BID DESCRIPTION APPOINTMENT OF A CONTRACTOR FOR THE RECONSTRUCTION OF THE 3KV DC TRACTION AND AC DISTRIBUTION SUBSTATIONS BETWEEN NEW CANADA AND LAWLEY TRAIN STATION FOR THE PERIOD OF SIX MONTHS	
BID NUMBER: 12/06/2023 /GAU-(EL)	

FORM-C

FORM C: TENDER FORM

CURRENT TENDER DETAILS	
Request number:	**12/06/2023/GAU-(EL)**
Request for Tender:	**APPOINTMENT OF A CONTRACTOR FOR THE RECONSTRUCTION OF THE 3KV DC TRACTION AND AC DISTRIBUTION SUBSTATIONS BETWEEN NEW CANADA AND LAWLEY TRAIN STATION FOR THE PERIOD OF SIX MONTHS**

I / We _____
(Insert Name of Tendering Entity)

of _____

_____
(Full address)
Conducting business under the style or title of:
_____
Represented by:
_____
in my capacity as:
_____

being duly authorised thereto by a Resolution of the Board of Directors / Certificate of Partners, Members or Participants, as the case may be, dated _____, a certified copy of which is annexed hereto, hereby offer to undertake and complete the above-mentioned work (hereinafter called "the WORKS") at the prices quoted in the bills of quantities / schedule of quantities or, where these do not form part of the contract, at a lump sum, in accordance with the terms set forth in the accompanying letter(s) reference _____ and dated _____ (if any) and the documents listed in the accompanying schedule of tender documents for the sum of R _____

_____ (amount in words), (All applicable taxes included)

N.B. (i) In the event of any discrepancy, the amount in words will take precedence over the amount in figures.

(ii) Where items in the priced bills of quantities submitted with the tender for the WORKS other than architectural building work are incorrectly extended arithmetically, the unit rate will be treated as decisive.

(iii) In tenders for architectural building work the total amount will be treated as decisive. If amounts for individual items cannot be reconciled with the total amount, the amounts for individual items shall be adjusted to the satisfaction of the PRASA to conform to the total amount.

The following list of persons are hereby authorised to negotiate on behalf of the abovementioned entity, should PRASA decide to enter into Post Tender Negotiations with shortlisted bidder(s).

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FULL NAME(S)	CAPACITY	SIGNATURE
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

I/We hereby offer to supply the abovementioned Services at the prices quoted in the schedule of prices in accordance with the terms set forth in the documents listed in the accompanying schedule of RFP documents.
I / We accept that should PRASA accept my / our tender and issue me / us with the notice of acceptance, this tender and, if any, its covering letter and any subsequent exchange of correspondence together with the PRASA acceptance thereof, such acceptance shall be subject to a written contract to be concluded between the PRASA and me / us.

I / We undertake to produce acceptable documentary proof of the necessary coverage for Workmen's Compensation, Securities and Insurance within **30 (thirty)** working days of notification of awarding of the contract, and to sign a formal contract if called upon by the PRASA to do so within **7 (seven)** working days of notification by the PRASA that the contract documents are ready for signature.

I / We undertake to complete the whole of the WORKS within _____
(in words) from the date of notification to me / us of acceptance of the tender, subject to completion in stages if and as laid down in the project specification and to such extensions of time as may be granted. Failing completion of the WORKS or any stage of the WORKS within the period(s) stipulated or by such extended date(s) as may be allowed by the PRASA I / we shall pay to the PRASA in terms of the Conventional Penalties Act 15 of 1962, the penalty for which provision is made in the project specification. The ordering of any alterations, extras, additions or omissions shall not in any way prejudice the PRASA claim for such penalty.

Application for relief from the obligation to pay a penalty will be considered by the PRASA, but shall be granted only if I / we can prove to the reasonable satisfaction of the PRASA that the penalty is out of proportion to the prejudice suffered by the PRASA by reason of the act or omission in respect of which the penalty was stipulated.

I / We declare that this tender holds good until _____**(a minimum period of 90 days from closing date is required).**

I / We further agree that if, after I / we have been notified of the acceptance of my / our tender, I / we fail to enter into a formal contract if called upon to do so, or fail to furnish satisfactory security for the due and proper completion of the WORKS, the PRASA may, without prejudice to any other legal remedy which it may have, recover from me / us any

expense to which it may have been put in calling for tenders afresh and / or having to accept any less favourable tender.

I / We undertake, in the event of my / our tender being accepted, to deposit with the PRASA as security for the due and proper completion of the WORKS, a Performance Bond issued by a South African registered Bank to the value of **ten (10) per cent** of the contract price (VAT inclusive).

I/ We declare that, being a company / partnership / close corporation / joint venture, I / we have duly completed the annexe hereto and certified it as correct.

The several documents involved are to be taken as complementary to each other. In the event of any conflict between the content of any of the documents listed in the schedule of tender documents (other than the project specification) and the project specification, the latter shall prevail. In the event of any conflict between the letter that accompanies the tender or other relevant correspondence and the contents of the documents listed in the schedule of tender documents (including the project specification) such letter or correspondence shall prevail.

I/we agree that non-compliance with any of the material terms of this RFP, including those mentioned above, will constitute a material breach of contract and provide PRASA with cause for cancellation.

THUS DONE and SIGNED at _____

on this _____ day of _____

	DULY AUTHORISED SIGNATORY(IES)		WITNESSES
1.	_____	1.	_____
2.	_____	2.	_____
3.	_____	3.	_____

PRICING SCHEDULE

PRELIMINARY AND GENERAL For
The reconstruction of the 3 kV DC Traction, and AC Distribution Substations between New Canada Train Station and Lawley Train Station.

Item	Description	Unit	Quantity	Rate	Amount
1,0	**DESIGN WORK**				
1,1	Structural Engineer services and buildings certificate of occupancy.	sum	1		
1,2	Complete design for 3kV DC Traction and AC Distribution substations	sum	1		
1,3	Design complete toilet facility for 3kV DC Traction substations including Municipality approvals.	sum	1		
1,4	Civil design and completion certificate for 3kV DC Traction and AC Distribution substations approved by professional Civil Engineer or Technologist.	sum	1		
1,5	Electrical design and completion certificate for 3kV DC Traction and AC Distribution substations approved by Professional Electrical Engineer or Technologist.	sum	1		
1,6	Electrical Protection and Earthing system designed and approved by Specialist.	sum	1		
1,7	Soil resistance test for Earth Mat and report approved by a Specialist.	sum	1		

1,8	Electrical fence design and installation Completion certificate approved by Specialist	each	1		
1,9	Telecommunication system design and installation completion certificate approved by a specialist	sum	1		
1,10	Design intrudes alarm system and installation completion certificate approved by a specialist	sum	1		
1,11	Buildings Electrical Certificate of Compliance (CoC) for all Substations buildings	sum	1		
2,0	**FIXED CHARGE AND VALUE RELATED ITEMS**				
2,1	SANS 1921-1-2004: Part 1: General Engineering and Construction Works.	sum	1		
2,2	Compliance with Environmental requirements.	sum	1		
2,3	Compliance with Health and Safety requirements.	sum	1		
2,4	Transportation of Contractors Staff to and from sites. Contractor to specify the type of transport.	sum	1		
2,5	Other Compliance with Quality Requirements.	sum	1		
3,0	**ESTABLISHMENT OF FACILITIES ON SITE FOR THE CONTRACTOR**				
3,1	Communications	sum	1		
3,2	Signage on each site.	sum	1		
4,0	**SCHEDULED TIME RELATED ITEMS.**				
4,1	Offices and Storage Sheds.	Months	6		
4,2	Chemical Toilets.	Months	6		
4,3	Workshops.	Months	6		
4,4	Tools, Ladders, Scaffolding and Ropes.	Months	6		

4,5	Water Supply and Electrical Supply.	Months	6		
4,6	Plant and Equipment.	Months	6		
4,7	Protective Wear, Safety Clothing, and ID's.	Months	6		
4,9	Light Duty Vehicles (LDV's).	Months	6		
4,10	Trucks.	Months	6		
4,11	Cranes.	Months	6		
4,12	Machinery and Plant required for Earth Works.	Months	6		
4,13	Other Construction Vehicles.	Months	6		
4,14	Security x 24 Hours. As per the Health and Safety Spec	Months	6		
4,15	Community Liaison Officer	Month	6		
5,0	**CONSTRUCTION MANAGEMENT & SUPERVISION FOR THE DURATION OF CONSTRUCTION.**	Months	6		
6,0	**TESTING OF TRANSFORMER.**				
6,1	Allow an amount for the PRASA three employee i.e. (Project Manager, Technical Staff and Engineer) to conduct an out of tank inspection on the transformer and to witnessing all routine manufacturers tests carried out by the manufacture in the land of origin.	sum	1		
6,2	In terms of the Contract allow an amount for Type Tests of the transformer if such tests do not exist.	sum	1		
7.0	**SITE DE-ESTABLISHMENT**				
7.1	Removing facilities from site	sum	1		
7.2	Site rehabilitation	sum	1		
TOTAL FOR PRELIMINARY & GENERAL CARRIED FORWARD TO THE SUMMARY OF PRICES					

NEW CANADA TRACTION 3kV DC SUBSTATION (88kV Nominal Voltage - Single Unit)

BILL OF QUANTITIES

ELECTRICAL AND CIVIL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**88kV HV METAL OXIDE SURGE ARRESTERS**				
1,1	Design, supply and construct a foundation/s for an 88kV AC HV Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	1		
1,2	Design, supply, and construct support steel structure/s for 88kV AC Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	1		
1,3	Design, supply and install an 88kV AC HV Metal Oxide Gapless Surge Arresters for an outdoor yard complete with associated components.	set of 3	1		
1,4	Supply cables and termination as well as protection integration of 88kV HV AC Metal Oxide Gapless Surge Arresters to each phase of medium voltage supply and substation main earth electrode/earth mat.	sum	1		
2,0	**88kV HV AC MOTOR OPERATED DISCONNECT SWITCH**				
2,1	Design, supply and construct a foundation/s for an 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	1		
2,2	Design, supply, and construct support steel structure/s for 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	1		
2,3	Design, supply and install an 88kV AC HV Motor Operated Disconnect switch for an outdoor yard complete with associated components.	set of 3	1		
2,4	Supply cables and termination as well as protection integration of 88kV HV AC Disconnect Switch to Control Panels.	Sum	1		

3,0	**88kV HV AC PRIMARY CIRCUIT BREAKER**				
3,1	Design, supply and construct a foundation/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	1		
3,2	Design, supply, and construct support steel structure/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	1		
3,3	Design, supply and install an 88kV AC HV Primary Circuit Breaker for the outdoor yard complete with associated components.	Each	1		
3,4	Supply cables and termination as well as protection integration of 88kV HV AC Primary Circuit Breaker to Control Panels.	sum	1		
4,0	**CURRENT TRANSFORMERS**				
4,1	Design, supply and construct a foundation/s for 88kV AC Current Transformer for an outdoor yard complete.	sum	1		
4,2	Design, supply and install 88kV, HV Current Transformers in the set of two complete with associated components.	Set of 2	1		
4,3	Supply cable and termination as well as protection integration of 88kV HV AC Current Transformers to Control Panels.	sum	1		
5,0	**6.1 MVA TRACTION TRANSFORMER** See specification BBB5019 and BBB8205				
5,1	Supply and install a 6.1MVA Traction Transformer with vector group determined by the designer and voltage ratio of 88kV/1.22kV/1.22kV/2.36kV complete with all the necessary ancillary equipment and material. The transformer impedance shall not be less than 8%.	Each	1		
6,0	**AUXILLIARY TRANSFORMERS** See specification BBB8204				
6,1	Design, supply and install a 100kVA, 2.36kV/400V, Dyn11, 3-phase AC, 50Hz Main Auxiliary Transformer complete.	Each	1		
6,2	Design, supply and install 88kV gapless surge arrester complete.	Each	3		
6,3	Design, supply and install a 400V, 3P, 150A, 25kA, plug-in, draw-out type circuit breaker complete.	Each	1		

6,4	Supply and install the LV circuit breaker weatherproof stainless steel enclosure box, IP55 and support galvanised steel pole complete with circuit breaker tray, gland plate, support bracket, bolts, nuts, and washers.	Each	1		
7,0	**ELECTRICITY METERING**				
	See SANS 474:2006; NRS 057:2005				
7,1	Design, supply and install complete metering system with associated equipment and cables	sum	1		
8,0	**CONCRETE PLINTH AND BUNDWALL FOR TRANSFORMERS**				
8,1	Supply and install Main Traction and Auxiliary Transformer plinth and bund wall.	Each	1		
9,0	**CABLES AND BUSBARS**				
	See specification BBC 0198, CEE-0023.				
9,1	Supply and install suitably rated 6.6kV AC XLPE type A (three core) 25mm^2 copper cable complete with all the necessary termination kit to supply power to the main auxiliary transformer fed from 2.36kV of the traction transformer tertiary.	m	300		
9,2	Supply and install 110mm diameter HDPE sleeve pipes for cables crossing the railway lines.	m	500		
9,3	Supply and install 100mm^2 Cu, PVC insulated negative return bonds from the negative return manhole busbar to rail.	m	200		
9,4	Supply and install a negative manhole busbar with a minimum continuous rating of 4000A.	m	2		
9,5	Supply and install suitably rated 88kV AC XLPE type A (three core) 50mm2 copper cable complete with all the necessary termination kit.	m	300		
9,6	Supply and install suitably rated 6.6kV/11kV AC XLPE type B (single core) 630mm^2 Aluminium cable complete with the necessary termination kit for the main 3kV DC circuit and connection to the negative bus bar inside the building.	m	600		

9,7	Supply and install 800mm^2 Aluminium feeder wires with associated structures, termination kit to supply power to OHTE and provision for the return cable.	M	1000		
9,8	Supply and install control cables	sum	1		
9,9	Supply and install suitably rated (100x10mm) rigid flat copper bus bars (2 parallel bus bars per phase arrangement) between the secondary winding of the traction transformer and the wall bushings, complete with flexible removable connections to avoidoverstressing of connections and insulators. The bus bars shall also be for the interconnection between the wall bushingsand the rectifier (2 parallel bus bars per phase arrangement), from the rectifier to the reactor and to the positive isolator for the main positive bus bar on the wave filter equipment.The bus bar shall also include the negative return circuit and wall insulators. Bus bars shall be colour coded and to be SANS approved.	m	200		
10,0	**TRACTION SUBSTAITION BUILDING AND ASSOCIATED EQUIPMENT**				
10,1	Refurbish substation building/s and associated structures with vandal-proofdoors.	sum	1		
10.1a	Supply and deliver wooden house for Security guardroom as per section 4.1.5	Sum	1		
10,2	**Associated Equipment**				
10.2.1	Supply a self-supporting aluminium ladder with a height not exceeding 1.5m.	Each	1		
10.2.2	Supply and mount against the wall a key box with a lid and make provision for at least fifteen (15) keys.	Each	1		
10.2.3	Supply and install suitable brackets forstoring the ladder, special tools, and earthing apparatus, and brackets on the wall immediately adjacent to the annex door for mounting of fire extinguishers.	sum	1		
10.2.4	Supply a steel cabinet/desk combination approximately 1150mm wide, 600mm deep and 1200mm high.	Each	1		

10.2.5	Supply and mount on the wall above the desk an A1 size picture frame with transparent cover.	Each	1		
10,3	**Toilet Facility**				
10.3.1	Design, supply and construct complete unisex toilet with associated accessories and connect sewer pipe to municipalities main network.	sum	1		
11,0	**FENCING, GATES AND KERBING**				
	Welded Mesh Fence and Gates				
11.1	Supply and install a 1.8m welded mesh fence complete.	m	350		
11.2	Supply and install a 1.8m welded mesh fence gate complete.	Each	2		
11.3	Supply and install a 1.2m welded mesh fence complete for HT Outdoor equipment.	M	50		
11.2.4	Supply and install a 1.2m welded mesh fence gate complete.	Each	1		
12,0	**EXCAVATION, BACKFILLING AND COMPACTION**				
	See Specification CEE-0023				
12,1	**Platform**				
12.1.1	Excavate existing ground to prepare insitu layer and compact. Supply and compact final layer G5 material and backfill foundation trenches.	m^3	60		
12,2	**Cables and Earthing**				
12.2.1	Excavations for trenches in soil, importation of soil as per specification to bed cables, backfilling of trenches, compacting with mechanical rammer.	m^3	96		
13,0	**OUTDOOR EARTH MAT**				
	See specification CEE-0177, BBB3059, BBB5452, BBB2721				
13,1	Supply and install a complete earth mat in the substation yard and also adhering to drawing no. BBB3620.	Sum	1		

13,2	Supply and install 95mm^2 PVC insulated stranded copper conductor to bond various equipment to the earth mat complete with copper tinned lugs. Copper conductor and lugs to be SANS approved.	m	150		
13,3	Supply and install anticorrosive compound such as Zinc oxide to all crimped connections and exothermic welds.	Sum	1		
13,4	Allow a rate to braze or exothermic weld all the below ground connections.	Sum	1		
13,5	Supply and install Malthoid or any approved insulation material to insulate the main traction transformer from concrete plinth.	Sum	1		
13,6	Supply and install copper earth rods of 1.5m in length, which are suitably threaded to each end complete with a coupling and two brass rod termination clamps. Earth rods to be installed as per drawing BBB 3620. Earthrods not to be less than 70mm^2 copper in accordance with SANS1063.	Sum	1		
13,7	Supply and install braded copper bonds on all gates. Bonds shall be painted silver. Wire size bonds shall be the equivalent of 95mm^2 copper conductor.	Sum	1		
13,8	Supply and install AC earth leakage current transformer	Each	2		
13,9	Supply and install a weatherproof stainless-steel enclosure in which to house the AC earth leakage current transformer complete with the mounting required.	Each	2		
13,10	Supply and install environmentally approved weed killer and then a 100mm layer of crusher stone.	m^2	1000		
14,0	**ANODE WALL PLATE AND BUSHINGS**				
14,1	Supply and install a hot dip galvanised Anode Wall Plate	Set	1		
14,2	Supply and install suitably rated wall bushings	Each	6		
15,0	**YARD LIGHTING**				
15,1	Design, supply and install wall mounted 400 W outdoor industrial lights with associated components including clamps, cables, fittings, protective steel cage.	Each	8		
15,2	Supply and install a solid-state type of light-sensitive control unit with an impact	Each	1		

	resistance translucent cover.				
15,3	Design, supply and install Emergency outdoor lights supplied by solar panels.	Each	4		
15,3	**3kV DC RECTIFIER**				
	See specification BBB0496, BBB5452				
15.3.1	Design, supply and install a 6MW AC to DC rectifier complete with control panel and instruments, a diode monitoring panel with displays, cooling fans, attenuation circuit and associated equipment. The rectifier shall be of the 12-pulse configuration type.	Each	1		
15.3.2	Design, supply and install a rectifier bay screen manufactures from 25mm woven wire type expanded metal fixed to an angle iron frame supported by square pillars complete with a bay gate and fixing material per rectifier unit. The rate to include the painting of screen, gate, and pillars.	Set	1		
16,0	**REACTOR COIL**				
	See specification BBB3890, BBB5452				
16,1	Supply and install a 1.8mH, air core reactor, complete with insulators and mounting brackets.	Each	1		
17,0	**WAVE FILTER EQUIPMENT**				
	See Specification BBB3139, BBB3162, and BBB 5452				
17,1	Supply and install wave filter 1.173mH inductor coils complete with associated components and BBB3483.	Each	1		
17,2	Supply and install wave filter 1.759mH inductor coils complete with associated components and BBB3483.	Each	1		
17,3	Supply and install dry type wave filter 10uf capacitors complete with associated components.	Each	2		
17,4	Supply and install dry type wave filter 50uf capacitors complete with associated components.	Each	1		
17,5	Supply and install wave filter discharge 75kΩ, 150kW resistor on a suitable panel or bar complete with discharge and earthing mechanism.	Each	4		
17,6	Design, supply and install frames and support brackets for the mounting of the wave filter capacitors, inductors, resistors, and associated equipment.	Each	1		

17,7	Supply and install a fuse holder mounted on insulators complete with a 100A HRC fuse to protect the wave filter equipment and isolating and earth switch.	Each	1		
18,0	**3kV DC POSITIVE ISOLATOR AND UNDER VOLTAGE RELAY**				
	See specification BBB4724, BBB3005				
18,1	Supply and install positive isolator and earthing switch complete with operating mechanism situated in a metal panel complete with metering and wiring.	Each	1		
18,2	Supply and install a 3kV DC under voltage relay as part of the low voltage control gear of the positive isolator, complete with 3kV DC voltage divider, optic fibre transmitter, optic fibre receiver and control circuitry.	Each	1		
19,0	**MECHANICAL KEY INTERLOCKING SYSTEM**				
19,1	Supply and install a mechanical key exchange system to prevent on load operation.	Set	1		
20,0	**3kV DC MODULAR HIGH SPEED CIRCUIT BREAKER PANEL**				
	See specification CEE-0099, CEE-0227, BBB5452				
20,1	**3kV DC High Speed Circuit Breaker**				
20.1.1	Supply and install 3kV DC, 4000A, HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB.	Each	4		
20,2	**Electronic Control Relay**				
20.2.2	Supply and install an Electronic Control Relay with a 2-year warranty as per the requirements stated in clause 9.3.11 of the Scope of Works.	Each	4		
20,3	**3kV DC Universal Busbar Earth Switch**				
20.3.1	Supply and install a separate 3kV DC positive bus bar earth switch completes with electrical	Each	1		

	interlocking, mechanism, and indication lights to be connected.				
21,0	**PRIMARY CIRCUIT CONTROL PANEL AND AC/DC DISTRIBUTION PANEL**				
	See specification BBB2721				
21,1	**Primary Circuit Breaker Control Panel**				
Item	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**
21.1.1	Design, supply and install an indoor floor standing primary circuit breaker control panel complete with flag annunciator unit, protection relays (IEDs), phase failure relays, instruments meters, control equipment,event, and fault recorder, indicating lights, a panel light, emergency stop button, terminal strips, bus bars, protection test blocks, wiring labels etc.	Sum	1		
21,2	**AC/DC Distribution Panel**				
21.2.2	Design, supply and install an indoor floor standing AC/DC distribution panel complete with relays, instruments, meters, selector switches, AC and DC circuit breakers, isolators, earth switches, lightning arresters, a panel light, change over contactors, terminal strips, bus bars, labels, voltage comparators, phase failure and sequence detection relays, timers, wiring, mechanical key interlocking etc. The board shall make provision for 30% additional space for future requirements.	Each	1		
21,3	**Special Labels**				
21.3.1	Supply and install special labels in accordance with SANS 10142-1 and associated safety regulations to each section of the AC/DC distribution panel warning against various supplies entering the board, various voltages in the board and the automatic change over supply which must be isolated when work needs to do in the board or on any supply. All other control panel shall be clearly labelled as well. Labels must also be secured to the outside covers of plugs and light switches. All labels shall comply with the relevant specification.	Sum	1		

22,0	**BATTERY CABINET, BATTERY CHARGER AND BATTERIES**				
	See specification BBB2502, BBB 5452				
22,1	**110V DC Battery Charger**				
22.1.1	Supply and install a 230V AC to 110V DC, 30A battery charger.	Each	1		
22,2	**110V DC Battery Bank**				
22.2.1	Supply and install 110V DC, 200Ah, 53 maintenance-free gel batteries	Sum	1		
22,3	**Battery Stand**				
22.3.1	Supply and install a rigid battery bank stand capable of supporting the entire battery bank and also allows for 360-degree access to the battery bank for ease of maintenance.	Each	1		
23,0	**TELECONTROL OUTSTATION**				
	See specification BBC0653				
23,1	Supply and install a cabinet SIS500outstation to be floor mounted.	Each	1		
23,2	Supply and install a communication panel to link the SIS500 outstation to optic fibre backbone for Telecontrol complete with a fibre optic modem multiplexer, patch panel and power supply. The cabinet to be mounted on top of the SIS500 outstation.	Each	1		
23,3	110V – 24V DC – DC converter installed inside	Each	1		
23,4	Logic Rack with 1 X PSU card	Each	1		
23,5	Logic Rack with DO cards	Each	2		
23,6	Logic Rack with DI cards	Each	3		
23,7	Logic Rack with LMCU Digital card	Each	1		
23,8	Logic Rack with Pulse Rail Cards	Each	1		
23,9	Logic Rack with Latch Rail Cards	Each	12		
23.10	Logic Rack with Digital input Rail Cards	Each	48		
23.11	Logic Rack with IO Cables 40cm long	Each	10		
23.12	Logic Rack with RS232 cable	Each	3		

23.13	Logic Rack with Common negative return cable	Each	3		
24.4.3	Supply and install a PVC weatherproof outdoor light switch for the toilet complete with cover box and cover plate.	Each	1		
24.4.5	Supply and install surface mounted DC rated single lever one-way light switch complete with cover box and cover plated.	Each	1		
24,5	**Wire Ways and Galvanised Steel Tubing**				
24.5.1	Supply and install metal trunking complete with clip-in cover plates, splices, elbows, tees, end caps and other accessories.	Sum	1		
24.5.2	Supply and install 20mm galvanised steel tubing complete with fittings, couplings, inspection boxes, covers and sets as required.	Sum	1		
24.5.3	Supply and install standard adapters to support LED light fittings onto the trunking. Two per light fitting. Supply and install steel wire cable and suitable insulated brackets to suspend trunking from the substation roof. Brackets shall be insulated from earth potential.	Sum	1		
24.5.4	Supply and install PVC insulated wire for lights and switched socket outlets circuits (red, white, blue, black, and grey). Wire to be SANS approved.	Sum	1		
24,6	**AC Distribution Box**				
24.6.1	Supply and install surface mounted industrial type AC distribution board. The board to be powder coated Eau-de- nil.	Sum	1		
24,7	**DC Distribution Box**				
24.7.1	Supply and install surface mounted industrial type DC distribution board. The board to be powder coated Eau-de-nil.	Sum	1		
24,8	**LV Cables**				
24.8.1	Supply and install low voltage cables PVC, PVC. SWA, PVC multicore cables between all the indoor and outdoor equipment. Allow to terminate all the cables onto equipment. Rate to include compression glands, and any other accessories.	Sum	1		
25,0	**COOLING AND VENTILATION**				
25,1	**Substation Fresh Air Supply**				

25.1.1	Supply and install a fresh air supply fan consisting of two fans with a combined rating of 2.7m^3/s at 150Pa.	Each	1		
25,2	**Thermostat Control Switch**				
25.2.1	Supply and install a thermostat control switch. The thermostat control switch shall operate the two fresh air supply fans through a contactor installed in an AC/DC distribution panel. The position of the thermostat shall be determined on site.	Each	1		
25,3	**Battery Room Extractor Fan**				
25.3.1	Supply and install a battery room extractor fan with local isolator rated for 0.2m^3/s at25Pa. The fan shall be appropriate for the zone location.	Each	1		
25,4	**Toilet Extractor Fan**				
25.4.1	Supply and install the toilet extractor fan rated from 0.035m^3/s. The rate shall include a delay timer for the fan which will be connected to the toilet light circuit.	Each	1		
26,0	**INDOOR EARTHING**				
26,1	Supply and install indoor earthing according to drawing CEE-TBD-7.	Sum	1		
26,2	**DC Earth Leakage Relay**				
26.2.1	Supply and install DC earth leakage relay. The rate shall include zoning for earth fault locations.	Each	1		
26,3	**Cable Earth Fault Relay**				
26.3.1	Supply and install cable earth faulty indication relay.	Each	1		
27,0	**NEGATIVE RETURN MONITORING SYSTEM**				
	See specifications BBC1843 and BBC1844				
27,1	Supply and install a negative return monitoring system complete.	Each	1		
28,0	**FIRE FIGHTING**				
28,1	**Fire Risk Assessment**				
28.1.1	Conduct a fire risk assessment and provide a report with recommendations.	Sum	1		
28,2	**Fire Fighting Equipment**				

28.2.1	Design, supply and install firefighting equipment as per the accepted recommendations of the fire risk assessment.	Sum	1		
29,0	**SECURITY SYSTEM**				
29,1	Design, supply and install the security system complete with access control, vehicle registration identification, perimeter intruder detection system, CCTV cameras (2x Type 1 and 8x Type 4), IP cameras and electric fence.	Sum	1		
29,2	Supply and install the complete support structure for the outdoor cameras	Sum	1		
30,0	**WARNING NOTICES AND SIGNS**				
30,1	Supply and install a complete set of warning notices and signs as per the specifications.	Sum	1		
31,0	**SUNDRIES**				
	Sundries to be determined by Contractor				
31,1	Supply and install sundries as determined	Sum	1		
32,0	**DECOMISSIONING AND DEMOLITION**				
32,1	**DECOMISSIONING**				
32.1.1	Decommissioning of existing equipment. The rate to including transportation to a storage facility at Roodepoort Depot including non-ferrous metals (i.e., cable conductors, etc.)	Sum	1		
32.1.2	Conduct an oil test for PCB on all the electrical equipment with oil insulation.	Sum	1		
32.1.3	Handling and disposal of oil containing PCB.				
32.1.4	Dismantling and disposal of hazardous and non-re-usable material (i.e., asbestos) to an environmentally approved disposal site.	Sum	1		
33,2	**DEMOLITION**				
33.2.1	Demolish the existing transformer, buildings, plinth, and all damaged concrete platforms. The rate shall include removal and transportation of rubble to an environmentally approved dumping site.	Sum	1		
34,0	**TRAINING**				

34,1	Provide training on all substation equipment installed. The rate shall include theoretical training in a classroom setting and practical training on site. Allow for at least 6 Technicians, 2 Supervisors and 1 Technical manager.	Sum	1		
35,0	**MANUALS AND DATA PACK**				
Item	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**
35,1	Provide 3 sets of detailed operating and maintenance instructions of all equipment, switchgear relays, transformers, and other electrical equipment. Hard copies and electronic format on CD/Memory Stick.	set of 3	1		
36,0	**TEST AND COMMISSIONING**				
36,1	**Factory Acceptance Test**				
36.1.1	Allow for factory functional tests to be conducted by the manufacturers of all the equipment at their premises.	Sum	1		
36,2	**Site Acceptance Test**				
36.2.1	Allow for functional equipment testing on site.	Sum	1		
36,3	**Cold Commissioning**				
36.3.1	Allow for functional testing on all equipment (primary and secondary plant) and circuitry to prove proper functioning and installation thereof.	Sum	1		
36,4	**Hot Commissioning**				
36.4.1	Allow for functional testing to prove the satisfactory operation of all equipment under live conditions.	Sum	1		
37,0	**TEMPORARY WORKS**				
37,1	Allow for any deemed temporary works.	Sum	1		
38,0	**SPARES**				
Item	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**
38,1	Supply a 3kV DC HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB. This shall include a fully fitted DC feeder protection relay.	Each	1		
38,2	Supply rectifier diodes with the same specification as the installed rectifiers.	Each	8		

38,3	Supply rectifier diode monitoring card.	Each	1		
38,4	Supply rectifier attenuation circuit fuse.	Each	1		
38,5	Supply rectifier fan motor.	Each	1		
38,6	Supply fan control card circuit relays and timers.	Each	1		
38,7	Supply rectifier RC ("Snubber) Circuit.	Each	5		
38,8	Supply wave filter circuit fuse.	Each	1		
38,9	Supply 110VDC under voltage monitoring relays.	Each	2		
38,10	Supply 400V AC power protection relay.	Each	2		
38,11	Supply a 65W 230V AC indoor LED luminaire lamp.	Each	1		
38,12	Supply a 65W 110V DC indoor LED luminaire lamp.	Each	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

NANCEFIELD TRACTION 3kV DC SUBSTATION (88kV Nominal Voltage - Single Unit)

BILL OF QUANTITIES

ELECTRICAL AND CIVIL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**88kV HV METAL OXIDE SURGE ARRESTERS**				
1,1	Design, supply and construct a foundation/s for an 88kV AC HV Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	1		
1,2	Design, supply, and construct support steel structure/s for 88kV AC Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	1		

1,3	Design, supply and install an 88kV AC HV Metal Oxide Gapless Surge Arresters for an outdoor yard complete with associated components.	set of 3	1		
1,4	Supply cables and termination as well as protection integration of 88kV HV AC Metal Oxide Gapless Surge Arresters to each phase of medium voltage supply and substation main earth electrode/earth mat.	Sum	1		
2,0	**88kV HV AC MOTOR OPERATED DISCONNECT SWITCH**				
2,1	Design, supply and construct a foundation/s for an 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	1		
2,2	Design, supply, and construct support steel structure/s for 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	1		
2,3	Design, supply and install an 88kV AC HV Motor Operated Disconnectswitch for an outdoor yard complete with associated components.	set of 3	1		
2,4	Supply cables and termination as well as protection integration of 88kV HV AC Disconnect Switch to Control Panels.	Sum	1		
3,0	**88kV HV AC PRIMARY CIRCUIT BREAKER**				
3,1	Design, supply and construct a foundation/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	1		
3,2	Design, supply, and construct support steel structure/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	1		
3,3	Design, supply and install an 88kV AC HV Primary Circuit Breaker for the outdoor yard complete with associated components.	Each	1		
3,4	Supply cables and termination as well as protection integration of 88kV HV AC Primary Circuit Breaker to Control Panels.	Sum	1		

4,0	**CURRENT TRANSFORMERS**				
4,1	Design, supply and construct a foundation/s for 88kV AC Current Transformer for an outdoor yard complete.	sum	1		
4,2	Design, supply and install 88kV, HV Current Transformers in the set of two complete with associated components.	Set of 2	1		
4,3	Supply cable and termination as well as protection integration of 88kV HV AC Current Transformers to Control Panels.	sum	1		
5,0	**6.1 MVA TRACTION TRANSFORMER** See specification BBB5019 and BBB8205				
5,1	Supply and install a 6.1MVA Traction Transformer with vector group determined by the designer and voltage ratio of 88kV/1.22kV/1.22kV/2.36kV complete with all the necessary ancillary equipment and material. The transformer impedance shall not be less than 8%.	Each	1		
6,0	**AUXILLIARY TRANSFORMERS** See specification BBB8204				
6,1	Design, supply and install a 100kVA, 2.36kV/400V, Dyn11, 3-phase AC, 50Hz Main Auxiliary Transformer complete.	Each	1		
6,2	Design, supply and install 88kV gapless surge arrester complete.	Each	3		
6,3	Design, supply and install a 400V, 3P, 150A, 25kA, plug-in, draw-out type circuit breaker complete.	Each	1		
6,4	Supply and install the LV circuit breaker weatherproof stainless steel enclosure box, IP55 and support galvanised steel pole complete with circuit breaker tray, gland plate, support bracket, bolts, nuts, and washers.	Each	1		
7,0	**ELECTRICITY METERING**				
7,1	See SANS 474:2006; NRS 057:2005 Design, supply and install complete metering system with associated equipment and cables	Sum	1		

8,0	**CONCRETE PLINTH AND BUNDWALL FOR TRANSFORMERS**				
8,1	Supply and install Main Traction and Auxiliary Transformer plinth and bund wall.	Each	1		
9,0	**CABLES AND BUSBARS** See specification BBC 0198, CEE-0023.				
9,1	Supply and install suitably rated 6.6kV AC XLPE type A (three core) 25mm^2 copper cable complete with all the necessary termination kit to supply power to the main auxiliary transformer fed from 2.36kV of the traction transformer tertiary.	m	300		
9,2	Supply and install 110mm diameter HDPE sleeve pipes for cables crossing the railway lines.	m	500		
9,3	Supply and install 100mm^2 Cu, PVC insulated negative return bonds from the negative return manhole busbar to rail.	m	200		
9,4	Supply and install a negative manhole busbar with a minimum continuous rating of 4000A.	m	2		
9,5	Supply and install suitably rated 88kV AC XLPE type A (three core) 50mm2 copper cable complete with all the necessary termination kit.	m	300		
9,6	Supply and install suitably rated 6.6kV/11kV AC XLPE type B (single core) 630mm^2 Aluminium cable complete with the necessary termination kit for the main 3kV DC circuit and connection to the negative bus bar inside the building.	m	600		
9,7	Supply and install 800mm^2 Aluminium feeder wires with associated structures, termination kit to supply power to OHTE and provision for the return cable.	m	500		
9,8	Supply and install control cables	Sum	1		

9,9	Supply and install suitably rated (100x10mm) rigid flat copper bus bars (2 parallel bus bars per phase arrangement) between the secondary winding of the traction transformer and the wall bushings, complete with flexible removable connections to avoid overstressing of connections and insulators. The bus bars shall also be for the interconnection between the wall bushings and the rectifier (2 parallel bus bars per phase arrangement), from the rectifier to the reactor and to the positive isolator for the main positive bus bar on the wave filter equipment. The bus bar shallalso include the negative return circuitand wall insulators. Bus bars shall be colour coded and to be SANS approved.	m	200		
10,0	**TRACTION SUBSTAITION BUILDING AND ASSOCIATED EQUIPMENT**				
10,1	Refurbish substation building/s and associated structures with vandal-proof doors.	Sum	1		
10,1 a	Supply and deliver wooden house for Security guardroom as per section 4.1.5	Sum	1		
10,2	**Associated Equipment**				
10.2.1	Supply a self-supporting aluminium ladder with a height not exceeding 1.5m.	Each	1		
10.2.2	Supply and mount against the wall a key box with a lid and make provision for at least 15 keys.	Each	1		
10.2.3	Supply and install suitable brackets for storing the ladder, special tools, and earthing apparatus, and also brackets on the wall immediately adjacent to the annex door for mounting of fire extinguishers.	Sum	1		
10.2.4	Supply a steel cabinet/desk combination approximately 1150mm wide, 600mm deep and 1200mm high.	Each	1		

10.2.5	Supply and mount on the wall above the desk an A1 size picture frame with transparent cover.	Each	1		
10,3	**Toilet Facility**				
10.3.1	Design, supply and construct complete unisex toilet with associated accessories and connect sewer pipe to municipalities main network.	Sum	1		
11,0	**FENCING, GATES, AND KERBING**				
11,1	**Welded Mesh Fence and Gates**				
11.1.1	Supply and install a 1.8m welded mesh fence complete.	m	350		
11.2.2	Supply and install a 1.8m welded mesh fence gate complete.	Each	2		
11.2.3	Supply and install a 1.2m welded mesh fence complete. for HT Outdoor equipment	m	50		
11.2.4	Supply and install a 1.2m welded mesh fence gate complete.	Each	1		
12,0	**EXCAVATION, BACKFILLING AND COMPACTION** See Specification CEE-0023				
12,1	**Platform**				
12.1.1	Excavate existing ground to prepare inset layer and compact. Supply and compact final layer G5 material and backfill foundation trenches.	m^3	60		
12,2	**Cables and Earthing**				
12.2.1	Excavations for trenches in soil, importation of soil as per specification to bed cables, backfilling of trenches, compacting with mechanical rammer.	m^3	96		
13,0	**OUTDOOR EARTH MAT** See specification CEE-0177, BBB3059, BBB5452, BBB2721				
13,1	Supply and install a complete earth mat in the substation yard and also adhering to drawing no. BBB3620.	Sum	1		
13,2	Supply and install 95mm^2 PVC insulated stranded copper conductor to bond various equipment to the earth matt complete with copper tinned lugs. Copper conductor and lugs to be SANS approved.	m	150		

13,3	Supply and install anticorrosive compound such as Zinc oxide to all crimped connections and exothermic welds.	Sum	1		
13,4	Allow a rate to braze or exothermic weld all the below ground connections.	Sum	1		
13,5	Supply and install Malthoid or any approved insulation material to insulate the main traction transformer from concrete plinth.	Sum	1		
13,6	Supply and install copper earth rods of 1.5m in length, which are suitably threaded to each end complete with a coupling and two brass rod termination clamps. Earth rods to be installed as per drawing BBB 3620. Earth rods not to be less than 70mm^2 copper in accordance with SANS1063.	Sum	1		
13,7	Supply and install braded copper bonds on all gates. Bonds shall be painted silver. Wire size bonds shall be the equivalent of 95mm^2 copper conductor.	Sum	1		
13,8	Supply and install AC earth leakage current transformer	Each	2		
13,9	Supply and install a weatherproof stainless-steel enclosure in which to house the AC earth leakage current transformer complete with the mounting required.	Each	2		
13,10	Supply and install environmentally approved weed killer and then a 100mm layer of crusher stone.	m^2	1000		
14,0	**ANODE WALL PLATE AND BUSHINGS**				
14,1	Supply and install a hot dip galvanised Anode Wall Plate	Set	1		
14,2	Supply and install suitably rated wall bushings	Each	6		
15,0	**YARD LIGHTING**				
15,1	Design, supply and install wall mounted 400 W outdoor industrial lights with associated components including clamps, cables, fittings, protective steel cage.	Each	8		

15,2	Supply and install a solid-state type of light-sensitive control unit with an impact resistance translucent cover.	Each	1		
15,3	Design, supply and install Emergency outdoor lights supplied by solar panels.	Each	4		
15,3	**3kV DC RECTIFIER** See specification BBB0496, BBB5452				
15.3.1	Design, supply and install a 6MW AC to DC rectifier complete with control panel and instruments, a diode monitoring panel with displays, cooling fans, attenuation circuit and associated equipment. The rectifier shall be of the 12-pulse configuration type.	Each	1		
15.3.2	Design, supply and install a rectifier bay screen manufactures from 25mm woven wire type expanded metal fixed to an angle iron frame supported by square pillars complete with a bay gate and fixing material per rectifier unit. The rate to include the painting of screen, gate, and pillars.	Set	1		
16,0	**REACTOR COIL** See specification BBB3890, BBB5452				
16,1	Supply and install a 1.8mH, air core reactor, complete with insulators and mounting brackets.	Each	1		
17,0	**WAVE FILTER EQUIPMENT** See Specification BBB3139, BBB3162, and BBB 5452				
17,1	Supply and install wave filter 1.173mH inductor coils complete with associated components and BBB3483.	Each	1		
17,2	Supply and install wave filter 1.759mH inductor coils complete with	Each	1		

	associated components and BBB3483.				
17,3	Supply and install dry type wave filter 10uf capacitors complete with associated components.	Each	2		
17,4	Supply and install dry type wave filter 50uf capacitors complete with associated components.	Each	1		
17,5	Supply and install wave filter discharge 75kΩ, 150kW resistor on a suitable panel or bar complete with discharge and earthing mechanism.	Each	4		
17,6	Design, supply and install frames and support brackets for the mounting of the wave filter capacitors, inductors, resistors, and associated equipment.	Each	1		
17,7	Supply and install a fuse holder mounted on insulators complete with a 100A HRC fuse to protect the wave filter equipment and isolating and earth switch.	Each	1		
18,0	**3kV DC POSITIVE ISOLATOR AND UNDER VOLTAGE RELAY**				
	See specification BBB4724, BBB3005				
18,1	Supply and install positive isolator and earthing switch complete with operating mechanism situated in a metal panel complete with metering and wiring.	Each	1		
18,2	Supply and install a 3kV DC under voltage relay as part of the low voltage control gear of the positive isolator, complete with 3kV DC voltage divider, optic fibre transmitter, optic fibre receiver and control circuitry.	Each	1		
19,0	**MECHANICAL KEY INTERLOCKING SYSTEM**				
19,1	Supply and install a mechanical key exchange system to prevent on load operation.	Set	1		
20,0	**3kV DC MODULAR HIGH SPEED CIRCUIT BREAKER PANEL**				
	See specification CEE-0099, CEE-0227, BBB5452				

20,1	**3kV DC High Speed Circuit Breaker**				
20.1.1	Supply and install 3kV DC, 4000A, HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB.	Each	4		
20,2	**Electronic Control Relay**				
20.2.2	Supply and install an Electronic Control Relay with a 2-year warranty as per the requirements stated in clause 9.3.11 of the Scope of Works.	Each	4		
20,3	**3kV DC Universal Busbar Earth Switch**				
20.3.1	Supply and install a separate 3kV DC positive bus bar earth switch completes with electrical interlocking, mechanism, and indication lights to be connected.	Each	1		
21,0	**PRIMARY CIRCUIT CONTROL PANEL AND AC/DC DISTRIBUTION PANEL**				
	See specification BBB2721				
21,1	**Primary Circuit Breaker Control Panel**				
21.1.1	Design, supply and install an indoor floor standing primary circuit breaker control panel complete with flag annunciator unit, protection relays (IEDs), phase failure relays, instruments meters, control equipment, event, and fault recorder, indicating lights, a panel light, emergency stop button, terminal strips, bus bars, protection test blocks, wiring labels etc.	Sum	1		
21,2	**AC/DC Distribution Panel**				
21.2.2	Design, supply and install an indoor floor standing AC/DC distribution panel complete with relays, instruments, meters, selector switches, AC and DC circuit breakers, isolators, earth switches, lightning arresters, a panel light, change over contactors, terminal strips, bus bars,	Each	1		

	labels, voltage comparators, phase failure and sequence detection relays, timers, wiring, mechanical key interlocking etc. The board shall make provision for 30% additional space for future requirements.				
21,3	**Special Labels**				
21.3.1	Supply and install special labels in accordance with SANS 10142-1 and associated safety regulations to each section of the AC/DC distribution panel warning against various supplies entering the board, various voltages in the board and the automatic change over supply which must be isolated when work needs to do in the board or on any supply. All other control panel shall be clearly labelled as well. Labels must also be secured to the outside covers of plugs and light switches. All labels shall comply with the relevant specification.	Sum	1		
22,0	**BATTERY CABINET, BATTERY CHARGER, AND BATTERIES** See specification BBB2502, BBB 5452				
22,1	**110V DC Battery Charger**				
22.1.1	Supply and install a 230V AC to 110V DC, 30A battery charger.	Each	1		
22,2	**110V DC Battery Bank**				
22.2.1	Supply and install 110V DC, 200Ah, 53 maintenance-free gel batteries	Sum	1		
22,3	**Battery Stand**				
22.3.1	Supply and install a rigid battery bank stand capable of supporting the entire battery bank and also allows for 360-degree access to the battery bank for ease of maintenance.	Each	1		
23,0	**TELECONTROL OUTSTATION** See specification BBC0653				
23,1	Supply and install a cabinet SIS500 outstation to be floor mounted.	Each	1		

23,2	Supply and install and communication panel to link the SIS500 outstation to optic fibre backbone for Telecontrol complete with a fibre optic modem multiplexer, patch panel and power supply. The cabinet to be mounted on top of the SIS500 outstation.	Each	1		
23,3	110V – 24V DC – DC converter installed inside	Each	1		
23,4	Logic Rack with 1 X PSU card	Each	1		
23,5	Logic Rack with DO cards	Each	2		
23,6	Logic Rack with DI cards	Each	3		
23,7	Logic Rack with LMCU Digital card	Each	1		
23,8	Logic Rack with Pulse Rail Cards	Each	1		
23,9	Logic Rack with Latch Rail Cards	Each	12		
23.10	Logic Rack with Digital input Rail Cards	Each	48		
23.11	Logic Rack with IO Cables 40cm long	Each	10		
23.12	Logic Rack with RS232 cable	Each	3		
23.13	Logic Rack with Common negative return cable	Each	3		
24,0	**LV ELECTRICAL LIGHT AND POWER DISTRIBUTION INSIDE THE SUBSTATION BUILDING**				
24,1	**Switched Socket Outlet**				
24.1.1	Supply and install all the switched socket outlet.	Each	4		
24,2	**AC Luminaires Indoor Lighting**				
24.2.1	Supply and install 65W, 230V AC LED luminaire suspended 1m below roof ceiling.	Each	8		
24,3	**DC Luminaires Indoor Lighting**				
24.3.1	Supply and install 65W, 110V DC LED luminaire suspended 1m below roof ceiling.	Each	2		
24,4	**Light Switches**				
24.4.1	Supply and install surface mounted single lever two-way light switch complete with cover box and cover plated.	Each	2		

24.4.2	Supply and install surface mounted single lever one-way light switch complete with cover box and cover plated.	Each	1		
24.4.3	Supply and install a PVC weatherproof outdoor light switch for the toilet complete with cover box and cover plate.	Each	1		
24.4.5	Supply and install surface mounted DC rated single lever one-way light switch complete with cover box and cover plated.	Each	1		
24,5	**Wire Ways and Galvanised Steel Tubing**				
24.5.1	Supply and install metal trunking complete with clip-in cover plates, splices, elbows, tees, end caps and other accessories.	Sum	1		
24.5.2	Supply and install 20mm galvanised steel tubing complete with fittings, couplings, inspection boxes, covers and sets as required.	Sum	1		
24.5.3	Supply and install standard adapters to support LED light fittings onto the trunking. Two per light fitting. Supply and install steel wire cable and suitable insulated brackets to suspend trunking from the substation roof. Brackets shall be insulated from earth potential.	Sum	1		
24.5.4	Supply and install PVC insulated wire for lights and switched socket outlets circuits (red, white, blue, black, and grey). Wire to be SANS approved.	Sum	1		
24,6	**AC Distribution Box**				
24.6.1	Supply and install surface mounted industrial type AC distribution board. The board to be powder coated Eau-de-nil.	Sum	1		
24,7	**DC Distribution Box**				
24.7.1	Supply and install surface mounted industrial type DC distribution board. The board to be powder coated Eau-de-nil.	Sum	1		
24,8	**LV Cables**				

24.8.1	Supply and install low voltage cables PVC, PVC. SWA, PVC multicore cables between all the indoor and outdoor equipment. Allow to terminate all the cables onto equipment. Rate to include compression glands, and any other accessories.	Sum	1		
25,0	**COOLING AND VENTILATION**				
25,1	**Substation Fresh Air Supply**				
25.1.1	Supply and install a fresh air supply fan consisting of two fans with a combined rating of 2.7m^3/s at 150Pa.	Each	1		
25,2	**Thermostat Control Switch**				
25.2.1	Supply and install a thermostat control switch. The thermostat control switch shall operate the two fresh air supply fans through a contactor installed in an AC/DC distribution panel. The position of the thermostat shall be determined on site.	Each	1		
25,3	**Battery Room Extractor Fan**				
25.3.1	Supply and install a battery room extractor fan with local isolator rated for 0.2m^3/s at 25Pa. The fan shall be appropriate for the zone location.	Each	1		
25,4	**Toilet Extractor Fan**				
25.4.1	Supply and install the toilet extractor fan rated from 0.035m^3/s. The rate shall include a delay timer for the fan which will be connected to the toilet light circuit.	Each	1		
26,0	**INDOOR EARTHING**				
26,1	Supply and install indoor earthing according to drawing CEE-TBD-7.	Sum	1		
26,2	**DC Earth Leakage Relay**				
26.2.1	Supply and install DC earth leakage relay. The rate shall include zoning for earth fault locations.	Each	1		
26,3	**Cable Earth Fault Relay**				
26.3.1	Supply and install cable earth faulty indication relay.	Each	1		
27,0	**NEGATIVE RETURN MONITORING SYSTEM** See specifications BBC1843 and BBC1844				
27,1	Supply and install a negative return monitoring system complete.	Each	1		

28,0	**FIRE FIGHTING**				
28,1	**Fire Risk Assessment**				
28.1.1	Conduct a fire risk assessment and provide a report with recommendations.	Sum	1		
28,2	**Fire Fighting Equipment**				
28.2.1	Design, supply and install firefighting equipment as per the accepted recommendations of the fire risk assessment.	Sum	1		
29,0	**SECURITY SYSTEM**				
29,1	Design, supply and install the security system complete with access control, vehicle registration identification, perimeter intruder detection system, CCTV cameras (2x Type 1 and 8x Type 4), IP cameras and electric fence.	Sum	1		
29,2	Supply and install the complete support structure for the outdoor cameras	Sum	1		
30,0	**WARNING NOTICES AND SIGNS**				
30,1	Supply and install a complete set of warning notices and signs as per the specifications.	Sum	1		
31,0	**SUNDRIES** Sundries to be determined by Contractor				
31,1	Supply and install sundries as determined	Sum	1		
32,0	**DECOMISSIONING AND DEMOLITION**				
32,1	**DECOMISSIONING**				
32.1.1	Decommissioning of existing equipment. The rate to including transportation to a storage facility at Roodepoort Depot including non-ferrous metals (i.e., cable conductors, etc.)	Sum	1		
32.1.2	Conduct an oil test for PCB on all the electrical equipment with oil insulation.	Sum	1		
32.1.3	Handling and disposal of oil containing PCB.				

32.1.4	Dismantling and disposal of hazardous and non-re-usablematerial (i.e., asbestos) to an environmentally approved disposalsite.	Sum	1		
33,2	**DEMOLITION**				
33.2.1	Demolish the existing building, transformer plinth and all damaged concrete platforms. The rate shall include removal and transportation of rubble to an environmentally approved dumping site.	Sum	1		
34,0	**TRAINING**				
34,1	Provide training on all substation equipment installed. The rate shall include theoretical training in a classroom setting and practical training on site. Allow for at least 6 Technicians, 2 Supervisors and 1 Technical manager.	Sum	1		
35,0	**MANUALS AND DATA PACK**				
35,1	Provide 3 sets of detailed operating and maintenance instructions of all equipment, switchgear relays, transformers, and other electrical equipment. Hard copies and electronic format on CD/Memory Stick.	set of 3	1		
36,0	**TEST AND COMMISSIONING**				
36,1	**Factory Acceptance Test**				
36.1.1	Allow for factory functional tests to be conducted by the manufacturers of all the equipment at their premises.	Sum	1		
36,2	**Site Acceptance Test**				
36.2.1	Allow for functional equipment testing on site.	Sum	1		
36,3	**Cold Commissioning**				
36.3.1	Allow for functional testing on all equipment (primary and secondary plant) and circuitry to prove proper functioning and installation thereof.	Sum	1		
36,4	**Hot Commissioning**				
36.4.1	Allow for functional testing to prove the satisfactory operation of all equipment under live conditions.	Sum	1		
37,0	**TEMPORARY WORKS**				

37,1	Allow for any deemed temporary works.	Sum	1		
38,0	**SPARES**				
38,1	Supply a 3kV DC HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB. This shall include a fully fitted DC feeder protection relay.	Each	1		
38,2	Supply rectifier diodes with the same specification as the installed rectifiers.	Each	8		
38,3	Supply rectifier diode monitoring card.	Each	1		
38,4	Supply rectifier attenuation circuit fuse.	Each	1		
38,5	Supply rectifier fan motor.	Each	1		
38,6	Supply fan control card circuit relays and timers.	Each	1		
38,7	Supply rectifier RC ("Snubber) Circuit.	Each	5		
38,8	Supply wave filter circuit fuse.	Each	1		
38,9	Supply 110VDC under voltage monitoring relays.	Each	2		
38,10	Supply 400V AC power protection relay.	Each	2		
38,11	Supply a 65W 230V AC indoor LED luminaire lamp.	Each	1		
38,12	Supply a 65W 110V DC indoor LED luminaire lamp.	Each	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

MIDWAY TRACTION 3kV DC SUBSTATION (88kV Nominal Voltage - Double Units)

BILL OF QUANTITIES

ELECTRICAL AND CIVIL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**88kV MV METAL OXIDE SURGE ARRESTERS**				
1,1	Design, supply and construct a foundation/s for an 88kV AC MV Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	2		
1,2	Design, supply, and construct support steel structure/s for 88kV AC Metal Oxide Gapless Surge Arresters for an outdoor yard complete.	set of 3	2		
1,3	Design, supply and install an 88kV AC MV Metal Oxide Gapless Surge Arresters for an outdoor yard complete with associated components.	set of 3	2		
1,4	Supply cables and termination as well as protection integration of 88kV MV AC Metal Oxide Gapless Surge Arresters to each phase of medium voltage supply and substation main earth electrode/earth mat.	Sum	1		
2,0	**88kV MV AC MOTOR OPERATED DISCONNECT SWITCH**				
2,1	Design, supply and construct a foundation/s for an 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	2		
2,2	Design, supply, and construct support steel structure/s for 88kV AC Motor Operated Disconnect switch for an outdoor yard complete.	set of 3	2		

2,3	Design, supply and install an 88kV AC MV Motor Operated Disconnect switch for an outdoor yard complete with associated components.	set of 3	2		
2,4	Supply cables and termination as well as protection integration of 88kV MV AC Disconnect Switch to Control Panels.	Sum	1		
3,0	**88kV MV AC PRIMARY CIRCUIT BREAKER**				
3,1	Design, supply and construct a foundation/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	2		
3,2	Design, supply, and construct support steel structure/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	2		
3,3	Design, supply and install an 88kV AC MV Primary Circuit Breaker for the outdoor yard complete with associated components.	Each	2		
3,4	Supply cables and termination as well as protection integration of 88kV MV AC Primary Circuit Breaker to Control Panels.	Sum	1		
4,0	**CURRENT TRANSFORMERS**				
4,1	Design, supply and construct a foundation/s for 88kV AC Current Transformer for an outdoor yard complete.	Each	2		
4,2	Design, supply, and construct support steel structure/s for 88kV AC Primary Circuit Breaker for an outdoor yard complete.	Each	2		
4,3	Design, supply and install 88kV, MV Current Transformers in the set of two complete with associated components.	Set of 2	2		
4,4	Supply cable and termination as well as protection integration of 88kV MV AC Current Transformers to Control Panels.	sum	1		
5,0	**6.1 MVA TRACTION TRANSFORMER**				

	See specification BBB5019 and BBB8205				
5,1	Supply and install a 6.1MVA Traction Transformer with vector group determined by the designer and voltage ratio of 88kV/1.22kV/1.22kV/2.36kV complete with all the necessary ancillary equipment and material. The transformer impedance shall not be less than 8%.	Each	2		
6,0	**AUXILLIARY TRANSFORMERS**				
	See specification BBB8204				
6,1	Design, supply and install a 100kVA, 2.36kV/400V, Dyn11, 3-phase AC, 50Hz Main Auxiliary Transformer complete.	Each	2		
6,2	Design, supply and install 88kV gapless surge arrester complete.	Each	6		
6,3	Design, supply and install a 400V, 3P, 150A, 25kA, plug-in, draw-out type circuit breaker complete.	Each	2		
6,4	Supply and install the LV circuit breaker weatherproof stainless steel enclosure box, IP55 and support galvanised steel pole complete with circuit breaker tray, gland plate, support bracket, bolts, nuts, and washers.	Each	2		
7,0	**ELECTRICITY METERING**				
	See SANS 474:2006; NRS 057:2005				
7,1	Design, supply and install complete metering system with associated equipment's and cables	Each	2		
8,0	**CONCRETE PLINTH AND BUNDWALL FOR TRANSFORMERS**				
8,1	Supply and install Main Traction and Auxiliary Transformer plinth and bund wall.	Each	2		
9,0	**CABLES AND BUSBARS**				
	See specification BBC 0198, CEE-0023.				

9,1	Supply and install suitably rated 6.6kV AC XLPE type A (three core) 25mm^2 copper cable complete with all the necessary termination kit to supply power to the main auxiliary transformer fed from 2.36kV of the traction transformer tertiary.	m	600		
9,2	Supply and install 110mm diameter HDPE sleeve pipes for cables crossing the railway lines.	m	500		
9,3	Supply and install 100mm^2 Cu, PVC insulated negative return bonds from the negative return manhole busbar to rail.	m	400		
9,4	Supply and install a negative manhole busbar with a minimum continuous rating of 4000A.	m	4		
9,5	Supply and install suitably rated 88kV AC XLPE type A (three core) 50mm2 copper cable complete with all the necessary termination kit.	m	600		
9,6	Supply and install suitably rated 6.6kV AC XLPE type B (single core) 630 mm^2 Aluminium cable complete with the necessary termination kit for the main 3kV DC circuit and connection to the negative bus bar inside the building.	m	600		
9,7	Supply and install 800mm^2 Aluminium feeder wires with associated structures, termination kit to supply power to OHTE and provision for the return cable.	m	800		
9,8	Supply and install control cables	Sum	1		

9,9	Supply and install suitably rated (100x10mm) rigid flat copper bus bars (2 parallel bus bars per phase arrangement) between the secondary winding of the traction transformer and the wall bushings, complete with flexible removable connections to avoid overstressing of connections and insulators. The bus bars shall also be for the interconnection between the wall bushings and the rectifier (2 parallel bus bars per phase arrangement), from the rectifier to the reactor and to the positive isolator for the main positive bus bar on the wave filter equipment. The bus bar shallalso include the negative return circuitand wall insulators. Bus bars shall be colour coded and to be SANS approved.	m	400		
10,0	**TRACTION SUBSTAITION BUILDING AND ASSOCIATED EQUIPMENT**				
10,1	Refurbish substation building/s and associated structures with vandal-proof doors.	Sum	1		
10,1 a	Supply and deliver wooden house for Security guardroom as per section 4.1.5	Each	1		
10,2	**Associated Equipment**				
10.2.1	Supply a self-supporting aluminium ladder with a height not exceeding 1.5m.	Each	1		
10.2.2	Supply and mount against the wall a key box with a lid and make provision for at least 15 keys.	Each	1		
10.2.3	Supply and install suitable brackets for storing the ladder, special tools, and earthing apparatus, and also brackets on the wall immediately adjacent to the annex door for mounting of fire extinguishers.	Sum	1		
10.2.4	Supply a steel cabinet/desk combination approximately 1150mm wide, 600mm deep and 1200mm high.	Each	1		

10.2.5	Supply and mount on the wall above the desk an A1 size picture frame with transparent cover.	Each	1		
10,3	**Toilet Facility**				
10.3.1	Design, supply and construct complete unisex toilet with associated accessories and connect sewer pipe to municipalities main network.	Sum	1		
11,0	**FENCING, GATES, AND KERBING**				
11,1	**Welded Mesh Fence and Gates**				
11.1.1	Supply and install a 1.8m welded mesh fence complete.	m	350		
11.1.2	Supply and install a 1.8m welded mesh fence gate complete.	Each	1		
11.1.3	Supply and install a 1.2m welded mesh fence complete.	m	50		
11.1.4	Supply and install a 1.2m welded mesh fence gate complete.	Each	1		
12,0	**EXCAVATION, BACKFILLING AND COMPACTION**				
	See Specification CEE-0023				
12,1	**Platform**				
12.1.1	Excavate existing ground to prepare inside layer and compact. Supply and compact final layer G5 material and backfill foundation trenches	m^3	50		
12,2	**Cables and Earthing**				
12.2.1	Excavations for trenches in soil, importation of soil as per specification to bed cables, backfilling of trenches, compacting with mechanical rammer.	m^3	50		
13,0	**OUTDOOR EARTH MAT**				
	See specification CEE-0177, BBB3059, BBB5452, BBB2721				
13,1	Supply and install a complete earth mat in the substation yard and also adhering to drawing no. BBB3620.	Sum	1		
13,2	Supply and install 95mm^2 PVC insulated stranded copper conductor to bond various equipment to the	Sum	1		

	earth mat complete with copper tinned lugs. Copper conductor and lugs to be SANS approved.				
13,3	Supply and install anticorrosive compound such as Zinc oxide to all crimped connections and exothermic welds	Sum	1		
13,4	Allow a rate to braze or exothermic weld all the below ground connections	sum	1		
13,5	Supply and install Malthoid or any approved insulation material to insulate the main traction transformer from concrete plinth.	Sum	1		
13,6	Supply and install copper earth rods of 1.5m in length, which are suitably threaded to each end complete with a coupling and two brass rod termination clamps. Earth rods to be installed as per drawing BBB 3620. Earth rods not to be less than 70mm^2 copper in accordance with SANS1063.	Sum	1		
13,7	Supply and install braded copper bonds on all gates. Bonds shall be painted silver. Wire size bonds shall be the equivalent of 95mm^2 copper conductor.	Sum	1		
13,8	Supply and install AC earth leakage current transformer	Each	4		
13,9	Supply and install a weatherproof stainless-steel enclosure in which to house the AC earth leakage current transformer complete with the mounting required	Each	4		
13,10	Supply and install environmentally approved weed killer and then a 100mm layer of crusher stone	m^2	1000		
14,0	**ANODE WALL PLATE AND BUSHINGS**				
14,1	Supply and install a hot dip galvanised Anode Wall Plate	Set	1		
14,2	Supply and install suitably rated wall bushings	Each	6		
15,0	**YARD LIGHTING**				

15,1	Design, supply and install 400 W outdoor industrial lights with associated components including limescales, fittings, protective steel cage.	Each	8		
15,2	Supply and install a solid-state type of light-sensitive control unit with an impact resistance translucent cover.	Each	1		
15,3	Design, supply and install Emergency outdoor lights supplied by solar panels.	Each	4		
15,3	**3kV DC RECTIFIER** See specification BBB0496, BBB5452				
15.3.1	Design, supply and install a 6MW AC to DC rectifier complete with control panel and instruments, a diode monitoring panel with displays, cooling fans, attenuation circuit and associated equipment. The rectifier shall be of the 12-pulse configuration type.	Each	2		
15.3.2	Design, supply and install a rectifier bay screen manufactures from 25mm woven wire type expanded metal fixed to an angle iron frame supported by square pillars complete with a bay gate and fixing material per rectifier unit. The rate to include the painting of screen, gate, and pillars.	Set	2		
16,0	**REACTOR COIL** See specification BBB3890, BBB5452				
16,1	Supply and install a 1.8mH, air core reactor, complete with insulators and mounting brackets.	Each	2		
17,0	**WAVE FILTER EQUIPMENT** See Specification BBB3139, BBB3162, and BBB 5452				
17,1	Supply and install wave filter 1.173mH inductor coils complete with associated components and BBB3483.	Each	2		
17,2	Supply and install wave filter 1.759mH inductor coils complete with associated components and BBB3483.	Each	2		
17,3	Supply and install dry type wave filter 10uf capacitors complete with associated components.	Each	4		

17,4	Supply and install dry type wave filter 50uf capacitors complete with associated components.	Each	2		
17,5	Supply and install wave filter discharge 75kΩ, 150kW resistor on a suitable panel or bar complete with discharge and earthing mechanism.	Each	8		
17,6	Design, supply and install frames and support brackets for the mounting of the wave filter capacitors, inductors, resistors, and associated equipment.	Each	2		
17,7	Supply and install a fuse holder mounted on insulators complete with a 100A HRC fuse to protect the wave filter equipment and isolating and earth switch.	Each	2		
18,0	**3kV DC POSITIVE ISOLATOR AND UNDER VOLTAGE RELAY**				
	See specification BBB4724, BBB3005				
18,1	Supply and install positive isolator and earthing switch complete with operating mechanism situated in a metal panel complete with metering and wiring.	Each	2		
18,2	Supply and install a 3kV DC under voltage relay as part of the low voltage control gear of the positive isolator, complete with 3kV DC voltage divider, optic fibre transmitter, optic fibre receiver and control circuitry.	Each	2		
19,0	**MECHANICAL KEY INTERLOCKING SYSTEM**				
19,1	Supply and install a mechanical key exchange system to prevent on load operation.	Set	2		
20,0	**3kV DC MODULAR HIGH SPEED CIRCUIT BREAKER PANEL**				
	See specification CEE-0099, CEE-0227, BBB5452				
20,1	**3kV DC High Speed Circuit Breaker**				

20.1.1	Supply and install 3kV DC, 4000A, HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB.	Each	5		
20,2	**Electronic Control Relay**				
20.2.2	Supply and install an Electronic Control Relay with a 2-year warranty as per the requirements stated in clause 9.3.11 of the Scope of Works.	Each	5		
20,3	**3kV DC Universal Busbar Earth Switch**				
20.3.1	Supply and install a separate 3kV DC positive bus bar earth switch completes with electrical interlocking, mechanism, and indication lights to be connected.	Each	2		
21,0	**PRIMARY CIRCUIT CONTROL PANEL AND AC/DC DISTRIBUTION PANEL**				
	See specification BBB2721				
21,1	**Primary Circuit Breaker Control Panel**				
21.1.1	Design, supply and install an indoor floor standing primary circuit breaker control panel complete with flag annunciator unit, protection relays (IEDs), phase failure relays, instruments meters, control equipment, event, and fault recorder, indicating lights, a panel light, emergency stop button, terminal strips, bus bars, protection test blocks, wiring labels etc.	Each	2		
21,2	**AC/DC Distribution Panel**				

21.2.2	Design, supply and install an indoor floor standing AC/DC distribution panel complete with relays, instruments, meters, selector switches, AC and DC circuit breakers, isolators, earth switches, lightning arresters, a panel light, change over contactors, terminal strips, bus bars, labels, voltage comparators, phase failure and sequence detection relays, timers, wiring, mechanical key interlocking etc. The board shall make provision for 30% additional space for future requirements.	Each	2		
21,3	**Special Labels**				
21.3.1	Supply and install special labels in accordance with SANS 10142-1 and associated safety regulations to each section of the AC/DC distribution panel warning against various supplies entering the board, various voltages in the board and the automatic change over supply which must be isolated when work needs to do in the board or on any supply. All other control panel shall be clearly labelled as well. Labels must also be secured to the outside covers of plugs and light switches. All labels shall comply with the relevant specification.	Sum	1		
22,0	**BATTERY CABINET, BATTERY CHARGER, AND BATTERIES** See specification BBB2502, BBB 5452				
22,1	**110V DC Battery Charger**				
22.1.1	Supply and install a 230V AC to 110V DC, 30A battery charger.	Each	2		
22,2	**110V DC Battery Bank**				
22.2.1	Supply and install 110V DC, 200Ah, 53 Maintenance-free Gel batteries	Sum	2		
22,3	**Battery Stand**				

22.3.1	Supply and install a rigid battery bank stand capable of supporting the entire battery bank and allows for 360-degree access to the battery bank for ease of maintenance.	Each	2		
23,0	**TELECONTROL OUTSTATION** See specification BBC0653				
23,1	Supply and install a cabinet SIS500 outstation to be floor mounted.	each	1		
23,2	Supply and install a communication panel to link the SIS500 outstation to optic fibre backbone for Telecontrol complete with a fibre optic modem multiplexer, patch panel and power supply. The cabinet to be mounted on top of the SIS500 outstation.	each	1		
23,3	110V – 24V DC – DC converter installed inside	Each	1		
23,4	Logic Rack with 1 X PSU card	Each	1		
23,5	Logic Rack with DO cards	Each	2		
23,6	Logic Rack with DI cards	Each	3		
23,7	Logic Rack with LMCU Digital card	Each	1		
23,8	Logic Rack with Pulse Rail Cards	Each	1		
23,9	Logic Rack with Latch Rail Cards	Each	12		
23.10	Logic Rack with Digital input Rail Cards	Each	48		
23.11	Logic Rack with IO Cables 40cm long	Each	10		
23.12	Logic Rack with RS232 cable	Each	3		
23.13	Logic Rack with Common negative return cable	Each	3		

24,0	**LV ELECTRICAL LIGHT AND POWER DISTRIBUTION INSIDE THE SUBSTATION BUILDING**				
24,1	**Switched Socket Outlet**				
24.1.1	Supply and install all the switched socket outlet.	Each	3		
24,2	**AC Luminaires Indoor Lighting**				
24.2.1	Supply and install 65W, 230V AC LED luminaire suspended 1m below roof ceiling.	Each	8		
24,3	**DC Luminaires Indoor Lighting**				
24.3.1	Supply and install 65W, 110V DC LED luminaire suspended 1m below roof ceiling.	Each	2		
24,4	**Light Switches**				
24.4.1	Supply and install surface mounted single lever two-way light switch complete with cover box and cover plated.	Each	2		
24.4.2	Supply and install surface mounted single lever one-way light switch complete with cover box and cover plated.	Each	1		
24.4.3	Supply and install a PVCweatherproof outdoor light switch for the toilet complete with cover box and cover plate.	Each	1		
24.4.5	Supply and install surface mounted DC rated single lever one-way light switch complete with cover box and cover plated.	Each	1		
24,5	**Wire Ways and Galvanised Steel Tubing**				
24.5.1	Supply and install metal trunking complete with clip-in cover plates, splices, elbows, tees, end caps and other accessories.	Sum	1		
24.5.2	Supply and install 20mm galvanised steel tubing complete with fittings, couplings, inspection boxes, covers and sets as required.	Sum	1		

24.5.3	Supply and install standard adapters to support LED light fittings onto the trunking. Two per light fitting. Supply and install steel wire cable and suitable insulated brackets to suspend trunking from the substation roof. Brackets shall be insulated from earth potential	Sum	1		
Supply and install PVC insulated wirefor lights and switched socket outlets circuits (red, white, blue, black, and grey). Wire to be SANS approved.		Sum	1		
AC Distribution Box					
Supply and install surface mounted industrial type AC distribution board. The board to be powder coated Eau-de-nil.		Each	1		
DC Distribution Box					
Supply and install surface mounted industrial type DC distribution board. The board to be powder coated Eau-de-nil.		Each	1		
LV Cables					
Supply and install low voltage cables PVC, PVC. SWA, PVC multicore cables between all the indoor and outdoor equipment. Allow to terminateall the cables onto equipment. Rate to include compression glands, and any other accessories.		Sum	1		
COOLING AND VENTILATION					
Substation Fresh Air Supply					
Supply and install a fresh air supplyfan consisting of two fans with a combined rating of 2.7m^3/s at 150Pa.		Each	1		
Thermostat Control Switch					
Supply and install a thermostat control switch. The thermostat controlswitch shall operate the two fresh air supply fans through a contactor installed in an AC/DC distribution panel. The position of the thermostat shall be determined on site.		Each	1		
Battery Room Extractor Fan					
Supply and install a battery roomextractor fan with local isolator rated for 0.2m^3/s at 25Pa. The fan shall be appropriate for the zone location.		Each	1		

25,4	**Toilet Extractor Fan**				
25.4.1	Supply and install the toilet extractor fan rated from 0.035m^3/s. The rate shall include a delay timer for the fan which will be connected to the toilet light circuit.	Each	1		
26,0	**INDOOR EARTHING**				
26,1	Supply and install indoor earthing according to drawing CEE-TBD-7.	Sum	1		
26,2	**DC Earth Leakage Relay**				
26.2.1	Supply and install DC earth leakage relay. The rate shall include zoning for earth fault locations.	Each	1		
26,3	**Cable Earth Fault Relay**				
26.3.1	Supply and install cable earth faulty indication relay.	Each	1		
27,0	**NEGATIVE RETURN MONITORING SYSTEM** See specifications BBC1843 and BBC1844				
27,1	Supply and install a negative return monitoring system complete.	Each	1		
28,0	**FIRE FIGHTING**				
28,1	**Fire Risk Assessment**				
28.1.1	Conduct a fire risk assessment and provide a report with recommendations.	Sum	1		
28,2	**Fire Fighting Equipment**				
28.2.1	Design, supply and install firefighting equipment as per the accepted recommendations of the fire risk assessment.	Sum	1		
29,0	**SECURITY SYSTEM**				
29,1	Design, supply and install the security system complete with access control, vehicle registration identification, perimeter intruder detection system, CCTV cameras (2x Type 1 and 8x	Sum	1		

	Type 4), IP cameras and electric fence.				
29,2	Supply and install the complete support structure for the outdoor cameras	Sum	1		
30,0	**WARNING NOTICES AND SIGNS**				
30,1	Supply and install a complete set of warning notices and signs as per the specifications.	Sum	1		
31,0	**SUNDRIES** Sundries to be determined by Contractor				
31,1	Supply and install sundries as determined	Sum	1		
32,0	**DECOMISSIONING AND DEMOLITION**				
32,1	**DECOMISSIONING**				
32.1.1	Decommissioning of existing equipment. The rate to including transportation to a storage facility at Roodepoort Depot including non-ferrous metals (i.e., cable conductors, etc.)	Sum	1		
32.1.2	Conduct an oil test for PCB on all the electrical equipment with oilinsulation.	Sum	1		
32.1.3	Handling and disposal of oil containing PCB.				
32.1.4	Dismantling and disposal of hazardous and non-re-usablematerial (i.e., asbestos) to an environmentally approved disposal site.	Sum	1		
33,2	**DEMOLITION**				
33.2.1	Demolish the existing buildings, transformer plinth and all damaged concrete platforms. The rate shall include removal and transportation of rubble to an environmentally approved dumping site.	Sum	1		

34,0	**TRAINING**				
34,1	Provide training on all substation equipment installed. The rate shall include theoretical training in a classroom setting and practical training on site. Allow for at least 6 Technicians, 2 Supervisors and 1 Technical manager.	Sum	1		
35,0	**MANUALS AND DATA PACK**				
35,1	Provide 3 sets of detailed operating and maintenance instructions of all equipment, switchgear relays, transformers, and other electrical equipment. Hard copies and electronic format on CD/Memory Stick.	set of 3	3		
36,0	**TEST AND COMMISSIONING**				
36,1	**Factory Acceptance Test**				
36.1.1	Allow for factory functional tests to be conducted by the manufacturers of all the equipment at their premises.	Sum	1		
36,2	**Site Acceptance Test**				
36.2.1	Allow for functional equipment testing on site.	Sum	1		
36,3	**Cold Commissioning**				
36.3.1	Allow for functional testing on all equipment (primary and secondary plant) and circuitry to prove proper functioning and installation thereof.	Sum	1		
36,4	**Hot Commissioning**				
36.4.1	Allow for functional testing to prove the satisfactory operation of all equipment under live conditions.	Sum	1		
37,0	**TEMPORARY WORKS**				
37,1	Allow for any deemed temporary works.	Sum	1		

38,0	**SPARES**				
38,1	Supply a 3kV DC HSCB, complete with metal housing, rack-out truck, base rails, a track breaker, main and auxiliary contacts, flapper gear, and any other fittings or component required for the correct operation of the HSCB. This shall include a fully fitted DC feeder protection relay.	Each	1		
38,2	Supply rectifier diodes with the same specification as the installed rectifiers.	Each	8		
38,3	Supply rectifier diode monitoring card.	Each	1		
38,4	Supply rectifier attenuation circuit fuse.	Each	1		
38,5	Supply rectifier fan motor.	Each	1		
38,6	Supply fan control card circuit relays and timers.	Each	1		
38,7	Supply rectifier RC ("Snubber) Circuit.	Each	5		
38,8	Supply wave filter circuit fuse.	Each	1		
38,9	Supply 110VDC under voltage monitoring relays.	Each	2		
38,10	Supply 400V AC power protection relay.	Each	2		
38,11	Supply a 65W 230V AC indoor LED luminaire lamp.	Each	1		
38,12	Supply a 65W 110V DC indoor LED luminaire lamp.	Each	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

NEWCANADA TO VEREENIGING TELECOMUNICATIONS SYSTEMS

BILL OF QUANTITIES (BOQ)
TELECOMMUNICATION WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**TELECONTROL TRANSMISSION NETWORK SYSTEMS**				

1.1	Supply and installation of Telecontrol Transmission Network Node, Din rail mount, complete with accessories at Electrical Substations in Gauteng Region.	Each	11		
1.2	Supply and installation of 19''INCH Din rail mount plate	Each	11		
1.3	Supply and installation of 110VDC - 48VDC power supply unit	Each	11		
1.4	Supply and Installation of a Serial Drop cable (3m)	Each	33		
1.5	Supply and Installation of 1U 19'' brush panels and accessories.	Each	22		
1.6	Supply and Installation of a ground copper bar and accessories.	Each	11		
1.7	Supply and Installation of SFP 1310nm – EX, 40 km range.	Each	6		
1.8	Supply and Installation of SFP 1310nm – LX, 10 km range.	Each	6		
1.9	Supply and Installation of SFP 1310nm – EX, 20 km range.	Each	10		
1.10	Supply and Installation of SFP 1550nm – ZX, 70 km range.	Each	4		
1.11	Supply and Installation of OS License (one per node)	Each	1		
1.12	Supply and Installation of Redundancy licence. (One per node)	Each	4		
1.13	Supply and Installation of Node license (one per node) up to 100 nodes	Each	11		
1.14	Supply and Installation of Power cable, 2-wire, 10 A, 110VDC, 2,5m Length	Each	22		

1.15	Supply and Installation of Ethernet CAT5e Patch Lead Cable 1m, complete with RJ45 connectors.	Each	33		
1.16	Supply and install duplex Single mode APC LC - LC patch lead 10m.	Each	33		
1.17	Supply and installation of 12U 19inch: 600mm (H) x 600mm (W) x 450mm (D) cabinet at Electrical Substations	Each	11		
1.18	Supply and Installation of an Interface Module (IFM): Gigabit Ethernet Interface, 4-SFP 1G Ports Base-X	Each	1		
1.19	Supply and Installation of an Interface Module (IFM): 10 Gigabit Ethernet Interface, 1-SFP 10G Port	Each	2		
1.20	Supply and Installation of an Interface Module (IFM): Ethernet Interface, 4-Ethernet Ports LAN	Each	1		
1.21	Supply and Installation of an Interface Module (IFM): 7-Serial Interface card for RS232	Each	1		
1.22	Supply and installation of Telecontrol Transmission Network Node, rack mount 19''INCH and accessories at the Electrical corridor junctions.	Each	1		
1.23	Supply and Installation of a Node Support module (NSM) slot 1.	Each	1		
1.24	Supply and Installation of an DC Power Supply Unit (PSU): Input range: 88 - 300VDC	Each	2		
2,0	**TRAINING**				
2,1	The contractor shall provide training for installation and commissioning of the network node.	Each	4		
3,0	**TEST, COMMISSIONING AND HANDOVER**				
3,1	Test, commissioning, and handing over of the entire installation.	Sum	1		
3,2	Supply electronic and hardcopy (2) copies of complete "As build/ As installed" equipment manuals.	Sum	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

88KV MIDWAY INTAKE AC DISTRIBUTION SUBSTATION

BILL OF QUANTITIES

CIVIL AND ELECTRICAL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**88kV MV AC DISCONNECTOR**				
1,2	Design, supply, and construct support steel structure for 88kV AC Disconnector outdoor yard complete.	set of 3	1		
1,3	Design, supply and install an 88kV AC MV Disconnect for outdoor equipment complete	set of 3	1		
1,4	Design, supply and install an 88kv AC current transformer for outdoor equipment complete	set of 3	1		
2,0	**88kV MV AC PRIMARY CIRCUIT BREAKER**				
2,1	Design, supply and construct a foundation for 88kV, MV AC Primary Circuit Breaker outdoor yard complete.	Each	1		
2,2	Design, supply and construct a foundation for 88kV, MV AC Current transformers outdoor yard complete.	Each	1		
2,3	Design, supply and construct a support steel structure for 88kV AC Primary Circuit Breaker outdoor yard complete.	Each	1		
2,4	Design, supply and construct a support steel structure for 88kV AC current transformer outdoor yard complete.	Each	1		
3,0	**5MVA, 88kV/6.6kV DISTRIBUTION TRANSFORMER**				
3,1	Supply and install a 5MVA, 88kV/6.6kV, Dyn11, 3-phase AC, 50Hz, stepdown Distribution Transformer complete for the outdoor yard.	Each	1		

3,2	Design, supply and install/construct Auxiliary Transformer plinth and bund wall.	Each	1		
4,0	**100kVA, 6.6kV/400V DISTRIBUTION TRANSFORMER**				
4,1	Supply and install a 100kVA, 6.6kV/400V, Dyn11, 3-phase AC, 50Hz, stepdown Distribution Transformer complete for indoors.	Each	2		
4,2	Design, supply and install/construct Auxiliary Transformer plinth and bund wall complete.	Each	2		
5,0	**6.6kV, MV VACUUM CIRCUIT BREAKERS**				
5,1	Design, supply and install a 6.6kV, MV Vacuum circuit breakers for indoor substation complete.	Each	5		
6,0	**FUSE LINK PANEL**				
6,1	Design, supply and install a 5A, 6.6kV AC, 3Phase fuse link for the protection of the Auxiliary Transformer complete with the support bracket, bolts, nuts, washers, and a suitable link stick.	Each	1		
7,0	**TELECONTROL OUTSTATION AND TELECOMMUNICATION**				
7,1	Supply and install a cabinet SIS500 outstation to be floor mounted.	Each	1		
7,2	Supply and install a communication panel to link the SIS500 outstation to optic fibre backbone for Telecontrolcomplete with a fibre optic modem multiplexer, patch panel and power supply. The cabinet to be mounted on top of the SIS500 outstation.	Each	1		
7,3	110V – 24V DC – DC converter installed inside	Each	1		
7,4	Logic Rack with 1 X PSU card	Each	1		
7,5	Logic Rack with DO cards	Each	2		
7,6	Logic Rack with DI cards	Each	3		

7,7	Logic Rack with LMCU Digital card	Each	1		
7,8	Logic Rack with Pulse Rail Cards	Each	1		
7,9	Logic Rack with Latch Rail Cards	Each	12		
7.10	Logic Rack with Digital input Rail Cards	Each	48		
7.11	Logic Rack with IO Cables 40cm long	Each	10		
7.12	Logic Rack with RS232 cable	Each	3		
7.13	Logic Rack with Common negative return cable	Each	3		
9,2	**110V DC Battery Bank**				
9.2.1	Supply and install 110V DC, 200Ah, 53 lead acid battery bank.	Each	1		
9,3	**Battery Stand**				
9.3.1	Supply and install a rigid battery bank stand capable of supporting the entire battery bank and also allows for 360-degree access to the battery bank for ease of maintenance.	Each	1		
10,0	**LOW AND MEDIUM VOLTAGE CABLES**				
10,1	Supply and install low voltage cables PVC, SWA, PVC multicore cables between all the indoor and outdoor equipment. Allow to terminate all the cables onto equipment. Rate to include compression glands, and any other accessories.	Sum	1		
11,0	**METAL ELECTRICAL BOX**				
11,1	Supply and install a IP65 Rated Orange Metal, 500x400x200 mm to be fitted with 3xDIN rail and connector blocks.	Each	1		
12,0	**LOW VOLTAGE DISTRIBUTION BOARD**				
12,1	Supply and install 400V, LV DB board, Metal 18 way MINI Rail surface mount complete.	Each	1		
13,0	**EARTH**				
13,1	Supply and install an earth matt and spikes in accordance with Engineering Instructions.	Sum	1		

14,0	**SUBSTATION BUILDING**				
14,1	Refurbish substation building/s and associated structures with vandal-proof doors.	Sum	1		
14.1 a	Supply and deliver wooden house for Security guardroom as per section 4.1.5	Each	1		
14,2	Supply and install double 5ft Fluorescent fittings and tubes	Each	3		
14,2,1	Supply and install 400w 220v, LED Flood lights to be installed on the outside walls of the Substation.	Each	3		
14,3	Trench 110 meters by 1.2 meters deep to bury cables underground in accordance to Engineering Instructions.	m	110		
14,4	Provision is to be made for 500mm deep cable trenches inside substation foundations.	Sum	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

RMS SUBSTATION 6.6kV AC DISTRIBUTION SUBSTATION

BILL OF QUANTITIES

CIVIL AND ELECTRICAL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**1MVA, 6.6kV/400V DISTRIBUTION TRANSFORMER**				
1,1	Supply and install a 1MVA, 6.6kV/400V, Dyn11, 3-phase AC, 50Hz, stepdown Distribution Transformer complete for the outdoor yard.	Each	2		
1,2	Design, supply and install/construct Auxiliary Transformer plinth and bund wall.	Each	2		

2,0	**6.6kV, MV VACUUM CIRCUIT BREAKERS**				
2,1	Design, supply and install a 6.6kV, MV Vacuum circuit breakers complete for an indoor substation.	Each	4		
3,0	**3 POLE CIRCUIT BREAKER 100AMP**				
3,1	Design, supply and install a 400V, 100Amp, 3 Pole Circuit Breaker with drawable complete.	Each	6		
4,0	**TELECONTROL OUTSTATION AND TELECOMMUNICATION**				
4,1	Supply and install a cabinet SIS500 outstation to be floor mounted.	Each	1		
4,2	The contractor shall Supply and install a tele-control system (Transnet Sys500 with PRASA modifications – 2 x RS232 serial input)	Each	1		
4,3	110V – 24V DC – DC converter installed inside	Each	1		
4,4	Logic Rack with 1 X PSU card	Each	1		
4,5	Logic Rack with DO cards	Each	2		
4,6	Logic Rack with DI cards	Each	3		
4,7	Logic Rack with LMCU Digital card	Each	1		
4,8	Logic Rack with Pulse Rail Cards	Each	1		
4,9	Logic Rack with Latch Rail Cards	Each	12		
4.10	Logic Rack with Digital input Rail Cards	Each	48		
4.11	Logic Rack with IO Cables 40cm long	Each	10		
4.12	Logic Rack with RS232 cable	Each	3		
4.13	Logic Rack with Common negative return cable	Each	3		

5,0	**BATTERY CABINET, BATTERY CHARGER, AND BATTERIES**				
5,1	**110V DC Battery Charger**				
5.1.1	Supply and install a 230V AC to 110V DC, 30A battery charger.	Each	1		
5,2	**110V DC Battery Bank**				
5.2.1	Supply and install 110V DC, 200Ah, 53 maintenance free Gel batteries bank.	Each	1		
5,3	**Battery Stand**				
5.3.1	Supply and install a rigid battery bank stand capable of supporting the entire battery bank and allows for 360-degree access to the battery bank for ease ofmaintenance.	Each	1		
6,0	**LOW AND MEDIUM VOLTAGE CABLES**				
6,1	Supply and install low voltage cables PVC, PVC. SWA, PVC multicore cables between all the indoor and outdoor equipment. Allow to terminate all the cables onto equipment. Rate to include compression glands, and any other accessories.	Sum	1		
7,0	**METAL ELECTRICAL BOX**				
7,1	Supply and install a IP65 Rated Orange Metal, 500x400x200 mm to be fitted with 3xDIN rail and connector blocks.	Each	1		
8,0	**LOW VOLTAGE DISTRIBUTION BOARD**				
8,1	Supply and install 400V, LV DB board, Metal 18-way MINI Rail surface mount.	Each	1		
8,2	Design, supply and install a 400V LT panel.	Each	1		

9,0	**EARTHING**				
9,1	Supply and install an earth matt and spikes inaccordance with Engineering Instructions.	Sum	1		
10,0	**SUBSTATION BUILDING**				
10,1	Design and build the new substation building/s and associated structures with vandal-proof doors.	Sum	1		
10,1 a	Supply and deliver wooden house for Security guardroom as per section 4.1.5	Each	1		
10,2	Supply and install double 5ft Fluorescent fittings and tubes	Each	4		
10,3	Trench 110 meters by 1.2 meters deep to bury cables underground in accordance with Engineering Instructions.	m	110		
10,4	Provision is to be made for 500mm deep cable trenches inside substation foundations.	Sum	1		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

NEWCANADA 6.6kV AC H-FRAMES

BILL OF QUANTITIES

CIVIL AND ELECTRICAL WORKS

A bidder shall refer to the Project specification for detailed information per item

Item	Description	Unit	Quantity	Rate	Amount
1,0	**50kVA, 6.6kV/400V DISTRIBUTION TRANSFORMER**				
1,1	Supply and install a 50kVA, 6.6kV/400V, Dyn11, 3-phase AC, 50Hz, stepdown Distribution Transformer complete for the outdoor yard.	Each	2		
2,0	**DROP OUT FUSES**				
2,1	Design, supply and install a 6.6kV Drop-Out Fuses for outdoor H - frame complete.	Each	6		
2,2	Design, supply and install lightning protection system complete	sum	1		
3,0	**3 POLE CIRCUIT BREAKER 100AMP**				
3,1	Design, supply and install a 400V, 100Amp, 3 Pole Circuit Breaker withdrawable complete	Each	2		
4,0	**LOW AND MEDIUM VOLTAGE CABLES**				
4,1	ABC Aluminium LT 4 core cables and provide brackets and structures to support. Allow terminating all the cables onto the equipment. Rate to include compression glands and any other accessories.	sum	1		
5,0	**POLE-MOUNTED METAL ELECTRICAL BOX**				
5,1	Supply and install a Pole Mounted Box IP65 Rated Orange Metal to Be Supplied with Rail Mast Mounting and Be Lockable complete.	Each	2		
TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES					

SUMMARY OF PRICES

Item	Description	Amount
1	Brought forward from – PRELIMINARY AND GENERAL	
2	Brought forward from – NEW CANADA TRACTION 3kV DC SUBSTATION	
3	Brought forward from – NANCEFIELD TRACTION 3kV DC SUBSTATION	
4	Brought forward from – MIDWAY TRACTION 3kV DC SUBSTATION	
5	Brought forward from – NEWCANADA TO VEREENIGING TELECOMUNICATIONS SYSTEMS	
6	Brought forward from – 88KV MIDWAY INTAKE AC DISTRIBUTION SUBSTATION	
7	Brought forward from – RMS SUBSTATION 6.6KV AC DISTRIBUTION SUBSTATION	
8	Brought forward from – NEW CANADA 6.6kV AC H-FRAMES	
9	Sub Total	
10	15% VAT	
11	Grand Total = (Sub Total + 15% VAT)	