

Compliance Specification Sheet: BID SPECIFICATION – APPOINTMENT OF A CONTRACTOR FOR THE: SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 3kV DC TRACTION AND DISTRIBUTION EQUIPMENT AT SUBSTATIONS ALONG THE DAVEYTON-JOHANNESBURG CORRIDOR FOR METRORAIL GAUTENG PROVINCE



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COMPLIANCE SPECIFICATION SHEET

ANNEXURE 6

1 SPECIFICATIONS OF THE WORK OR PRODUCTS OR SERVICES REQUIRED

No.	Specification Description	PRASA'S Evaluation Compliance Response: (Yes/No)
1.	AC DISCONNECT SWITCH	
1.1	Supply and install the support steel work in accordance to specification BBB5452 clause 11.0 and clause 8.0 of specification BBB7842 and all other items required for proper support thereof.	
1.2	Supply and install new set of AC disconnects combined with earthing switches in accordance with specification BBB7842.	
1.3	Complete and return annexure 2 of specification BBB7842. Failure to do this shall result in the disqualification of the tender.	
1.4	These AC disconnecting switches shall be installed between the ESKOM 88kV/44kV aerial busbars and the primary circuit breaker.	
1.5	The disconnecting switches shall have auxiliary contacts for interlocking with primary circuit breaker as per specification BBB7842 clause 7.11.	
2.	PRIMARY CIRCUIT BREAKER (PCB)	
2.1	Supply and install support steel work and all other sundry items required for the proper support of the complete breaker.	
2.2	Supply and install new 88kV/44kV, 3 phase (SF6) gas filled circuit breaker complete with operating mechanisms and all material and equipment for proper mounting and	

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	connection to the existing infrastructure. The circuit breaker shall be supplied and installed in accordance with the required of specifications BBB1267 version 6 and SANA 62271-100.	
2.3	Supply and installation (including connection) of the control and power cables, earthing and other items necessary for the full functionality of the equipment. The operation of the circuit breaker shall be in accordance and interfaced with specification BBB2721 version 10 attached.	
2.4	The circuit breaker shall be of ratings specified in the data sheet of specification BBB1267.	
2.5	The circuit breaker shall be installed with the mechanism box of the breaker facing the traction transformer.	
3.	METAL OXIDE SURGE ARRESTORS	
3.1	Supply and install Metal oxide surge arrestors as per clause 10 BBB5452 and specification BBB0845.	
3.2	Cater for the supply and erection of new structures and foundations to mount this equipment. The structures shall be connected to the rest of the substation earth as per applicable specifications.	
3.3	The surge arresters shall be connected between each phase of the high voltage supply and substation main earth electrode/earth mat.	
3.4	The maximum protected distance from the main transformer bushing terminal to the surge arrester terminal shall be as indicated in table below: Nominal System R.M.S Voltage (kV) Maximum Distance (Metres) 44kV 5 88kV 6	

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3.5	The neutrals of high voltage supplies are to be treated as effectively earthed unless otherwise specified.	
4.	6MW RECTIFIER	
4.1	Supply and install rectifiers in accordance with specification BBB0496 version 15.	
4.2	The rectifier shall be a 12-pulse configuration with the AC input voltages that can be in the order of 1150V to 1375V phase to phase.	
4.3	The nominal DC output voltage rating of the system is 3150 Volts but can vary between 2400 V DC and 3900V DC.	
4.4	<p>The DC output of the equipment shall be rated at 6MW full load continuously with overload ratings related to full load as follows:</p> <ul style="list-style-type: none"> • 2 x full load for 30 minutes • 3 x full load for 1 minutes • 3.5 X full load for 10 seconds. • 4.25 x full load instantaneous tripping. <p>These values shall be proved theoretically</p>	
4.5	The equipment shall withstand a short circuit for 200 milli-seconds.	
4.6	The rectifiers and associated equipment shall be designed to minimise any tendency to resonate or to produce high voltage surges when operating in conjunction with DC smoothing equipment.	
4.7	The fence at the rectifier bays shall be renewed with a fence of similar specification; new mechanical interlocks shall be supplied and installed as per specification BBB5452 Version 3.	
4.8	The rectifier fence shall be painted as per clause 44 of specification BBB5452.	
5.	WAVE FILTER	
5.1	The contractor shall supply and install a 12 pulse filter unit according to the requirements of specification BBB5452 clause 20 and all specifications referred to in the clause.	

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5.2	The existing wave filter room shall be used to house the new equipment. All wave filter equipment supplied shall be able to fit into the existing wave filter room while maintaining all required clearances.	
5.3	Be responsible for the supply and installation of the equipment.	
5.4	The safety interlocking shall be renewed and tested by the contractor.	
5.5	The test report shall be supplied with the equipment.	
5.6	The contractor shall be responsible to dispose any Polychlorinated Biphenyl in accordance with section 17 of the National Environmental Management ACT 107 of 1998.	
6.	TELE-CONTROL	
6.1	Supply and install a tele-control system for the control and monitoring of various substation equipment	
6.2	Tenderers shall note that the only approved supplier is Murton Electronics for this equipment.	
6.3	The contractor shall ensure that Tele-control Logic Rack and its associated electronic cards is version 2.099 with LMCU modem version 3.	
6.4	Ensure that the tele-control is fully functional before commissioning can be done.	
6.5	Supply and install network switches (OTN or better in terms of speed and capacity). This shall comply with IEC61850.	
7.	POSITIVE ISOLATOR	
7.1	Supply and install a 3kV DC substation positive isolator in accordance with the Specification BBB4724 version 4 and all other associated works and equipment for the complete functionality of the positive isolator.	
7.2	Supply and installation of XLPE cables for the full functionality of the positive isolator.	
7.3	Supply and install an under-voltage relay with each positive isolator.	

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7.4	Be responsible for the testing and commissioning of all equipment supplied under this contract.	
7.5	The DC positive isolator metal cubicle/housing shall be insulated from the substation floor.	
8.	AC/DC DISTRIBUTION AND PCB CONTROL PANELS	
8.1	The contractor shall supply, install and commission a new AC/DC distribution and control panels in accordance with specification BBB5452 and BBB2721.	
8.2	The contractor shall be responsible for the supply, connection and testing of the panels.	
8.3	The interlocking shall comply with specification BBB5452 clause 31.	
8.4	The panel shall have glands plates situated at least 400mm above ground; no use of spacers shall be allowed.	
8.5	The DC earth leakage relays shall be mounted on the side of the distribution panel inside polycarbonate boxes (not Perspex).	
8.6	The tripping of the relays shall be via a slave relay which shall be provided by the contractor.	
8.7	Notwithstanding what is rated in specification BBB2721, the contractor shall supply protection relays.	
8.8	All cabling shall be PVC wire armoured.	
8.9	Tenderers shall refer to specification BBB5452 for interlocking, cabling, labels and terminals, testing and commissioning.	
8.10	The only approved interlocking is castell type.	
9.	CURRENT TRANSFORMERS	
9.1	The main current transformers shall be free standing and shall be mounted on foundations and steel work (Supplied and installed by the contractor) as per clause 39 and 40 of BBB5452.	
9.2	The main current transformer shall be supplied and installed according to specification BBB0937.	

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9.3	The current transformer shall be the two core type providing for metering and protection.	
9.4	The contractor shall supply and install an earth leakage current transformer (this shall be supplied as per clause 17 of specification BBB5452. The drawings referred to in this specification are applicable for connecting the transformer to the earth mat)	
10.	AUXILIARY TRANSFORMER	
10.1	The auxiliary transformer shall be free standing and rated at 150KVA.	
10.2	Phases: 3, Frequency: 50Hz, Type of cooling: ONAN, Vector group: Dyn 11. Voltage: 1220/400V	
10.3	The protection for the auxiliary transformer shall be supplied as per specification BBB2721.	
10.4	This transformer is connected to the secondary side of the traction transformer.	
10.5	The auxiliary transformer shall be protected by a barrier and the barrier shall be insulated from earth and connected to the AC earth leakage current transformer.	
10.6		
11.	FOUNDATIONS FOR SUBSTATION OUTDOOR EQUIPMENT	
11.1	The successful tenderer shall be responsible for the supply and casting of concrete foundations for support structures in the traction substations high voltage yard. The strength of the foundation shall be 25MPa and a certificate specifying the strength shall be submitted to the technical officers.	
11.2	The successful tenderer shall carry out his or her own survey in regard to the soil types and their load bearing capabilities.	
11.3	Equipment support foundations shall be finished off 200mm above the finished earth level of the yard.	
11.4	All foundation edges shall be bevelled and the surface must be float finished.	

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11.5	All support foundations shall be at the same level.	
11.6	The design of the concrete plinth for the main traction transformer shall include a concrete gutter around the perimeter of the plinth to contain any spillage of transformer oil.	
11.7	The auxiliary transformer if separate shall be provided with its own concrete plinth with concrete gutter, or may be installed on the same plinth as the main traction transformer.	
11.8	The 28-day strength of all concrete used shall be a minimum of 20Mpa.	
11.9	Hand mixed concrete is not acceptable, it must be mechanically mixed.	
12.	BUSBARS	
12.1	Supply and installation of busbars (solid aluminium) with clamps from the secondary side of the traction transformer to the wall bushings.	
12.2	Supply and installation of flying busbars (200mm ² aluminium wires) with clamps from the Eskom supply point to the AC disconnect switch, from the AC disconnect switches to the PCB, from the current transformers to the PCB and from the PCB to the traction transformer. The busbars shall incorporate a degree of flexibility to avoid any overstressing of connections due to foundations movement and expansions.	
12.3	Supply and installation of solid aluminium busbars (50mm X 25mm aluminium (grade 6063) from the secondary side of the main transformer to the wall bushings.	
12.4	Supply and installation of three copper busbars (thickness 5mm, width 26mm) between the main transformer and the auxiliary transformer.	
12.5	Where two different conductor material joints are used, the Bi-Metallic plates (clamps) shall be used.	

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12.6	Each clamp shall be torqued on flying busbars connection in accordance with manufacturer's specification.	
13.	OUTDOOR EARTHING	
13.1	The outdoor earthing shall be done in accordance with specification BBB 3059 and drawing BBB 3620.	
13.2	No joining of cables or busbars will be accepted, the contractor shall provide cables or busbars that are long enough for the application. No junction boxes shall be used underground.	
13.3	The contractor shall be responsible for all the necessary connection between the equipment and other connections in the substation including connection to the earthmat.	
13.4	Cables and earthing conductors connected to the equipment installed on steel support structures shall be supported on the structure vertically and horizontally by means of cable trays.	
13.5	PVC insulated 95mm ² copper cables shall be used where insulated earthing conductors are required for the interconnecting of the high voltage equipment on the AC leakage system.	
13.6	All cabling for protection and earthing shall be supplied and installed by the contractor.	
13.7	The depth of the trenches shall not be less than 700 millimetres.	
14.	INDOOR EARTHING	
14.1	Supply and installation in the substation of all earthing conductors for the earthing of all metal work which includes supporting frames, control panels, battery charger, positive isolator panel, track breaker cells, rectifier bay screens, chequer plates and metal bases of insulators mounted directly on the walls or floors.	
14.2	The contractor shall supply and install all indoor earthing as per the specification BBB5452 and drawing CEE-TBD-0007.	

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14.3	The contractor shall make use of 95mm ² flexible copper (PVC insulated stranded copper cable) for the indoor earthing.	
14.4	All cabling required for the indoor earthing shall be supplied and installed by the contractor.	
15.	MECHANICAL INTERLOCKING	
15.1	Supply and install an interlocking mechanism complete of the key exchange type, which includes the AC disconnects, positive isolator, auxiliary transformer short out links to the HT bay gate in the correct sequence in accordance with specification BBB5452 version 6 clause 31.	
15.2	The preferred mechanical interlocking system is the castell key type.	
16.	SUPPLY AND INSTALLATION OF CABLES	
16.1	The contractor shall supply and install all control and power cables in accordance with the specification BBC 0198 version 1 and CEE 0023 of 1990.	
16.2	The contractor shall supply all control cables, from the AC disconnects to the indoor substation building.	
16.3	The contractor shall make provision for terminating the armoured cables both in the substation indoor building and outdoor yard.	
16.4	The contractor shall supply joint kits and all necessary terminations.	
16.5	The contractor shall supply and connect the 95mm ² PVC insulated welding cable to interconnect all new and existing equipment to the DC earth leakage relay system.	
17.	HIGH MAST LIGHTS	
17.1	The contractor shall supply and install 13m high mast with four balanced 400W mercury vapour lights.	
17.2	The high mast light shall come with a day light switch.	
17.3	The lightning protection shall be provided for each and every mast.	

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17.4	The circuit breaker for each high mast light shall be provided by the contractor.	
17.5	The cable from the distribution board to the high mast light shall be provided by the contractor.	
17.6	A way of lowering and raising the lights bracket (lantern carriage assembly) to and from the ground must be provided so that the lights can be serviced from the ground, e.g. mid-hinge high mast lights, winch arrangement mechanism.	
17.7	A suitable terminal box shall be provided as part of the supply at the base compartment of the high mast for terminating the incoming cable.	
17.8	The mast when fully equipped with luminaries must be designed to withstand wind velocity appropriate to the site conditions.	
17.9	The high mast lights shall conform in all respect to the highest standard of engineering, design, workmanship and latest revisions of relevant standards at the time of offer.	
18.	AERIAL FEEDER CONDUCTORS	
18.1	The contractor shall supply and install 800mm ² aluminium aerial feeder conductors from the substation to the track switch structure.	
18.2	The contractor shall cast concrete foundations for the steel mast to be used to suspend the aerial feeder conductors.	
18.3	The installation of aerial feeder conductors shall include erecting of the mast, installation of track switches, construction of the switch structure and all the associated works.	
18.4	Where two different conductor material joints are used, the Bi-Metallic plates (clamps) shall be used.	
18.5	Each clamp shall be torqued on flying busbars connection in accordance with manufacturer's specification.	
19.	CRUSHER STONES	

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19.1	The contractors shall supply and lay 50mm layer of river sand across the substation yard including the High Voltage Yard.	
19.2	The contractor shall supply and lay 100mm layer of 25mm crusher stones across the substation yard including the High Voltage Yard.	
20.	OUTDOOR, INDOOR AND EMERGENCY LIGHTING	
20.1	The contractor shall supply and install normal outdoor lights (400Watts) including cabling, Photo cell and all associated works.	
20.2	The contractor shall supply and install normal indoor lights, including cabling, DB and all the associated works.	
20.3	The contractor shall supply and install emergency indoor lights, including cabling and all the associated works.	
21.	SUBSTATION ROOF	
21.1	The contractor shall supply and install new roof for the substations (IBR sheets 2mm thick) with ventilation and gutters and all associated works.	
21.2	The roof area will vary with each substation and the exact dimensions will be given in the Bill Of Quantity per site.	
22.	SWITCH GEAR	
22.1	The Contractor shall supply and install 3 phase, 11kV VCB switchgears in accordance with specification BBB 4182 complete with protection relays. It is required that the switchgears to be supplied shall be completely insulated from the ground and other existing steel work inside the Substation.	
22.2	The Contractor shall supply control cables to connect new switchgears to telecontrol equipment.	
22.3	The contractor shall supply and install the control panel in accordance with specification CEE 0082.90.	

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22.4	The contractor shall supply and install termination kits per cable installation. All cabling and wiring shall be in accordance with specification BBC 0198 version 1 and SANS 10142-1.	
22.5	The contractor shall re-use existing trenches and modify checker plates to correct switchgear size and re-paint checker plated black.	
22.6	The Contractor shall supply and install cables to and from the structures outside the substation, Transformer and switchgears.	
23.	LV CONTROL PANEL	
24.1	Supply and install low voltage control panel with the components as indicated in the bill of quantity in accordance with specification no. CEE. 0082.90	
24.2	The control panel must be painted orange with the practice recommended in SABS 064. 1979 and as specified in Spoornet's specification CEE.0045.90.	
24.	BATTERIES AND BATTERY CHARGERS	
25.1	Supply and install a new cabinet in accordance with specification CEE-0085_2010.	
25.2	Supply and install 230V (AC)/110V (DC), 10A battery charges.	
25.3	Supply and install the batteries 9x25Ah Nickel-Cadmium and all cabling that is necessary to connect the batteries to the protection system in the substation.	
25.	6MW MAIN TRACTION TRANSFORMER	
26.1	The contractor shall be responsible for the delivery, assembling, filling of transformer oil and installation on site of the main traction transformer in accordance with Transnet Freight Rail's Specification BBB 5019 version 6.	
26.2	The rating of the transformer shall be such that when it is operated in conjunction with the rectifier equipment specified in section 5.4 and with the auxiliary transformer	

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	<p>connected to the tertiary winding the output of the transformer shall be as follows:</p> <ul style="list-style-type: none"> • 2 x full load for 30 minutes • 3 x full load for 1 minutes • 3.5 X full load for 10 seconds. • 4.25 x full load instantaneous tripping. <p>These values shall be proved theoretically</p>	
26.	TESTING AND COMMISSIONING	
27.1	<p>The contractor shall be responsible for Factory Acceptance Test (FAT) and commissioning tests of equipment supplied and installed under this contract. The testing schedule for all the equipment should be provided prior delivery of the equipment. The FAT shall be conducted locally.</p>	
27.2	<p>The contractor shall be responsible for the site acceptance Test and commissioning test and PRASA's test officer shall witness and accept the test result by the test officer.</p>	
27.3	<p>The handover certificate shall be issued once the work and commission is complete and complies with all specifications. This however, does not relieve the contractor of his obligation to honour warranties and guarantees of equipment supplied and installed under this contract.</p>	
27.	3KV HIGH SPEED CIRCUIT BREAKER	
28.1	<p>The 3kV DC Track Feeder High Speed Circuit Breakers shall be supplied and installed in accordance with clauses 25 and 26 of specification BBB 5452 and specifications CEE.0099_ISS_2013 and CEE.0227.</p>	
28.2	<p>The Contractor shall provide trucks, modular steel cells, high speed circuit breakers, feeder protection relay and other associated components necessary to produce a complete functioning modular track breaker unit in accordance with the BOQ per substation.</p>	

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28.3	The modular steel cells shall consist of a feeder cable earth switch with a warning label stating that “Do not apply earth before track switch is open”.	
28.4	A separately enclosed earthing switch to earth the 3kV DC positive busbar shall be supplied and installed to one end of the connected cells.	
28.5	The earthing contacts shall be visible through fixed polycarbonate panels in the enclosure when applying the earth.	
28.6	This earthing switch shall be robust and lockable in both positions (earthed and not earthed) and electrically interlocked with the primary circuit breaker and all HSCBs to prevent accidental earthing of the live busbar.	
28.7	The electrical interlock shall cause the substation to trip and lock out.	
28.8	The shutter gear in the cells, covering the busbars when the circuit breaker is withdrawn shall be robust and mechanically locked to prevent it from being opened while the truck is withdrawn from the cell.	
28.9	The High-Speed Circuit Breaker shall be supplied with adequate surge protection.	
28.	50kva Transformers	
29.1	The contractor shall supply and install 50kVA, 11kV-400V, 3 Phase Transformer in accordance to the scope of work/specification (annexure 3)	
29.2	The contractor shall design, supply and install the H-Frame steel structure with foundations and anti-climbing devices with associated accessories.	
29.3	The contractor shall supply a 100A Low Voltage switch with associated accessories.	
29.4	The contractor shall make a provision of 4 wooden poles to erect the bundle conductor between the relay rooms and the H-frame structures.	
29.5	The contractor shall design and install a steel cage with a locking mechanism to house the transformer with an anti-	

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	tampering device that will be connected remotely to the control office.	
29.6	Provision of the remote activation system shall be designed, supplied and installed by the contractor. Training shall be conducted by the contractor to PRASA employees.	
29.7	The medium of communication between the anti-tampering will be fibre that will be made available by PRASA.	
29.	DRAWINGS AND MANUALS	
23.1	The format shall comply with specification C0224 issue 2002.	
23.2	The contractor shall supply two (2) manuals and drawings for the following equipment:	
23.3	Auxiliary transformer	
23.4	Primary circuit breaker	
23.5	Rectifier	
23.6	AC/DC distribution and PCB control panels	
23.7	Positive isolator	
23.8	Surge arrester	
23.9	High mast lights	
30.	HEALTH, SAFETY AND ENVIRONMENT	
24.1	All work in this contract shall comply with the Occupational Safety Act, 1993 (Act No: 85 of 1993, National Environmental management 107 of 1997 Act and construction regulation 2014). These items shall all be included in the tendered rates. A copy of the act as well as an approved safety file shall be kept on site for the duration of the project.	
24.2	The contractor shall be responsible for the safety of personnel on site; a detailed safety plan shall therefore be submitted with the tender offer for evaluation. The following shall also form part of the safety plan:	
24.3	Transportation of equipment and personnel.	
24.4	Transportation, storage and handling of hazardous equipment	

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24.5	The site access certificate shall only be issued (to the successful bidder) after the evaluation and approval of the safety file.	
24.6	The Contractor shall comply with all applicable legislation and PRASA's safety requirements adopted from time to time and instructed by the Project Manager / Technical Officer. Such compliance shall be entirely at the contractor's cost, and shall be deemed to have been allowed for in the rates and prices in the contract.	
24.7	The Contractor shall ensure that a safety officer is on site at all times.	
24.8	The Contractor shall report all incidents in writing to the Project Manager / Technical Officer. Any incident resulting in the death of or injury to any person on the works shall be reported within 1 hour of its occurrence and any other incident shall be reported within 24 hours of its occurrence.	
24.9	The Contractor shall make necessary arrangements for sanitation, water and electricity at these relevant sites during the installation of the equipment.	
31.	QUALITY ASSURANCE	
25.1	Contractors shall submit descriptive literature consisting of detailed technical specifications, constructional details and principal dimensions, together with clear illustrations of the equipment offered.	
25.2	Contractors shall submit equipment type test certificates for equipment to be supplied in this contract. These shall be in English.	
25.3	The Project Manager shall be notified timeously for inspection of equipment before it is delivered to site.	
25.4	Testing and Commission schedules shall be provided for all equipment provided under this contract.	
25.5	Method statement of all activities shall be approved by PRASA's project manager.	
25.6	Quality control plan shall be submitted and approved by PRASA's project manager.	

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32.	Construction Related Security	
26.1	All security companies used by the Contractor shall be PSIRA registered with a valid letter of good standing.	
26.2	Security personnel shall all be PSIRA registered with a clear criminal record and no criminal pending cases.	
26.3	All security official utilised on this project shall be South African Citizen.	
26.4	The security to be provided by the contractor shall be responsible for both the appointed contractor's assets and PRASA's assets on site until the site is handed over to PRASA. A list of all functioning equipment that do not form part of this scope of work will be shared with the successful bidder and shall be signed off by both the successful bidder and PRASA's representative.	
26.5	Any lost or stolen material shall be replaced by the contractor at his own cost within 14 days. Failure to replace the stolen items will result in payment of invoices being withheld.	
26.6	The boundary limits for each substation will include all assets in the substation until the switching structure. The equipment associated with the switching structure is also included in the boundary limits.	
26.7	The contractor shall provide on-site security for personnel and material stock and should ensure that patrols are in place at the site handed over to the contractor until the completed work is handed over to PRASA. No claims of material or losses must be lodged with the client for stolen goods during the construction before the completed work is handed over to PRASA.	
26.8	Furthermore it is the contractor's responsibility to ensure that valuable metal i.e. copper is adequately protected while in transit to and from site.	
26.9	The contractor shall make sure that all material removed from site is quantified, counted, logged in the site diary and that it is co-signed by PRASA representative on site before it is removed from site.	

Compliance Specification Sheet: BID SPECIFICATION – APPOINTMENT OF A CONTRACTOR FOR THE: SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 3kV DC TRACTION AND DISTRIBUTION EQUIPMENT AT SUBSTATIONS ALONG THE DAVEYTON-JOHANNESBURG CORRIDOR FOR METRORAIL GAUTENG PROVINCE



Name of the Bidder:

Tender Number:

26.10	Scrap metal removed from the section shall be adequately protected until it is delivered to PRASA's stores.	
26.11	PRASA reserves the right to conduct ad-hoc inspections to ensure Compliance.	