



SUBSTATION PROJECT SPECIFICATION

**Ref No.
2018/75**

FOREWORD

All works are to be carried out in accordance with the listed standards. The project specification is specific for the Eastern Cape Operating Unit and these requirements compliments the Eskom national standards. This project specification is to be read in conjunction with the Scope of Works, Bill of Quantities and drawings which are included in the design package for the purpose of pricing and implementing the list of activities in the BOQ.

1. STANDARDS

Doc No.	Rev/Edition	Doc Title	Attached
Part 2 Earthing - Standards			
DST_34-1245	0	Standard: Substation earthing. Drawings (D-DT-5240)	No
Part 7 Substations - Standards			
SCSASABB5	1	Standard for road works for substations and access roads	No
DSP_34-1241	0	Distribution Group's specific requirements for the use of furniture in substation buildings	No
DST_34-209	0	MV cabling in substations	No
DISASAAQ1	5	Quality checking of distribution substation construction before handing over for commercial operation	No
Part 22 Cables - Standards			
DST_34-1177	0	General Information and requirements for high-voltage cable systems	No
DST_34-937	0	Insulation requirements for medium voltage cable-connected equipment with air-filled enclosures	No
DST_34-1176	0	Distribution Standard Part 22: Cables Section 0: General Information and requirements for low-voltage cable systems. Drawings	No
DST_34-209	1	MV cabling in substations	No
Asbestos Handling - Standards			
ESKPAAG5	1	Distribution Standard: Requirements for the safe processing, storing, removing and handling of asbestos and asbestos containing material, equipment and articles	No
Equipment Labels			
DSP-34-254	1	Manufacturing specification for Distribution equipment labels	No
Stoning			
240-108982466	1	Standard for HV yard stone in Eskom substation	No
SANS - Standards			
SANS 1200A	3	General	No
SANS 1200C	1	Site clearance	No
SANS 1200D	3	Earthworks	No
SANS 1200DB	3	Earthworks (Trenches)	No
SANS 1200LC	1	Cable ducts	No
SANS 1200L	2	Drainage	No
SANS 1200G	1	Concrete	No
SANS 1200H	3	Steel erection	No

SANS 1200MJ	1	Civil Eng. Construction of segmented paving	No
SANS 1058	2.01	Quality of concrete paving blocks	No
SANS 920	2.03	Reinforcement	No
SANS 121	2	Galvanizing	No
SANS 227	4.04	Face bricks	No
SANS 82	3	Bending of reinforcing	No
SANS 10044-1	3	Welding	No
General			
ESKARAAG4		All work is to be carried out in strict terms of Operating Regulations for High Voltage Systems – With special reference to (5.03.6.3) & Prohibition Notice's	No

2. DESCRIPTION OF WORKS

See Scope of Works document

Adjacent plant

HV/MV/LV - Electrical Equipment

HV/MV/LV - Conductor & Cables

3. SETTING OUT

The Contractor is to familiarise himself with the site conditions. The benchmark (BM) must be constructed or indicated by the Clerk of Works, which shall serve as a reference level and must be clearly marked. Before any construction work may commence the contractor must set out the corners of the internal and external fence as well as the control room from the X Y axis. The position of the main gates must line up with the access road.

4. CIVIL WORK

4.1. EXCAVATIONS

Substations are deemed as “restricted areas” and the use of plant and/or machinery for construction activities such as excavations or for the removal of rubble is not permitted without prior approval [i.e. only hand digging and jackhammers are allowed]. Excavations required for foundations, earth mat, cable trenches, road and stone kerbing etc. are included in the respective items, these are measured as supply and install complete. Only the extra-over excavation in rock is measured separately.

Any variance between the actual and measured quantities must immediately be brought to the attention of the Project Manager, in writing, failing which; all excavations shall be measured and paid as per the Bill of Quantities [BOQ].

Foundations are to be dug as close as possible to the required size. Where the depth of the foundation is deeper than 1.5m, shoring shall be used in accordance with OHSA. The bottom of all foundations shall be level and cut squarely with the sides of the foundation. Compaction of the bottom of the foundation and backfill shall be as per 4.2.

Excavations are specified below as per SANS 1200D:

a) Soft excavation

In the case of restricted excavation, soft excavation shall be excavation in material that can be effectively removed by a back-acting excavator of flywheel power approximately 0.10 kW per millimetre of tined-bucket width, without the use of pneumatic tools such as paving breakers.

b) Intermediate excavation

In the case of restricted excavation, intermediate excavation shall be excavation (excluding soft excavation) in material that requires a back-acting excavator of flywheel power exceeding 0.10 kW per millimetre of tined-bucket width or the use of pneumatic tools before removal by equipment equivalent to that specified in (a) above

c) Hard rock excavation

In the case of restricted excavation, hard rock excavation shall be excavation in material (excluding boulder excavation) that cannot be effectively removed without blasting or without wedging and splitting.

d) Boulder excavation Class B

Material containing 40% or less by volume of boulders of size in the range of 0.03-20m³, in a matrix of soft material or smaller boulders, and which require individual drilling and blasting in order to be loaded by a track type front-end loader or back-acting excavator.

4.2. COMPACTION

All compaction shall be compacted at OMC to a density of at least 93% of Mod. AASHTO maximum density for cohesive soil or 95% in the case of non-cohesive soil, all fill shall be compacted in layers not exceeding 150mm and each layer shall be compacted to the above density.

If the Project Engineer is not satisfied with the compaction, he will request that the contractor have a compaction test done by an approved company. If the results are successful, Eskom will be liable for all costs. Should the results fail, the contractor will be liable for all costs and the costs of any re-test required.

4.3. CONCRETE

All equipment foundations and bases shall have a minimum strength of 25MPa on day 14 with a nominal stone aggregate size of 20-25mm. Transformer foundations shall have a minimum strength of 25MPa on day 21 with a nominal stone aggregate size of 20-25mm. Blinding and strip footings shall have a minimum strength of 15MPa on day 7. Any additives to the concrete shall have the approval of the Project Engineer. All tolerances shall be for "Degree of Accuracy II" as per SANS 1200G.

Samples of all stone, sand and water to be used in the concrete shall be tested and approved prior to construction commencing. The laboratory results must be sent to Eskom for approval by the Project Engineer, if a non-approved supplier is used to supply the above material.

When concrete is mixed on site, cube tests must be made available for the Project Engineer to have tested if required. If cube tests fail, all foundations already cast will be tested at the contractors cost. The timing of the test shall be at Eskom's preferences (i.e. random). One cube of each set shall be tested at 7 days and the other at 28 days. The result shall be forwarded to the Project Engineer for approval. Concrete hardener ABE Korocron shall be applied to the concrete floor area of the oil containment area. Apply as per the suppliers specifications.

4.4. FORMWORK

The finish of all exposed surfaces of concrete shall have a smooth "off-shutter" finish and be free of all blemishes, honeycombing and irregularities.

4.5. GEO-PIPES

Use Tee-pieces to interlinked Geo-pipes and End-caps to seal off the start. Leave the discharge ends open. Where the geo-pipes are installed on the inside of the perimeter fence, the trench dug for the earthing must not be closer than 600mm from the fence. The round copper will be installed on the outside edge, as close as possible to the fence. Backfill 100mm of soil before the geo-pipe is installed.

4.6. OPTIC FIBRE PIPE

Use Kabelflex DN110 pipe for the piping of the optic fibre. The supplier of the pipe is Nextube. Always leave draw wire in the pipes where the optic fibre will be installed.

4.7. OIL CONTAINMENT AREA DRAINAGE

Use 75mm diameter uPVC class 4 pipes for the water drainage pipe from the valve chamber of the oil containment area. Where uPVC pipes cross a road, class 6 drainage pipes are to be used.

Concrete piping with an internal diameter of 300mm is to be used for active drainage system from oil containment area to oil dam. Each joint of the concrete pipe must have an approved rubber seal.

4.8. OIL CONTAINMENT AREA WALLS, JOINTS AND STEPS

Face bricks are to have a minimum of 20% water absorption. All joints constructed with 10mm thick mortar (1:4) cement: sand raked finish. Containment walls shall be capped with a roll course.

Steps constructed of face bricks, built on the 100mm internally slab and externally on a 150mm concrete foundation. Step risers to be maximum 180mm and treads to be 220mm wide.

4.9. BUND DRAINAGE OUTLET PIPE (GALVANIZED)

A 400mm length of 75mm diameter galvanized pipe, with 30mm of thread on 1 end and a 150 x 150 x 3mm thick galvanized steel plate welded to it, 120mm from the non-threaded side.

This plate shall be built into the bund wall. All welds to be seal welded.

4.10. GRATING & SUPPORTS

An assembly and detail drawing is included. All grating to be MENTIS RS80 Rectagrid with bearer bars 30mm x 4.5mm. Grating to be open-ended banded along discontinuous edges. All dimensions to be checked prior to manufacture. Support Steelwork to be 500x25x5mm flat galvanized iron. Welding is to conform to SANS 0167-1984. All welds to be seal welded. Steelwork to be hot dip galvanized to SANS 763 for coastal areas. All steelwork to be fabricated, erected and levelled to a tolerance of 1.5mm.

4.11. REINFORCING

All bars shall be neatly bent cold, accurately fixed and securely wired in the shape and position as shown on the drawings. The reinforcing shall be free of loose rust and grease. Unless otherwise stated on the drawings the concrete cover for all reinforcing shall be 40mm or as specified on drawings. All reinforcing overlaps shall have a lap length of 350mm.

4.12. H.D. BOLTS

All H.D. Bolts are to be fixed, using steel templates. The Clerk of Works shall inspect the position of H.D. Bolts before concrete is poured. When removing holding down bolts from a foundation, the bolts must be cut off 25mm below finished level of concrete and the holes must be finished with a 25MPa floated concrete grout. All H.D. Bolts are to be painted with one coat of silver paint.

4.13. REMOVABLE OF CONCRETE BASES

Foundations, which are to be removed, must have the resulting holes backfilled and compacted as per 4.2. Foundations, which are to be removed to 100mm below ground level, must have their H.D. Bolts cut off at concrete height. The earth tails are to be removed to 100mm below ground level. If an old foundation clashes with any of the new works the old foundation must be removed in such a way that will allow the installation of the new foundation.

If an existing foundation is to be re-used, the existing H.D. Bolts are to be cut off 10mm below the top of the foundation. The hole left by the removed H.D. Bolt must be closed with a 25MPa floated concrete grout.

4.14. CHEMICAL ANCHORS DETAIL

66/132kV Breakers H.D. Bolts: Sika Anchorfix-1 fast curing anchoring adhesive to be used to secure bolt to foundation. The bolt to be M24 x 630mm galvanized threaded rod, cut at 45° at the one end and supplied with two nuts and two washers per bolt and to protrude 130mm above finished foundation level after installation. Installation of bolt and Sika Anchorfix-1 is to comply with the supplier's specification.

4.15. STONING

The existing stone layer must be carefully removed to ensure it remains "clean" and stockpiled separately for later re-spreading. Clerks of Works to give approval for re-use. The final yard stone layer is to be 100mm thick [min] using yard stone size of 26/38mm. Stone to comply with Eskom specification (Standard for HV Stones in Eskom Substation), Unique Identifier: 240-108982466. Project Engineer has to give approval before the yard stone is to be spread. The road stone layer is to be 25mm thick [min] using a road stone size of 9mm.

No vehicles are permitted to drive on the yard stone once the stone has been spread and levelled. Stoning must be the last activity to be done in a construction phase.

4.16. GROUTING

Grout must be square with the footing and must be free from honeycombing. Concrete to be 15Mpa (13mm stone). No grouting to be done on the footing of tubular support structures.

4.17. SEALANT

Sika flex-pro 2HP joint sealant must be used in accordance to supplier's specification, for the sealing of the oil containment area.

4.18. OIL ABSORBING CUSHIONS

“Drizit cushions” may be purchased from “Cape Chemical Industries” or from approved suppliers. Two cushions must be installed per valve chamber.

4.19. WEED KILLER (HERBICIDE)

Prior to spraying of weed killer, the yard is to be cleared of scrub. For pricing purposes, the spraying of weed killer includes the clearing of scrub.

The type of weed killer to be used is Edge SC and red dye. Spray weed killer according to manufacturer’s specification.

4.20. BERM

Compaction of the Berm shall be as per **4.2**. The size of Berm is indicated on drawings.

4.21. PREFORMED CONCRETE KERBING BLOCKS

Stone kerbing is to be bedded in a 75mm thick concrete bed and a 75mm thick side layer. Road and cable trench kerbing is to be bedded in a 100mm thick concrete bed and a 100mm thick side layer.

4.22. RETAINING WALLS

Terra Force blocks are to be used to construct retaining walls. The blocks are to be installed according to the manufacturer’s specifications. Terra Force must be priced with main offer and a similar product can be offered as an alternative with the tender document. Before the installation of Terra Force Wall a design must be submitted to the Project Engineer which has been approved by a Civil Engineer.

4.23. PAVING BLOCKS

Use 80mm thick type S-B geometrical interlocking grey paving blocks from 35MPa concrete. Install the paving blocks according to the manufacturer’s specifications. A certificate stating supplier may be required.

5. STEELWORK ASSEMBLE AND ERECTION

Structure shall be erected, aligned, squared, plumbed and levelled to an accuracy specified in SANS 1200 H (6.2.2.C) 2 – II

All steelwork assembled according to Eskom supplied drawings. No damage to the galvanising will be accepted.

5.1. ERECTION OF EQUIPMENT AND STEEL

Equipment and steel shall be erected according to manufacturer’s specification and substation drawings. Tubular busbar post insulators may be shimmed for alignment using stainless steel shims as per drawing D-EC-2112 Rev 0. Isolators and breakers final settings must be checked by Eskom before commissioning.

5.2. RE-USE OF EQUIPMENT SUPPORTS, COLUMNS, BEAMS AND EARTHPEAKS

When steelwork is re-used all the nuts and bolts must be replaced with new nuts and bolts of the same type and size.

NB: (The nuts and bolts must be hot spun galvanized).

5.3. BUNDLING NOTES

Decommissioned steelwork bundles must be tied with 3mm thick galvanized wire at 500mm spacing to form manageable bundles. Use 3mm thick aluminium labels to label each bundle. Each bundle must be labelled to identify the type of structure it belongs to and numbered to ensure that all the individual bundles can be placed together to form that specific structure. The punched letters on the labels must be 1mm deep, 4mm high and 3mm wide and maintain 2mm spacing between words.

5.4. BOLTS

All bolts supplied are to be set screws hot spun galvanized stainless steel or otherwise instructed. Rawl bolts and hook bolts shall be galvanized. All bolts to have 2 washers and 1 nut. No damage to galvanizing will be accepted. HD bolts have to be painted with silver paint after the bolts have been torqued.

5.5. DOG BOX BREAKER SUPPORTS

For dog box breakers M10 x 35mm long stainless steel set screws (with one nut and 2 washers per set screw) are to be supplied for the fixing of the support lacings and for fixing the breaker to the support. 32 set screws will be required per support and breaker installation.

5.6. BREAKERS AND LINE TERMINATIONS

The drilling of the SPC clamps used for line terminations and breakers is to line up with the line flag and the breaker connection plate. A M12 x 65mm stainless steel bolt is to be used for the breaker application. A M16 x 50mm galvanized bolt is to be used for the line termination connection.

5.7. PANEL BOLTS

When protection panels are secured to channels in the floor, bolts and “spring nuts” shall be used.

6. EARTHING

All earth tails installed and connected as per detail on the drawings. The earth tails are to be installed at a min. depth of 500mm. For standard earthing specification, see drawing D-DT-5240. The specification mentions crimping of earthing, no crimping is allowed. All joints to be silbrallo alloy brazed and painted with bitumen paint. All earthing connections must be tinned. All tinned copper must be treated as described prior to making a connection. Wash and brush tinned area with water. Apply thin layer of non-oxide grease only to tinned areas facing galvanized steelwork. Where connection is made to galvanized steelwork the surface shall be coated with non-oxide grease prior to bolting. Working standards must be adhered to when earthing equipment that is in service.

All column earthing must have an 18mm dia. hole drilled in the centre of the column HD bolt plates. The columns are to be earthed to the main earth mat using 50 x 3mm flat copper to the 16mm dia. holes. 50 x 3mm flat copper is to be used to interlink the HD bolt plates inside the foundation. See the earth mat layout drawing for the direction of the earth tails.

For the earthing of transformer surge arrestors, one 50 x 3mm flat copper earth tail is connected to the earthing square on top of the transformer plinth and run up the transformer connecting to the surge arrestor bracket. In cases where individual surge arrestor brackets were used, the earthing of these brackets is to be interlinked and connected to the earthing square on top of the transformer plinth. If no earthing point is available on the transformer, earthing points are to be indicated by the Project Engineer.

When earthing the neutral bushing of the transformer the section of earthing between the neutral bushing and the current transformer is to be insulated. If the current transformer is of the coil type, the insulated copper is to extend 100mm beyond the current transformer. Heat shrink is to be used for the insulation.

The main earth mat runs on the inside and the outside of the perimeter fence. Bring the earth tail up to the fence post from the main earth mat on the outside of the perimeter fence and secure it to the fence post by using the earthing hole on the post. The fence post must also be connected to the main earth mat on the inside of the perimeter fence, but not by utilizing the earthing hole on the post. The earthing tail from the main earth mat on the inside of the perimeter fence must be brazed to the earthing tail running to the fence post from the main earth mat outside the perimeter fence. Braze it at a point below ground level that would utilize the least amount of flat copper. Create a t-joint when the brazing is done.

6.1. FLEXIBLE LEADS

300mm x 150A flexible copper leads with 16mm, 12mm lugs and gate clamps are to be used for gates. All lugs to have heat shrink covering of 50-70mm. Gate clamp: D-EC-1960. (Gate clamp must only be used if there is no earthing point on the gate).

A 300mm x 150A (16mm) flexible copper lead with M16 and M10 lugs is to be used to connect the steel structure (or isolator handle) and junction box earthing stud respectively. The lugs non-conductive area is to be covered with a heat shrink sleeve.

6.2. CT & VT EARTHING

CT - 300mm x 300A flexible copper leads (welding cable) with 16mm and 12mm lugs are to be used for breakers and current transformers. All lugs to have heat shrink covering of 50 - 70mm.

VT – Flat copper 50 x 3mm is to be used to earth VT from earthing stud to main earth mat.

7. BUSBARS AND STRINGERS

7.1. DROPPERS AND STRINGERS

All droppers and stringers must be installed according to the drawings. The natural curve of the conductor must be used at all times. No excessive stress shall be permitted on the equipment. Substation phasing is to be done as per station electric diagram. Post Insulators are to be aligned by using stainless steel shims.

7.2. TUBULAR BUSBARS

Centipede conductor shall be laid in each of the tubes. The conductor must be $\frac{2}{3}$ the length of the tube it is laid in. The end of the conductor must be secured to a tube conductor end cap. If any tube needs to be cut it may only be cut with a pipe cutter. Burrs inside the pipe must be cleaned out after the tube has been cut to allow for the installation of the end cap.

7.3. CLAMPS AND LUGS (FOR CONDUCTOR)

All clamps and acrylic covers are to be purchased from ELB McWade Electrical or approved suppliers. The clamps must be in accordance with the Eskom specifications.

Clamps and lugs crimped as per manufacturer's specification. Conductors must be clean, then greased with non-oxide grease prior to installation of clamps. Bolted clamps are to be torqued as specified on section drawings. All lugs to have heat shrink covering of 70mm.

All 11/22kV transformer connections must be taped (only when acrylic covers are not used), including the 22/11kV transformer surge arrester connections.

First BICC compound is to be used to fill all the cavities of the clamp and to be formed before the tape is applied. Apply 2 layers of 3M 23 electrical tape and 2 layers of 3M Super 33+ tape to the clamp.

7.4. LABELS

For equipment & busbar labels, 2 x M10 x 35mm long stainless steel set screws with one nut and 2 washers per set screw are to be supplied for the installation.

8. FENCING AND GATES

8.1. PALISADE FENCING

All fencing shall be done as per the Standard Eskom Drawings D-DT-5237 sheets 1 & 2 and the fencing layout drawing. The Clerk of Works to give benchmark level when there is a difference in level of the fence. The panels to be used are to be calculated using the fencing layout drawing. The distance of closing panels (i.e. the last panel on each side) are to be measured once all other posts are in position and this measurement is to be used to manufacture the closing panel. Clerk of Works is to approve the proposal before the panels are manufactured. The fencing drawings are not to be modified in any way, unless approval is given by the Project Engineer. The pales to be used must be the "classic palisade" D section with countersunk bolts and shear nuts.

8.2. TEMPORARY FENCE

Note that while fencing work is being carried out, at no point is the substation perimeter to be left open and unattended. A temporary fence must be installed as per the following details:

Install a 2,4m high fence using wooden posts to which 1.8m diamond mesh with a mesh size of 50mm x 50mm must be secured. 3 x strands of draw wire must be installed to secure the mesh to the posts and an additional 3 strands of barbed wire evenly spaced must be installed above the mesh. Top strand of barbed wire must be 50mm from top of posts. The fencing post spacing shall not exceed 4m intervals.

The fence must be connected to the main earth mat as detailed in the Earthing Standard D-DT-5240. Install the applicable danger labels on the fence.

The mesh must be earthed using 10mm round copper laced into mesh from top to bottom at 4 positions by means of binding wire. An earth must be installed at each end of the fence and at 20m intervals. All gates shall be earthed using flexible earth leads as per standard.

8.3. BRACKETS

Palisade fencing: the signs are to be installed using label brackets as indicated on D-EC-1949.

Mesh Fencing: the signs are to be installed using “A Grade Galvanized Binding Wire” on the corners of the labels or as needed to ensure that the label is well secured to the mesh.

8.4. 2.4M STEEL POST MESH FENCE

The mesh, draw wire and flat rap used on the fence must be of a Grade-A galvanizing.

8.5. LABELS AND SIGNS

Install the following signs per gate (gate with two panels is classified as one gate), sign ABC, sign DE, sign F and sign G. Install sign ABC on the first fence panel next to the gate and on the first panel at each corner face of the fence panel and then at intervals not exceeding 20m along the fence. Labels are to be installed in the middle of a fence panel. The word sum used in the BOQ is inclusive of all fencing labels.

8.6. BRASS PRONGS

A nut is to be removed from the bushing of the equipment identified in the scope of works, which needs prongs. The inner thread of the nut is to be used to determine the inner thread of the brass prongs. Prongs are to be tinned.

HV transformers: the prongs are to be 26mm diameter x 110mm long. The internal thread of the prongs is to be 75mm in length.

MV transformers: the prongs are to be 38mm diameter x 110mm long. The internal thread of the prongs is to be 75mm in length.

Prongs for non-standard isolators are to be 26mm diameter, 200mm in length of which 90mm to be turned down to 18mm diameter with a 45° chamfer. No tapping is required for this prong.

8.7. YARD LIGHTS

Yard lights are to be installed in the direction as indicated on the layout drawings.

Product: Zumtobel PRL 250 HPS/Wide beam (48000 Lumen 400W option).

8.8. SHARK NETTING

Shark netting is to be in accordance to the specification contained on D-DT-6103.

8.9. SWITCHGEAR RACK-OUT PLATE

After the switchgear has been installed, skid plates must be fitted to the floor. The plates shall be 3mm thick x 1225mm wide stainless steel plates with 8 x 50mm CSK stainless steel screw at 500mm centres. Plates must be taken up to face of wall opposite the indoor breakers.

8.10. INDOOR SWITCHGEAR – EARTHING PANEL COVER

A canvas or PVC cover must be made to protect the earthing panel from the ingress of dust etc. while not in use. The inside dimensions of the cover must be 1310mm x 810mm x 1300mm high.

8.11. LABELS

Labels to be supplied are to be obtained from an Eskom approved supplier. The labels supplied are to comply with the Manufacturing specification for Distribution equipment labels and D-DT-5047 sheet 2 Rev.3. The label schedule defines equipment labels required. The rate for Isolator labels shall include the non-standard padlock and a key tag. The key tag shall be 100 x 25mm and shall include both the “label designation” and “label description”. The station electric drawing must be forwarded to an approved label manufacturer who will design the mimic panel and key panel backing.

8.12. FIRE EXTINGUISHERS

Two extinguishers are to be installed in the control room. One to be in the entrance hall opposite to the control room door mounted on the wall in a glass fibre box with the standard labelling. The second to be mounted in the control room to the left or right of the entrance on a bracket with the standard labelling (no glass fibre box needed). Both extinguishers will be 9kg DCP.

8.13. NON STANDARD PADLOCK

A non-standard padlock is required for all isolators installed as part of the project and shall be 50mm brass with either an 8mm brass or stainless steel shank complete with 3 keys.

8.14. SUBSTATION EARTHS/LINK STICK

The link stick consists of the following sections;

- IDUBE CES20.6 - Control Earth Substation 95mm² 6m Red Jumpers with Screw-on Clamp on one end and Earth Clamp Substation on the other side.
- IDUBE CES20.4 - Control Earth Substation 95mm² 4m Red Jumpers with Screw-on Clamp on one end and Earth Clamp Substation on the other side.
- S9D Operating Head.
- Chance Round Telescopic Link Stick 20ft" Orange.

9. HIGH VOLTAGE CABLE

9.1. LAYING OF HV CABLE

HV Cable must be laid in accordance to the supplier's specification. Danger tape must be installed above cable if laid directly in the ground. If a cable is laid in a purposely built trench only the bottom two layers of bedding material, as per D-DT-0854 sheet 4, will be required.

Cable route markers engraved with the cable size, number and the direction of the cable shall be installed as per standard specification (see D-DT-8012).

When specified, concrete cable slabs indicated on D-EC- 5254 sheet 1C are to be installed directly next to each other.

9.2. TERMINATION OF HIGH VOLTAGE CABLE

Cable terminations shall be in accordance with the requirements of 240-56030625 (DSP_34-162) and shall be installed according to the manufacturer's installation instructions.

9.3. CABLE LUGS

Cable lugs are to be soldered and not crimped.

9.4. STUD PALM CLAMPS

Stud palm clamps to be drilled for 16mm clearance and all drilling burrs to be removed.

9.5. CLEATS

Cleats are to be supplied to specification D-DT-8019 sheet 1 & 2.

9.6. DANGER TAPE

300mm wide danger tape for High Voltage cables shall be used. The danger tape will be laid in accordance to drawing D-DT-0854 sheet 1.

9.7. INSULATION RESISTANCE TEST

High Voltage cables to be insulation resistance tested before and after the ends have been made off.

9.8. EARTHING OF CABLE

Earthing of High Voltage cable will be done according to the Station Electric Diagram.

9.9. CAPPING OF CABLES

Cable that is not immediately jointed or terminated shall be sealed by means of a plumbed PVC cap overnight. Cables must be capped in accordance with manufacturer's specifications immediately after cutting to prevent the ingress of moisture. The ends of the cables shall be raised and tied as high as possible above the floor without exceeding the minimum bending radius.

10. LOW VOLTAGE CONTROL CABLE

10.1. LAYING OF LV CONTROL CABLE

LV Control Cable must be laid in accordance to the supplier's specification. Cables will be laid perpendicular or parallel to the existing trenches.

Cables will enter the trench perpendicular to the stone level and will run vertically neatly loomed to the gland plate. Before reaching the gland plate the cables will be separated to allow entry through the

respective gland holes. Looming shall be achieved using metal strapping with a protective sheath to prevent cable damage.

10.2. GLANDS

Glands to be supplied are to be obtained from an Eskom approved supplier. Glands are to be installed as per supplier's specification and are to be secured adequately to the gland plate. Glands are to be covered using a shroud.

10.3. LOOMING OF CONTROL CABLE CORES

Cores are to be loomed parallel and perpendicular to the direction of the terminal blocks. Cores are to remain straight during looming. Cores are to be looped out of the loom at the appropriate terminal to be connected. Said loop must allow for an appropriate amount of slack to prevent tension on the connection when completed. The loop shall make a minimum of one half revolution (preferred one revolution) of the loom before reaching the terminal location.

Note: Where trunking is available cores shall be loomed in the trunking and exit via the gaps provided. No looping out of the loom is required.

10.4. CONTROL CABLE CORE LUGS

Lugs to be supplied are to be obtained from an Eskom approved supplier.

Spade lugs are to be used as default however should the terminal be incompatible an alternative lug may be used. All lugs shall be fully inserted into the terminal. Should the lug be longer than the terminal, the lug must be cut to length to allow the full length of the conductive section of the lug to be within the terminal.

A maximum of two cores (lugs) are to be inserted per terminal. Should two cores be required in a single terminal the lugs must be placed back to back to ensure the conductive sections of both lugs are flush.

Lugs will be colour coded as follows:

Red - 1.5mm cores

Blue - 2.5mm cores

Yellow - 4.5mm cores

10.5. EARTHING OF CABLE

Spare cores are to be earthed in the JB using an earthing bolt.

10.6. INSULATION RESISTANCE TEST

Control cables are to be insulation resistance tested after the ends have been made off.

10.7. CONTINUITY TEST

Control cables are to be continuity tested prior to labelling and post lugging to ensure core conductor continuity and correct core labelling.

11. CONTROL BUILDING

11.1. GATES AND RAILS

Security gates must sit parallel when closed and under no tension. The securing of the hand rails is to be done using foundation bolts (HD bolts) and a plate or a chemical anchor.

11.2. WALLS

An experienced brick layer is to be used to ensure quality and ensure that the 10mm cavity wall is to remain clear.

11.3. TRENCHING

The cable duct trench to enter the control room must be aligned on site. The control room drawing is a guide only.

11.4. EARTHING

50x3mm flat copper earth strapping must be placed in the cavity wall during construction to allow for the earthing of the control room roof and antenna respectively.

11.5. KEY PANEL

A lockable wooden framed key panel is required which shall have a station electric layout similar to mimic panel mounted on the 10mm wooden backboard. The key panel shall be 75mm deep and will be complete with a 4mm glass door panel. The equipment detailed on the station electric will determine the physical size of the key panel. A brass cup hook must be fitted at each isolator position from which the non-standard keys will be hung.

11.6. MIMIC PANEL

The mimic panel is to be A1 Falcon frame with chromadek backing or equal approved product. The mimic panel shall include 12mm diameter magnetic buttons [1 of each colour per isolator] “Green” for open, “Red” for closed and “Black” for earthed.

11.7. AIR CONDITIONING UNIT

The air conditioner must be a wall mount 20 - 36 000 BTU split unit. The unit must be able to heat and cool. In case of a power failure the unit must restart when the power is restored. It must have a remote control that is hard wired to the unit. Allow for an external input to switch the unit on. The air conditioning condenser is to be 2500mm above ground level; the final position of said unit is to be determined on site.

11.8. WATERWORKS

The septic tank drainage pipe is moveable, the drawing is a guide. The position is dependent on soil conditions affecting drainage. An exterior water tank tap is to be added to the water tank.

11.9. PAVING

The paving around the control building is to have a fall away from the control building.

11.10. BATTERY ROOM

The battery room floor is to be dropped and tiled with non-slip tiles. All grouting in the battery room is to be acid resistant.

12. PRICING SPECIFICATION

12.1. TRENCHING

For pricing purposes, a trench of 1000mm x 400mm has been assumed. Compaction shall be as per 4.2 for sub-grade requirements.

12.2. KERBING AND FENCING

The rate for the installation of kerbing and fencing must include all the excavations required.

12.3. PAVING

The price for paving must include all preparation work as well as all material needed.

12.4. FOUNDATIONS

When the installation of a foundation is priced, include the following as part of the price:

- (a) Excavation volume as per the foundation drawing – allowance should be made for over break
- (b) Concrete volume as per the foundation drawing
- (c) Shuttering required as per the foundation drawing
- (d) Holding down bolts and the installation of it with a template
- (e) Connection of the flat copper to the holding down bolts, as well as the trenching required to the main earth mat and the connection at that point.

12.5. PROTECTION CABLES & PANELS

When pricing the installation of protection LV cables, include the removal and the re-installation of all trench covers on route.

The excavation, back fill and compaction of the sections of cable between the trench and the equipment is measured separately and is classified as soft and pick able.

Where new panels are installed a 50 x 50 x 5 angle iron the length of the panel must be bolted to the back of the panel to support the chequer plate covers over the cable trenches. The paint finish will be a layer of undercoat [red oxide], and the final layer must be battleship grey.

12.6. REMOVAL OF EXCESS SOIL

Excess soil which results from any activity requiring excavation is to be removed from the substation site and disposed of within Eskom's boundary which will not exceed 100m from the substation. The excess material is to be flattened as per the existing area contours. The cost for the removal of the soil is to be included in the relevant activity requiring excavation.

12.7. EQUIPMENT

For all equipment that is supplied by Eskom Distribution, the contractor must supply the bolts, washers, bevelled washers and nuts of the correct size to secure the equipment to the steelwork.

12.8. EQUIPMENT LABELS

The rate shall include the bolts required to connect the label to the equipment steelwork.

12.9. SPC, STP, KCP, P AND POST INSULATOR MOUNTED TUBULAR BUSBAR CLAMPS

Supply the bolts, nuts and washers required when the above mentioned clamps are installed.

12.10. DISPOSAL OF WASTE

Waste shall include spoil materials, decommissioned concrete, equipment packaging (Primary and Secondary), cable armouring and PVC sheathing from protection cables, etc. Rate to include provision of separate waste bins for PVC, Aluminium, Copper and general waste.

13. GENERAL

All quantities in the bill of quantities are provisional. Quantities must be verified on site with the Project Manager before invoices are submitted. The contractor must familiarize himself/herself with the scope of works, drawings and the Bill of Quantities [BOQ]. Material supplied by contractor to be checked and approved by Clerk of Works prior to installation/erection. Rubble is to be disposed of at the nearest municipal dump site.