SCOPE OF WORKS
FOR THE SUPPLY AND INSTALLATION OF A TRU, FDU, NDU, TEST POINTS AND ANODE GROUND-BED FOR TRANSNET PIPELINES

TABLE OF CONTENTS

1. GENERAL

1.1. Introduction

1.1.1. *Transnet Pipelines* (TPL) a petroleum pipeline operator intends to initialise a project to upgrade the cathodic protection system at various sites in need of an upgrade. The objective is to ensure compliance with our strategic outlook on pipeline maintenance and integrity management aligned with international NACE standards for cathodic protection.

1.1.2. This enquiry is for the appointment of a cathodic protection *Contractor* to supply required materials and install such materials for a functional cathodic protection system and to ensure that the NACE and SANS criterion for pipeline protection which stipulates the measurement of" true", "OFF" or polarized potential of more negative than -0.85Vcse as is achieved.

1.1.3. This scope of work covers the supply, ascertainment, manufacture, erection, application, delivery, handling, transportation, unloading / receiving, installation, construction, assembly, system testing, quality assurance and commissioning of the works at the sites tendered for. Depending on the site, the work may include the construction of platforms to secure CP & ACM enclosures, the construction of horizontal or vertical ground-beds. Furthermore, the works may require liaison with foreign pipeline owners for the cross-bonding purposes and working in remote areas.

1.1.4. TPL shall include with this scope of works a "Bill of Quantities (BOQ)" to assist *Contractor*s with costing the various items and/or tasks.

1.1.5. The *Contractor* shall also note that in certain instances, TPL may provide certain materials for free, however the contractor is obliged to install such material. The material will be shown on the BOQ but will be explicitly shown as "Free issue" material and the *Contractor* must only price the installation cost.

1.1.6. The *Contractor* shall be paid for work done to date as per the BOQ items and rates and a proportion of each lump sum which is the proportion of the work covered by the item which the *Contractor* has completed. TPL has included with this scope of works "drawings" to further assist the *Contractors* with the BOQ pricing.

1.2. Abbreviations & Definitions

To understanding this scope of works, the following abbreviations apply in addition to the NEC.

Abbreviation	Meaning given to the abbreviation
AIA	Approved Inspection Authority
BOQ	Bill of Quantities
CAD	Computer Aided Design
COC	Certificate of Compliance
COVID-19	Corona Virus Disease 2019
DB Box	Electrical Distribution Box
FAT	Factory Acceptance Test
FIC	Field Inspection Checklist
GA	General Arrangement
LV	Low Voltage
NEC	New Engineering Contract

OHS Act	Occupational Health and Safety Act, 85 of 1993
PDF	Portable Document Format
PPE	Personal Protective Equipment
SAT	Site Acceptance Test
SHE	Safety, Health and Environment
TPL	Transnet Pipelines
PQP	Project Quality Plan
QCPs	Quality Control Plans
QCP	Quality Control Plan
FICs	Field Inspection Checklists
WPS	Welding Procedure Specifications
NCR	Non-Conformance Report
QA	Quality Assurance
QC	Quality Control
AC	Alternating Current
CH:	Valve Chamber
CIPS	Close Interval Potential Survey
CP	Cathodic Protection
CSE	Copper Sulphate Electrode
$Cu/CuSO_4$	Copper/Copper Sulphate
DC	Direct Current
DCVG	Direct Current Voltage Gradient Survey
DSR	Deep Soil Resistivity
ECDA	External Corrosion Direct Assessment
HDG	Hot Dip Galvanized
HIRA	Hazard Identification & Risk Assessment
HV	High Voltage
IF	Insulating Flange
IJ	Insulation Joint
ISO	International organization of standard
ICCP	Impressed Current Cathodic Protection
MMO	Mixed Metal Oxide
NACE	National Association of Corrosion Engineers

NDU	Natural Drainage Unit
PCM	Pipeline Current Mapping
PRE	Permanent Reference Electrode
PSP	Pipe to Soil Potential
ROCLA	Heavy duty concrete bathroom-like unit use to house a TRU/FDU/NDU
SRB	Sulphate Reducing Bacteria
SWA	Steel Wire Armoured Cable
TRU	Transformer Rectifier Unit

Bill of quantities	(BOQ) – Pricing instructions that are contained in the tender document and indicate the quantities to be supplied or installed
Cathodic protection	The process to reduce or prevent corrosion of metal structures in contact with an electrolyte by the flow of direct current from the electrolyte onto the surface of the structure
Impressed current cathodic protection	(ICCP) – Cathodic protection system utilising anodes which are energized by an external DC power source. The ICCP system is designed to deliver relatively large currents from a limited number of anodes
Sacrificial anode cathodic Protection	(SACP) - Cathodic protection system utilising sacrificial anodes which have a higher energy level or potential with respect to the structure to be protected. The SACP system is designed to deliver relatively small currents from many anodes
Cathodic protection system	A combination of equipment installed to provide cathodic protection to the pipeline
Drain point	The point on the pipeline where the connection of the negative terminal of the cathodic protection voltage source is made to conduct (drain) the returning current from the pipeline to the voltage source
Electrolyte	Conductive material such as soil or water in which an electric current can flow
Earth spike	A threaded metal spike, typically 1,5 m long an electroplated as per SANS 1063
Foreign structures / pipelines	Metal structures or pipelines other than the pipeline under consideration, in contact with the same electrolyte as the pipeline and which are or may become under the influence of the pipeline's cathodic protection system. Foreign structures / pipelines may be owned by the principal or other companies and may or may not be equipped with cathodic protection
Ground-bed	A system of buried or submerged electrodes used to conduct the required current into and through the electrolyte to the steel surface to be protected
Lightning arrestor	A device used on cathodic protection systems to protect the insulation and conductors of the system from the damaging effects of lightning

Midpoint	The point on a pipeline between two cathodic protection stations where the influence of the two cathodic protection stations is expected to be equal and the protection levels are usually lowest
Natural potential	The pipe to soil potential measured when no cathodic protection is applied, and polarisation caused by cathodic protection is absent
“OFF” potential	The pipe to soil potential measured immediately after the cathodic protection system is switched off and the applied electrical current stops flowing to the pipeline surface but before polarisation of the pipeline has decreased
“ON” potential	The pipe to soil potential measured while the cathodic protection system is continuously operating
Pipe-to-soil potential	The difference in electrochemical potential between a pipeline or foreign structure/pipeline and a specified reference electrode in contact with the electrolyte. Similar terms such as structure to soil potential, pipe to electrolyte potential is sometimes used
Polarisation	The change of the pipe to soil potential caused by the flow of DC current between an electrolyte and a steel surface
Reference electrode	An electrode which the electro chemical potential is accurately reproducible and serves as a reference for pipe to soil potential measurements
Stray currents	Electrical currents running through the electrolyte, originating from a foreign DC/AC source which causes interaction with the and cathodic protection system and adversely acts upon foreign structures/pipelines

1.3. General Notes

1.3.1 **Most of the work as described in this specification represents works on existing facilities that will or may be in operation during the Contract, for this reason all necessary precautions are to be taken to ensure that normal pipeline and work operation is not disrupted in any way. Contractors are thus required to note that access to the site will be limited and dependent on operational constraints. Contractors will therefore be required to co-operate responsibly with operational staff and to schedule their work programmes to achieve completion of the project. *Contractors* are to note that work shutdown periods shall be scheduled according to TPL operational constraints and may fall over weekends/public holidays. TPL will not be held responsible, in terms of cost, for any site delay that may arise from petroleum line operations enforced by TPL.**

1.3.2 **The *Contractor* shall supply adequate and competent labour, supervision, tools, equipment, services, testing devices for each item necessary to complete the work. TPL reserves the right to terminate the contract at any point if it is found that the Contractor’s performance, supervision, tools, equipment, services, testing devices and material do not comply with specified requirements. The Contractor will only be allowed to claim for work completed to the specified acceptable standard.**

1.3.3 *Contractors* are to note that the responsibility for the installation and commissioning of all elements of equipment as specified in the design document shall remain with the Contractor. In this regard, the Contractor is required to satisfy himself that all applicable elements of the Equipment offered can comply with all specifications and reports as included or mentioned in the Tender Documents. Failure to meet specification shall render the successful Contractor liable to rectify the problem at no cost to TPL.

1.3.4 The successful Contractor is to note that TPL reserves the right to free-issue certain items of equipment as listed on the BOQ. Free issuing of these items, once accepted by the Contractor, in no way diminishes the Contractor responsibilities as detailed in the contract documentation. The Contractor shall conduct quality checks as to familiarise himself with the working condition and cosmetic appearance of the free issue items. Acceptance of free-issued equipment by the Contractor shall include the following:

1.3.5 Acceptance of responsibility in terms of any damages or losses from date/time of handover until end of project handover phase.

1.3.6 Acceptance to be indicated in writing.

1.3.7 The Contractor is to note with regards to works onsite, that responsibility for the protection of all existing equipment and services shall rest solely with the Contractor. The Contractor shall be required to bear all cost which may arise as result of damage which may have been caused to equipment or services or which may arise because of his operation on the respective sites.

1.3.8 The Contractor shall only utilise testing devices and measuring equipment that are certified and carry a valid calibration certificate as issued by an approved calibration authority. Documentation reflecting the type, name and calibration certificate of the test equipment that will be utilised to complete the work and shall be available at the request of the Project Manager.

1.3.9 Where control equipment, peripherals or instrumentation from various suppliers or manufacturers are offered for controlling the various sub-systems or portions of a sub-system, it shall be the responsibility of the Contractor to ensure the various portions are fully integrated into a single coherent system. Where specific project development is required, TPL shall first approve these.

1.3.10 Contractors are to note that no system or sub-systems shall be designed especially for this project, as it is a requirement that only proven systems and sub-systems be installed.

1.3.11 The Contractor shall submit the required Safety, Health and Environment (SHE) Compliance File for approval by TPL, before any works can commence. The content of the SHE Compliance File is dictated by the work undertaken and shall ensure full compliance to the requirements of applicable legislation and best practice standards. The Contractor is also to refer to the attached SHE Compliance file review-guidelines for the SHE Compliance file to fulfil the requirements of applicable legislation and best practice standards.

1.3.12 The Contractor and his personnel/sub-contractors shall attend the compulsory TPL induction training before commencement of the work. Standing time approximately 2 hours. The induction training can either be conducted at TPL Pinetown/Alrode workshop or at an alternative TPL facility as arranged by the Project Manager.

1.4. Notes to Contractors

1.4.1 The Contractor shall submit a LUMP SUM price for completion of all elements of the works. Contractors are to note that TPL will entertain no additional claims of any nature.

1.4.2 The Contractor shall supply a detailed breakdown of all costs to complete all the work as specified for the specific site(s). With reference to the attached BOQ pricing schedule, cost shall include all travel, accommodation, labour, supervision, tools, equipment, services, testing devices and specified equipment as outlined in the BOQ. Contractor to note, TPL will not entertain any additional claims for labour cost over weekends, public holidays or after-hours labour. Any work not complying with specifications as contained herein and elsewhere in the contract document shall be redone at the Contractor's own expense. Contractors are required to return together with their tenders fully completed BOQ. The tender document will be deemed incomplete if either one of the above documents are not fully completed and contains as a minimum the items as per the respective documents supplied with the tender documents.

1.4.3 The Contractor is to note that for materials and parts not included in this document the Contractor shall provide an installed price for these parts at cost plus a predetermined mark-up. This predetermined mark-up is to be supplied by the Contractor with a supplier's invoice before payment will be approved. If the Contractor is an agent of a particular range of products their price lists are to be included in the tender documentation. The Contractor must note this is an installed price and must include travelling, accommodation, site installation, labour, materials and all equipment involved. Please note no further claims of any nature will be allowed and cost prices of items will be verified with suppliers before payment is approved.

1.4.4 The *Contractor* shall supply day and hourly work rates for the various grade of staff required.

1.4.5 The *Contractor* shall furnish proof of actual experience in the class of work for which they have tendered and must submit with the tender on the relevant form attached to the tender documents, a statement of works recently carried out. The list shall include the value of previous contracts, completion dates, contact names and telephone numbers.

1.4.6 The *Contractor* to note that incomplete tender documents will not be considered.

1.4.7 The Contractor shall ensure that they have the requisite insurances in place prior to commencement of the project.

1.5. Project Time Schedule

1.5.1 Programme to Be Furnished After Contract Award

1.5.1.1 The order in which the works are to be carried out shall be as directed by the Project Manager. Within fourteen (14) days after the acceptance of his Tender, the Contractor shall submit to the Project Manager for his approval a detailed work programme conforming to the Project Manager's requirements, showing the order of procedure and method in which he proposes to carry out the works, and shall, whenever required by the Project Manager, furnish for his information, particulars of the Contractor's arrangement for carrying out the works, of the construction plant and temporary works which the Contractor intends to supply, use or construct as the case may be. The programme shall cater for duration(s) by which information is to be supplied by the Project Manager. This programme shall be referred to as the Programme, be issued as a Gantt chart based on a detailed activity linked programme and be subdivided into operations of day(s) or week(s) duration. The programme shall be man loaded by crafts and craft mix ratio of skilled and unskilled. The submission to and approval by the Project Manager of such programme or the furnishing of such particulars, shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

1.5.1.2 This programme, when accepted by the Project Manager will be binding on the Contractor. Amendment to the programme can only be effected by the Project Manager's acceptance of the Contractor's revised programme.

1.5.1.3 The programme shall be used to monitor progress. The programme shall remain in force but the resources to achieve the programme shall be updated at each site meeting and the Contractor shall report progress to date and what steps shall be taken to ensure adherence to programme.

1.5.1.4 Should the successful Contractor at any time during the contract fall behind the approved programme, then the Project Manager may require the Contractor to adjust his manner of working and/or employ additional staff, at NO additional cost to TPL, in order that the approved programme can be achieved.

1.5.2 Programme to Be Furnished with Tender

1.5.2.1 The tender programme shall be in Gantt chart format programme. Contract award shall be designated week 0. The tender programme shall not be less than the kick-off meeting, access to site, design, procurement, manufacture, delivery to site, installation, site acceptance testing, defect correction, commissioning, and handover periods for each site at a time. This programme shall also be cost loaded to indicate expected cash flow.

1.5.3 Programme on Which Tenders Are to Be Based

1.5.3.1 Various key elements of the entire project are indicated below: -

- Contract award
- Kick-off meeting
- Access to site (only after TPL Induction and Site-Specific Induction)
- Meetings
- Design
- Procurement
- Manufacture
- Delivery to site
- Installation
- Inspections and testing
- Site acceptance testing
- Defect correction
- Commissioning & Handover

1.6. Reference Documentation

1.6.1 The requirements of the materials, design, installation, commissioning, examination, inspection and testing of equipment and facilities onsite shall be in accordance with the relevant sections of the below mentioned codes.

1.6.2 Where Government, Local authorities and other statutory body's regulations, laws and requirements are more stringent than those specified hereunder, the regulations, laws and requirements shall take precedence.

1.6.3 Where no specific rules, regulations, codes, or requirements are contained in this specification nor covered by the below mentioned codes, the *Contractor* shall, in consultation with TPL, adhere to internationally accepted engineering practices or original manufacturers specification.

1.6.4 The TPL issued drawings will be for information, ascertainment and/or construction and does not relieve the *Contractor* of any responsibility to submit to TPL, prior to construction, all corrected and accepted drawings for TPL acceptance and obtaining a TPL signature of acceptance prior to any construction.

1.6.5 To understanding these Standards, the following abbreviations apply.

- SANS - South African National Standards
- SABS - South African Bureau of Standards
- BS - British Standards
- IEC - International Electro technical Commission
- NEC - New Engineering Contract

General:

TITLE	SANS	IEC	BS	OTHER
Code of Practice for Wiring of Premises and incorporated standards	SANS 10142			
The installation and Maintenance of Electrical Equipment used in explosive atmospheres.	SANS 10086-1			
Explosive Atmospheres	SANS 60079			
Protection against lighting: Physical damage to structures and life hazard	SANS 10313			
Protection against lighting	SANS 62305			
Protection against lighting (EMI)	SANS 61312			
Hot dipped galvanised coatings on fabricated iron and steel articles.	SANS 121:2011			
Occupational Health and Safety Act and Regulations. 85 of 1993				
Conditions of Contract				NEC
NACE international standard practice – Control of external corrosion on underground or submerged metallic piping systems				NACE SP0169 – 2013
Petroleum and natural gas industries - cathodic protection of pipeline transportation systems. part 1 on-land pipelines				ISO15589-1
Protection against corrosion by stray current from direct current systems				EN50162
Cathodic protection measurement techniques				EN13509
Measurement techniques related to criteria for cathodic protection on underground or submerged metallic piping systems				TM0497
The use of coupons for cathodic protection monitoring applications				NACE SP0104-2014
The use of coupons for cathodic protection monitoring applications. NACE international task group 210 - coupon technology - technical report on the application and interpretation of data from external coupons used in the evaluation of Cathodically protected metallic structures				NACE RP0104-2004

The wiring of premises part 1: Low voltage installations	SANS 10142-1			
The design and installation of an earth electrode specifications	SANS 10199			
Materials of insulated electric cables and flexible cord's part 1: **Conductors**	SANS 1411-1			
Materials of insulated electric cables and flexible cord's part 2: **Poly-vinyl-chloride (PVC)**	SANS 1411-2			
Materials of insulated electric cables and flexible cord's part 3: **Elastomers**	SANS 1411-3			
Materials of insulated electric cables and flexible cord's part 5: **Cross – linked polyethylene (XLPE)**	SANS 1411-4			
Electric cables with extruded solid for fixed installations (300/500v to 1900/3300v) part 1: **General**	SANS 1507-1			
Electric cables with extruded solid dielectric insulation for fixed installations (300/3300v) part 2: **Wiring cables**	SANS 1507-2			
Cathodic protection measurement techniques	SANS 53509:2009			

1.6.6 The latest revision of the following TPL standard specifications, where applicable, shall apply. It is a requirement that *Contractors* comply with all applicable clauses of the specifications in the execution of the work they undertake.

- PL652 Rectifier Specification
- PL121418 Resistance Panel A4
- PL400H Holiday Detector Specification
- PL415G Steel Insulation Flange Specification
- PL727 Specification for Cable, Racking, Trenching & Earthing Reticulation
- PL711 Specification for Equipment Cabinets to House Electronic Equipment
- PL804 General welding specification
- EA08729A01 Rev A Transnet Equipment Shelter GA (Rocla enclosure Specification)
- EA08768A01 Rev A Transnet Equipment Shelter Inner Grid (Rocla Specification)
- EA08768A03 Rev A Transnet Equipment Shelter Outer Grid (Rocla Specification)
- Drawing number 2684358-C-PL1-CP-DD-181.
- Drawing number 2684358-C-CP-DD-180.

Note: Copies are available on request.

2. General Works Execution and Site Requirements

2.1 Site Meetings

2.1.1 The *Contractor* shall attend site meetings when convened by the *Project Manager*. Such meetings will be for the purpose of discussing progress, delays, materials, conditions, and specifications, as well as the co-ordination of site activities. The meetings will be chaired by the *Project Manager,* or his Deputy and the proceedings shall be noted and circulated by the *Project Manager*.

2.2 House Keeping

2.2.1 The *Contractor* shall maintain the work sites always clean and tidy.

2.2.2 The *Contractor* shall take all reasonable precautions to protect existing equipment while work is in progress. Protection of existing equipment shall include protection against dust or any other harmful matter.

2.3 Materials

2.3.1 The *Contractor* shall ensure that all metal items other than stainless steel or other non-ferrous metals are hot dipped galvanised.

2.3.2 The *Contractor* shall ensure that precaution is taken against electrolytic corrosion where different metals are used on items of equipment.

3. General Operating Conditions

3.1 Hazardous Area

3.1.1 All areas demarcated as “Exd” areas are to be treated as hazardous and *Contractors* shall ensure that the necessary care is taken to prevent damage and fire.

3.2 Climatic Conditions

3.2.1 Unless otherwise specified, all control equipment, peripherals and ancillary equipment shall be capable of operating in an uncontrolled environment, and at ambient temperatures, which vary between -5 degrees Celsius and 50 degrees Celsius.

3.2.2 *Contractors* must state the heat, power and environment requirements for all equipment offered in the tender.

3.2.3 The equipment must operate satisfactorily between sea level and 2000 metres above sea level.

3.2.4 The equipment must be capable of operating in a relative humidity range from 5% RH to 95% RH.

3.2.5 Dust and vapours accumulate rapidly, and selection of equipment and installation thereof shall be given careful consideration to minimise the detrimental effects of this.

3.2.6 Severe lightning occurs in certain of the areas in which the equipment will operate. TPL will not regard damage to equipment resulting from a lightning strike or a power surge as unavoidable except where such a strike is a "direct strike".

4. Scope of Works

4.1 Design

4.1.1 TPL shall issue the *Contractor the* proposed cathodic protection schematic drawings, proposed cathodic protection layout with proposed cable routing and the relevant BOQ as per respective TPL site.

4.1.2 The TPL issued drawings will be for information, ascertainment and/or construction and does not relieve the *Contractor* of any responsibility to submit to TPL, prior to construction, all corrected or accepted and approved drawings for TPL acceptance and must obtain a TPL signature of acceptance prior to procurement and construction.

4.1.3 The *Contractor* shall also ascertain if the proposed cathodic protection drawing outlined in clause 4.1.1 meet the NACE or SANS requirements for an installed CP system which are determined as per the attached CP design report.

4.2 Cathodic protection and Civil Work

4.2.1 The Contractor shall supply and install new equipment and fittings as per the BOQ submitted during the respective tender, the approved design and scope of works as per specific site and associated drawings.

4.2.2 Transnet shall determine all cable routes prior to the Contractor commencing with the works.

4.2.3 The *Contractor* shall provide security for high-risk areas for personnel and materials for the duration of the project works.

4.2.4 The *Contractor* shall be required to excavate the rail/anode header cable trench as per site design specification.

4.2.5 The *Contractor* shall supply and install a single phase or three phase TRU FDU in accordance with the TPL manufacturing specification. These units shall be installed on site once they have been factory tested and have passed the FAT.

4.2.6 The TRU or FDU shall be installed inside a steel lined ROCLA enclosure and the door hinges shall be inside the ROCLA enclosure. The enclosure shall comprise a suitable DB box and KW/h meter. The TRU or FDU shall be earthed using a 6m X 6m zinc earth-mat covered in a 100mm layer of low resistance backfill such as a 50/50 mix of gypsum and bentonite.

4.2.7 *Contractor* shall be required to excavate to pipe depth and expose the pipeline circumferentially to allow for the negative cable attachment of 16mm^2 4 core SWA, black cable and a monitoring cable of 16mm^2 single core black cable. The cables shall be looped around the bottom of the pipe and attached to the pipeline at the 12 o'clock position, attachment shell be done by thermite welding procedure.

4.2.8 Supply and install a permanent reference electrode (Cu/$CuSO_4$ PRE) and a DC / AC monitoring coupon approximately 300mm away from the pipeline. The PRE and coupon shall face the pipeline and installed in a bed of selective backfill or low resistance backfill such as 50/50 mix of gypsum and bentonite prior to backfilling of the excavation. The PRE and coupon tails shall be as per the design specification.

4.2.9 All vandalised or broken-down concrete enclosures within the installation site shall be removed and discarded appropriately and any exposed cable shall be cap, sealed and buried to prevent the loss of any protective CP current.

4.2.10 In the case of a TRU installation, the contractor shall supply and install a positive header cable, typically 35mm^2 4 core SWA, red cable or red sleeve, the length of which shall be determined as per the CP design specification and terminated at the positive terminal of the TRU.

4.2.11 The contractor shall supply and install a power cable, typically 16mm^2 4 core aluminium or steel cable, the length of which shall be determined as per the CP design specification.

4.2.12 In the case of an FDU installation, the contractor shall supply and install 2 of 5m X 35mm^2 steel wire cable (Kwena cable), attached to the railway line as per the blue bond procedure. This cable will be buried at a depth of 1.5m from the railway line and then joined by using a suitable splicing kit to the predetermined length (as per CP design) of 35mm^2 4 core SWA, red cable/ red sleeve to be terminated at the positive terminal of the FDU. All cable crimping shall be done using a hydraulic crimping tool.

4.2.13 The *Contractor* shall also note that other items on the BOQ will be issued "free of charge" by TPL as indicated under the column "material supplied by" of the BOQ, the *Contractor* will have to insert both the material and the labour rate for such items.

4.2.14 The *Contractor* shall ensure that the cable routing follows the TPL proposed or accepted cable routing as it makes use of agreed servitudes. The Contractor shall ensure that the trenching routes are pegged by TPL surveyors and appropriate wayleaves signed by those taking responsibility.

4.2.15 Where no clear servitudes exist, TPL shall deploy land liaison officers and land surveyors to negotiate appropriate cable trenching routes with foreign landowners.

4.2.16 The Contractor shall ensure that all excavations across road crossings/hardened surfaces are re-instated such that the previous finish and all layer works are matched.

4.2.17 All agreed cable routes shall be pegged using wooden pegs, sprayed with luminous paint in order to guide the contractor during the trenching phase of the works.

4.2.18 Cable trenches shall typically be ±1.5m deep and 300mm wide and encased in 20MPa ready-mix concrete to prevent the theft and vandalism of the cable.

4.2.19 Horizontal ground-bed trenches shall typically be ±2.5m deep and 600mm wide

4.2.20 The shallow vertical ground-bed shall consist of shallow vertical holes drilled or indicated to a depth as specified in the attached design report at a diameter of 210mm installed to the specified depth of cover and spaced according to the design specification. Typically, each hole will comprise a maximum of 3 anodes spaced 1.5m from centre to centre with individual tails being terminated inside the anode junction box. A PVC casing of suitable length shall then be installed at the mouth of the bore hole to prevent the bore-hole form collapsing. The casing shall extend beyond at least 300mm above natural ground level.

4.2.21 For the construction of the deep-well vertical ground-bed, the contractor shall Supply Mixed Metal Oxide (MMO) Anodes in canisters as per design specification. At least the 2m bottom portion of the Ground-bed is to be filled with calcined petroleum coke of particle size **95**% <1.5mm and 5% <0.5mm before start of active zone. **A**node**s** shall be installed centrally in the active zone inside the calcined petroleum coke bed. Anodes shall be spaced 1.5m from centre to centre with individual tails being terminated inside the anode junction box. The coke shall be mixed with soapy water (liquid soap) to form slurry prior to pumping or pouring inside the bore hole. No dry coke shall be allowed. The top anode shall be covered with at least 1m coke bed. The remainder of the Ground-bed or inactive zone is to be backfilled with graded washed silica sand of particle size 5-7mm with quantities indicated in the design specification.

4.2.22 Where the contractor is required to supply and install a standard concrete bunker enclosure, TPL shall provide a drawing of such bunker which shall at least have the following dimensions:

- Outer Dimensions:
  - Front view dimensions: 1442mm X 796mm
  - Side view dimensions: 1442mm X 695mm (base) X 502mm (top)
- Bunker Inner Dimensions:
  - Front view dimensions: 796mm X 430mm
  - Side view dimensions: 415mm X 325mm
- The concrete strength of the bunker shall not be less than 45MPa. Each unit shall have a testing certificate and test block available upon request.
- The bunker shall have at a minimum, Y12 HDG rebar cast into the concrete and provision for an M24 eye bolt for lifting the bunker.
- The door shall be at least 5mm thick, grade S355 case hardened steel for added strength and corrosion prevention.
- The locking mechanism of the bunker shall consist of 2 X shrouded bolt locks. The bolts shall attach to a built-in case-hardened striker plate, the configuration of which mitigates against vandalism.
- The bunker shall be provided complete with chaises and suitable gland plate.

4.2.23 Where the contractor is required to supply and install a mega concrete bunker enclosure, TPL shall provide a drawing of such bunker which shall at least have the following dimensions:

- Bunker Outer Dimensions:
  - Front view dimensions: 1435mm X 1420mm
  - Top view dimensions: 1420mm X 1050mm
- Bunker Inner Dimensions
  - Front view dimensions: 770mm X 875mm
- The concrete strength of the bunker shall not be less than 45MPa. Each unit shall have a testing certificate and test block available upon request.
- The bunker shall have at a minimum, Y12 HDG rebar cast into the concrete and provision for an M24 eye bolt for lifting the bunker.
- The door shall be at least 5mm thick, grade S355 case hardened steel for added strength and corrosion prevention.
- The locking mechanism of the mega bunker shall consist of 3 X shrouded bolt locks. The bolts shall attach to a built-in case-hardened striker plate, the configuration of which mitigates against vandalism.
- The mega bunker shall be provided complete with chaises and suitable gland plates

4.2.24 Where the contractor is required to supply and install a Underground chamber test post, TPL shall provide a drawing of such underground test post which shall at least have the following dimensions:

Underground test post Dimensions

- The inner dimensions of the underground test post frame shall be suitable for the installation of a standard bunker chassis (dimension 500mm x 300mm) and TPL type link panels, with noncorrosive material, and the inner depth should be 1000m plus.
- All underground cable attached to moving components must be flexible with less copper and terminated to the termination box that allows for four core cables and single core to be terminated.
- Due to the nature of installation of underground test post that is in level with the ground level, the design of the test post must be of the underground type with IP rating of 68, for water and dust not to slip through
- The installation of the underground test post shall have reinforced concrete surround that is 300mm out, and the concrete strength of have reinforced concrete surround shall not be less than 45MPa.
- Access of the underground test post shall be opened with the app, and any unauthorised entry and temper (vibration and light sensor) shall be reported on the central platform, for any theft of vandalism control measure (Optional).
- Underground test post should be able to monitor DC, AC, and instant off CP potentials remotely (Optional).
- The *Contractor* shall ensure that a suitable IP65 rated enclosure is used for cable terminations inside of chambers or as per the CP design requirement.

4.2.25 The *Contractor* shall ensure that a suitable IP66 rated enclosure is used for cable terminations inside of enclosures in areas vulnerable to explosions, such as petroleum and gas plants.

4.2.26 The *Contractor* shall ensure that all fittings, conduits, saddles, and housings are corrosion resistant, dust and moisture resistant and where applicable explosion proof.

4.2.27 The *Contractor* shall ensure that key personnel have the requisite training in the tasks that they are employed to do. The minimum requirements being the following:

- NACE 1 certification
- Legal liability
- Supervisory training
- Introduction to project management
- HIRA
- First aid training
- Excavation training
- Permit issuer and receiver training

4.2.28 The *Contractor* shall ensure that cable attachments are conducted in compliance with NACE specifications and as per TPL cable attachment specification.

4.2.29 The *Contractor* shall ensure that all site work is conducted with a permit in place, the permit shall be issued to the contractor's site supervisor daily.

4.2.30 Where required and accepted by the TPL *Project Manager*, the *Contractor* shall ensure that all excavations are done and completed by hand (machines not permitted before the pipeline is partially exposed). Allowance is to be included to detect services along a route prior to trenching. Any existing services damaged during excavation will be repaired at the *Contractor's* cost.

4.2.31 The contractor shall carry out commissioning of the TRU or FDU, ensure that all installations, including cabling are labelled as per TPL requirements. Where required, data logging and coating integrity testing (PCM or CIPS survey) and CIPS to determine the effectiveness of the CP system. The commissioning of the CP system and associated reports including quality control documents and as-built drawings will form a part of the hand-over package.

4.2.32 The Contractor shall ensure that all circuits are labelled according to TPL specification.

4.2.33 The *Contractor* shall ensure that all cables are labelled at both ends according to TPL specification (Laser engraved 316 stainless steel tags, tied with stainless steel cable ties).

4.2.34 The *Contractor* shall be responsible for issuing COC's on completion of the work. (Classification certificates are required for all equipment installed in hazardous areas).

4.3 Hold Points

4.3.1 Prior to commencement of procurement and manufacture, design acceptance shall be obtained from the *Project Manager*. Hold points for acceptance to proceed shall entail as a minimum submission of the following documentation: -

- Detailed design report
- Rectifier schematic drawings showing the new rectifier design layout
- Installation and equipment drawings
- GPS co-ordinates of proposed cable routes and key installations
- Equipment and material lists.
- Construction drawings of any equipment that will be manufactured.

4.3.2 The *Contractor* should take note that acceptance by the *Project Manager* of submitted drawings does not relieve the *Contractor* of responsibility for errors in design documents or drawings issued.

4.3.3 The *Contractor* shall note that all documentation and drawings issued by TPL are supplied in good faith and may not be complete in every detail. The *Contractor* shall be responsible for ascertaining the validity and correctness of all drawings issued.

4.4 Quality Requirements

4.4.1 This section outlines the minimum requirements to ensure that products and services supplied to TPL are manufactured, provided, constructed, or installed in accordance with all specified requirements as defined in this scope of works.

4.4.2 The *Contractor* is responsible for all quality activities necessary to ensure the work meets the requirements specified in this scope of works and shall manage and coordinate all quality aspects of the work in accordance with the requirements of this scope of works, together with the *Contractor's* PQP and QCPs once reviewed and accepted by TPL.

4.4.3 **Project Quality Plan**

The PQP shall entail the following:

- Overview and understanding of scope of works and key requirements
- Organogram with positions, roles and responsibilities
- Procedures:
    - Document control – the *Contractor* shall provide a description of how documents provided by TPL will be managed e.g., management tools and databases, internal and external distribution of documents to TPL, third parties, internal review and approval routes and authorities, receipts, registrations, codes, standards, and specifications.
    - Design control – where the *Contractor* is responsible for any aspects of design related to the scope of works, they must provide procedures for the control of these design activities. This must also factor in the roles and responsibilities
- Project Schedule - As per this scope of works requirements
- Commissioning and training plan.

4.4.4 **Quality Control Plans**

The QCPs shall be submitted before the commencement of the project.

QCPs must clearly identify all inspection, test, and verification requirements to meet this scope of works including destructive and non-destructive testing where applicable, witness and hold

points. The *Contractor* prepares and submits QCPs to TPL for review in accordance with the requirements of this scope of works and PQP. The QCP shall include:

QCPs shall include reference to all tests specified in the scope of works.

Inspection and Testing

The *Contractor* is responsible for the conduct of all *Contractor* inspections and tests. This responsibility includes:

- Documenting inspection and test results in the QCPs and relevant FIC.
- Progressively inspecting the quality of the scope of works performed, including that of all Sub-Contractors.
- Inspecting to meet all scope of works requirements, in number, type and form
- Inspecting day to day activities, material receipts, issue of material for installation, in-process inspections, and final inspections.

Schedule of Inspection - The *Contractor* shall submit a schedule showing the proposed dates for inspections and tests nominated in the QCP where witness and hold points are required. The schedule shall be regularly updated with progress and issued to TPL to show the current inspection and test status.

Field Inspection Checklists - For site installation and construction activities, the *Contractor* prepares FICs to permit inspection and testing of installed equipment and constructed facilities in accordance with the respective QCPs.

Inspection Points - The QCP identifies points in the fabrication, manufacturing and/or installation process that are selected for inspection. Hold Point (H), Witness Point (W) Review Point (R), Surveillance (S).

Welding Procedures - Where the *Contractor's* scope of works includes fabricated weldments, WPS defining the method, preparation, and sequences to be adopted to achieve a satisfactory welded joint shall be provided for all weld types required in the execution of this scope of works.

Material Traceability - Where, and to the extent that material traceability is required, the *Contractor* shall provide its procedures for the maintenance of material identification throughout all phases of manufacture.

Material Certification - Where specified in this scope of works the following certificates shall also be provided to TPL: A certificates of compliance, A certificates issued by a laboratory or test facility independent of the *Contractor's* work, any other form of certification affecting the scope of works.

Non-Conforming Products

The *Contractor* shall establish and maintain procedures to control material or products that do not meet the specified requirements.

All *Contractor* product and/or materials identified as not conforming to requirements shall be dealt with promptly as follows:

- If the Contractor discovers material or product which is not in accordance with the requirements of the scope of works e.g., a non-conformance, the *Contractor* shall immediately initiate the non-conformance procedure. If TRANSNET or its agent identifies a non-conformance, a TRANSNET NCR may be raised.

Corrective and Preventative Action

- If the Contractor proposes a disposition of any non-conforming materials or product which varies from the requirements of this scope of works, such a proposal shall be

submitted in writing to TPL whose decision on the proposal shall be obtained in writing before the non-conforming material or product is covered up or incorporated into the works or is the subject of any other disposition.

- The disposition of non-conformances which do not vary the requirements of the *Contract*, specification or drawings may be approved by the *Contractor* following discussion and agreement with TPL.

Inspection, Measuring and Test Equipment

Calibration - The *Contractor* shall ensure the calibration of test and measuring equipment is performed and maintained in accordance with the relevant *Contractor* procedures and/or the equipment manufacturer's specifications.

Use of Inspection, Measuring and Test Equipment - The *Contractor* shall ensure that authorized equipment users:

- Use the equipment in accordance with manufacturer's instructions, and accepted industry practices
- Ensure the equipment is covered by a current calibration certificate
- Conduct the measurements or tests in accordance with the equipment manufacturer's specifications or other relevant specification
- Prior to commencement of each inspection or test activities:
  - Identify the measurements to be made
  - Determine the accuracy required
  - Select the appropriate inspection, measuring or test equipment for this scope of works.

4.4.5 Quality Records

Contractors shall maintain Quality Records necessary to provide objective evidence that demonstrates and verifies achievement of the Quality Assurance (QA) / Quality Control (QC) requirements associated with this scope of works. All Quality Records including original source material test certificates and non-destructive test reports, shall be retained by the *Contractor* during the project, and be provided to TPL at the times, and in the quantities specified in this scope of works.

4.5 Documentation

The *Contractor* shall supply the documentation listed below: -

- Two (2) complete sets of the following (in files) and one soft copy on a separate memory stick for each TPL site (Documents must be printable, drawings must also include PDF and CAD versions): -
  - Detailed as built drawings (all drawing types that are outlined on clause 4.1.1 and/or 4.1.5) the as built drawing simply details all cables and equipment installed, it does not change the approved drawings
  - Detailed as design report
  - Required spreadsheet with data logging readings
  - Comprehensive maintenance manuals
  - Detailed spares catalogues
  - Electrical Certificate of Compliance (Original and a copy of the COC) (including equipment certificates).
  - Factory inspection and testing documents
  - Site testing, certification, commissioning, and completion documents
  - Equipment warranty certificates.

- A formal completion certificate signed and dated by both the *Contractor* and the *Project Manager* shall be provided.

4.6 Installation and Site Works

4.6.1 The *Contractor* shall prior to making any design changes to the existing equipment and proposed drawings submit drawings and detailed design report to the *Project Manager* for prior acceptance. Drawings shall include equipment schedules detailing all major components as per clause 4.1 requirements.

4.6.2 The *Contractor* shall ensure that all equipment arrive timeously onsite. The *Contractor* shall be responsible for any damages to equipment prior to completion and hand over. Should such a delay occur, the *Contractor* shall immediately inform the *Project Manager* in writing such that action can be taken to mitigate the delay.

4.6.3 The *Contractor* shall ensure that all onsite and work specific safety protocols and precautions are always followed. The *Contractor* shall also ensure that the relevant PPE is always worn**.** The *Contractor* is also to ensure compliance to COVID-19 related regulations and mitigations where applicable. The *Contractor* will need to provide their COVID-19 management and risk plan. The COVID-19 risk are also outlined on the attached cathodic protection Upgrade Project Baseline Assessment with COVID-19 Risks (IMS risk assessment register) (Optional).

4.6.4 The *Contractor* shall always ensure compliance with SHE requirements prescribed by applicable legislation and best practice standards. The *Contractor* will be responsible for the SHE requirements that TPL may require to be implemented. The *Contractor* shall ensure that no person or employees are allowed to enter any of the work sites on their behalf, unless that employee or person has under-gone, SHE induction pertaining to the hazards prevalent to the site at the time of entry.

4.6.5 The *Contractor* shall, in the presence of the *Project Manager* and any other Transnet staff deemed necessary test and commission the upgraded installation and all associated equipment.

4.7 Factory Inspection and Testing

4.7.1 It shall be the responsibility of the *Contractor* to compile a complete Factory Acceptance Test Schedule prior to scheduling a Factory Acceptance Testing (FAT). This schedule shall be used for FAT of the equipment supplied by the *Contractor*.

4.7.2 Factory Acceptance Test schedule/s shall be comprehensive and must cover all aspects of the equipment to be tested and shall be submitted to the *Project Manager* for acceptance at least two weeks prior to commencement of FAT.

4.7.3 The *Project Manager* reserves the right to add or delete any item or test on the Factory Acceptance Test schedule to verify that the supplied equipment complies with specification.

4.7.4 The *Contractor* shall perform the FAT at the supplier’s manufacturing facility under their supervision, in accordance with standard specifications.

4.7.5 The *Contractor* shall be responsible for providing all test equipment and facilities required for the period of the FAT such as the *Project Manager* may deem necessary, and to produce a report of the tests completed.

4.7.6 Should the Factory Acceptance Tests be suspended due to the failure of any test or because of equipment failure, re-scheduling of the Factory Acceptance Tests shall be at the discretion of the *Project Manager*. Failure of Factory Acceptance Tests may result in the *Contractor* being back charged for the man hours expended by the TPL representatives witnessing the tests.

4.7.7 The Factory Acceptance Test schedule will include as a minimum, the following checks, and tests:

Inspections

- A physical check of all equipment shall be made against the applicable drawings.
- Non-compliance will be marked in red on drawings for correction before acceptance.

4.8 Site Testing, Certification and Commissioning

4.8.1 It shall be the responsibility of the *Contractor* to compile a complete Site Acceptance Test and Commissioning Schedule to be used for site acceptance testing, certification, and commissioning of the equipment to be installed by the *Contractor*.

4.8.2 The Site Acceptance Test and Commissioning schedule shall be comprehensive and shall cover all aspects of the equipment to be tested and commissioned and shall be submitted to the *Project Manager* for acceptance, prior to commencement of Site Acceptance Testing (SAT).

4.8.3 The *Contractor* shall be responsible for providing all test equipment and facilities required for the period of the SAT such as the *Project Manager* may deem necessary, and to produce a report of the tests completed.

4.8.4 The *Project Manager* reserves the right to add or delete any item or test on the Site Acceptance Test and Commissioning schedule to verify that the installed equipment complies with the applicable specification.

4.8.5 The *Contractor* shall perform the SAT, electrical compliance certification and commissioning of the supplied/installed equipment. The *Contractor* shall at his own expense rectify all defects. Should a defect result in time delays and additional material/labour cost, such additional cost incurred shall be for the *Contractor's* account.

4.8.6 The *Contractor* shall perform 24-hour data logging and demonstrate pipeline polarisation for the client. IF is specified in BOQ.

4.8.7 Site Acceptance and Handover of all items of the equipment shall be concluded once SAT, certification and commissioning of all supplied/installed equipment has been completed, all fault lists have been completed to compliance and the following documentation has been submitted to and accepted by the *Project Manager*:

- Complete FAT and SAT documentation, comprising of test schedules and commissioning report (as applicable)
- Completed Electrical Certificates of Compliance (Original and a copy of the COC) (including equipment certificates)
- Final Contract Documentation as outlined on clause 4.4
- A formal completion certificate signed and dated by both the *Contractor* and the *Project Manager* shall be provided

Documentation format and number of copies shall be in accordance with TPL specifications.

5. APPENDICES

The following TPL documentation shall be read in conjunction with this scope of works.

- Bill of Quantities
- Technical evaluation
- Design details scope of works requirements include rectifier's installation layout for each specific site
- CP Upgrade Project Baseline Assessment with COVID-19 Risks(IMS risk assessment register)
- SHE Compliance file review-guidelines
- Transnet Contractor Management Procedure TRN-IMS-GRP-PROC-014
- TPL Sample QCP
- Rectifier Specification or Test Point Specification

6. MAINTENANCE

- Not Applicable(N/A)

7. GUARANTEE

Guarantee initiation shall be from the date recorded on the *Contractor's* completion certificate. The completion certificate shall for validity purposes contain the signature of both the *Contractor* and the *Project Manager*.

All electrical components supplied under this specification shall be warranted for a minimum of 12 months from the date of completion. All TRUs and FDUs shall be warranted for a minimum of 12 months from the date of completion. Mechanical equipment shall be warranted for a minimum of 12 months from the date of completion. The defect period (including workmanship) shall be guaranteed for a period of 52 weeks. Upon receiving a notice from TPL, the *Contractor* shall at its own cost and expense and without reimbursement by TPL promptly correct, repair or replace the items, which are not in conformance with this specification. *Contractor's* warranty shall cover all costs (including, without limitation, those costs associated with parts, labour, technical support, travel, transportation, and shipping and handling). The *Contractor* is also to issue TPL all the respective equipment warranty certificates.

8. SIGNATURES

	Name	Title	Signature	Date
Compiled by	L. Molemi	CP Manage		07/12/2022
Reviewed by	M. Du Sart	Risk Operation Manager		09.12.2022
Reviewed by	P. Selwane	Environmental Specialist		09/12/2022
Reviewed by	L. Majozi	Quality Control Auditor		09.12.2022
Approved by	S. Rugbeer	Acting Electrical Manager		12/12/2022