



11KV Cable Installation from Eskom Syferkuil Substation to Paledi Mall Bulk Supply

Client: TWIN CITY DEVELOPMENTS

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1.SCOPE OF WORK

PRIOR TO OUTAGE / LIVE CONNECTION

- 1. Install a 160mm dia sleeve underneath the R71 road by boring where the existing 11kV overhead lines from Syferkuil substation crosses the road.
- 2. Excavate a 1100mm deep, 600mm wide, 1km long cable trench under the existing 11kV overhead lines from pole STC1 in the Syferkuil substation yard up to the new R71 road crossing position.
- 3. Excavate a cable from the R71 road crossing position up to pole STC13/3 at the Paledi Mall overhead CT/VT bulk supply point.
- 4. Install bedding material in the trench as per specification 100mm compacted.
- 5. Install a 300mm² 3C, 11kV, Al, SWA Eskom specification cable in the excavated trench in 300m lengths. Backfill and compact in 250mm layers as per specification.
- 6. Install 3x 300mm² 3C, 11kV joints to specification.
- 7. Excavate holes for 11m poles in the vicinity of pole STC1 and pole STC13/3.
- 8. Set the settings on the recloser protecting the feeder suitable for cable protection.

DURING OUTAGE / LIVE CONNECTION

- 9. Install 2 new 11m in-line horizontal terminal structures in the vicinity of pole STC1 and pole STC13/3 with stays.
- 10. Terminate the newly installed 11kV cable on the 2 new terminal structures.
- 11. Install terminal assemblies on the next structure on the STC line STC 2 and STC 13/2 with stays and isolate the existing 11kV overhead line (for future re-energizing).
- 12. Energize the newly installed cable and supply Paledi Mall via the newly installed cable.

2.PROJECT SPECIFICATIONS

2.1 Standards

The following standards will be adhered to:

- SANS 10198 (Cable Installation),
- NRS 013 (MV Cables)
- 240-130615754- System Earthing;
- 240-56063792 MV Cables
- 240-56030619 MV Cable Accessories
- 240-4568397 Compaction Testing;
- 240-56063792 MV XLPE Cables;
- 240-99376650 MV/LV Self-Build Projects;
- 240-75883906 MV Reticulation: General;

2.2 Site

The site is located 30km east of Polokwane on the R71 Tzaneen road in Mankweng.

2.3 Cable Trenches

The Contractor shall preserve the site as far as possible. Only the minimum of trees, shrubs, rocks, etc shall be removed and cleared for the cable route, while adhering to the EIA environmental requirements for the project.

Where surplus material has to be disposed of the Contractor shall dump the material in the area provided by him. The Contractor shall at his own cost load and transport to this site all surplus material, unsuitable material for backfilling etc.

The cable trench shall be excavated along the routes indicated on the relevant drawings. The trench shall be absolutely straight and shall comply with all requirements. The Engineer shall determine the length of the trench to be excavated, which shall not exceed 400 m, before the cable is installed and the trench backfilled.

If any obstacle or interference should be encountered which may require alterations to the trench or routes, such alterations shall receive prior written approval of the engineer.

The trench shall be excavated to a depth indicated on the drawings for the different cables. Where depths are not indicated on the drawings, the following shall apply:

For MV cables 1000 mm and for all LV cables the trench shall be deep enough so that the top layer of LV cables is buried a minimum of 500 mm below final ground levels.

The Contractor shall excavate by hand where he cannot excavate by means of machines due to limited access and the proximity of other services.

The bottom of the trench shall be level and shall follow the contours of the final ground level. Where the excavation is in excess of the required depth, the excavation shall be backfilled and compacted with suitable material to the required depth.

The Contractor shall trim the trenches and clean up the bottom of the trenches after he has completed the required excavation.

The Contractor shall remove all sharp projections, which could damage the cable where the trench is excavated through rocky formations, and shall remove all loose rocks, material, etc from the bottom of the trench.

No excavated material shall be left closer than 300 mm from the edge of the excavation to prevent spill of the material back into the trench and to facilitate trench inspections. The excavated material which is considered by the Engineer to be suitable for bedding material for the cable shall be placed separately on one side of the trench so that it is available when required.

Once the excavations for cable trenches and joint pits have been completed, the Contractor shall give the Engineer 24 hours notice to inspect the trench and to be present when the measurements are made. No inspections shall be undertaken on Saturdays, Sundays and public holidays.

The Contractor shall maintain the excavation in a good condition, free of water, mud, loose ground, rocks, stones, gravel and other strange material until the cables are installed and the excavation is backfilled and compacted.

Mechanical excavators may be used for trenching operations provided that they are not used in close proximity to other plant, services or other installations likely to be damaged by the use of such machinery. The use of mechanical excavators shall be subject to the approval of the Engineer.

Should excavations be done in close proximity of existing services extreme care must be taken. Only labourers with experience of these conditions may be utilised.

The bottom and sides of trenches must be of smooth contour, and shall have no sharp dips or rises which may cause tensile forces in the cable during backfilling.

Backfilling of trenches may commence after the trenches have been approved and shall be compacted in layers of 150 mm. Sufficient allowance must be made for final settlement. For the first layer of 150 mm, sifted soil of which 75 mm must be below and 75 mm must be above the cable, must be used. Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so.

The Electrical Contractor shall be responsible to take the necessary precautions where excavations may be dangerous. Refer to the Occupational Health & Safety Act 1993, Reg. D13 of the General Safety Regulations. The Contractor must ensure that all buildings, sewer, etc, are protected against caging.

2.4 Cable Trenches: Soil Type

Trenching rates are based on trenches in soil, soft rock and hard rock on the quantities given in the Bill of Quantities:

SOFT TO MEDIUM: Shall mean hand pickable soil and includes loose gravel, clay, backfilled soil, loose or soft shale, loose literati and rocks less than 75 mm diam.

MEDIUM TO HARD: Shall mean rock which is hand pickable including hard shale, dense literati and rocks exceeding 75 mm in diam to 0,03 cubic metres volume.

HARD ROCK: Shall mean granite, quartz sandstone, slate and stone of similar hardness as well as rocks exceeding 0,03 cubic metre volume.

Should explosives be necessary and the Contractor receive permission to use explosives, the Electrical Contractor shall remain responsible for all work done with the explosives and shall comply to all conditions, regulations, requirements etc. imposed by the governing bodies.

2.5 Backfilling

After bedding the cables, the trenches shall be backfilled with excavated material able to pass through a 100mm sieve and backfilled in layers of 150mm. Each layer must be compacted to 90% MOD AASHTO. Additional soil may have to be imported should a substantial percentage of the excavated material consist of rock. Any sections of excavated material containing more than 70% rock shall not be used as backfill, but shall be replaced with imported material.

2.6 Cable Accessories

All MV cable accessories shall adhere to Eskom standard 240-56030619.

All MV cable joints and terminations shall be of the Raychem or equal and approved equivalent type.

The manufacturers' installation procedures shall be strictly adhered to. Upon request all jointers/terminators shall produce proof of training in the performing of the joints/terminations used.

Low voltage joints shall be of the epoxy-resin type.

For indoor use the cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with XLPE cables complying with the latest edition of SANS 1507. All glands shall be installed with non-deteriorating neoprene shrouds.

Earth continuity conductors shall comprise of stranded copper conductors.

Cable route markers shall be constructed of reinforced concrete.

Plastic cable warning tape shall consist of a strip of polyethylene of thickness 0,04 mm and of nominal width 230 mm, completely impregnated with a pigment such that the colour of the tape is yellow, colour No B49 of SANS 1091, and having printed at intervals not exceeding 1 metre along its length, a black-triangle and an electric flash symbol and the words "Danger, Gevaar, Ingozi".

The plastic warning tape shall be installed on all cable routes at 200 mm above the top cable layer.

1m x 350mm x 50mm concrete protective slabs shall be used with crossing of other services. The slabs shall be constructed of 20 MPa concrete and each slab shall be reinforced with one longitudinal and three transverse mild steel rod of minimum diameter 8 mm. The slabs shall be manufactured in such a way that the slabs interlock with each other thus avoiding shifting of the slabs after installation.

Cable sleeves shall be of the PVC NxTube type or equivalent with standard: 110mm dia (Black) for power cable street crossings.

2.7 Joints

11kV joint kits will be according to D DT 8008.

Where cable joints are to be made, a joint hole must be excavated of sufficient size to enable the cable jointer to work efficiently and unimpeded.

Each cable end must be left in a loop of 0,9 m to prevent any tension on the joint.

During backfilling the section supporting the joint must be compacted to the extent that no movement will take place after the trenches have been backfilled.

All joints in underground cables and terminations shall be made either by means of compound filled boxes according to the best established practice by competent cable jointers using first class materials or by means of approved epoxy-resin pressure type jointing kits. Epoxy-resin joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions.

Where cables are cut and not immediately made off, the ends are to be sealed without delay.

Jointing pits shall be excavated to a depth of 1,2 m and shall be rectangular in shape and large enough for the cable jointers to work comfortably and in an efficient manner. Where more than one joint is to be made in the same position the joint pit shall be large and long enough to allow staggered joints to be made. The minimum size of a joint pit shall be as follows:

- one joint : 2,5 m long x 2	1,25 m wide
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- two joints : 3,0 m long x 1,5 m wide

2.8 Cable Installation

Cables must be removed from the drums in such a manner that the cable is not subjected to mechanical damage, twisting or tension exceeding that stipulated by the cable manufacturer.

The laying of cables shall not commence until the trenches have been inspected and approved. The cables must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

Cables will be installed according to D DT 0854:



Cable rollers shall be used when cables are drawn into trenches. The cable rollers shall be placed so that the cable does not touch the bottom or the sides of the trench. The rollers shall be of an approved construction without any sharp metal parts, which could damage the cables.

If the Contractor intends using a winch to draw the cable into the trench, a cable stocking shall be used or the draw wires shall be soldered to the cable so that the tension is exerted on all the cores, lead sheath and/or steel wire armouring at the same time.

The maximum tension on a cable during laying operations shall not exceed the value specified by the manufacturer.

Should the Engineer not be satisfied with the manner or method employed to lay the cable he shall have the authority to instruct the Contractor to lay the cable by hand or in accordance with approved standards.

The medium-voltage cables shall be laid in such a manner that the beginning of a drum shall be laid from the end of the previous drum to ensure that the lay of the cores remain the same.

Medium-voltage cables shall overlap by at least 1 m, but not more than 1,5 m at joints.

Sufficient lengths of cable shall be left at the beginning and end of the cable routes to allow for the termination of the cables. The Contractor shall take the necessary precautions to protect the cable ends until they are terminated. The cable ends shall be sealed by means of lead or heat shrink sealing caps to ensure that the cable is waterproof. The Engineer may request moisture ingress tests on cables should it be found that end-capping of cable was not adequately done and specific lengths of cable may then need to be cut and discarded.

Where cables are drawn through sleeves, care shall be taken that they are not kinked or excessively bent. No bend in a cable shall have a radius less than the minimum bending radius specified by the cable manufacturer.

The Contractor shall keep accurate records of each length of cable laid. The following information shall be recorded:

- Cable drum number
- Size of cable
- Laid from where to where
- Length of cable
- Date laid.

The Contractor shall be liable for the repair of the cable due to the faulty manufacture of the cable, should this information not be recorded directly after the cable has been laid.

Every cable shall be marked by means of a aluminium label on which the size of cable and its source or destination and cable number is punched. The label shall be installed around the inner PVC sheath immediately above the cable gland.

The cable shall, after the completion of the trench, be laid with the minimum of delay.

2.9 Cable Markers

Cable markers must be provided on all cable runs at 50 m intervals on straight runs and at all bends. The position of cable markers must be confirmed on site.

Cable markers must consist of 150mm x 150mm x 300mm high concrete blocks with aluminium or other rust free metal plates marked with arrows to indicate the route.

The cable markers must protrude 25mm above ground level.

2.10 Crossing of Other Services

Where a cable crosses over other services, the cable shall not be installed at a depth less than 800 mm below ground level and if this is not possible the cable shall be installed underneath the other service and shall be protected in the prescribed manner by means of concrete slabs. The depth of the cable shall be maintained for one metre on either side of the crossing.

If it is not possible to cross over or underneath a service in the prescribed manner, the matter shall be referred to the Engineer for a decision.

The following minimum clearances shall be maintained between electrical cables and other services:

Service Type	Vertical	Horizontal
Tellecom Pipes	0,3 m	0,3 m
Water pipes	0,3 m	0,3 m
Sewer pipes	0,3 m	0,8 m
Storm water pipes	0,3 m	0,6 m
Other electrical cables	0,15 m	0,15 m

1.11 Cable Testing

The Contractor shall undertake the following tests in the presence of the Engineer before the Engineer shall agree to accept any part of the installation. The Contractor shall, furthermore undertake any other tests the Engineer may prescribe to satisfy himself that the work is of an acceptable standard.

Voltage tests

Each section of the cable installation between miniature substations shall be subjected to a preliminary voltage or insulation resistance test to prove the insulation resistance.

Continuity test

The resistance between each core and the lead sheath of the cable shall be measured for each section while the core and sheath is short circuited at the far end to ascertain if all connections have been correctly made.

All test instruments shall be of a high quality and shall, if required, be calibrated by the SABS or such body approved by the Engineer at the cost of the Contractor.

DC medium-voltage tests

Each cable circuit, including joints and terminations, shall be tested by means of a direct current voltage of 18 kV between the different cores and between the cores

and the lead sheath or copper tape screen for a period of 15 minutes. The voltage shall be gradually raise to 18 kV and kept there for 15 minutes.

The Contractor shall undertake all repairs and replacements at his own costs in the event of the installation failing the above-mentioned tests.

1.12 Structure Assemblies

All bolts and nuts shall be punched after final tensioning. The nuts and exposed bolts shall be painted with an acceptable plumbate-based galvanised iron primer.

Stay layout and planting of the stay rod is critical and the Construction Supervisor must ensure that it is done according to provided drawings.

The poles must be plumb.

Ensure that all electrical clearances are met.

A certificate, confirming that all the above was completed according to Specifications, shall be completed by the Construction Supervisor or his delegate.

1.13 Structure Earthing

All insulator bases will be bonded as per the Eskom standard. A 500mm gap will be provided and a down wire installed on all structures as per the Eskom standard.

The Construction Supervisor must accept the earthing installation at all equipment earth electrodes. The Project Engineer or his delegate will approve the results provided by the Construction Supervisor.

1.14 Risk Mitigation

Due to a high theft risk the duration of installed, but unenergized cable must be minimized. Security will be required to patrol the installed cable during the night. Due to work in close proximity to overhead lines the contractor will need to work with an Eskom permit. The contractor must thus apply for authorization at the local Eskom CNC. A safety plan must be submitted and approved by Eskom prior to start of construction. ANNEXURE 1: ENGINEERING SURVEY DRAWINGS ANNEXURE 2: WAYLEAVES & APPROVALS ANNEXURE 3: DISTRIBUTION ENVIRONMENTAL SCREENING DOCUMENT

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ANNEXURE 4: LIST OF COORDINATES ANNEXURE 5: BILL OF QUANTITIES