:

2.1 SUBSTATION

2.1.1 CIVIL WORK

2.1.1.1 **Earth Works**

2.1.1.1.1 The identified substation site shall be cleared and prepared.

2.1.1.1.2 An access road to the substation shall be provided.

2.1.1.2 **Foundations**

2.1.1.2.1 Foundations shall be excavated and cast for all support steel structures, buildings and transformer plinth.

2.1.1.2.2 All concrete work shall comply with Specification S 420.

2.1.1.3 **Building**

2.1.1.3.1 The building shall be a brick construction with a concrete roof.

2.1.1.3.2 It shall consist of the main substation building and a separate transformer room. The space shall be sufficient to accommodate all specified equipment.

2.1.1.3.3 The design shall make "space" provision for a 400 V AC switch board panel in the main building. This switch board does not form part of this project.

2.1.1.3.4 The 11 kV/400 V AC distribution transformer/s for the transformer room does not form part of this project.

2.1.1.4 **Fencing**

2.1.1.4.1 Palisade fencing and sliding gates is required along the substation property perimeter.

2.1.2 STRUCTURAL WORK

2.1.2.1 **Steel Support Structures**

2.1.2.2 Steel support structures, preferably of the lattice type, shall support the feeders that tap off the existing 88 kV Eskom transmission lines.

2.1.2.3 All steel structures shall be hot-dip (galvanised) zinc coated to SANS 763.

2.1.3 ELECTRICAL WORK

2.1.3.1 **OUTDOOR EQUIPMENT**

2.1.3.1.1 **Primary Surge Arresters**

2.1.3.1.1.1. The 88 kV AC metal oxide primary surge arresters shall be in accordance with Specification BBB0845 Version 3.

2.1.3.1.1.2. They shall be mounted on a steel pedestal designed to accommodate the surge arresters and to allow for the specified clearances for the rated voltage.

2.1.3.1.2 **AC Disconnects**

2.1.3.1.2.1. The 88 kV AC 3 phase disconnects combined earth switches shall be in accordance with Specification BBB7842 Version 1.

2.1.3.1.3 **Primary Circuit Breaker**

2.1.3.1.3.1. The 88 kV AC 3 phase primary SF6 circuit breaker complete with control panel shall be in accordance with Specification BBB1267 Version 8.

2.1.3.1.4 **Current Transformers**

2.1.3.1.4.1. The 88 kV AC post type current transformers shall be in accordance with Specification BBB0937 Version 2.

2.1.3.1.4.2. They shall be mounted on a steel pedestal designed to accommodate the surge arresters and to allow for the specified clearances for the rated voltage.

2.1.3.1.5 **Secondary Surge Arresters**

2.1.3.1.5.1. The 88 kV AC metal oxide secondary surge arresters shall be in accordance with Specification BBB0845 Version 3.

2.1.3.1.5.2. They shall be mounted on a steel pedestal designed to accommodate the surge arresters and to allow for the specified clearances for the rated voltage.

2.1.3.1.6 **Main Distribution Transformer**

2.1.3.1.6.1. The 5 MVA 88/11 kV 3 phase 50 Hz distribution transformer shall be in accordance with Specification BBB8205 Version 1.

2.1.3.1.6.2. The schedule of technical requirements, Appendix 1, of the aforementioned specification needs to be completed by Transnet Capital Projects (TCP) prior to tendering.

2.1.3.1.7 **Auxiliary Distribution Transformer**

2.1.3.1.7.1. The 50 kVA 11 KV/400 V 3 phase 50 Hz auxiliary distribution transformer shall be in accordance with Specification BBB8205 Version 1.

2.1.3.1.7.2. The schedule of technical requirements, Appendix 1, of the aforementioned specification needs to be completed by TCP prior to tendering.

2.1.3.1.8 **Safety Barriers**

2.1.3.1.8.1. Engineering Instruction CEE-S016's requirements regarding safety barriers around the outdoor and between the outdoor and indoor equipment yards shall be incorporated in the Project Specification.

2.1.3.1.9 **Overhead Feeders/Conductors**

2.1.3.1.9.1. Inter connecting feeders and conductors of the correct size, rating and material shall be installed between the various outdoor equipment.

2.1.3.1.9.2. Clamps shall be of the correct material and properties to prevent any corrosive action between the different materials.

2.1.3.1.10 **Interlocking**

2.1.3.1.10.1. Interlocking of critical equipment i.e. AC Disconnects and the Primary Circuit Breaker shall form part of the design.

2.1.3.2 **INDOOR EQUIPMENT**

2.1.3.2.1 **Medium Voltage Switchgear**

2.1.3.2.1.1. The 11 kV AC metal enclosed switchgear panels with indication and protection devices shall be in accordance with Specification BBB4182 Version 2.

2.1.3.2.1.2. The schedule of technical requirements, Appendix 1, of the aforementioned specification needs to be completed by TCP prior to tendering.

2.1.3.2.1.3. The relevant information contained in Engineering Instruction CEE-P0009 shall be incorporated in the Project Specification.

2.1.3.2.1.4. The following switchgear panels are required:

2.1.3.2.1.4.1. Incomer.

2.1.3.2.1.4.2. Transmission Line No. 1. Protecting the new transmission line supplying the existing Main Substation.

2.1.3.2.1.4.3. Transmission Line No. 2. Protecting the new transmission line supplying the existing West Side and East Side mini substation.

2.1.3.2.1.4.4. Transmission Line No. 3. Protecting the new in feed to the existing transmission line network.

2.1.3.2.1.4.5. DC Loco Mini Substation. Protecting the new DC Locomotive Running Shed mini substation and supply cable.

2.1.3.2.1.4.6. Auxiliary Transformer (50 kVA). (Fuse Switch Disconnector) Protecting the transformer.

2.1.3.2.1.4.7. Local Transformer. (Spare) Will protect a local transformer to be installed at a later stage.

2.1.3.2.2 **Battery Charger**

2.1.3.2.2.1. The information contained in Engineering Instruction CEE-0085.90 shall be incorporated in the Project Specification for the 110 V DC battery charger unit and batteries.

2.1.3.2.2.2. The capacity (Amp-hour) shall be determined by the amount of 11 kV AC switchgear breakers required in the design.

2.1.3.2.2.3. The schedule of technical requirements, Appendix 1, of the aforementioned Engineering Instruction which will form part of the Project Specification shall be completed by TCP prior to tendering.

2.1.3.2.3 **Low Voltage Switchgear / board**

2.1.3.2.3.1. A 400 V AC switch board will not form part of this the project scope, provision of space for installing one in the future shall however be incorporated in the design.

2.1.3.2.4 **Power And Lighting Equipment**

2.1.3.2.4.1. A 220 V AC power and lighting design and layout inside the substation building shall form part of the indoor equipment.

2.1.3.2.4.2. An additional 110 V DC standby fluorescent lighting design and layout shall be required.

2.1.3.2.4.3. Specification CEE-0035.90 shall be applicable.

2.1.3.2.4.4. Provision shall be made for outside/area lighting.

2.1.3.2.4.5. The power and lighting work shall be done in accordance with the requirements of SANS 10142-1.

2.1.3.2.4.6. A Certificate of Compliance (COC) for the power and lighting installation shall be required from the Contractor.

2.1.3.2.5 **Tele-control**

2.1.3.2.5.1. Provision shall be made for tele-control operation of the switchgear breakers.

2.1.3.2.5.2. TCP shall be responsible for arranging the supply, installing and commission of the equipment by TFR.

2.2 NETWORK CHANGES

2.2.1 TRANSMISSION LINES

2.2.1.1 General

2.2.1.1.1 A 11 kV AC 3 phase transmission line shall be installed from the New Substation to the existing Main Substation (± 3,5 km)

2.2.1.1.2 A 11 kV AC 3 phase transmission line shall be installed from the New Substation to the existing East and West Side mini substations (± 3 km).

2.2.1.1.3 The applicable clauses of Specification CEE-0237.96 shall be complied with.

2.2.1.1.4 All “tap off” positions from the transmission line shall be provided with hand operated switches, fused cut outs and surge arresters. The supply cables from these positions to the loads mentioned in clauses 2.2.1.1.1 and 2.2.1.1.2 shall form part of the works.

2.2.1.2 Structures

2.2.1.2.1 The existing Overhead Track Equipment (OHTE) steel mast structures shall be used where the transmission line route runs along the existing electrified track.

2.2.1.2.2 New structures shall be required where the above is not the case.

2.2.1.2.3 The most practical and economic routes are to be determined.

2.2.1.3 Conductors

2.2.1.3.1 The 11 kV AC 3 phase aluminium transmission line conductor sizes shall be determined by the rated loads they are to supply. Some additional capacity is to be incorporated in the design to allow for possible future expansions.

2.2.1.3.2 The conductors shall be mounted on insulators installed on brackets fitted to the mast structures.

2.2.1.3.3 A single earth conductor shall be installed on these brackets.

2.2.2 MINI SUBSTATION

2.2.2.1 A 315 kVA 11 kV/400 V AC mini substation shall be installed at the DC Locomotive Running Shed.

2.2.2.2 A supply cable of sufficient rating shall be installed between the New Substation and this mini substation (± 1 km).

2.2.3 TRANSMISSION LINE IN FEED

2.2.3.1 A 11 kV AC 3 phase transmission line in feed supply shall be installed from the New Substation to the existing nearby transmission line.

2.2.3.2 The “tap off” position from the transmission line shall be provided with a hand operated switch, fused cut outs and surge arresters. The supply cable from this switch to the New Substation shall form part of the works.

3.0 DESIGN

3.1 Designs for the required works shall be the responsibility of TCP based on the applicable drawings and standards as specified by TFR and available on the TFR ProjectWise server.

3.2 The requirements of Specification CEE-0088.92 and Engineering Instruction CEE-P0085.90 shall be adhered to.

4.0 EARTHING

4.1 Earthing of all equipment for the New Substation installation shall be required.

4.2 The applicable portions of Drawing BBB3620 shall be complied with.

4.3 Earthing of the transmission line installations shall be required.

4.4 Earthing principles stipulated in the guidelines of Engineering Instructions CEE-0177.86 and CEE-P026 as well as SANS 10142-1 shall be applicable.

5.0 BONDING

5.1 Mast bonding of the transmission line installations on or near the OHTE is required.

6.0 CABLING

6.1 The supply of cabling shall be in accordance with Specification BBC0198 Version 1.

6.2 Cable lying, termination, jointing, testing and commissioning shall comply with the requirements of Engineering Instruction CEE-0023.90.

6.3 Engineering Instructions CEE-P045 and CEE-GI016's information shall be applicable for cable back filling and marking purposes.

7.0 QUALITY INSPECTIONS

7.1 All major items of equipment shall be subject to TFR quality control tests and inspections prior to the delivery to site.

8.0 STANDARDS

The following publications (latest edition) are applicable and shall be adhered to.

8.1 **Transnet Freight Rail Specifications**

BBB0845 Version 3	-	Requirements for metal oxide surge arresters without caps for AC systems in accordance with SANS 60099-4.
BBB0937 Version 2	-	Requirements for outdoor post type current transformers for traction and distribution substations.
BBB1267 Version 8	-	Requirements for outdoor alternating current circuit breakers for traction and distribution substations.
BBB4182 Version 2	-	Indoor, medium voltage metal enclosed switchgear and control gear in accordance with IEC 62271-200.
BBB7842 Version 1	-	Outdoor, high voltage, alternating current disconnectors combined with earthing switches.

	BBB8205 Version 1	-	High voltage supply transformers in accordance with IEC 60076 and BS 171 (For nominal system voltages 33 kV up to 132 kV).
	BBC0198 Version 1	-	Requirements for the supply of electrical cables.
	S 420	-	Specification for concrete work.

8.1.1 Specifications available on the TFR ProjectWise server.

8.2 **South African National Standards**.

	SANS 763	-	Hot dip galvanised zinc coatings.
	SANS 10142-1	-	Wiring of premises.

8.2.1 Specifications that need to be incorporated into the design to perform the works to TFR required standards.

9.0 DRAWINGS

9.1 The following Transnet Freight Rail drawings are applicable.

	BBB3620	-	3 kV DC earthing arrangement traction substation.

9.2 Drawings available on the TFR ProjectWise server.

9.3 “As Built” drawings of the new installations shall be required.

10.0 ENVIRONMENTAL

10.1 The requirement of an environmental impact assessment shall be investigated and obtained by TCP if required.

11.0 TESTING AND COMMISSIONING

11.1 After the work has been completed the installations shall be tested and commissioned.

11.2 All pre-commissioning tests shall be performed by the Contractor and witnessed by TFR.

12.0 GENERAL

12.1 Transnet Freight Rail shall be used in lieu of Transport Services/Spoornet in publications mentioned as part of this User Requirement Specification.

12.2 A Project Specification incorporating the requirements as specified in this URS as well as the Main URS shall be compiled by TCP for tendering purposes and submitted to Transnet Freight Rail for ratification. The correctness of the detail shall remain the responsibility of TCP.

END