



**Durban 3kV DC Traction Substation Plus 11kV and 400V AC Distribution Substation**

*BILL OF QUANTITIES*  
ELECTRICAL AND CIVIL Work

Item	Description	Unit	Quantity	Material Rate	Labour Rate	Amount
<b>1,0</b>	<b>11kV AC METAL CLAD SWITCHGEAR</b> See clauses 9.1.1 and 11.1.1 of the Scope of Work for applicable requirements					
1,1	Supply and install 11kV AC Metal Clad switchgear for the three 11kV incoming supplies, complete with withdrawable circuit breaker, surge arresters, CTs, VTs, protection relays, auxiliary relays, control switches, indications and interlocking with busbar couplers	No	3			
1,2	Supply and install 11kV AC Metal Clad switchgear for two 11/2x1.22, 2.36kV AC traction transformers, complete with earthing switch, CTs, auxiliary relays, control switches, indications and mechanical interlocking	No	2			
1,3	Supply and install 11kV AC Metal Clad switchgear for 11kV AC feeders, complete with CTs, auxiliary relays and control switches	No	2			
1,4	Supply and install 11kV AC Metal Clad switchgear for two 11kV/400V AC distribution transformers, complete with CTs, auxiliary relays, control switches and indications	No	2			
1,5	Supply and install 11kV AC Metal Clad switchgear for 11kV AC spare circuits complete with CTs, auxiliary relays and control switches	No	2			
1,6	Supply and install 11kV AC Metal Clad switchgear for the busbar coupler circuit breaker complete with interlocking with the incoming 11kV circuit breakers	No	3			
1,7	Supply and install Metal Clad busbar riser panel complete with CTs	No	2			
1,8	Supply and install Metal Clad busbar riser panel complete with CTs and VT	No	1			
1,9	Supply and install 11kV AC Metal Clad metering panel complete with CTs and busbar VTs	No	3			
1,10	Supply and install Metal Clad panel complete, for busbar zone protection equipment	No	1			
<b>2,0</b>	<b>11kV AC TRACTION TRANSFORMERS</b> See specification clauses 9.1.2.1 and 11.1.2 of Scope of Work for applicable requirements					
2,1	Supply and install 6.1MVA Traction Transformers with vector groups of Yd.d1yn0 and voltage ratio of 11kV/1.22kV/1.22kV/2.36kV AC complete with all the necessary ancillary equipment and material	No	2			
2,2	Supply and install Malthoid or any approved insulation material to insulate the main traction transformer from concrete plinth. (Minimum resistance 10Ω)	No	2			
<b>3,0</b>	<b>AUXILIARY TRANSFORMERS</b> See clauses 9.1.2.2 and 11.1.3 of Scope of Work for applicable requirements					
3,1	Supply and install a 50kVA, 2.36kV/400V AC, Dyn11, 3-phase AC, 50Hz Auxiliary Transformer complete with all the necessary ancillary equipment.	No	2			
3,2	Supply and install 400V, 3P, 25kA, withdrawable type moulded case circuit breaker complete for protection of LV cable from the auxiliary transformer to the AC / DC Distribution panel	No	2			
3,3	Supply and install indoor powder coated metal enclosure, and support galvanised steel pole complete with back plate, gland plate, support bracket, bolts, nuts and washers for moulded case circuit breaker.	No	2			
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<b>4,0</b>	<b>ISOLATION TRANSFORMER</b> See specification clauses 9.1.2.3 and 11.1.4 of the Scope of Work for applicable requirements					
4,1	Supply and install a 50kVA, 400/400V AC (1:1), Dyn11, 3-phase AC, 50Hz Isolation transformer complete with all the necessary ancillary equipment.	No	1			
<b>5,0</b>	<b>3kV DC RECTIFIERS</b> See specification clauses 9.1.2.4 and 11.1.4 of the Scope of Work for applicable requirements					
5,1	Design, supply and install 6MW AC to DC rectifiers complete with control panels and instruments, diode monitoring panels with displays, cooling fans, attenuation circuits and associated equipment. The rectifiers shall be of the 12-pulse configuration type	No	2			
5,2	Supply and install anode wall plate and wall bushings rated for the 6MVA transformer output at 6.6kV AC. Wall plate as per drawing no 1656-001-SUB-E008	Sets per unit	2			
<b>6,0</b>	<b>REACTOR COILS</b> See clauses 9.1.2.5 and 11.1.7 of the Scope of Work for applicable requirements					
6,1	Supply and install 1.8mH, air core reactors, complete with insulators and mounting brackets	No	2			
<b>7,0</b>	<b>WAVE FILTER EQUIPMENT</b> See clauses 9.1.2.6 and 11.1.8 of the Scope of Work for applicable requirements					
7,1	Supply and install wave filter 1.173mH inductor coils complete with associated components as indicated on drawings 1656-002-SUB-E001, E002 and BBB3483	Set	2			
7,2	Supply and install wave filter 1.759mH inductor coils complete with associated components as indicated on drawings 1656-002-SUB-E001, E002 and BBB3483	Set	2			
7,3	Supply and install dry type wave filter 10µF capacitors complete with associated components as indicated on drawings 1656-002-SUB-E001 and E002	No	4			
7,4	Supply and install dry type wave filter 50µF capacitors complete with associated components as indicated in drawings 1656-002-SUB-E001 and E002	No	2			
7,5	Supply and install wave filter discharge 75kΩ, 150kW resistor on a suitable panel or bar complete with discharge and earthing mechanism as indicated on drawings 1656-002-SUB-E001 and E002	No	8			
7,6	Design, supply and install frames and support brackets for the mounting of the wave filter capacitors, inductors, resistors and associated equipment	No	2			
7,7	Supply and install fuse holders mounted on insulators complete with a 100A HRC fuse to protect the wave filter equipment and isolating and earth switches as indicated in drawings 1656-002-SUB-E001 and E002	No	2			
<b>8,0</b>	<b>3kV DC POSITIVE ISOLATORS AND UNDER VOLTAGE RELAYS</b> See clauses 9.1.2.7, 9.1.2.8, 11.1.9 and 11.1.10 of the Scope of Work for applicable requirements					
8,1	Supply and install positive isolator and earthing switches complete with operating mechanism situated in a metal panel complete with metering and wiring.	No	2			
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8,2	Supply and install a 3kV DC under voltage relays as part of the low voltage control gear of the positive isolator, complete with 3kV DC voltage dividers, optic fibre transmitters, optic fibre receivers, ammeters, voltmeters and control circuitry	No	2			
<b>9,0</b>	<b>3kV DC MODULAR HIGH SPEED CIRCUIT BREAKERS, CELLS AND PROTECTION RELAYS</b> See clauses 9.1.2.9, 9.1.2.10 and 11.1.11 of the Scope of Work for applicable requirements					
<b>9,1</b>	<b>3kV DC High Speed Circuit Breakers and Cells</b>					
9.1.1	Supply and install 3kV DC HSCB mounted on a rack out truck, complete with steel modular cell, base rails, connecting gear, and any other fittings or component required for the functional and safe operation of the HSCB. The ratings shall be based on drawing 1656-001-SUB-E001	No	22			
<b>9,2</b>	<b>DC Feeder Protection Relay</b>					
9.2.1	Supply and install a DC Feeder Protection relays for the fault current sensing on the OHTE and control of the HSCB	No	22			
<b>9,3</b>	<b>3kV DC Busbar Earth Switches</b>					
9.3.1	Supply and install separate 3kV DC positive busbar earth switches complete with electrical interlocking, mechanism and indication lights to be connected as shown on drawings 1656-001-SUB-E001 and E002	No	3			
<b>10,0</b>	<b>NEGATIVE RETURN MONITORING SYSTEM</b> See clauses 9.1.2.10 and 11.1.12 of the Scope of Work for applicable requirements					
10,1	Supply and install a negative return monitoring system complete.	No	1			
<b>11,0</b>	<b>TRACTION SUBSTATION BATTERY CHARGER AND BATTERIES</b> See clauses 9.1.2.13 and 11.1.12 of the Scope of Work for applicable requirements					
<b>11,1</b>	<b>110V DC Battery Charger</b>					
11.1.1	Supply and install a 230V AC to 110V DC, 30A battery charger	No	1			
<b>11,2</b>	<b>110V DC Battery Bank</b>					
11.2.1	Supply and install 110V DC, 53 lead acid battery bank	Sum	1			
11.2.2	Supply and install a rigid battery bank stand capable of supporting the entire battery bank that allows for adequate access to the battery bank for ease of maintenance	No	1			
<b>12,0</b>	<b>SELF-CONTAINED BATTERY CHARGER AND BATTERIES</b> See clauses 9.1.3.1 and 11.1.14 of the Scope of Work for applicable requirements					
12,1	Supply and install a 230V AC to 110V DC, self-contained battery charger and batteries for 11kV AC switchgear	No	1			
<b>13,0</b>	<b>LOW VOLTAGE DISTRIBUTION TRANSFORMERS</b> See clauses 9.1.4.1 and 11.1.15 of the Scope of Work for applicable requirements					
13,1	Supply and install 800kVA, 11kV/400V 3-phase 50Hz Distribution Transformers with vector groups of Dyn11 complete with all the necessary ancillary equipment and material	No	2			
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<b>14,0</b>	<b>LOW VOLTAGE DISTRIBUTION PANEL</b> See clauses 9.1.4.2 and 11.1.16 of the Scope of Work for applicable requirements					
14,1	Supply and install a 440/230V AC Distribution panel	No	1			
<b>15,0</b>	<b>TELECONTROL OUTSTATION AND TELECOMMUNICATION</b> See clauses 9.1.5 and 11.1.17 of the Scope of Work for applicable requirements					
15,1	Supply and install a floor standing telecontrol outstation with an A and B cabinet complete with a SIS500 communication unit and rail cards	No	1			
<b>16,0</b>	<b>TRACTION PRIMARY CIRCUIT CONTROL PANEL AND AC/DC DISTRIBUTION PANEL</b> See clauses 9.2.3, 9.2.4, 11.1.18 and 11.1.19 of the Scope of Work for applicable requirements					
<b>16,1</b>	<b>Primary Circuit Breaker (Rectifier unit) Control Panel</b>					
16.1.1	Design, supply and install an indoor floor standing primary circuit breaker (rectifier unit) control panel for traction substation 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, busbars, protection test blocks, wiring labels etc.	No	2			
<b>16,2</b>	<b>AC/DC Distribution Panel</b>					
16.2.1	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, busbars, labels, voltage comparators, phase failure and sequence detection relays, timers, wiring, mechanical key interlocking etc. The panel board shall make provision for 30% additional space for future additions	No	1			
<b>16,3</b>	<b>Special Labels</b>					
16.3.1	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 done 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.	Sum	1			
<b>17,0</b>	<b>Rectifier Bay Fence and Gate</b> See clause 11.1.20 and of Scope of Work for applicable requirements					
17,1	Supply and install a rectifier HV Bay with 1.8m high screen, manufactured 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 as illustrated on drawing no. 1656-001-SUB-E003. The rates shall include the painting of screen, gate and pillars.	Sets	2			
<b>18,0</b>	<b>INDOOR EARTHING</b> See clauses 9.1.2.14 and 11.1.22 of Scope of Work for applicable requirements					
18,1	Design, supply and install indoor earthing in the substation building. Drawing CEE-TBD-7 to be used as a guideline.	Sum	1			
18,2	Supply and install gas arrester spark gap and gate switch at doors leading into the traction transformer rooms.	No	4			
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<b>18,3</b>	<b>AC Earth Leakage Protection</b>					
18.3.1	Supply and install AC earth leakage busbar, CTs and protection relay	No	2			
<b>18,4</b>	<b>DC Earth Leakage Protection</b>					
18.4.1	Design, supply and install DC earth leakage protection including the DC earth leakage busbar and protection relay. The design shall include zoning for different earth fault areas.	Sum	1			
18.4.2	Supply and install cable earth fault indication relay	No	1			
<b>19,0</b>	<b>New Track Feeder Switch Structure</b> See clause 9.3.1 and 10.7 of the Scope of Work for applicable requirements					
19.1	Supply and install new track feeder switch structure and foundations in the outdoor yard.as shown on drawing nos 1656-001-SUB-E005 & E006	No	1			
19.2	Supply and install hand operated track feeder switches complete with capacitor, surge arrester, operating rod, handle, brackets, clamps, bolts and nuts	No	9			
19.3	Earthing and bonding of switch structure, including spark gaps	Sum	1			
<b>20,0</b>	<b>Partially Completed Existing Track Feeder Switch Structure</b> See clause 9.3.2 of the Scope of Work for applicable requirements					
20.1	Finalise partially completed switch structure in the outdoor yard	No	1			
20.2	Earthing and bonding of switch structure, including spark gaps	Sum	1			
<b>21,0</b>	<b>SITE PREPARATION AND EARTHWORKS</b> See clause 10.3 of the Scope of Work for applicable requirements					
21.1	Grade and compact existing ground to levels ensuring runoff of stormwater away from the building. The Contractor to determine the quantities from the drawings	Sum	1			
<b>22,0</b>	<b>SUBSTATION BUILDING AND SERVICES</b> See clause 10.8 of the Scope of Work for applicable requirements					
<b>22,1</b>	<b>Building Construction Work</b> See clause 10.8.1 of the Scope of Work for applicable requirements					
22.1.1	Construct dividing brick wall (8m long x 7m high x 230mm thick) between traction transformers complete with two 920 x 2465mm interleading doors	No	1			
22.1.2	Construct dividing walls (8m long x 7m high x 230mm thick) between distribution transformers complete with two 920 x 2465mm interleading doors	No	1			
22.1.3	Replace double door in old CO2 room with heavy duty double swing doors	No	1			
22.1.4	Remove / demolish single doors and brick up. Finishing to surrounding walls	No	3			
22.1.5	Remove existing roller shutter doors and frames, install new heavy duty double swing doors and brick-up rest of the walls	No	5			
22.1.5	Supply material and construct transformer plinths for traction transformers as well as the auxiliary transformers complete with HDPE cable sleeve pipes, as per the design indicated on drawing no. 1656-001-SUB-A001 and A002	No	2			
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22.1.6	Supply material and construct transformer plinths for distribution transformers complete with HDPE cable sleeve pipes, as per the design indicated on drawing no. 1656-001-SUB-A001 and A002	No	2			
22.1.7	Construction of gutter or bund area around transformer complete with fibre grid covers and supporting frames	No	4			
22.1.8	Demolish existing 3.5m long x 2.5m high x 340mm thick brick wall between existing CO2 room and metering room as shown on drawing 1656-001-SUB-A001	No	1			
22.1.9	Demolish existing brick wall between MV switchgear room and existing CO2 room and metering room as shown on drawing 1656-001-SUB-A001. (7.1m long x 6m high x 340mm thick)	No	1			
22.1.10	Demolish the concrete slab above the existing metering room as shown on drawing 1656-001-SUB-A001	m <sup>2</sup>	12			
22.1.11	Supply and install 200 X 250 mm galvanized and painted steel gutters on the sloping sides of the roof	m	100			
22.1.12	Supply and install 250X150mm galvanized and painted steel rectangular downpipes at the predetermined column centres	No	14			
22.1.13	Remove and replace roller shutter doors in the new 11kV / 400V distribution transformer rooms and the traction transformer rooms	No	4			
22.1.14	Remove and replace existing ventilation louvres in external walls	m	140			
22.1.15	Repair / replace roof ridge ventilators	m	12			
22.1.16	<b>COOLING AND VENTILATION</b> See clauses 10.8.1.7 and 11.1.24 of the Scope of Work for applicable requirements					
22.1.16.1	Supply and install supply air ventilation fans having a flow rate of 800 l/s complete with security grilles, louvres and a local isolator for the ventilation system in the traction transformer rooms	No	4			
22.1.16.2	Supply and install supply air ventilation fans having a flow rate of 750 l/s complete with security grilles, louvres and a local isolator for the ventilation system in the distribution transformer rooms	No	4			
22.1.16.3	Supply and install ventilation fans having a flow rate of 200 l/s complete with safety grilles, louvres and a local isolator for the ventilation system for the rectifiers	No	2			
22.1.16.4	Supply and install an extraction air ventilation fan having a flow rate of 100 l/s in the battery room complete with security grille, louvre and a local isolator. The fan shall be suitably rated for installation in a battery room	No	1			
22.1.16.5	Supply and install a thermostat control switches. The thermostat control switches shall operate the supply air ventilation fans through a contactor.	No	10			
22.1.17	Supply material and construct new cable trenches including steel chequer plates and frames as shown on drawing no.'s 1656-0001-SUB-A001 and A002	m	20			
22.1.18	Fill and compact unused cable trenches and cover with concrete screed as shown on drawing nos 1656-0001-SUB-A001 and E003	m	10			
22.2	<b>Building Refurbishment Work</b> See clause 10.8.2 of the Scope of Work for applicable requirements					
22.2.1	Repairs to roof	m <sup>2</sup>	280			
22.2.2	Repair fascia boards and flashing	m	90			
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Item	Description	Unit	Quantity	Material Rate	Labour Rate	Amount
22.2.3	Repairs and refurbishment to deteriorated external concrete surfaces	m <sup>2</sup>	70			
22.2.4	Repairs and refurbishment of external concrete apron	m <sup>2</sup>	235			
22.2.5	Repairs to soiled joint between concrete apron slabs and building walls	m	240			
22.2.6	Repairs to building floors	m <sup>2</sup>	400			
22.2.7	Prepare and epoxy paint all floors and bunded areas	m <sup>2</sup>	800			
22.2.8	Repairs to building walls	Sum	1			
22.2.9	Clean, sand and paint existing internal building doors	No	11			
22.2.10	Replace corroded skid rails for transformers and restore floor slab	m	60			
22.2.11	Repair / replacement of existing cable trench steel chequer plates and supporting frames	m <sup>2</sup>	40			
22.2.12	Repairs to lean-to canopy structure (replacement of supporting rusted bolts and nuts)	No	20			
<b>22,3</b>	<b>LV ELECTRICAL LIGHT AND POWER DISTRIBUTION INSIDE THE SUBSTATION BUILDING</b> See clause 11.2.15 of the Scope of Work and drawing 1656-002-SUB-E004 for applicable requirements					
<b>22.3.1</b>	<b>Switched Socket Outlet</b>					
22.3.1.1	Supply and install all the switched socket outlets complete with cabling and wiring as indicated in drawing no. 1656-001-SUB-E004	No	21			
<b>22.3.2</b>	<b>AC Luminaires</b>					
22.3.2.1	Supply and install 46W, 230V AC LED luminaire suspended from roof ceiling at 4m above floor level, as indicated in drawing no. 1656-001-SUB-E004	No	57			
22.3.2.2	Supply and install 46W, 230V LED emergency type luminaire suspended 4m above floor level as shown on the layout drawing 1656-001-SUB-E004	No	20			
22.3.2.3	Supply and install 46W, 230V LED luminaire for hazardous areas (Battery room) suspended from the roof as shown on the layout drawing 1656-001-SUB-E004	No	1			
22.3.2.4	Supply and install 46W, 230V LED emergency type luminaire for hazardous areas (Battery room) suspended from the roof as shown on the layout drawing 1656-001-SUB-E004	No	1			
22.3.2.5	Supply and install 57W, 230V LED type flood light on outside of the building for general area lighting as shown on the layout drawing 1656-001-SUB-E004	No	1			
22.3.2.6	Supply and install a solid-state type light sensitive day / night control unit with an impact resistance translucent cover	No	1			
<b>22.3.3</b>	<b>Light Switches</b>					
22.3.3.1	Supply and install surface mounted single lever two-way light switch complete with cover box and cover plated as indicated on drawing 1656-001-SUB-E004	No	22			
22.3.3.2	Supply and install surface mounted single lever one-way light switch complete with cover box and cover plated as indicated on drawing 1656-001-SUB-E004	No	2			
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<b>22.3.4</b>	<b>Wire Ways and Galvanised Steel Tubing</b>					
22.3.4.1	Supply and install metal trunking complete with clip-in cover plates, splices, elbows, tees, end caps and other accessories.	Sum	1			
22.3.4.2	Supply and install 25mm galvanised steel tubing complete with fittings, couplings, inspection boxes, covers and sets as required.	Sum	1			
22.3.4.3	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 building roof. Brackets shall be insulated from earth potential.	Sum	1			
22.3.4.4	Supply and install PVC insulated wire for lights and switched socket outlets circuits (red, white, blue, black and grey).	Sum	1			
<b>22.3.5</b>	<b>AC Distribution Board</b>					
22.3.5.1	Supply and install an industrial type AC distribution board as shown on drawing 1656-001-SUB-E004	No	1			
<b>22,4</b>	<b>FIRE PROTECTION SYSTEM</b> See clause 9.4.1 of the Scope of Work for applicable requirements					
22.4.1	Conduct a fire risk assessment and submit a report with recommendations	Sum	1			
22.4.2	Design, supply, install and commission fire protection equipment as per the accepted recommendation in the fire risk assessment	Sum	1			
<b>22,5</b>	<b>INTRUDER SECURITY SYSTEM</b> See clause 9.4.2 of the Scope of Work for applicable requirements					
22.5.1	Conduct a intruder security risk assessment and submit a report with recommendations	Sum	1			
22.5.2	Design, supply, install and commission the security system complete with, access control, vehicle registration identification, perimeter intruder detection system, CCTV cameras (2 x Type 1 and 12 x Type 4), IP cameras and electric fence.	Sum	1			
22.5.3	Supply and install the complete support structure for the outdoor cameras	Sum	1			
<b>22,6</b>	<b>Associated Building Equipment</b>					
22.6.1	Supply a self-supporting aluminium folding ladder with a height not exceeding 1.5m, including bracket mounted on the building wall	No	1			
22.6.2	Supply and mount a key box with lid to accommodate at least 15 keys and mounted on the building wall	No	1			
22.6.3	Supply and install suitable brackets for special tools, earthing apparatus, and brackets on the walls for mounting of hand held fire extinguishers	Sum	1			
22.6.4	Supply a steel cabinet/desk combination approximately 1150mm wide, 600mm deep and 1200mm high.	No	3			
<b>23,0</b>	<b>MECHANICAL KEY INTERLOCKING SYSTEM</b> See clause 11.3 of the Scope of Work for applicable requirements					
23,1	Supply and install a mechanical key exchange interlocking system to prevent on load operation as indicated on drawing 1656-001-SUB-E002	Set	2			
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<b>24,0</b>	<b>MV CABLES AND BUSBARS</b> See clause 11.1.4 of Scope of Work and BBB 5452 for applicable requirements					
24,1	Supply and install 11kV AC XLPE SWA armoured copper cable complete with the necessary termination kit to supply power from the traction primary circuit breakers to the transformers. The Contractor to determine the size for the cable	m	120			
24,2	Supply and install 11kV AC XLPE SWA armoured copper cable complete with the necessary termination kit to supply power from the new Metal Clad switchgear to the outgoing 11kV feeder cables	m	162			
24,3	Supply and install 11kV AC XLPE SWA armoured copper cable complete with the necessary termination kit to supply power from the new Metal Clad switchgear to the distribution transformers. The Contractor to determine the size for the cable.	m	114			
24,4	Supply and install 6.6kV AC XLPE unarmoured (single core) 500mm <sup>2</sup> copper cables complete with the necessary termination kit to supply power from the positive isolators to the 3kV DC busbars.	m	100			
24,5	Supply and install 6.6kV AC XLPE AWA (single core) 500mm <sup>2</sup> copper cables (2 x per circuit) complete with the necessary termination kit to supply power to the OHTE track feeder switches	m	3400			
24,6	Supply and install 6.6kV AC XLPE AWA (single core) 500mm <sup>2</sup> copper cable complete with the necessary termination kit for return current to the substation negative return busbar	m	300			
24,7	Supply and install 160mm diameter HDPE sleeve pipes for cables under vehicle access ways in the outdoor yard	m	420			
24,8	Supply and install a negative return manhole and busbar with a minimum continuous rating of 4000A	No	1			
24,9	Supply and install copper busbars between the traction transformer secondary and anode wall plate. The Contractor to determine the size of the busbars	Per unit	2			
24,10	Supply and install copper busbars between the anode wall plate and the rectifier. The Contractor to determine the size of the busbars	Per unit	2			
24,11	Supply and install copper busbars between the rectifier and the reactor coil as well as to the positive isolator for both units. The Contractor to determine the size of the busbars	Sum	1			
24,12	Supply and install copper busbars between the rectifiers and the reactor coils as well as to the positive isolator for both units. The Contractor to determine the size of the busbars	Per unit	2			
24,13	Supply and install copper cabling and wiring to the wave filter equipment for both units. The Contractor to determine the size of the cables	Per unit	2			
<b>25,0</b>	<b>LV CABLES</b>					
25,1	Supply and install low voltage power cables PVC, PVC. SWA, PVC multicore cables from the distribution transformers to the LV distribution panel	m	100			
25,2	Supply and install low voltage power and control cables PVC, PVC. SWA, PVC multicore cables between all the indoor and outdoor equipment . Allow to terminate all the cables onto equipment. Price to include compression glands, and any other accessories	Sum	1			
25,3	Supply and install low voltage power cables PVC, PVC. SWA, PVC multicore cables from the load side of the outgoing circuit breakers in the LV distribution panel to splicing existing outgoing cables.	Sum	1			
<b>Total Carried Forward to the Next Page</b>						

Item	Description	Unit	Quantity	Material Rate	Labour Rate	Amount
<i>Total Brought Forward from the Previous Page</i>						
<b>26,0</b>	<b>EXCAVATION, BACKFILLING AND COMPACTION</b> See drawing 1656-001-SUB-E005 and specification CEE-0023 for applicable requirements					
26,1	Excavations for cable trenches in soil, importation of soil as per specification to bed cables, backfilling of trenches, compacting with mechanical rammer	Sum	1			
<b>27,0</b>	<b>OUTDOOR EARTHING</b> See clause 11.2.2 of Scope of Work for applicable requirements					
27,1	Conduct soil resistivity survey and measurements, design complete earthmat for installation in the outdoor yard	Sum	1			
27,2	Supply and install the complete earth mat in the substation yard as per the accepted design	Sum	1			
27,3	Supply and install sacrificial anodes and bond to the earth mat	Sum	1			
27,4	Supply and install 95mm <sup>2</sup> PVC insulated stranded copper conductor to bond various equipment to the earthmat complete with copper tinned lugs. Copper conductor and lugs to be SANS approved.	Sum	1			
27,5	Supply and install anticorrosive compound such as Noxide to all crimped connections and exothermic welds	Sum	1			
27,6	Allow a rate to braze or exothermic weld all the below ground connections	Rate				
<b>28,0</b>	<b>CRUSHER STONE</b> See clause 11.2.3 of Scope of Work for applicable requirements					
28,1	Supply and install environmentally approved weed killer and then lay a 100mm layer of 19mm crusher stone in the areas shown on drawing 1656-001-SUB-E005	Sum	1			
<b>29,0</b>	<b>KERBING</b> See clause 11.2.4 of Scope of Work for applicable requirements					
29,1	Supply and install vehicle mountable kerbing in the outdoor yard, as shown on drawing 1656-001-SUB-E005	m	15			
29,2	Supply and install kerbing as shown on drawing 1656-001-SUB-E005	Sum	1			
<b>30,0</b>	<b>WARNING NOTICES AND SIGNS</b> See clause 11.3 of the Scope of Work for applicable requirements					
30,1	Supply and install a complete set of warning notices and signs as per the relevant specifications	Sum	1			
<b>31,0</b>	<b>DECOMMISSIONING AND DEMOLITION</b> See clauses 3.1.1 and 10.2 of Scope of Work for applicable requirements					
<b>31,1</b>	<b>DECOMMISSIONING</b>					
31.1.1	Decommissioning and removal of existing re-usable equipment and storage of equipment in the Durban Electrical Depot, including non-ferrous metals (i.e. copper & aluminium, etc.) inside the building and the outdoor yard.	Sum	1			
31.1.2	Decommissioning and removal of existing non-reusable equipment inside the substation building and the outdoor yard as well as transportation thereof to a suitable dumping site within 30km from the substation site	Sum	1			
<i>Total Carried Forward to the Next Page</i>						

Item	Description	Unit	Quantity	Material Rate	Labour Rate	Amount
<b>Total Brought Forward from the Previous Page</b>						
31.1.3	Rate per km for transportation of non re-usable equipment in excess of 30km from the substation site	Rate/km	1			
31.1.4	Conduct an oil test for PCB on all the electrical equipment with oil cooling and insulation	Sum	1			
31.1.5	Handling and disposal of oil and equipment containing PCBs	Sum	1			
31.1.6	Dismantling and disposal of hazardous (i.e. asbestos) and non re-usable material to an environmentally approved disposal site	Sum	1			
<b>31,2</b>	<b>DEMOLITION</b>					
31.2.1	Demolish old feeder switch structure and foundations in the outdoor yard. The rate shall include removal and transportation of rubble to an environmentally approved dumping site	Sum	1			
<b>32,0</b>	<b>TEST AND COMMISSIONING</b> See clauses 12.1 to 12.5 of Scope of Work for applicable requirements					
<b>32,1</b>	<b>Factory Acceptance Test</b>					
32.1.1	Factory acceptance tests. The rate shall include FATs to be conducted by the manufacturer of equipment at their premises. Costs for travel and accommodation abroad shall be priced in item 7.1 of the P&Gs	Sum	1			
<b>32,2</b>	<b>Site Acceptance Tests</b>					
32.2.1	Functional testing of all equipment installed on site	Sum	1			
<b>32,3</b>	<b>Cold Commissioning</b>					
32.3.1	Functional testing of all equipment (primary and secondary plant) and circuitry to prove proper installation and functioning thereof, before MV equipment is energised at 11kV	Sum	1			
<b>32,4</b>	<b>Hot Commissioning</b>					
32.4.1	Functional testing of all equipment (primary and secondary plant) and circuitry to prove proper installation and functioning thereof under live conditions - MV equipment energised at 11kV	Sum	1			
<b>32,5</b>	<b>Documentation</b> See clause 12.6 of Scope of Work for applicable requirements					
<b>32.5.1</b>	<b>Substation Drawing</b>					
32.5.1.1	Supply and mount an A1 size drawing frame, having a transparent cover, against the building wall above the desk to accommodate the substation single line diagram	No	3			
<b>32.5.2</b>	<b>Data Pack Including Manuals</b>					
32.5.2.1	Provide 3 sets of equipment and wiring drawings for which approval from the Employer is required.	Sets	3			
32.5.2.2	Provide 3 sets of detailed operating and maintenance instruction manuals of all equipment, switchgear relays, transformers and other electrical equipment supplied and installed. Hard copies and electronic format on CD/Memory Stick.	Sets	3			
32.5.2.3	Provide data packs complete with all documentation	Sets	3			
<b>Total Carried Forward to the Next Page</b>						

Item	Description	Unit	Quantity	Material Rate	Labour Rate	Amount
<i>Total Brought Forward from the Previous Page</i>						
<b>33,0</b>	<b>TRAINING</b> See clause 13 of the Scope of Work for applicable requirements					
33,1	Provide training on all substation equipment installed. The rate shall include theoretical training in a class room environment and practical training on site. Allow for at least 6 technicians, 2 supervisors and 1 manager	Sum	1			
<b>34,0</b>	<b>TEMPORARY WORKS</b> See clause 5 of the Scope of Work for applicable requirements.					
34,10	Allowance for any temporary works, deemed necessary	Sum	1			
<b>36,0</b>	<b>SUNDRIES</b> Sundries to be determined by Contractor					
36,1	Supply and install sundries as determined	Sum	1			
<b>37,0</b>	<b>SPARES</b> See clause 14 of the Scope of Work for applicable requirements					
37,1	Supply rectifier diodes with the same specification as the installed rectifiers	No	16			
37,2	Supply rectifier diode monitoring card	No	1			
37,3	Supply rectifier attenuation circuit fuse	No	1			
37,4	Supply rectifier fan motor	No	1			
37,5	Supply fan control card circuit relays and timers	No	1			
37,6	Supply rectifier RC ("snubber") circuit	No	10			
37,7	Supply wave filter circuit fuse	No	1			
37,8	Supply 110V DC under voltage monitoring relay	No	2			
37,9	Supply 400V AC power protection relay	No	1			
37,10	Supply a 65W 230V AC LED indoor luminaire	No	1			
37,11	Supply a 65W 230V AC LED indoor emergency type luminaire	No	1			
37,12	Additional Spares deemed necessary, specify	Sum	1			
<b>TOTAL FOR BILL OF QUANTITIES CARRIED TO THE SUMMARY OF PRICES</b>						



**prasa tech**  
TECHNICAL DIVISION

**PRELIMINARY AND GENERAL**

Item	Description	Unit	Qty	Rate	Amount
<b>1,0</b>	<b>FIXED CHARGE AND VALUE RELATED ITEMS.</b>				
1,1	Contractual requirements.	Sum	1		
1,2	Forward Cover	Sum	1		
1,3	SANS 1921-1-2004: Part 1: General Engineering and Construction Works.	Sum	1		
1,4	Compliance with Environmental requirements.	Sum	1		
1,5	Compliance with Health and Safety requirements.	Sum	1		
1,6	Transportation of Contractors Staff to and from site. Contractor to specify the type of transport.	Sum	1		
1,7	Other Compliance with Quality Requirements	Sum	1		
<b>2,0</b>	<b>ESTABLISHMENT OF FACILITIES ON SITE FOR THE CONTRACTOR</b>				
2,1	Offices and Storage Sheds.	Sum	1		
2,2	Chemical Toilets.	Sum	1		
2,3	Workshops.	Sum	1		
2,4	Tools, Ladders, Scaffolding and Ropes.	Sum	1		
2,5	Water Supply.	Sum	1		
2,6	Electrical Supply (Including Generators).	Sum	1		
2,7	Communications.	Sum	1		
2,8	Plant and Equipment.	Sum	1		
2,9	Protective Wear, Safety Clothing and ID's.	Sum	1		
2,10	Light Duty Vehicles (LDV's).	Sum	1		
2,11	Trucks. Contractor to specify the type of trucks.	Sum	1		
2,12	Cranes. Contractor to specify the type of cranes.	Sum	1		
2,13	Machinery and Plant required for Earth Works.	Sum	1		
2,14	Other Construction Vehicles. Contractor to specify.	Sum	1		
2,15	Signage on each site.	Sum	1		
<b>Total Carried Forward to the next Page</b>					

Item	Description	Unit	Qty	Rate	Amount
<b>Total Brought Forward from the Previous Page</b>					
<b>3,0</b>	<b>SCHEDULED TIME RELATED ITEMS.</b>				
3,1	Offices and Storage Sheds.	Months			
3,2	Chemical Toilets.	Months			
3,3	Workshops.	Months			
3,4	Tools, Ladders, Scaffolding and Ropes.	Months			
3,5	Water Supply and Electrical Supply.	Months			
3,6	Plant and Equipment.	Months			
3,7	Protective Wear, Safety Clothing and ID's.	Months			
3,9	Light Duty Vehicles (LDV's).	Months			
3,10	Trucks.	Months			
3,11	Cranes.	Months			
3,12	Machinery and Plant required for Earth Works.	Months			
3,13	Other Construction Vehicles.	Months			
3,14	Security x 24 Hours. As per the Risk Aseesment	Months			
3,15	Community Liaison Officer	Months			
3,16	Performance Bond	Months			
<b>4,0</b>	<b>CONSTRUCTION MANAGEMENT &amp; SUPERVISION FOR THE DURATION OF CONSTRUCTION.</b>	Months			
<b>5,0</b>	<b>COMPANY AND HEAD OFFICE OVERHEAD COSTS FOR THE DURATION OF THE CONTRACT.</b>	Months			
<b>6,0</b>	<b>AWARENESS TRAINING OF CONTRACTORS STAFF</b>				
6,1	Time (As per day rate schedule, all staff for a day)	Sum	1		
6,2	Accommodation (All staff for one night)	Sum	1		
6,3	Travelling (All travelling for two days)	Sum	1		
6,4	Others	Sum	1		
6,5		Sum	1		
6,6		Sum	1		
6,7		Sum	1		
6,8		Sum	1		
6,9		Sum	1		
<b>Total Carried Forward to the next Page</b>					

Item	Description	Unit	Qty	Rate	Amount
<b>Total Brought Forward from the Previous Page</b>					
<b>7,0</b>	<b>TESTING OF TRANSFORMER.</b>				
7,1	Allow an amount for the Client (x2 people) and his representative (Consultant, x1 person) 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		
7,2	In terms of the Contract allow an amount for Type Tests of the transformer if such tests does not exist.	Sum	1		
7,3	Other Costs (Specify)	Sum	1		
7,4					
7,5					
7,6					
<b>8,0</b>	<b>SITE DE-ESTABLISHMENT</b>				
8,1	Removing facilities from site	Sum	1		
8,2	Site rehabilitation	Sum	1		
<b>TOTAL FOR PRELIMINARY &amp; GENERAL CARRIED FORWARD TO THE SUMMARY OF PRICES</b>					



## SUMMARY OF PRICES

Item	Description	Amount
1	Brought forward from – PRELIMINARY AND GENERAL	
2	Brought forward from - BILL OF QUANTITIES	
3	Sub Total	
4	CONTINGENCY (10%) of item (3) above	
5	Sub Total	
6	Contract Price Adjustment (CPA) - 5% of item (5) above	
7	Sub Total	
8	Plus 15% VAT	
9	<b>Grand Total of Tender (Including VAT) Carried Forward to the Tender Form.</b>	

**Total tender price in words.**

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CONTRACTOR

\_\_\_\_\_  
DATE

\_\_\_\_\_  
WITNESS (1)

\_\_\_\_\_  
WITNESS (2)

\_\_\_\_\_  
for PRASA

\_\_\_\_\_  
DATE

\_\_\_\_\_  
WITNESS (1)

\_\_\_\_\_  
WITNESS (2)