

ANNEXURE B

SPECIFICATIONS A - F

RUSTENBURG LOCAL MUNICIPALITY



TECHNICAL & PROJECT SPECIFICATION REGARDING “BILL OF QUANTITY” PART A TO F

RUSTENBURG LOCAL MUNICIPALITY

BID RLM/DTIS/0020: ELECTRICAL LABOUR: APPOINTMENT OF SERVICE PROVIDER/S FOR THE PROVISION SUPPLY AND DELIVERY OF LABOUR ON ELECTRICAL MAINTENANCE FOR RUSTENBURG LOCAL MUNICIPALITY AS AND WHEN REQUIRED FOR A PERIOD OF 3 YEARS

C3 Scope of Work

1 DESCRIPTION OF THE WORKS

Background

This tender is based on a "Bill of Quantity" which is a breakdown of all possible labour work that could be done if and when needed within the contract period. This type of contract consists of an enormous amount of small works orders issued and managed by different authorized RLM units and officials. The work was usually done by skilled full time employees. Thus it is not a pre-planned and dedicated once-off budgeted capital project, but the contractor and his team is regarded as RLM employees for the duration of the contract.

This is a multi-year project in order to execute Labour services **as and when requested**. The maintenance program will be for a period of three years.

The scope will be defined in every individual works-order. **The contract cannot claim any remuneration if he is not appointed for any work whatsoever. RLM reserves the right to advertise and outsource any part of the Bill of Quantity in a separate tender and to adjudicate it on a full scale basis to another Contractor.**

This includes special appointments in writing to request a complete standby team for Public Holidays, the Festive Season etc. The RLM dictates and officially instruct the Contractor to have a 24 hour standby team available to attend to all Construction and Maintenance issues by authorized RLM officials with a response time of 4 hours.

Discussion

The "Bill of Quantity" tender required fixed prices to be submitted per item (type of work). A fixed percentage (5%) rate for **Material in the event that the RLM cannot supply**, and a unit rate for **Labour (Which includes plant and material that the Contractor must supply such as lugs, sleeves etc.)** as can be seen in the "Bill of Quantity".

Work that must be done in Townships will be Labour intensive and in this event Local Labourers will be used on a day to day basis

1.17.1 The site and type of works are as follows:

Greater Rustenburg area – all required scheduled and unscheduled construction, maintenance and emergency electrical works in town as well as in the rural areas as well as possible wiring and electrical upgrading as and when needed in the Municipal buildings as required by the Directorate: Technical and Infrastructural Services. All connections to customers are also included.

1.17.2 Contractor's Site Camp

The successful contractor will be requested to erect a site camp at a centralized location within the jurisdiction of the RLM. The exact location of the site camp will be the responsibility of the successful contractor and will be established after the contract handover. The contractor shall make his own arrangements for services as well as sufficient security, to the satisfaction of the Engineer, at the site camp and as indicated in the “Bill of Quantity” under Preliminary & General.

NOTE THAT SECURITY GUARDS CAN ONLY BE CLAIMED EXTRA IF THE RLM INSTRUCT THE CONTRACTOR TO SAFEGUARD ANY RLM ASSET.

ALL OTHER MATERIAL AND ASSETS OF THE CONTRACTOR THAT NEEDS TO BE SAFEGUARDED IS THE RESPONSIBILITY OF THE CONTRACTOR.

RLM only takes responsibility after the hand-over of each project is completed.

1.18 SCOPE OF WORK

MV AND L RETICULATION & INFRASTRUCTURE

The contract comprises of the execution of all required scheduled and unscheduled construction, maintenance and emergency electrical works.

The breakdown on the “Bill of Quantity” Part A to F gives a fair indication of what might be expected. All connections to customers are also included.

The works in general comprise of the following:

- Underground high voltage
- Underground low voltage
- Overhead high voltage
- Overhead low voltage
- Drilling
- Electrical connections
- Emergency works
- Scheduled Preventative Electrical Maintenance
- Unscheduled Preventative Electrical Maintenance
- Part A to J etc.

STREETLIGHTS & HIGH MAST LIGHTING

This part of the contract comprises of the execution of all required scheduled and unscheduled Streetlights & High mast lighting related maintenance and related emergency electrical works. The breakdown on the "Bill of Quantity" Part G gives a fair indication of what might be expected

The works in general comprise of the following:

The works will, in principle include maintenance on electrical systems forming part of the existing Infrastructure being the property of the client The following disciplines are included (*if and when required*)

- Maintenance & preventative maintenance on existing street lighting system
- Maintenance & preventative maintenance on 30m High masts etc.
- Maintenance & preventative maintenance on up to 54m stadium High masts etc.
- Maintenance on underground and overhead low voltage infrastructure systems related to streetlights.
- Repairs to all control circuits
- Reporting
- All possible works as per Schedule of Quantity
- Emergency works as determined by HOD

BUILDINGS AND GENERATORS

This part of the contract comprises of the execution of all required scheduled and unscheduled building & generator related maintenance and emergency electrical works. The breakdown on the "Bill of Quantity" Part H gives a fair Indication of what might be expected

The works in general comprise of the following:

- Scheduled Preventative Electrical Maintenance, upgrading and alterations on Generators & Buildings & Facilities.
- All unscheduled building & generator & facilities related maintenance.
- All emergency electrical works related to buildings & generators in town as well as in the rural areas
- Possible wiring and electrical upgrading as and when needed in the Municipal buildings, etc.
- Implementation of generator cascading / time grading
- All possible works as per Schedule of Quantity • Emergency works as determined by HOD.
- Emergency works as determined by HOD.

SIGNALLING EQUIPMENT

This part of the contract comprises of the execution of all required scheduled and unscheduled signalling equipment maintenance and related emergency electrical works. The breakdown on the "Bill of Quantity" Part I gives a fair indication of what might be expected.

The works in general comprise of the following:

- Scheduled Electrical Maintenance on signalling equipment
- All unscheduled signalling equipment maintenance.
- All emergency electrical works related to signalling equipment in town as well as the rural areas
- Possible wiring and electrical upgrading of signalling equipment as and when needed in the Municipal networks, etc.
- Traffic signal fault finding, repairs including Cable fault location and repair.
- All possible works as per Schedule of Quantity.
- Emergency works as determined by HOD.

LOAD CONTROL RELAYS AND METERS

This part of the contract comprises of the execution of all required scheduled and unscheduled load control relay and metering equipment maintenance and related emergency electrical works. The breakdown on the "Bill of Quantity" Part J gives a fair indication of what might be expected.

The works in general comprise of the following:

- Scheduled & unscheduled Inspections on all related equipment
- Scheduled & unscheduled Electrical Maintenance on single and three phase conventional meters
- Scheduled & unscheduled Electrical Maintenance on single and three phase pre-paid meters
- Scheduled & unscheduled Electrical Maintenance on Load control relays
- Possible wiring and electrical upgrading of load control relays and metering equipment as and when needed the Municipal networks, etc.
- Issuing of notices.
- Replacement and sealing of equipment
- Reporting on a daily basis
- All possible works as per Schedule of Quantity
- Emergency works as determined by HOD.

1.19 NOTICES

The contractor shall issue all notices and make the necessary arrangements with the supply authorities/clients with respect to the installation. The contractor shall further take full responsibility for any damages caused to existing services, and will be held responsible for the cost of repairs.

The contractor shall issue all notices regarding switching operations to consumers affected by such operations.

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REQUIRED FOR A PERIOD OF 3 YEARS
RDP AREAS

SPECIFICATION

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GENERAL TECHNICAL SPECIFICATION

1. SCOPE

This specification covers the installation of material and equipment for medium and low voltage overhead lines as well as underground medium voltage cabling and accessories for a certain area.

2. GENERAL

All work and materials shall comply with the terms and directions of the latest amendment of addition of the following:

Occupational Health & Safety Act, 1993 (Act No 85 of 1993), and Regulations of the Republic of South Africa.

Post Office Act No 44 of 1958 and the requirements of the Department of Posts and Telecommunications

Electricity Act, No 41 of 1987 of the Republic of South Africa

The Code of Practice for Overhead Power lines for Conditions Prevailing to South Africa

Explosive Act, No 26 of 1956

Eskom Operating Regulations for High Voltage Systems

Eskom Distribution Standards

- Part 1 - Planning
- Part 2 - Earthing
- Part 4 - MV Reticulation
- Part 9 - Buyers Guide
- Part 10 - Construction Guide

The manufacturing of equipment, material used and all equipment shall further comply to all relevant SABS Specifications, with specific reference to the following:

SABS Standards:

- SABS 763 - Hot dipped galvanizing
- SABS 780 - Distribution transformers
- SABS 833 - High and low voltage bushings
- SABS 166/167 Insulators for lines
- SABS 178 - Insulators and conductor fittings
- SABS 182 - ACSR conductors for overhead power transmission
- SABS 753 - Pine poles and cross-arms for power transmission, low voltage and telephone systems
- SABS 754 - Eucalyptus poles and cross-arms for power voltage and telephone systems

3. ENVIRONMENTAL CONDITIONS

The system shall be suitable for operation under the following working conditions

Minimum temperature of line and earth conductor	-5°C
Maximum temperature of line and earth conductor	75°C
Wind pressure per square meter on whole projected area of line conductors	430 N/m ²
Wind pressure per square meter on whole projected area of line conductors	720 N/m ²

4. **SETTING OUT OF WORKS**

All power lines and medium voltage underground cable shall be surveyed and set out by an approved surveyor. The surveyor will be responsible for the following:

The compiling and submission of way-leave agreements where power lines and cables traverse private property.

The determining & pegging of the viable line route with the relevant regulations & standards taken into account.

The submission of an as pegged plan revealing structure types, span lengths, the angle of deviations, clearances, existing pole numbers and GPS co-ordinates of existing, transformer and switching structures.

5. **MEDIUM VOLTAGE CABLES**

5.1 Scope

This is a standard specification for the supply of underground medium voltage cables.

5.2 Applicable Standards

1. SANS 1339
Electric cables-Cross linked polyethylene (XLPE) insulated cables for voltages 3.8/6.6kV to 19/33kV
2. SANS 10198
Voltage testing after laying, jointing and terminating for cables of rating not exceeding 33kV
3. All relevant NRS specifications

5.3 Requirements

General

Medium voltage cables shall be copper or aluminium, three core, copper tape screened, PVC bedded, unarmoured PVC sheathed and shall conform to SABS 1339 – 1992 Type B, with a conductor size 50mm² or larger than 50mm²

All cable supplied under this contract shall be new.

The cables shall be able to sustain continuous conductor temperatures of 90°C, and overload excursions up to 130°C for a period of 8 hours per event. The insulation of the cable shall further withstand conductor temperatures of up to 250°C for 1 second during short circuit conditions.

Cable Ends

All cable ends shall be similar to **HEATSHRINK** or approved equivalent. The termination procedure specified by the manufacturer shall be strictly followed.

Terminations may only be carried out by a certified electrician that has completed a termination / jointing course with the manufacturer. Proof of the cable jointer's qualification shall be submitted to the Engineer.

The phase conductors shall be terminated to the switchgear terminal box / bus bars with suitable cable lugs. The conductors shall be crimped to the cable lugs. Cable lugs shall be insulated by means of a special boot rated for the nominal voltage of the cable.

Cable Joints

Joints shall only be allowed where more than one drum length of cable is necessary to complete a specified medium voltage feeder, with the prior consent of the Engineer.

All MV-cable joints used shall be similar to RAYCHEM or approved equivalent. The jointing procedure stipulated by the manufacturer shall be strictly followed.

No crossing of cores shall be made in joints of medium-voltage cables.

Joints may only be carried out by a certified electrician that has completed a termination / jointing course with the manufacturer. Proof of the cable jointer's qualification shall be submitted to the Engineer.

Lengths

Cables shall be manufactured and supplied in one length to the lengths specified unless these lengths exceed a standard drum length, in which case a ruling shall be obtained from the Engineer.

5.4 Cable Tests

After the installation, jointing or termination of a medium voltage cable, one of the following voltage tests shall be carried out prior to the energizing of the cable:

AC Over voltage commissioning tests

Test Wave	Duration (Min)	Commissioning Test Voltage (kV) r.m.s.			
		Cable Operating Voltage			
		6.6	11	22	33
VLF (0.1Hz)	60	11	19	38	57
Power Frequency	60	8	13	25	38

DC over voltage testing may not be conducted on medium voltage cabling except in cases where written permission has been obtained from the Engineer. In these cases, the voltage and duration should be limited to the following values:

DC Over voltage commissioning tests

Duration (Sec)	Commissioning Dc Test Voltage (kV)			
	Cable Operating Voltage			
	6.6	11	22	33
10	6	10	20	30

DC testing should be used for quick identification of gross faults only.

Discharging of an XLPE Cable after testing

An XLPE insulated cable should always be soft-discharged through a resistance of at least 200k Ω with the use of discharge sticks. The discharging of a cable directly to earth by means of a short circuit can cause severe damage to the cable.

It should be noted that damage to the cable as a result of any form of pressure testing due to a faulty test or test equipment will be for the account of the Contractor. Special care shall be taken to ensure that testing equipment is calibrated and that the correct test is carried out.

6. INSTALLATION OF MEDIUM VOLTAGE CABLES

6.1 General

PVC cable marking tape, 100mm wide shall be supplied and installed 400mm above all cables. The wording “Danger – Electrical Cable Below” shall be printed on all cable marking tape.

Cable markers are to be supplied and placed along the medium voltage cable routes at a spacing of 150m, and in any event, at all deviations in route, at all MV joints and at all road crossings. These shall be clearly marked to indicate a joint, route change or straight run.

6.2 Excavations

All cable trench excavation and backfilling shall be in accordance with this specification.

Medium Voltage cables shall be installed at a depth of **1000mm** and **low voltage cables** at a depth of **800mm** from final ground level to the top of the cable. For any deviation from the depths for the installation of cable specified, written approval shall be obtained from the Engineer. The cable trench shall be 600mm wide for one to three cables, and the width shall increase where more than three cables are installed in one trench.

Excavation of trenches may be done either by mechanical excavators or by hand. The definitions regarding excavation are as follows:

- **PICKABLE SOIL:** Shall mean hand pickable soil and includes loose gravel, clay, backfilled soil, loose or soft shale, loose material and rocks less than 75mm diameter.
- **SOFT ROCK:** Shall mean rock, which is hand pickable including hard shale, dense material and rocks exceeding 75mm in diameter to 0.03 cubic meter volume.
- **HARD ROCK:** Shall mean granite, quartz sandstone, slate and stone of similar hardness as well as rocks exceeding 0.03 cubic meter volumes.

Explosives may only be used for the purpose of excavations with written permission from the Engineer. The Contractor will remain responsible for all work done / damage caused by the use of explosives. The contractor shall further ensure that all work done with explosives shall comply to all conditions, regulations and requirements imposed by governing bodies.

The bottom and sides of trenches must be smooth and shall have no sharp dips or rises, which may cause tensile forces in the cable during backfilling or compaction. Trenches shall be set out and excavated in such a manner that the minimum bending radii of the cable is achieved when laying the cable.

6.3 Cable Bedding

All medium voltage cable shall be installed in a layer of **approved bedding material, 100mm below the cable to 100mm above the cable**. The bedding material shall be either sifted sand or imported sand. A sample of the material shall be approved by the engineer prior to the laying of cable.

Backfilling of trenches

Backfilling may only commence after a trench, the first layer of bedding and installed cable has been inspected, approved and signed off by the Engineer.

All backfilling shall be done in layers of **200mm**. Each layer shall be damped and compacted mechanically to achieve a 90% MOD AASHTO density.

The first layer of **200mm** of backfilling shall be sifted soil, of which **100mm below and 100mm above** the cable. The remaining backfill shall comprise of previously excavated material from which all large rocks, stones and rubble have been removed. The Contractor shall further be responsible for the removal of all rubble from site after the cable has been backfilled.

Contractors are to take note of complying with the provisions of the Occupational Health and Safety Act, 1993, regarding excavations. Open trenches shall at all times be sufficiently barricaded in accordance with the safety prescriptions.

Excavations, cable laying and backfilling operations shall be programmed to minimize damage and inconvenience to people due to open trenches, holes, dumped soil and stones. No cable trenches may be open for more than 2 consecutive days.

6.4 Cable Sleeves

All cable sleeves for electrical cables shall be supplied by the Contractor and delivered and off-loaded on site. The following types of sleeves shall be supplied:

For medium voltage cables: 160mm diameter Kabelflex type sleeves

For low voltage cables (road crossings): 110mm diameter Kabelflex type sleeves

Installation of cable sleeves:

It shall be the responsibility of the Contractor to ensure that all sleeves are correctly installed. Sleeves for road crossings shall project **1m beyond the kerb's rear edge both sides of the roads**.

The ends of all sleeves shall be sealed with paper plug before backfilling may commence.

6.5 MARKING OF CABLES

The medium voltage cable shall be installed as shown on the drawings. After these cables have

been installed, the length of the cable between each substation and mini-substation shall be measured as accurately as possible. This length shall be stenciled or engraved on both terminations at both ends of the cable.

All medium voltage cable shall be marked at all through-joints and at each cable marker by means of lead tape, clamped around the cable. The following information shall be punched onto the lead tape for the cable under consideration:

Voltage:

Cable size (mm²):

Date of installation:

Connected to:

Parallel cables must be marked:

6.6 Co-ordination with other services

The electrical services have been positioned to accommodate the execution of the works during or after the civil works (water and sewerage) have been completed in a specific area.

Where electrical cables cross other services such as water pipes, sewerage pipes, other electrical cables, pilot cables and telephone cables or where cables may be damaged by other during excavations, the electrical cables shall be protected with reinforced concrete slabs. The concrete slab shall protect the cable for at least 0.5m in both directions of the crossing.

Should the Contractor damage any service previously installed, he will be held liable for the cost of the repair, unless it is found that the particular civil service was not installed as per the co-ordinated drawings. It is the responsibilities of the Contractor to obtain up-to-date drawings to establish where other services have been installed.

7. **CLEARANCES – OVERHEAD LINES**

The minimum clearances of the conductors of the power lines shall be the following:

Maximum voltage, kV	1,1 kV & Less	12 kV	24 kV
Minimum safety clearances	-	0,20 m	-
Above ground outside townships	4,9 m	5,1 m	5,2 m
Above ground in townships	5,5 m	5,5 m	5,5 m
Above roads in townships, proclaimed roads outside townships and railways	6,1 m	6,3 m	6,4 m
To communication lines, other power lines or between power lines and cradles	0,6 m	0,8 m	0,9 m
To buildings, poles and structures not forming part of the power line	3,0 m	3,0 m	3,0 m

Clearance for shared services on Eskom structures is as follows:

The minimum mid span clearance for shared services on Eskom structures shall be:

1. Not less than 0,2 m between insulated LV power cables and telecommunication cables
2. Not less than 1,5 m between bare MV power conductors and telecommunication cables at the worst conditions of sag; and

3. For Telkom ground clearances

over roads	6,1 m
along roads in towns	3,7 m and
along roads outside towns	3,0 m

The minimum clearances for shared services on a structure are:

1. Telkom to ground 4,3 m
2. Telkom to low voltage 0,9 m
3. Telkom to medium voltage 1,5 m

8. CROSSING OF OTHER SERVICES

The following conditions shall apply when crossing a proclaimed road, communication line and a railway line:

1. Structures supporting crossing spans shall be so located that they will not touch the service crossed should the structure overturn
2. One structure supporting a crossing shall be placed as close as possible to the service crossed taking the aforementioned condition into consideration
3. The deviation from a right angle when crossing a communication line shall not be greater than 30°.
4. A clearance of 4,5 m shall be maintained in the span crossing a proclaimed road when a broken conductor condition occurs in any other span that the crossing span.
5. No joints shall be made in a span crossing a service.

9. CONDUCTOR TYPES & SPAN LENGTHS

The MV conductors shall consist of Aluminium Conductor Steel Reinforced “ACSR” conductors.

The following standard British size ACSR conductors shall be used having characteristics as indicated in the table below:

Code	Stranding And wire Diameter (mm)	Overall Diameter (mm)	Nominal Aluminium Area (mm ²)	Breaking Load (kg)	DC Resistance At 20°C (ohm/km)	Current Rating (A)
Fox	6/1/2,79	8,37	36,68	1340	0,7822	190
Mink	6/1/3,66	10,98	63,13	2230	0,4546	260
Hare	6/1/4,72	14,16	104,98	3670	0,2733	360

The maximum span lengths, sag and tension shall be as set out in the standard Eskom specification reference DISASAAM2.

10. POLES

Concrete poles shall be used as the standard pole. Concrete poles shall be of the Rocla, Infraset or similar approved manufacture. Concrete poles offered shall be Eskom approved. Concrete poles shall be for the cast type and shall have the following minimum tip strengths:

7m concrete pole	4kN
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9m concrete pole	6kN
11m concrete pole	8kN
13m concrete pole	10kN

All concrete poles shall be casted with sleeves for the installation of the equipment.
All poles shall bear the SABS mark.

Poles shall be planted at the following depths:

<i>Pole Length (m)</i>	<i>Tip Diameter (mm)</i>	<i>Planting Depth (mm)</i>
5	80	1000
7	120	1300
9	140	1500
10	160	1700
10 (Transformer)	180	1700
11	140/180	1800
13	160/200	2000

Pole holes shall be backfilled and compacted at layers not exceeding 100mm. The approved backfilled material shall be damped and compacted to a density of 90% of MOD AASHTO.

11. STAYS

The standard LV and MV stays assemblies shall be rated 35 and 96kN respectively. Stay wire shall be manufacturers from fully galvanized 11000MPA steel, and shall be 3/3.35 and 7/4mm for LV and MV respectively. Stays shall be connected to the pole by means for a double wrap guy grip, and shall be fitted with strain insulators.

All materials as well as the stay configurations shall fully comply to Eskom drawing D-DT-0341.

The number of stays per structure shall vary to suit the structure type, conductor size and line deviation angle. Where a 60° deviation is exceeded, bisector (two stays) shall be fitted to the structure.

Stays to be installed on strain structures shall impose as little crippling load as possible on the supporting poles.

12. TRANSFORMERS

All distribution transformers shall be in accordance with the requirements of SABS 7810 of 1979.

All transformers to be supplied shall be new. The contractor shall further ensure that the supplier of transformers is registered with Eskom and can be requested to provide proof or registration in writing.

Transformers, **50kVA and smaller**, shall always be mounted on a single transformer pole.
100kVA transformers shall be mounted on a single pole or platform mounted on a two-pole structure.
200kVA transformers shall be platform mounted on a two-pole structure.
315kVA and 500kVA transformers shall be platform mounted on a four-pole structure.

13. INSULATION CO-ORDINATION

Insulation co-ordination and the bonding of structures shall be performed as specified in App

B of SCSASABE 7 revision 1 of the MEDIUM VOLTAGE RETICULATION STANDARD.

The following table is a guideline for the bonding and BIL levels of structures:

<i>1</i>	<i>2</i>	<i>3</i>
	LIGHTNING STRIKERS PER YEAR	
<i>Pollution Level</i>	<i>Low (2 or Less)</i>	<i>High (More than 2)</i>
Low / Medium (Few / No Pollution related incidents)	<ul style="list-style-type: none">➤ No Bonding of insulators required➤ No BIL down conductor required➤ Use a 1,2MV BIL	<ul style="list-style-type: none">➤ Provide a 500mm gap between the BIL down wire and the nearest MV insulator➤ No Bonding between insulators is required unless vertical staggered bonding is required➤ Use a 300kV BIL
High / Very High (Frequent pollution related incidents)	<ul style="list-style-type: none">➤ Bonding of insulators required➤ No BIL down conductor required➤ Use a 1,2MV BIL	<ul style="list-style-type: none">➤ Provide a 500mm gap between the BIL down wire and the nearest MV insulator➤ Bond Between insulators➤ Use 300kV BIL

For the lightning ground flash density of certain areas of South Africa, refer to App B of SCSASABE 7 revision 1 of the MEDIUM VOLTAGE RETICULATION STANDARD.

14. EARTHING

The earthing shall comply with SCSASAAL 9 revision 2 of the EARTHING STANDARD.

Standard earth electrode configurations shall comply with Table 3 of the earthing standards for the applicable soil resistivity range. The Contractor shall undertake the necessary soil resistivity tests prior to the installation of the earth electrode. The soil resistivity results together with the Contractor's proposal for the electrode type shall be submitted to the Engineer for approval prior to the commencement of the installation.

The following are the maximum allowable electrode resistances:

- MV electrode resistance - 30 ohms
- LV electrode resistance - 20 ohms

The earthing of the transformers shall comply with the requirements of drawing on D-DT-0627 (sheet 1 of 2) rev 4 of the Earthing Standards.

In general the earthing of a transformer structure includes the following:

1. The star point of the transformer LV winding shall be earthed
2. The MV surge arrestors, transformer tank and other metalwork shall be bonded to the MV earth electrode (See D-DT-0628)

3. A combined MV / LV earth electrode may be employed only where the electrode resistance to earth does not exceed 1Ω .

Where separate MV & LV earths are used:

- The MV and LV earth electrodes shall be separated by not less than 5m.
- A neutral surge arrester in accordance with D-DT-3088 shall be installed between the LV neutral terminal and the transformer tank, and
- Care shall be exercised to ensure that there are no metallic or low impedance conducting path between the MV and LV earths.

15 NUMBERING OF STRUCTURES

Allowance shall be made by the bidders for the numbering of medium voltage poles in accordance with Eskom's standards for the numbering of high voltage equipment. In cases where a pole supports both low and medium voltage, both the medium and low voltage pole numbers will be displayed on the pole.

Wooden poles shall be numbered with an aluminium plate, fixed to the pole with nails, numbered by means of a punch, with the place and number sizes in accordance with Eskom's specification.

Concrete pole numbers shall be painted with a stencil. (Yellow background with 75mm black lettering). Provision shall further be made for MV line voltage identification plate and danger signs on all switching and transformer structures.

16 SAFETY

The Contractor shall make the necessary arrangements with the Supply Authority for the de-energizing of the network prior to any work being undertaken on the networks. The Contractor shall ensure that he is in possession of "permit to work" on the existing installation at all times when work is being undertaken on the existing installation.

Under no circumstances shall the Contractor or any of his personnel work on any structure which is live. The contractor shall be solely held responsible for any accident which may occur due to the failure of his personnel to conform to this stipulation.

17 LV ABC

The low voltage ABC shall conform to SCSSCAAD5. The following conductor sizes will be used:

- x 35 mm² phase conductor + 35 mm² bare neutral
- 1 x 35 mm² phase conductor + 35 mm² bare neutral
- x 70 mm² phase conductor + 50 mm² bare neutral

18 SPAN LENGTHS, SAG AND TENSION

The following span lengths, sag and tension charts shall be applicable:

1. Medium voltage:
The maximum span lengths shall be as per Tables D2, D3 and D4 for Fox, Mink and Hare conductors as set out in Annexure D of the medium voltage Distribution Standards.
The sag and tension shall comply with the tables in Annex B of the Medium Voltage Distribution Standards for the relevant conductor size and span lengths.

2. Low Voltage ABC

The sag and tension for the ABC conductor shall comply with the tables in Annex B of the low voltage Distribution Standards for the relevant ABC and span lengths.

19 SERVICE CONNECTIONS

The service connections cables to the houses shall all be underground **10mm² 2 Core Copper** PVC insulated, PVC Bedded, SWA, PVC sheathed low voltage cables.

The service connections shall thus comprise of the following:

- 1 – 4 or 5 – 8 pole mounted service PVC distribution boxes.
- **10mm² 2 Core Copper** PVC insulated, PVC Bedded, SWA, PVC sheathed low voltage cables.
- ECU/EDU mounted inside the house or housed in an outside enclosure.

20. MATERIAL SPECIFICATIONS

All materials shall conform to the latest Eskom material specification and shall be Eskom approved.

21. LINKS

The positions of huklinks shall be indicated to the Contractor once he commences on site.

22. SERVICE CONNECTION INSTALLATION

22.1 Pole Top Boxes

1. The **PVC** pole top box shall be installed on the pole approximately 300 mm beneath the ABC conductors. The pole boxes shall be connected to the ABC by means of the IPC's specified.
2. Approved compression glands (PVC/Steel) compression glands shall be used for the termination of the **10mm² 2 Core Copper Cables**. Unused outlets shall be blanked off.
3. All consumers supplied from a **PVC** pole top box shall be connected to the same phase except where a 5 -8 way pole top box is used, the consumers will be connected to two phases.

22.2 Service Connection Cable and ECU/ED

1. The service connection cable shall be 10mm² 2 Core Copper Cable. The Contractor shall supply and deliver to site the quantities of 10mm² 2 Core Copper Cable required.
2. The ECU/ED shall be installed in a wall mounted outdoor housing as approved by Eskom. The position of the ECU/ED shall be as close as possible to the termination point of the 10mm² 2 Core Copper Cable. The housing shall further be fixed to the walls by means of M12 rawl bolts. 10mm 2 Core Copper Cable mounted on the outside shall be surface mounted in vertical and horizontal runs and shall be fixed by saddles and "fisher" plugs at intervals not exceeding 500mm.

3. A 20 mm hole shall be drilled through the wall of the structure for the installing of the 10mm² 2 Core Copper Cable onto the structure. No chasing through the wall will be allowed. A PVC compression gland shall be installed to protect the cable where the walls of the structure comprise of corrugated iron sheeting.
4. The ready board/double SSO shall be installed as close as possible to the position where the 10mm² 2 Core Copper Cable enters the structure. The position shall be agreed to with the owner of the dwelling prior to the installation. Where it is not possible to install the ready board/double SSO close to where the cables enters the structure, the 10mm² 2 Core Copper Cable shall be surface mounted, fixed by means of saddles using "Fisher" type plugs and screws at intervals not exceeding 500 mm, in horizontal and vertical runs.

23 ECU/ED

1. The ECU/ED shall be supplied by the contractor unless otherwise specified.
2. The ECU/ED shall be mounted inside an enclosure fixed to the outside wall of brick built structures by means of four rawl bolts or approved similar means. "Fisher" type plugs and screws will not be acceptable. Where the walls of structures are not suitable for mounting the ECU/ED by means of rawl bolts or similar means, four holes shall be drilled through the structures and the ECU/ED shall be mounted using either galvanized M12 bolts, washers and nuts in the case of corrugated iron structures or galvanized M12 rods with washers and nuts with 60 mm x 60 mm x 6 mm galvanized square washers installed on the outside of the structure. The Contractor shall ensure that the ECU/ED plus ready board is installed completely level.

24 CERTIFICATE OF COMPLIANCE

1. The Contractor shall, in terms of the Occupational Health and Safety Act, issue and handover to the consumer the "Certificate of Compliance" for each connection forming part of the installation after testing and commissioning the installation. A copy of the Certificate of Compliances shall be handed to the Engineer within seven days of the issue thereof.
2. The Contractor shall furthermore submit the following information in the manner and format as required by the Engineer:
 - Consumer's name
 - Stand number
 - Pole number from where the connection has been made
 - Serial number of the ECU/ED
 - Date of installation

25 CONNECTION TO THE EXISTING NETWORK

The Contractor shall liaise with the Supply Authority for the connection of the MV lines to the existing network.

26 PROGRAMME OF WORKS

26.1 ISSUING OF WORK FOR MAINTENANCE

During Normal Working Hours

Maintenance work will be issued from the Rustenburg Electrical Engineering Services Workshop / Call Centre in the form of a maintenance request. The successful tenderer will be requested to collect the maintenance request form from the Electrical Engineering Services, investigate the fault and repair at rates indicated or submit a quotation if required. All works as stated above is to be covered under the

call out fee in the schedule of quantities.

If material other than the standard that has to be on the maintenance vehicle or equipment has to be procured or imported the works can be carried out after an additional return trip for which travelling can be claimed based on the distance from Rustenburg Electrical Engineering Services Workshop.

After Normal Working Hours

Maintenance work is to be carried out based on verbal instruction given by a representative as nominated by the Client. The said representative is responsible for the issuing of a maintenance request form before 12H00 on the first next working day.

Remuneration for after hours work will be based on the same rates and principles as per the normal contract. Provision was made the preliminary and general section for the pricing of the cost associated with the making available of standby personnel.

26.2 TIME FOR THE EXECUTION OF THE WORK

The successful tenderer will be requested to react to all normal maintenance work within 12 hours from the receipt of a maintenance request.

Emergency work is to be reacted to within 3 hours from the time the request was received.

The contractor shall at all times program and execute the work in such a way that the least possible disruption is caused to other construction activities, traffic and residents.

The Client reserves the right to cancel the maintenance contract with a 30 day written notice at any given time. Cancellation of the contract will be considered under the following circumstances other than that stipulated in the GCC:

- Insufficient resources resulting in reaction time to maintenance requests being longer than that stipulated; Insufficient supervision; Not adhering to the Electrical Local Municipality's Safety Policy and the approved safety plan.

26.3 SUPERVISION

The works shall at all times be carried under the supervision of a skilled and competent representative of the contractor.

The representative shall be authorized to receive instructions on behalf of the contractor and shall be an electrician registered at the Electrical Contractors Board of South Africa for each discipline which applies to the normal and standby teams.

The supervisor must at all times take note of the possible existence of existing infrastructure. Damages caused to existing infrastructure / structures due to neglect will be for the account of the successful tenderer.

26.4 MATERIAL

All material or equipment supplied under the contract will be similar to the equipment replaced. Deviations shall only be allowed with the written consent of the Head: Electrical Engineering Services. In cases where new infrastructure is being installed, all equipment shall conform to the relevant SABS standards and shall bear the SABS mark.

All material supplied under this contract shall be new. Used materials shall only be used with written permission from the Head: Electrical Engineering Services.

The materials removed from the system will remain the property of the RLM. The contractor will be requested to deliver such materials / equipment to the RLM's storage facility.

The contractor may be requested to install materials supplied by the RLM. The contractor shall take delivery of such material and accept full responsibility and safeguarding (in terms of the contract) thereof until the completion of the work.

Remuneration for equipment will be based on the standard percentage mark-up as specified in the Bill of Quantities. All forms of settlement discount will be taken into account when calculating the markup or final rate.

27 AS-BUILT DRAWINGS

One complete set of drawings shall be installed on the walls in the site office of the contractor. The drawings shall be updated daily by the Contractor to indicate changes in the installation. The updated drawings shall be handed to the Project Manager at the completion of each assessment stage.

28 PROGRESS REPORTS

The Contractor shall submit a weekly progress report. The form of these reports will be made available when the tender is awarded.

29 INVOICES – LOCAL LABOUR DETAILS WHEN APPLICABLE

The Contractor shall submit a Compulsory Local Labour report (Form 1 to 5) fully completed with every monthly invoice. Failure to submit the forms will result in non-payment.

- 1 Payment certificates will be done once a month.

All claims for payment should include the following per maintenance request

- a) Maintenance request / order form
- b) Accepted quotation (if applicable)
- c) Copies of the invoices of all material procured
- d) Itemized bill of quantity rate for labour work conducted
- e) Day work rates for items not covered in the schedule of quantities with time sheets.

Allowance should be made for the necessary travelling for investigation or repairs.

Basic faults can be repaired during the investigation.

Travelling as per the day work rates section will only be paid if special material / equipment as required for the completion of the work. Travelling will in all cases be based from the Electrical Engineering Services Workshop in Rustenburg up to the place of the fault.

Payment for materials will be based on the standard 10% markup on material (as prescribed completed in the schedule of quantities). The contractor should note that the claim for payment should include copies of the invoices for materials supplied. **No payment will be made if the actual invoices are not attached to the claim for payment.**

Labour rates will be based on the rates entered in the schedule of quantities. The rates are fixed for the first 12-months, thereafter escalation will be calculated and implemented as indicated in the schedule of quantities. Dayworks rates will be used where no rates are available in the schedule of quantities. Any dayworks rates claim should be accompanied by the necessary time sheet for people as well as a log sheet for any form of machinery or LDV's. Travelling will in all cases be remunerated from Rustenburg Electrical Engineering Services Workshop.

RDP Guiding specifications

30 GENERAL

This specification shall be read in conjunction with the other parts of this document. (Bills of Quantities and Contract Drawings)

This part of the documentation shall have preference. Should there be any discrepancies between the detail and general specification; preference should be given to the detail specification. The existence of discrepancies between the detail specification, the bills of quantities and the drawings should however be brought under the attention of the Engineer.

The works will be handed over to the Rustenburg Local Municipality upon completion thereof.

31 SCOPE OF WORK

31.1 The Site where this work will be done

This specification covers the installation of material and equipment for medium and low voltage overhead lines as well as underground medium voltage cabling and accessories for the RDP area.

The works can in general comprise of the following:

Collection and installation of 400mm sq 3C Al underground cables and associated terminations.

Replace 11kV- O/H lines on 11m concrete poles in accordance with Eskom Standards.

Collection and installation of pole-top transformers.

Installation of pole mounted transformer structures.

Installation of pole top boxes, underground 10mm 2 Core Copper Cable service connections, EDU's and ready boards

Installation of earthing systems.

Testing and commissioning of the works and COC's in the event of connections made.

32 NOTICES

The contractor shall issue all notices and make the necessary arrangements with the supply authorities/clients with respect to the installation. The contractor shall further take full responsibility for any damages caused to existing services, and will be held responsible for the cost of repairs.

The contractor shall issue all notices regarding switching operations to consumers affected by such operations.

33 DRAWINGS IN THE WORKS ORDERS

The drawings in general indicate the scope of electrical work to be performed under the contract, and do not show minute detail of the work to be executed.

34 SUPERVISION

The works shall at all times be carried under the supervision of skilled and competent representative of the contractor. The representative shall also be authorized to receive instructions on behalf of the contractor.

35 SITE INSTRUCTION BOOK & SAFETY

The contractor shall supply a site instruction book. The site instruction book shall be an A4 triplicate book and must at all times be available in the site office.

All site instructions, variation orders, abnormal occurrences and rainfall shall be noted in the site instruction book as well as the progress on all projects.

The successful tenderer will be required to compile a safety plan in accordance with the new OHS act. The safety plan should be submitted to the client for approval prior to the commencement of work.

The plan should be compiled by a specialist / Consultant and submitted prior to the starting with any works.

An item in Bill AA (Schedule of Quantities) were provided where all bidders should price for the compilation of the safety plan. The general compliance to the safety plan should also be allowed for under this item where expenses like a safety officer, daily safety checks, safety equipment and monthly safety meetings could be allowed for.

36 MATERIAL

The client shall supply all material or equipment required except for items such as putty, ferrules, lugs etc. not forming a part of a kit. The contractor shall take delivery and install such material or equipment. Material supplied by the Municipality cannot be claimed.

The installation price in the “Bill of Quantity” shall make provision for the time to install the material as well as the loading, transport, offloading etc. of the material issued.

Loading, transport, offloading etc. of material issued by the RLM CANNOT BE CLAIMED AS A SEPARATE CLAIM – INCLUDED IN RATES

All material and equipment supplied by the successful tenderer shall be in accordance with the latest RLM/Eskom standards.

All materials to be supplied by the Contractor shall be new.

SUPPLY AND CONNECTION

Not applicable

37 CABLES AND INSTALLATION OF CABLES

37.1 Excavations

All trenches for the installation of cables shall have a minimum depth of 1000 mm, and shall be 1000 mm away from the stand boundary. The contractor will be responsible for the marking and verification of stand pegs prior to trench inspections as well as the locating and exposure of existing services on the cable route.

The floor of the excavated trench shall be finished off to a smooth surface and shall follow the natural contour of the surrounding area. Trenches shall not be left open for more than 2 consecutive days. The contractor shall further ensure that open trenches are clearly marked to avoid injury to construction personnel and local residents.

The digging of the trenching shall further be programmed with other contractors onsite to cause the least possible disruptions.

37.2 Installation of Cables

All cables shall be installed in accordance with the General Electrical Specification of this document.

Bedding for medium voltage cable shall be imported river sand. Bedding for low voltage cable shall be sifted.

The successful contractor shall further take note of the following inspections:

- **An open trench inspection, with the bedding material stored next to the trench.**
- **An inspection when the first layer of bedding and cables has been installed.**

The contractor will be responsible for the marking and verification of stand pegs prior to trench inspections.

The Engineer should be notified two days in advance of the above inspections so that the Rustenburg Local Municipality can be notified.

The contractor shall install standard 100 mm wide yellow PVC danger tape with red wording, along the complete cable route. In cable trenches with a width of 700 mm and more, 2 sets of danger tape shall be laid 300 mm apart.

The sidewalk or ground level along the cable trench shall be leveled off and left tidy and clean after completion of the backfilling process. The contractor shall remove all surplus material from site and suitable disposed of. Cost hereof shall be included in his rates.

37.3 Cables

All cables supplied by the RLM is manufactured in accordance with the relevant sections of the General Technical Specification of this document and shall be of the Aberdare or African Cables manufacture.

11 kV cables shall be 3C Al 6,35/11 kV type B XLPE and shall be installed at a depth of 1 m below final ground level.

The contractor shall further confirm the position of all cables with the representative of the engineer and Local Authority prior to excavations.

No cable shall be laid, or trenches backfilled prior to an inspection by the representative of the Engineer. The Engineer shall be notified 24 hours in advance of such an inspection.

37.4 Termination of Cables

All medium voltage cable shall be terminated with RLM procured Raychem terminations with the heat shrink boot kit as approved by the Rustenburg Local Municipality.

38 **MEDIUM AND LOW VOLTAGE OVERHEAD LINES & ACCESSORIES**

All O/H/ line equipment and materials installed shall be in accordance with the latest RLM/Eskom Distribution Standards

38.1 Setting Out of Works

All structures forming part of the internal electrical infrastructure system will be pegged and installed at specified offsets from the stand pegs.

The pegged internal system will have to be inspected and signed off by a representative from the Engineer before construction may start.

38.2 Bush Clearing

The Contractor shall be responsible for all bush clearing. Most of the power lines will be erected in the existing road reserves or in the mid-block configuration between stands and therefore the bush clearing will consist mainly of the clearing of shrubs with individual trees.

The Contractor shall ascertain as part of his own inspection of the area conditions and the extent of bush clearing required.

38.3 Medium Voltage Networks

The medium voltage network shall be constructed in accordance with the following particular specification:

Configuration	Staggered vertical configuration – 600 mm spacing Delta Configuration (Within the township)
Nominal Line Voltage	11,000 Volts
Conductor	ACSR Code Name Hare and Fox
Basic Insulation Level (BIL)	300 kV
Poles	11 m Concrete – 8 kN
Insulator Material	Cycloaliphatic
Stays	Conventional type for medium Voltage O/H Lines – 96 kN
Numbering	To Eskom Standard

38.4 Distribution Transformers

The following transformers will/can be used in the contract:

25/50kVA 11000 / 400 / 231 V three phase
100kVA 11000 / 400 / 231 V three phase
200kVA 11000 / 400 / 231 V three phase
315kVA 11000 / 400 / 231 V three phase

Transformers, 50 kVA and smaller, is usually mounted on a single transformer pole.
100 kVA transformers shall be mounted on a single pole or platform mounted on a two-pole structure.
200 kVA transformers shall be platform mounted on a two-pole structure.
315 kVA and 500 kVA transformers shall be platform mounted on a four-pole structure.

All transformer structures is equipped with and may be replaced / maintained:

1. Drop out fuses
2. 11 kV surge arrestors
3. Low voltage fuses (a set of three) rated at 160A (Morsdorph type)
4. Neutral arrestor
5. Earthing arrangement as per Eskom requirements – Separated MV and LV earth

38.5 Anti - Climbing Up Devices

Anti-climbing up devices on all transformer poles and Medium Voltage strut poles may be replaced. The device consist of a piece of security blade fence, wrapped around the pole form 2 m to 4 m above ground level, stapled at every turn spaced at a maximum of 100mm. See Eskom specifications for full details.

The security blade fence shall be fixed with bandit strap in the case of concrete poles.

38.6 Excavation and Planting of Poles and stays

Pole holes will be excavated monthly in the mid-block between 500 and 1000 mm from the existing sewer lines and stand boundaries. The successful contractor should (in his rate for the excavation of pole holes) allow for:

1. The determining of the position and depth of existing services
2. Hand-excavation of the 500 mm layer above the line

Damage to existing services as a result of not obeying the aforementioned will be for the account of the contractor.

Poles and stays will be positioned to cause the least possible disruption to accesses to dwellings and stands.

Due to the occurrence of clay in the area, the successful contractor shall make provision for a pole / stay or strut pole hole that is 1 m long and 1 m wide to the specified depth. The hole shall be backfilled with Norite in layers not exceeding 150 mm damped and compacted to achieve a compaction of 90% MOD AASHTOO. The excess clay, rubble and soil surrounding the pole shall be removed after pole has been planted.

38.7 Earthing of infrastructure system

The complete infrastructure system is earthed by means of a split MV and LV earthing system at each transformer pole. In addition to the crow's feet specified and LV earth spike (1.5 m in length) is installed at each LV termination structure. The internal earth within the concrete pole is used to connect the bare neutral of the ABC to the earth spike.

38.8 Low voltage supply poles

Low voltage infrastructure poles from where dwellings will be connected is supplied with pole top boxes from where 10mm 2 Core Copper Cable service connections are supplied. Each dwelling is supplied from a CBI type QU-1 orange toggle 30A moulded case circuit breaker.

A 1 to 4 way pole top box is equipped with 1 to 4 30A circuit breakers. These breakers are supplied from one phase of the three phase infrastructure system. Pole top boxes which supplies more than 4 houses are equipped with 4 to 8 circuit breakers supplied from two phases of the three phase infrastructure system.

The pole top boxes are mounted and fixed as per the Eskom standards. All 10mm 2 Core Copper Cable connections are connected with approved compression glands where it enters the pole top box.

38.9 Service Connection installation

Service connections are by means of underground 10mm 2 Core Copper Cable. The 10mm 2 Core Copper Cable are grouped by means of cable ties from the pole top box to the top of the kicker pipe at intervals not exceeding 500 mm. The grouped cables are fixed to the concrete poles by means of bandit strap at 1 m intervals. PVC sheathes are provided at the bandit straps to avoid damage to the grouped 10mm 2 Core Copper Cable.

Each low voltage pole with a pole top box are supplied with a 50 mm galvanized kicker pipe that will be installed from 300 mm below ground level to 2700 mm above ground level. The kicker pipe is fixed by

means of bandit strap at intervals not exceeding 800 mm.

2 Core Cu Cable service connections are installed underground at a depth of 600 mm. The actual route is a straight line from the infrastructure pole to the closest wall of the dwelling.

2 Core Cu Cable entries to the dwelling are from floor level on the inside to 100 mm below ground level on the outside. No exposed 2 Core Cu Cable is allowed on the outside. The fixing of 2 Core Cu Cable on the inside is by means of suitably sized galvanized saddles fastened to the inside wall by means of “Fisher plugs” at 800 mm intervals. 2 Core Cu Cable is installed in neat horizontal and vertical runs. Damage to the plasterwork as a result of drilling when replaced shall be fixed in all cases.

38.10 Pre-Paid Energy Meters and Ready Boards

All pre-paid energy meters and ready boards to be replaced shall be supplied by the RLM. The combined units mounted on a passive base will be issued. The tenderer will be responsible for the collection of – at RLM stores, safe keeping and installation of the units in the event of replacements.

The units will be mounted inside each dwelling to the closest wall facing the supply pole. Provision will be made for four M10 rawl bolts for the fixing of the unit. Alternatively M10 threaded rod may be used. The rod shall be installed through the outside wall of the dwelling fitted with bolts and 50 mm washers on both sides. Excess rod will be cut off flush to the bolt, and the installation will be patched with plaster where damage to the wall has occurred as a result of the drilling.

Under no circumstances will “Fisher plugs” be accepted for the fastening of the passive base.

38.11 Labeling of system

Provision shall be made for the following labels to the infrastructure system when required.

1. Numbering of all concrete poles (MV and LV) by means of yellow painted background with black stenciled 75 mm lettering as per the drawings
2. Numbering of all link and fuse structures by means of name plates
3. Numbering of all transformer structures by means of name plates
4. Labeling of all circuit breakers in the pole top boxes by means of stickers.

The number plates on link- and transformer structures and houses shall be 0.6 mm yellow painted mild steel plate with 75 mm black letters.

38.12 Connection to the Existing Network

Allowance shall be made for the liaison with the RLM for inspections, the scheduling of outages for the connection to existing networks or to do maintenance and all the general scheduling with the representatives from RLM.

38.13 Reinstating of Fences

The Contractor shall be responsible for reinstating all fences damaged or removed in the execution of the contract.

38.14 Testing & Commissioning

Every dwelling connected shall be tested in accordance with the requirements of the SANSO 142. A

certificate of compliance from the ECA shall be issued for every house where work has been done.

38.15 DRAWINGS IN THE WORKS ORDERS

The drawings in general indicate the scope of electrical work to be performed under the contract, and do not show minute detail of the work to be executed.

38.16 SUPERVISION

The works shall at all times be carried under the supervision of skilled and competent representative of the contractor. The representative shall also be authorized to receive instructions on behalf of the contractor.

38.17 SITE INSTRUCTION BOOK & SAFETY

The contractor shall supply a site instruction book. The site instruction book shall be an A4 triplicate book and must at all times be available in the site office.

All site instructions, variation orders, abnormal occurrences and rainfall shall be noted in the site instruction book as well as the progress on all projects.

The successful tenderer will be required to compile a safety plan in accordance with the new OHS act. The safety plan should be submitted to the client for approval prior to the commencement of work.

The plan should be compiled by a specialist / Consultant and submitted prior to the starting with any works.

An item in Bill AA (Schedule of Quantities) were provided where all bidders should price for the compilation of the safety plan. The general compliance to the safety plan should also be allowed for under this item where expenses like a safety officer, daily safety checks, safety equipment and monthly safety meetings could be allowed for.

38.18 MATERIAL

The RLM shall supply all material or equipment required except for items such as putty, ferrules, lugs etc. not forming a part of a kit. The contractor shall take delivery and install such material or equipment. Material supplied by the Municipality cannot be claimed.

The installation price in the “Bill of Quantity” shall make provision for the time to install the material as well as the loading, transport, offloading etc. of the material issued.

Loading, transport, offloading etc. of material issued by the RLM CANNOT BE CLAIMED SEPERATE!!!!

RUSTENBURG LOCAL MUNICIPALITY

DIRECTORATE: TECHNICAL & INFRASTRUCTURAL SERVICES

UNIT: ELECTRICAL ENGINEERING SERVICES

SPECIFICATION NO G-013/1

**APPOINTMENT OF SERVICE PROVIDER/S FOR THE PROVISION SUPPLY AND DELIVERY OF LABOUR
ON ELECTRICAL MAINTENANCE FOR RUSTENBURG LOCAL MUNICIPALITY AS AND WHEN
REQUIRED FOR A PERIOD OF 3 YEARS**

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SPECIFICATION NO G-013/1

APPOINTMENT OF SERVICE PROVIDER/S FOR THE PROVISION SUPPLY AND DELIVERY OF LABOUR ON ELECTRICAL MAINTENANCE FOR RUSTENBURG LOCAL MUNICIPALITY AS AND WHEN REQUIRED FOR A PERIOD OF 3 YEARS

1. SCOPE

This specification covers the requirements for the supply of material and the erection, testing and commissioning of medium and low voltage open conductor overhead power lines. Low voltage is defined as being 0 – 1 000 Volt. Medium voltage is defined as being above 1 000 Volt up to 22 000 Volt.

2. STANDARDS

2.1 RELEVANT ACTS, REGULATIONS AND STANDARDS

All work and materials shall comply with the terms and directions of the latest amendment or addition of the following:

- 2.1.1 Occupational Health and Safety Act, 1993 (Act No 85 of 1993),
- 2.1.2 Post Office Act No 44 of 1958 and the requirements of the Department of Posts and Telecommunications.
- 2.1.3 Electricity Act, No 41 of 1987 of the Republic of South Africa.
- 2.1.4 The Code of Practice for Overhead Power lines for Conditions Prevailing in South Africa of the SAIEE (latest edition) and the Project Specification.

2.2 STANDARD SPECIFICATIONS

The following standard specifications shall be read in conjunction with this specification:

- 2.2.1 Standard guidelines for overhead reticulation
- 2.2.2 Materials: MV and LV overhead line reticulation; G-014/1.

3. GENERAL

Construction type

The type of construction will be as shown on the drawings for each type of structure.

Notices

Before the contractor intends erecting conductors across public roads, telephone lines or other power line servitudes, he shall be responsible for giving adequate notice to the appropriate authorities of the date on and time when he proposes performing the work.

All materials shall be new and SABS certified. All certificates must be submitted to Rustenburg Local Municipality before switch-on.

4. FACTORS OF SAFETY

Each structure used on this project shall have the following factors of safety:

Wooden structures not continually loaded 3,5

Wooden structures continually loaded 5,5

Line conductors, based on ultimate strength 3,0

Insulator units including caps and pins based on minimum working load 3,0

The structures shall furthermore have a factor of safety of 1,5 under a broken conductor condition.

No failure or permanent distortion shall occur to any structure when subjected to a load equivalent to 1,5 the maximum unbalanced load due to a broken conductor condition.

A broken conductor condition shall be assumed when any one conductor breaks without restriction as to the span in which the condition occurs.

5. CLEARANCES

The minimum clearances of the conductors of the power lines shall be 0,2 m more than stipulated in the following table to cater for sagging except when otherwise stipulated by the Head: Electrical. For instance the construction of a line crossing Power lines shall have a installation clearance of a minimum of $0,8 + 0,2 = 1,0$ m.

Maximum voltage, kV rms. Clearance phase to phase	<u>1,1 kV or less</u>	<u>12 kV</u>
Minimum safety clearance	-	0,20 m
Above ground outside townships	4,9 m	5,1 m
Above ground in townships	5,5 m	5,5 m
Above roads in townships, proclaimed roads outside townships and railways	6,1 m	6,3 m
To communication lines, other power lines or between		
Power lines and cradles	0,6 m	0,8 m
To buildings, poles and structures not forming part of the power line	3,0 m	3,0 m

6. MAXIMUM AND MINIMUM WORKING CONDITIONS

The following maximum and minimum working conditions shall be used:

Minimum temperature of line and earth conductor -5° C

Maximum temperature of line and earth conductor 75° C

Wind pressure per square meter on whole projected area of line conductors 430 N/m

Wind pressure per square meter on 1½ time projected area of one face of structures 720 N/m

7 CROSSING OF SERVICES

The following further conditions shall apply when crossing a proclaimed road, communication line and a railway line:

Structures supporting crossing spans shall be so located that they will not touch the service crossed should the structure overturn.

One structure supporting a crossing shall be placed as close as possible to the service crossed taking the aforementioned condition into consideration

The deviation from a right angle when crossing a communication line shall not be greater than 30°
A clearance of 4,5 m shall be maintained in the span crossing a proclaimed road when a broken conductor condition occurs in any other span than the crossing span

No joints shall be made in a span crossing a service

8. MATERIALS & EQUIPMENT

The following material and equipment shall be in accordance with Electrical Engineering Services' standards:

- 8.1 Wooden Poles
- 8.2 Steel Poles
- 8.3 Concrete Poles
- 8.4 Conductors
- 8.5 Insulators
- 8.6 Conductor Joints
- 8.7 Hardware and Fittings
- 8.8 Cross-Arms
- 8.9 Pole Stays
- 8.10 Medium Voltage Stay Assembly
- 8.11 Medium Voltage Stay Assembly
- 8.12 Drop-out Fuse Assembly
- 8.13 Surge Diverter
- 8.14 Isolating Links

9. INSTALLATION MATERIALS

- 9.1 Conductor joints

1. The Contractor shall, where possible, order the conductor lengths so that there are no joints in any of the Payment certificates will be done once a month.

All claims for payment should include the following per maintenance request

- a) Maintenance request / order form
- b) Accepted quotation (if applicable)
- c) Copies of the invoices of all material procured
- d) Itemized bill of quantity rate for labour work conducted
- e) Day works rates for items not covered in the schedule of quantities with time sheets.

Travelling as per the day works rates section will only be paid if special material / equipment as required for the completion of the work. Travelling will in all cases be based from the Electrical Engineering Services Workshop in Rustenburg up to the place of the fault.

Payment for materials will be based on the standard markup on material (as stipulated in the schedule of quantities). The contractor should note that the claim for payment should include copies of the invoices for materials supplied. **No payment will be made if the actual invoices are not attached to the claim for payment.**

Labour rates will be based on the rates entered in the schedule of quantities. The rates are fixed for the 1st year, thereafter escalation will be calculated as indicated in the bill of quantities. Day works rates will be used where no rates are available in the schedule of quantities. Any day works rates claim should be accompanied by the necessary time sheet for people as well as a log sheet for any form of machinery or LDV's. Travelling will in all cases be remunerated from Rustenburg Electrical Engineering Services Workshop.

Where joints are to be used the joints shall be of the preformed type manufactured to the minimum standards as per standard specification G-014/1

During assembly of a joint, there must be no possibility of relative movement between individual layers of the conductor.

Conductor joints to fit all Aluminium conductors specified.

9.2 Hardware and fittings

Intermediate pole conductor binding shall be effected by means of preformed wire ties. The ties shall be secured against unraveling by an approved stainless steel security band. Tension fittings shall be the preformed wire type together with suitable fittings for securing the tension insulators.

Tension insulator sets and fittings shall, unless otherwise approved, be ranged to give a minimum clearance of 150 mm between the jumper conductor and the rim of the live end insulator units. Tension sets shall be fitted with attachment plate to enable the load on the tension set to be relieved for maintenance purposes. Fittings made of steel or malleable iron shall be galvanized as specified to prevent corrosion. All bolts and nuts shall be as specified and unless otherwise approved shall be locked by means of lock nuts.

Split pins used on all insulator fittings shall be of stainless steel or other approved material and shall be backed by washers. Hump backed split pins shall not be used.

Two bolt parallel groove clamps of approved quality shall be used at jumper connections. The clamps shall not allow any slip or deterioration of the jumper connection at a load of less than 50 % of the ultimate strength of the conductor, and shall be designed so that loosening of the jumper connection is not possible in service.

9.3 Steel cross-arm

The steel cross-arms for the mounting of the expulsion fuses shall be manufactured from 100 x 50 x 6 mm channel iron. (See drawing AL3/15-1).

The steel cross-arms for the mounting of the transformer shall be manufactured from 100mm steel channel iron as indicated on the detail thereof in the drawings. (See drawing AL 3/15-2)

10. EARTHING

Galvanized steel wire, 3 x No 8 SWG 70 ton quality, shall be used for the earthing of the wooden pole structures where specified.

The earth-wire shall be stapled to the bottom end of the pole in a spiral form, using two meters of earth-wire and must then be stapled along the length of the pole to 150 mm below the intersection of the two steel bracing straps.

The bracket securing the middle conductor to the upright shall have an earth-wire connected between it and the bolt securing the cross-arm to the upright.

11 IDENTIFICATION AND DANGER PLATES

Conspicuous danger plates shall be fixed on all suspension and strain structures. The inscription and background of danger plates shall be vitreous enamel and the plate must be completely covered to prevent corrosion. Pressed aluminium plates shall be used for pole numbering.

12 ANTI-CLIMBING DEVICE

Each pole of a structure shall be fitted with six turns of galvanized barbed wire at a height of not less than 3 m above ground or as specified in the specified clearance heights of Eskom to prevent unauthorized persons coming into contact with live conductors by climbing such structures. Galvanized steel staples are to be used for securing these turns at approximately 150mm intervals on wooden poles.

13 SITE PREPARATIONS

13.1 Bush clearance

Bush clearance shall consist of a 3 000 mm strip, on either side of the line and for the total length of the overhead lines, and also the removal of the tree branches for 1 500 mm on either side of this 3 000 mm strip.

The removal of trees, if necessary, must be discussed with the Council

13.2 Cleaning of site:

The contractor shall remove everything that he brought onto the site or handled on the site in the execution of the contract, as well as all excess excavated material and rubble so as to leave the site in a neat and clean condition to the satisfaction of the representative after the completion of the works.

13.3 Pegging the route

The Contractor shall peg out the route for the overhead line (including the position of poles, stays and struts) but shall maintain close liaison with the Council's representative. The Council's representative shall inspect the route before the Contractor commences with the work.

Should the proposed position of poles appear unsatisfactory due to obstructions, poor soil conditions, rock, etc the Council's representative shall be consulted and a ruling obtained.

The Council reserves the right to alter the line route at any time prior to the installation of the overhead wires. Payment in respect of any additional or wasted work involved shall be at the documented rates.

The removal of obstructions along the route shall be subject to the approval of the Council.

14 EXCAVATIONS

The holes for poles shall be excavated to a depth of 1,8 m for poles up to 11m and 2.0m for 12m poles with dimensions of 1,5 m by 1,0 m.

The holes for stays shall be excavated to a depth of 1,8 m and shall have dimensions of 1,0 m by 1,0 m.

Once the structure has been erected and aligned and the stays installed, excavations shall be backfilled and compacted in layers of 150 mm to 95% MOD AASHO.

All holes that are going to be left open during the night must be barricaded using approved black and yellow danger tape.

Inspections must be carried out on all holes before poles or stays may be planted.

15 ERECTION OF STRUCTURES

The contractor shall ensure that the structures are not strained or damaged in any way during the erection thereof.

The structures shall be vertical to a tolerance of 0,5% at the top of the structure after erection.

Poles shall not exhibit either twisting or bowing greater than the approved tolerances, which will not exceed 2% of the mast length.

All ladders are to be removed when erection work is not in progress.

16 POLE STAYS

The central part of the 'make-off' shall be double-wrapped onto the pole top, after which the two legs shall be wrapped over the unformed wire to form a seven strand stay of similar strength and diameter to that of the normal stay-wire.

The stays shall be erected so as to form an angle of 45 degrees to the pole and must be set for sufficient tension.

16.1 Medium Voltage Stay Assembly

Medium voltage stays will be a Pole Top make-off wrapped around the pole securing it self by strangling effect.

16.2 Low Voltage Stay Assembly

Low voltage stays will be a Pole Top make-off wrapped around the pole securing itself by strangling effect.

16.3 Installation of stays

The stays shall be attached to all wooden pole strain and terminal structures in the positions indicated on the drawings. The stay shall be installed to form an angle of 45 degrees with the vertical. The stay plate shall be installed at a depth of 1,8 m.

The type of stays (aerial or diagonal stays) shall be as indicated on the contract drawings. Diagonal stays shall be installed at an angle of 45 degrees to the poles and all stays shall be provided with strain insulators at least 2 000 mm from pole top. Number of stays per pole will be specified in the Project Specification or indicated on the Drawings.

If two stays per pole are required the strain insulators shall be installed at different distances to prevent the insulators from clashing against each other and stays shall be planted approximately 2 000 mm apart.

Clamps will not be accepted for the termination of stays. Stays shall be determined over the thimbles on the stirrups with windup clamps. Stay-plates shall be planted 1 800 mm deep. Sizes of holes shall be such that stay rods are planted at the correct angle. When back filling the ground shall be watered and compacted every 150 mm.

Stays shall be fixed to poles by means of loops, and clamps shall be provided on poles to prevent the stays from sliding down. Stays shall be attached as near as possible to the point of application of the load (overhead conductors).

16.4 Stay rod assembly

The stay rod assembly-fastening nut must leave ample margin for future adjustment.

The stay-wire loop around the pole top must be horizontal and fixed be kept that way by means of two screws or staples.

All stay-wires at the stay plate must pass through buckles provided for that purpose.

Crosby clamps may be used for construction purposes only. The final installation shall consist of only specified stay-connections as stated above.

High and Low voltage stays must be installed simultaneously.

NOTE: UNDER NO CIRCUMSTANCES SHALL THE STAY ROD BE BENT.

The base plate shall be covered by large stones where after backfilling in easy stages with thorough consolidation of each stage. Where necessary, the stay shall be concreted in with 6:3:1 concrete mix.

16.4 Strain insulators

Strain insulators shall be provided in all stay wires in the following way:

Where MV and LV cables run together two porcelain insulators shall be installed in the stay-wire in the position indicated by the Engineer.

Where MV or LV cables run alone only one isolator will be used.

Stays shall be provided at all line terminations, angle poles, transformer structures, at tension poles and at all road/rail crossings.

Where stays are to be erected within any residential property, stub-stays shall be used unless the stay is located directly on the boundary between two erven.

The diameter of stay wire to be used with HV lines shall be 9.75 mm and with the LV lines shall be 9.75 mm.

17 STRINGING OF CONDUCTORS

Contractors are referred to the relevant clause in this specification with regard to joints in conductors. The engineer shall approve the method of stringing and the equipment to be used for stringing before the contractor commences the stringing of the conductors. The engineer may, if in his opinion the stringing work is been carried out in an unsatisfactory way, order the contractor to supply additional labour, plant and equipment to execute the work in a proper manner at no additional cost. The contractor shall furthermore make provision in his rates for providing additional labour and equipment required during the crossing of other services and for temporarily staying structures during the stringing operation.

The standard span lengths to be used are 80 m in areas outside townships and 50 m in townships. The term "span length" shall be taken as the horizontal distance between the centerlines of adjacent structures.

The phase configuration of the conductors shall be RED, WHITE and BLUE from left to right when looking in the direction of the load.

Adequate length of conductors shall be left at the strain structures for the bridging jumpers and these lengths of conductors shall be overlapped and joined at two points using approved two bolt aluminium parallel groove clamps.

An approved red-lead compound shall be used to seal the conductor ends.

Adequate length of conductors shall be left at the terminal structure for connection to the transformer fuse cutouts.

The contractor shall provide suitable dyno-meters, or other approved apparatus necessary for the checking of the work. Dyno-meters shall be tested and if necessary re-calibrated if so required by the representative.

The contractor shall submit for approval curves showing the correct initial and final sag and tension of the line conductors at the various temperatures and spans. The conductors shall be over-tensioned to the above curves to allow for any permanent settlement after the erection of the conductors.

18 POLE MOUNTED TRANSFORMERS

The pole mounted transformer structure shall be as indicated in the drawing.

Transformer mounting

The transformer shall be mounted on a base structure as indicated in the drawing.

Mounting of surge diverters and drop-out fuses

The three-surge arrester shall be mounted by means of their brackets to the transformer casing. The three dropout fuses shall be mounted on the galvanized cross-arm situated above the transformer.

Earthing of surge diverters and transformers

The earthing of surge diverters and transformers shall be to RLM standards.

19 TESTING AND COMMISSIONING

Before energizing the system, the following will be done:

- 19.1 A visual inspection by a responsible installation inspector of all joints and terminations.
- 19.2 Verification of the safety of the entire installation.
- 19.3 Notification of all staff working in the area.
- 19.4 Insulation resistance tests between all phases and neutral to earth and between all phases individually and between all phases and neutral.

20 ELECTROLYTIC CORROSION

When dissimilar metals, for example, copper and aluminium are bonded together, bi-metal connecting pieces which are designed for this purpose, shall be used to prevent electrolytic corrosion. This material shall only be used after approval by the Council.

END OF SPECIFICATION

RUSTENBURG LOCAL MUNICIPALITY

DIRECTORATE: TECHNICAL & INFRASTRUCTURAL SERVICES

UNIT: ELECTRICAL ENGINEERING SERVICES

SPECIFICATION NO G-014/1

APPOINTMENT OF SERVICE PROVIDER/S FOR THE PROVISION SUPPLY AND DELIVERY OF LABOUR ON ELECTRICAL MAINTENANCE FOR RUSTENBURG LOCAL MUNICIPALITY AS AND WHEN REQUIRED FOR A PERIOD OF 3 YEARS

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1. SCOPE

This specification covers the requirements for material of medium and low voltage open conductor overhead power lines. Low voltage is defined as being 0 – 1 000 Volt. Medium voltage is defined as being above 1 000 Volt up to 22 000 Volt.

2 NATIONAL AND INTERNATIONAL STANDARDS

The latest edition, including all amendments up to date of tender of the following particular national and international specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

SABS 135:	Isometric black hexagon and square bolts, screws, nuts
SABS 763:	Hot dip galvanizing
SABS 784:	Busbar and busbar connections
SABS 833:	High and low voltage bushings
SABS 1186:	Industrial safety signs
SABS 1091:	Colours
SABS 152:	Low voltage air-break switches
SABS 166/167:	Insulators for lines
SABS 178:	Insulator and conductor fittings
SABS 182:	Aluminium conductors, steel reinforced, for overhead power and transmission lines
SABS 177:	Ceramic and glass insulators for overhead lines of nominal voltage greater than 1000 V
SABS 161:	Low voltage porcelain insulators
SABS 171:	Low voltage lightning arrester
SABS 753:	Pine poles and cross-arms for power transmission, low voltage and telephone systems
SABS 754:	Eucalyptus poles and cross-arms for power transmission, low voltage and telephone system
BS 2569:	Zinc metal spraying
BS 4360:	Weldable structural sheets
BS 5135:	Metal arc welding of carbon steels
BS 162:	Electric power switchgear and associated apparatus
BS 3078:	Isolators
BS 223:	Isolator bushings
BS 381C:	Colours for specific purposes
BS 6004:	Underground cables
BS 137:	Insulators for lines
BS 3288:	Insulator and conductor fittings
NRS 022:	1993: Stays and associated components

3. MATERIALS

3.1 Wooden poles

Wooden poles shall be in compliance with SABS 753.

Medium voltage

11 m and 12 m poles to be used.

Low voltage

9 m poles to be used.

3.2 Steel poles

Steel poles shall be in compliance with SABS
To be used only as and where specified.

3.3 Concrete poles

Concrete poles shall be in compliance with SABS

11 m and 12 m poles to be used.

3.4 Conductors

Conductors shall be in compliance with SABS

Medium voltage

Earth wire to be used: Stranded Galvanised Steel – 7 X 16 Gauge & 7 X 14 Gauge

Steel reinforced, Aluminium conductor to be used.

Sizes:

6/1/ 2, 36 (GOPHER)

6/1/ 3, 35 (RABBIT)

6/1/ 3, 66 (MINK)

6/1/ 4, 72 (HARE)

Low voltage

All Aluminium conductors to be used.

Sizes:

7/2, 08 (ACASIA)

7/2, 77 (39)

7/3, 30 (HAZEC)

7/4, 65 (OAK)

7/3, 25 (158)

Single Core Insulated Stranded Copper:

2,5 mm

4 mm

6 mm

10 mm

16 mm

25 mm

35 mm

50 mm

70 mm

95 mm
185 mm
240 mm
300 mm

Bare Annealed Stranded Copper:

4 mm
10 mm
16 mm
25 mm
35 mm
50 mm
150 mm

ABC – Aerial Bundled Conductor:
3 X 70 X 54,6 without Streetlight Conductor
3 X 95 X 54,6 without Streetlight Conductor

3.5 Insulators

All insulators must be manufactured as follow:

- 3.5.1 Weathersheds: E.S.P. Rubber
3.5.2 Fibre-glass rod strength member: Type E Brosilicate
3.5.3 Fittings: Metal end

Minimum requirements

Insulator type		Post	Strain		
		A*		A*	
Coupling length	mm	217		314	
Number of weather sheds		3		4	
Diameter of weather shed	mm	115		92	
Creepage distance	mm	329		375	
Dry arcing distance	mm	183		186	
System highest voltage	kV	11		11	
Minimum specific creepage	mm/kV	27		31	
Power frequency Flashover Voltage	Dry (kV)	82		85	
	Wet (kV)	45		51	
Power frequency 1 minute Withstand voltage	Dry (kV)	85		78	
	Wet (kV)	38		43	
Impulse critical voltage	Pos (kV)	190		195	
	Neg (kV)	157		165	
Impulse withstand voltage	Pos (kV)	194		183	

	Neg (kV)	169		148	
Mechanical strength	KN	4		70	
Fittings		Tie top + M20 base		Clevis/ Tongue	
Approximate mass	Kg	1.6		1.8	

A Minimum requirements.

3.6 Conductor joints

The Contractor shall, where possible, order the conductor lengths so that there are no joints in any of the spans and that the jointing of conductors only takes place at termination structures.

Where joints are to be used the joints shall be of the preformed type, which shall have a mechanical strength of not less than 99% of the ultimate strength of the conductor when tested in accordance with BS 3288 Part 1 of 1973.

The electrical conductivity and current carrying capability of the joint shall not be less than that of the conductor.

During assembly of a joint, there must be no possibility of relative movement between individual layers of the conductor.

Joints shall fit all Aluminium conductors specified.

3.7 Hardware and fittings

All cast iron and steel fittings and hardware shall be manufactured in compliance with SABS 178-1970 where applicable and shall be hot-dipped galvanized to SABS 763-1966. No drilling, screw tapping or cutting of hardware and fittings shall be permitted after galvanizing.

Eye bolts used for the strain and terminal structures shall be manufactured from mild steel and shall have a minimum failing load of 70 kN. The bolt size shall be of the diameter indicated on the drawings with length to suit and the diameter of the eye and the eye material shall suit the dimensions of the shackle to be used.

The shackles shall be manufactured from forged steel and shall have a minimum failing load of 70 kN. The dimensions thereof shall suit the clevis of the insulators to be used.

The strain clamps shall be manufactured from malleable cast iron to BS 310 and shall have a minimum failing load of 70 kN. The dimensions of the clevis of the clamp shall be suitable for the tongue of the insulators to be used.

Intermediate pole conductor binding shall be effected by means of preformed wire ties. The ties shall be secured against unravelling by an approved stainless steel security band. Tension fittings shall be the preformed wire type together with suitable fittings for securing the tension insulators.

Tension insulator sets and fittings shall, unless otherwise approved, be ranged to give a minimum clearance of 150 mm between the jumper conductor and the rim of the live end insulator units. Tension sets shall be fitted with attachment plate to enable the load on the tension set to be relieved for maintenance purposes. Fittings made of steel or malleable iron shall be galvanized as specified to prevent corrosion. All bolts and nuts shall be as specified and unless otherwise approved shall be locked by means of lock nuts.

Split pins used on all insulator fittings shall be of stainless steel or other approved material and shall be backed by washers. Hump backed split pins shall not be used.

Two bolt parallel groove clamps of approved quality shall be used at jumper connections. The clamps shall not allow any slip or deterioration of the jumper connection at a load of less than 50 % of the ultimate strength of the conductor, and shall be designed so that loosening of the jumper connection is not possible in service.

3.8 Steel cross-arm

The steel cross-arms for the mounting of the expulsion fuses shall be manufactured from 100mm x 50 mm x 6 mm channel iron. See DWG. AL 3/15-1

The steel cross-arms for the mounting of the transformer shall be manufactured from 100 mm steel channel iron as indicated on the detail thereof in the drawings. See DWG. AL 3/15-2

3.9 Pole stays

Pole stays shall comprise the following:

Preformed pole make-off

Galvanized multi-strand steel wire, 7/3, 25 mm (9, 75)

Galvanized steel stay rod, M 20 x 2, 4 m, assembly including thimble

Galvanized steel stay plate, 450 mm x 450 mm x 6 mm.

Porcelain stay insulator, 136 mm x 85 mm type S22.

The central part of the 'make-off' shall be double-wrapped onto the pole top, after which the two legs shall be wrapped over the unformed wire to form a seven strand stay of similar strength and diameter to that of the normal stay-wire.

Stay rods, swivels, etc, shall comply with the relevant requirements of BS 16 and BS 464 and the stay wire shall comply with the requirements of BS183.

Galvanizing shall comply with the appropriate requirements of SABS 763.

Base-plates shall be provided with locking facilities to prevent turning of the stay rods.

Approved means shall be provided for setting and readjusting the stay for stretch and settlement.

The stays shall be erected so as to form an angle of 45 degrees to the pole and must be set for sufficient tension.

Porcelain stay insulators shall be used on all stays. They shall have a dry flash-over of 35 kV. Cullinan SAG S22 or equivalent shall be used.

3.10 Medium Voltage Stay Assembly

Medium voltage stays will be a Pole Top make-off wrapped around the pole securing itself by strangling effect.

The stay assembly for Medium Voltage will consist of the following from the pole top:

1. Pole top make-off wrap type
2. Guy grip dead end
3. Stay insulator
4. Stay wire 9,75 mm diameter
5. Guy grip dead end
6. Thimble
7. Stay rod 2,4 m
8. Stay plate 450mm x 450mm.

3.11 Low Voltage Stay Assembly

Low voltage stays will be a Pole Top make-off wrapped around the pole securing itself by strangling effect.

The stay assembly for Low Voltage will consist of the following from the pole top:

1. Pole top make-off wrap type
2. Stay wire 9,75 mm diameter
3. Guy Grip dead end
4. Stay rod 2,4 m
5. Thimble
6. Stay plate 450 x 450
7. Stay insulator

NOTE: All equipment shall be galvanized.

3.12 Drop-out Fuse Assemblies

The drop-out fuse assemblies shall comply with the requirements of STD.08 and shall comprise three single pole spring-loaded units suitable for mounting on a galvanized steel cross-arm. Each unit shall consist of:

Galvanized mounting brackets complete with fixing bolts

Insulator assembly manufactured from high quality glazed porcelain

Spring-loaded contact assembly. Positive spring action shall cause the ejection of the fuse holder from its contact point under fault conditions.

Fuse holder consisting of an insulated cartridge and the fuse element.

The minimum fault clearance level of the fuse cut out shall be 200 kVA.

3.13 Surge diverters

High voltage surge diverters shall comply with the requirements of STD.10 and shall be of the metal-oxide type and shall have a nominal rating as specified. The surge diverters shall include galvanised brackets for their mounting adjacent to the transformer's HV bushings.

3.14 Isolating Links

The links shall be of the outdoor, single phase, single break type suitable for vertical mounting on a channel iron support. All links shall be supplied complete with mounting base, retaining latch and large operating ring. The links shall be suitable for the connection of ACSR bare conductors. All ferrous parts of the link shall be hot- dipped galvanized and non-ferrous parts shall be plated to protect against corrosion. The links shall be insulated for the voltage specified and shall have a current rating of 400 amps and a short-circuit capacity of up to 350 MVA for 3 seconds.

RUSTENBURG LOCAL MUNICIPALITY

DIRECTORATE: TECHNICAL & INFRASTRUCTURAL SERVICES

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G 017/1

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1 SCOPE

This specification set out the minimum standards that shall be adhered to when underground reticulation systems is installed in the RUSTENBURG LOCAL MUNICIPALITY (RLM) electricity supply area.

2 STANDARDS

The following standards and regulations shall be adhered to at all times

- 2.1 Occupational Health and Safety Act (Act 85 of 1993)
- 2.2 Electricity Act
- 2.3 SABS 0142
- 2.4 All other legislation regarding Construction and Electricity maintenance and reticulation.

3 MATERIALS

All material shall comply with the relevant specifications of the Unit: Electrical Engineering Services.

4 COOPERATION AND PROGRAMMING OF CONSTRUCTION WORKS

- 4.1 Careful planning of construction work and co-operation with other parties involved in the installation of infrastructure is important.
- 4.2 The consultant or contractor must submit a program schedule of the works before construction of the works start.
- 4.3 The contractor shall plan his work in such a way that he can complete sections of the works as required by RLM.
- 4.4 The contractor or consultant shall arrange with the RLM representative to meet on site at regular intervals, in order to discuss any problems that may develop and to report on the progress of construction work.

5 PEGGING OF THE WORKS

- 5.1 The contractor shall mark cable routes and placement of miniature substations and distribution-kiosks on site. The representative shall, prior to installation of cables, miniature substations and distribution kiosks, approve these routes on site.
- 5.2 Should the precise position, route, height above or below ground level of any Part of the works or the equipment not be clearly indicated on the drawings or described in the specification, the matter shall be confirmed with the representative. No construction work for which there are not clear instructions shall be carried out.
- 5.3 The contractor shall take care not to remove any surveyor pegs on the construction site, as it may lead to prosecution. It will be the contractor's responsibility to locate surveyor's pegs required for marking out cable routes.
- 5.4 The contractor shall appoint a registered land surveyor to verify any peg where there is uncertainty of the exact location of the peg and, where Necessary, replace pegs along all cable routes that form part of the project. The land surveyor shall issue a certificate to this effect.

- 5.5 The contractor shall accept responsibility for the installation of electrical services in the correct position. The representative may be called upon to check the marking out of cable routes, etc prior to commencement of excavations or erection work. Should this not be done, the contractor shall be held responsible for rectifying any mistakes.

6 BUSH CLEARANCE

All trees, plants, rubble and surplus material removed by the contractor during excavations and which are not suitable for backfilling, shall be dumped at a rubbish dumping site and leveled.

7 EXISTING SERVICES

- 7.1 The contractor shall be responsible for locating all existing services, e.g. cables, telephone services, sewage lines, water and storm-water pipes, along the cable routes of the project.
- 7.2 The owners of such services may assist the contractor in locating their services but will not be obliged to do so in any way.

8 EXCAVATIONS AND TRENCHING

All excavations, trenching, back filling and road crossings shall be done strictly in accordance with Unit: Electrical Engineering Services specification number G-018/1; Cable trenching and laying of cables.

9 MINISUBSTATIONS

- 9.1 The miniature substation will not be provided with an earth-mat.
- 9.2 Excavations for mini-sub plinths shall be made until rock/Norite is reached and the depth of the excavation shall be such that several layers of Norite compacted to 93% MOD AAHSTO and 150 mm thickness each, can be laid underneath the plinth. The back filling shall be done to a height that will allow the miniature substation to be mounted 200 mm above ground level.
- 9.2 The Norite shall extend for 600 mm past the plinth in all directions.
- 9.3 For pre-cast plinths, three lintels are to be provided for each miniature substation, which must be installed prior to the placing of the plinth. The lintels must be installed perpendicular to the bare evenly spaced on both sides. The lintels must be positioned in such a way that it does not restrict cable access.
- 9.4 Pre-cast plinths are preferred by the RLM. A build up plinth will only be allowed if written the representative of the RLM gives consent.
- 9.5 Where the plinth is to be build up, it shall be done with SABS approved cement bricks. The plinth shall consist of double walls to be build on a concrete slab. The concrete slab mixture shall be mixed to a minimum strength of 35 MPa. (For 10 cement, 0.65 cub. meter crusher stone and 0.65 cub. meter sand must be added. The measurements of the plinth shall normally be as stated on Drawing BD4 - 122. The miniature substation may vary in size and it is expected of the contractor to measure all miniature substations prior to the installation of the plinth.

10 MV CABLES

All cable accessories shall be according to the cable manufacturer's recommendation.

(a)

Only specially trained artisans who are familiar with the Raychem type of system used will be allowed do cable joints and terminations. Full CV particulars of the artisan shall be submitted to the RLM for approval.

(b)

The artisan shall in the presence of the RLM representative perform at least one successful demonstration of a joint and termination prior to the making of any joint or termination.

Terminations and joints will be of the Raychem heat shrinkable type.

Cable lugs and ferrules shall be crimped with hydraulic crimping tools with hexagon dies on copper cables and indent on aluminium cables. RLM must approve crimping tools prior to usage.

Cable joints and terminations shall be done in dry conditions. Any cable joint not inspected by the Council because of insufficient notice being given shall be opened for inspection and redone at the discretion of the representative at the cost of the Contractor.

All joints and terminations shall be fully watertight and airtight and shall be free of voids and air-pockets. The crossing of cores in joints will not be permitted under any circumstances.

All XLPE insulation shall be cut with a rope.

Joint bays

10.1 Joint bays shall be 1,3 m deep, 1.5 m wide and 2.5 m long. Each bay shall be adequately covered to prevent, as far as practicable, dust and moisture from entering it and it shall be provided with adequate lighting, drainage, and ventilation for use during jointing operations. The sides of the hole shall be draped with a small tarpaulin or plastic sheeting to prevent loose earth from falling into the joint bay during jointing operations.

10.2 All cable joints shall be indicated on a map with co-ordinates to the 5th decimal in degrees Southern and Eastern. Positions as indicated by a GPS will be accepted.

(c) MV Joints

10.3 Joints in cable runs will not be allowed unless authorised by the Council.

10.4 The joint shall not impair the anti-electrolysis characteristics of the cable. The Contractor shall notify the RLM timeously of the day on which the jointing is to be carried out in order that an inspection may be arranged if so required.

(d) MV termination

- 10.5 The copper tapes of the earth screen on the cable shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes. The cable shall be firmly secured on the switchgear by means of a clamp to prevent mechanical stress on the cable and terminations.

Connection of cable conductors

- 10.6 Only class-A Bi-metal Simel type, Aluminium / Copper lugs shall be used to terminate aluminium conductors. Lugs shall be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579.
- 10.7 Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug.
- 10.8 Cables that are connected to clamp type terminals where the clamping screws are not in direct contact with the conductor need not be lugged but the correct terminal size shall be used.
- 10.9 Ferrules shall be used as far as possible where cable conductors are connected directly to equipment with screws against the conductor strands. When cutting away insulation from cable conductors to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be cut away to fit into lugs.
- 10.10 Where preformed aluminium cables are used, the cable shall first be pressed into a round shape to fit into the lug with a special tool. The lug shall then be crimped with the appropriate tool.
- 10.11 All cables intended for future extensions, e.g. consumer connections and at township boundaries, shall be sealed with the aid of heatshrink type cable end caps.
- 10.12 The correct size end-cap shall be used for each cable and fitting shall be carried out strictly in accordance with the manufacturer's instructions.

11 LV CABLES

- 11.1 All cable accessories shall be according to the cable manufacturer's recommendation.
- 11.2 Termination of all aluminium LV cables shall be carried out with Simel type bimetal Cu/Al lugs and ferrules. No other type of lug will be acceptable. Lugs and ferrules used on aluminium cables shall be chemically cleaned and dried prior to packing in heat sealed plastic pouches to prevent oxidation.

- 11.3 Formed aluminium cable cores shall be rounded to fit the appropriate cable lug or ferrule tightly prior to crimping. Crimping of aluminium lugs and ferrules must be done with a hydraulic indent crimping tool. Copper lugs must be hexagon crimped. Hand crimping tools will not be accepted.

Cable terminations

- 11.4 In the miniature substation and the distribution/metering kiosk, the armouring shall be bent back over the outer PVC sheath and a K-clamp shall clamp the cable and earth wire to an unistrut-channel to support the cable end.
- 11.5 For cables with copper earth conductors jointed to the armouring, special glands adhering to SABS 150 – 1970 shall be used.
- 11.6 All cable glands shall be screwed and fixed to the gland-plate. A Neoprene or PVC shroud shall be used to seal the gland and sheath watertight. Glands shall be fitted according to gland manufacturer's specification. Only Pratley type glands and shrouds are acceptable.
- 11.7 Suitable lugs shall be used to connect the cable cores to the equipment or busbars.
- 11.8 Where cable cores are connected to terminals, the contact surfaces shall be clean and dry.
- 11.9 Only crimping lugs shall be used where cables are connected directly to equipment. The correct size of lugs shall be used for each size of conductor.
- 11.10 Lugs shall be crimped. Specially designed shaped dies with hydraulic crimping tools shall be used. Heat-shrink tubes shall be used to insulate lugs. PVC tape shall not be accepted.

12 INSTALLATION OF CABLE SLEEVES

- 12.1 Where cable sleeves have to be installed to cross a road, which still has to be constructed, the sleeves shall be installed at least 1,5 m below the surface of the ground, in order to prevent damage to the sleeves during road construction works.
- 12.2 Under normal circumstances cable sleeves in road crossings shall be installed not less than 900 mm below kerb.
- 12.3 Cable sleeves installed in road or service crossings shall be straight and free from damage. No crooked or deformed sleeves shall be installed.
- 12.4 Cable sleeves shall be installed without any air pockets around them. The trench shall be backfilled in layers of 300 mm and compacted layer by layer to a density of at least 95% MOD AASHO.
- 12.5 The contractor shall obtain the services of an approved test laboratory to verify the grade of compaction at road crossings, if instructed to do so by RLM. The contractor shall bear the cost of any tests that prove that compaction has not been carried out according to the specification. All test certificates shall be handed to RLM before final acceptance of the installation.

- 12.6 A galvanized draw wire shall be installed in every sleeve, which is not used. The draw wire shall be at least 1 000 mm longer than the sleeve and 500 mm shall be rolled together at each end and left just inside the sleeve end. The sleeve ends shall be sealed by means of tight-fitting PVC ends caps.
- 12.7 Sleeves through which cables have been installed shall be sealed in an approved manner, preferably with a mixture of sand and cement or a commercial foam approved by Council.

13 METERKIOSKS / STUBBIES

- 13.1 All pillar-boxes, meter-kiosks and distribution-stubbies shall be manufactured to the Unit: Electrical Engineering Service's specifications LV-012/1 – Outdoor weatherproof pillar boxes.
- 13.2 All kWh meters will be supplied by RLM but installed by the contractor.
- 13.3 All internal wiring shall be done with SABS mark bearing PVC wire. The wiring shall be neatly bent and all terminations properly terminated. At no stage shall any strands be cut away.
- 13.4 Only CBI type circuit breakers will be used for all installations.
- 13.5 All circuit breakers shall be marked with engraved labels mounted on the stubby above the corresponding circuit breaker.
- 13.6 All stubbies/kiosks to be installed 100 mm above final sidewalk level.

14 MARKING AND LABELLING

- 14.1 Equipment shall be labelled as indicated on the layout drawings applicable to the electrical reticulation.
- 14.2 The name of the high voltage feeder cable shall be engraved on the label mounted on the appropriate isolator in the ring main unit in the miniature substation or high voltage distribution kiosk.
- 14.3 The name of the miniature substation or high voltage distribution kiosk shall be engraved on the label on the inside of the door of the high voltage compartment.
- 14.4 The names of all low voltage feeder cables shall be engraved on the labels fitted underneath the circuit breakers in miniature substations.
- 14.5 The contractor shall provide numbers on all low-voltage distribution pillars, painted in black with stencilled lettering with a minimum letter height of 50 mm. The numbers shall be provided on the pillars on the side facing the street.

15 EARTHING

- 15.1 A bare copper earth wire (as specified in project specifications) shall be run with all LV cables. All earthing joints shall be soldered. The representative shall approve the joints.

- 15.2 The complete electrical distribution system shall be earthed in accordance with the specific requirements indicated in the project specification, which accompanies this document. In the absence of any specific requirements, the general guidelines of this specification shall be followed.
- 15.3 Where applicable, the earthing installation shall be carried out in accordance with the Standard requirements of the SABS Code of Practice for the Wiring of Premises (SABS 0142), the AMEU Code of Practice for the Application of Neutral Earthing on Low Voltage Distribution Systems, as well as any other requirements laid down by the supply authority for the development to which this contract applies.
- 15.4 Unless it is specifically required or unavoidable, earthing for lighting protection, high voltage equipment and low voltage equipment, shall be kept separate, i.e. it shall not be bonded.
- 15.5 All earth resistance measurements specified, shall apply to dry weather conditions and where considered necessary, they shall be verified during the 12month retention period.
- 15.6 Unless otherwise specified in the project specification, miniature substation shall be earthed by connecting the 50 mm² bare copper earth wire(s) installed with the high voltage cable(s), to the earth busbar in the miniature substation.
- 15.7 Only where specifically required in the project specification, the contractor shall employ a specialist subcontractor for the design and installation of an earthing system for a miniature substation, in the same manner as for switching substations. The earth resistance in such cases shall not exceed 3 ohms.
- 15.8 The contractor shall ensure that the neutral on the low voltage or secondary side of the transformer is connected to the earth busbar in the miniature substation and also that all metal framework including the metal enclosure of the ring main unit, is properly bonded.
- 15.9 The neutral conductor of all low voltage primary feeder cables shall be bonded to earth at all distribution and/or meter boxes, streetlight poles, traffic lights etc.
- 15.10 The contractor shall ensure that the framework and components of any metal enclosure as well as the armouring of low voltage cables is properly bonded to the earth terminal.
- 15.11 Where cables with the earth continuity conductor as part of the armouring are used (ECC type cables) all the copper strands shall be brought through the cable gland and terminated together by means of a crimped cable lug.

- 15.12 Earth readings shall be 10 ohms or less. Readings shall be taken at a ninety degree angle to the trench with a calibrated instrument. Calibration certificate must not be older than twelve months.

16 INSPECTIONS

- 16.1 The contractor or consultant shall allow for inspection of installation work by the representative. At least two (2) days notice is required for any inspections of the installation work and the contractor shall be responsible for paying directly to the client all re-inspection fees required in case of work presented for inspection, which does not comply with the specification.
- 16.2 The contractor or consultant shall submit a pressure test certificate issued by an approved authority and covering the complete reticulation installation as specified in this contract before final handing-over will take place.
- 16.3 The contractor shall take note that the completed electrical reticulation installation shall be handed over to the RLM and all requirements as laid down by the RLM have to be complied with before final acceptance.
- 16.4 The handover shall be done by means of the official handover certificate available from the representative.

17 COMMISSIONING

17.1 Testing of cable installation

The following is the specific test requirements of the RLM. These test requirements are the same as those given in SABS Method 540. The following commissioning tests are applicable where requested:

Pressure tests on MV Cable.
Functional tests on all switchgear;
Final earthing tests;
Phase rotation;
Megger all LV cables;
Continuity test;
Visual inspection on the miniature sub-station oil levels.

- 17.2 The High Voltage pressure test shall be performed in the manner as described in Appendix D of SABS 97 of 1970 on all high voltage cables, joints and terminations.
- 17.3 Serving test at 5 kV, to prove that the outer sheath of the cable was not damaged during installation.
- 17.4 Transformer oil dielectric strength.
- 17.5 The HV and LV connections onto the transformers shall comply with a uniform standard to ensure consistent phase rotation. Phase rotation and phasing checks across open links shall be done at the time of project commissioning.

- 17.6 Test on completion of the laying of the cables shall be carried out in the presence of the representative as detailed and test results properly recorded and submitted in triplicate.
- 17.7 LV cable tests:
- a. Continuity tests on all cables cores.
 - b. Continuity tests on all cables to prove the earthing of cable armouring, screening and earth conductors.
 - c. All low voltage cables shall be megger-tested with the aid of a 500 V insulation-resistance tester to ensure a clean system, prior to commissioning. All circuit breakers shall be closed for the purpose of this test.
 - d. Where parallel cables have been installed, or where ring feeds exist, the phase colours shall be verified to ensure correct connections.
 - e. Underground service connection cables shall be positively identified by means of a megger test, prior to commissioning of the low voltage system.
- 17.8 All tests shall be carried out in the presence of the representative and sufficient notice shall be given prior to any tests being carried out.
- 17.9 The contractor shall provide all the necessary test equipment and instruments required for the proper testing and commissioning of the complete installation, as specified elsewhere in this document. Calibration certificates of these instruments shall be available.
- 17.10 Should any part of the installation fail during a test, or should the equipment fail to meet the requirements of the specification, the contractor shall replace, repair or correct the faulty components to the satisfaction of the RLM.
- 17.11 Should the installation be accepted and commissioned with certain outstanding items, a list of these items (punch list) will be compiled and rectified before the handover certificate shall be issued.

18 DRAWINGS

- 18.1 Drawings which depict existing services, e.g. water pipes, sewerage, telecommunication cables, etc will be obtained from the authority responsible for the service by the contractor or consultant. The correctness and accuracy of these drawings will however not be guaranteed and will be the contractor or consultants responsibility to establish the exact position of these services prior to commencement of excavations.
- 18.2 A complete set of updated drawings for the installation shall be available on site at all times, preferably displayed in the site office.
- 18.3 Before final acceptance of the completed installation, the contractor shall furnish all the necessary “as-built” information, marked up in red pen on paper prints of the

construction drawings. The information shall include every detail required to establish the exact position of all cables, cable joints and other equipment, which have been installed as part of this contract. Fixed references such as stand pegs or boundaries shall be used to locate the above items positively.

19. CLEANING OF SITE

After completion of construction activities, the contractor shall remove all his equipment and site facilities from the site and leave the site in a tidy condition.

END OF SPECIFICATION

RUSTENBURG LOCAL MUNICIPALITY

DIRECTORATE: TECHNICAL & INFRASTRUCTURAL SERVICES

UNIT: ELECTRICAL ENGINEERING SERVICES

TECHNICAL SPECIFICATION NO. G-018/1

CABLE TRENCHING AND THE LAYING OF CABLES

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CABLE TRENCHING AND THE LAYING OF CABLES

1 SCOPE

This specification is for the excavation, backfilling and compaction of cable trenches and the laying of cables.

2 GENERAL

- 2.1 The contractor shall adhere strictly to the regulations published in accordance with the Occupational Health and Safety Act (Act 85 of 1993). Special care shall be given to the requirements with respect to barricading and shoring.
- 2.2 Where trenching is carried out past the front side or through any private property, the contractor shall notify the owner three days in advance.
- 2.3 Where any other services or structures exist in the vicinity of excavations, the contractor shall obtain permission from the Unit: Electrical Engineering Services for the use of mechanical excavating machinery.
- 2.4 The contractor shall take the necessary precautions to protect trees, plants, shrubs, flowers and fences when excavating in built-up areas. Where possible, the owners shall be requested to remove any such vegetation, fences and paving or driveways prior to commencement of excavations, especially where these occur in the way of trenching or other excavations.
- 2.5 Where excavations are carried out in roads or on pavements, the contractor shall adhere strictly to the regulations published in the National Road Traffic Act (Act 93 of 1996).
- 2.6 It is the duty of the contractor to obtain the necessary drawings to establish the civil services as well as Telkom services.
- 2.7 The contractor shall ascertain the exact position of existing services by hand excavations of cross sections.
- 2.8 The contractor shall accept full responsibility for any damage caused to existing services during excavation work, whether caused directly or indirectly.
- 2.9 Excavated material shall not be dumped closer than 300 mm from both sides of any cable trenches.
- 2.10 Excavated material shall also not be placed where it may endanger human life.
- 2.11 All excavated material shall be dumped in such a manner that it will cause the minimum inconvenience to pedestrians and traffic. Under difficult circumstances the engineer may instruct the contractor to remove some or all of the excavated material to a remote storage position.
- 2.12 No excavated material shall be placed on top of any surveyor's pegs or stand beacons.
- 2.13 Under no circumstances will any cables be laid in trenches that have not been inspected by the RLM representative.

3 NEW CABLE TRENCHES

- 3.1 Cable trenches shall be excavated wide enough to accommodate the number of cables to be installed or to a width as prescribed in the detailed technical specifications.
- 3.2 Trenches shall be absolutely straight and excavated to a minimum depth of 1000 mm measured from the final sidewalk level or natural ground level, in the absence of a sidewalk. Within stand boundaries the trench shall be not less than 1000 mm deep for MV cables and 750 mm deep for LV cables. Trenches on the sidewalk shall be 1000 mm away from the stand boundary, measured to the centre of the trench.
- 3.3 Where cables have to be installed across a road or street, which has yet to be built, the cable trench shall be at least 1500 mm below the street surface, in order to ensure that the cables are not damaged during subsequent road construction activities.
- 3.4 The bottom of the excavated trench shall be level and has to follow the natural contour of the surrounding area.
- 3.5 Trenches shall be cleaned and any loose rocks and sharp edges, which may cause damage to the cables during and after installation, shall be removed prior to commencing with the installation of cables.

4 MAINTENANCE OF EXCAVATIONS

- 4.1 The contractor shall be responsible for maintaining excavations in good order, free from storm or rain water, seepage water, mud, loose ground, rock, stone, gravel or any other strange matter that may find their way into open trenches.
- 4.2 The contractor shall further take all the necessary precautions within his power to prevent any loose rock, stone or unwanted material that has been dumped alongside cable trenches, from entering open trenches.

5 STORAGE OF EXCAVATED MATERIAL

- 5.1 No excavated material shall be placed on top of any surveyor's pegs or stand beacons.
- 5.2 Excavated material shall not be dumped closer than 300 mm from the side of any cable trenches.
- 5.3 Excavated material shall also not be placed where it may endanger human life.
- 5.4 All excavated material shall be dumped in such a manner that it will cause the minimum inconvenience to pedestrians and traffic. Under difficult circumstances the representative may instruct the contractor to remove some or all of the excavated material to a remote storage position.

6 CLASSIFICATION OF EXCAVATION MATERIAL

- 6.1 "Soft material" is defined as soil which can be easily excavated and does not contain any "rock" or "hard material", e.g. gravel, earth, turf, scale, sand, silt and clay, which may contain loose rocks with a nominal diameter of up to 300 mm.

- 6.2 "Hard material" is defined as material that can only be excavated with the aid of pneumatic tools or mechanical ripper, including soil containing loose boulders with a nominal diameter of between 300 mm and 1000 mm.
- 6.3 "Rock" is defined as material consisting of boulders with a nominal diameter of more than 1000 mm, including solid rock in bulk or banks or ledges, the practical excavation of which would necessitate the use of explosives and/or drilling and wedging.
- 6.4 The Council representative shall do classification of excavation material, but should the contractor disagree with the representative's decision, an independent third party acceptable to both the engineer and the contractor, shall be called in to do a classification. The decision of this third party shall be accepted as final.
- 6.5 The contractor shall acquaint him with the nature of the material to be excavated for the works prior to submitting his tender. Submission of a tender shall be deemed to be an acknowledgement that he has done so.

7 INSTALLATION OF CABLES

- 7.1 The bottom of the cable trench shall consist of soft bedding soil that has to be placed there by the contractor, prior to the hauling in of cables. See clause 8 for bedding specifications.
- 7.2 The soil that will be used for the covering layer shall be available next to the cable trench when cables are being inspected and shall be sufficient to cover the cables with a layer of at least 150 mm thickness.
- 7.3 Medium and low voltage cables shall be laid in the same direction on the complete cable route between termination points, in order to maintain a consistent core rotation throughout.
- 7.4 All LV cables shall be laid on the same horizontal level and as straight as possible along straight sections of the cable route. The spacing between cables shall be 150 mm between centres, except for secondary low voltage cables, which may be laid against each other.
- 7.5 The sequence of LV cables in the trench as seen from the stand boundary shall be as follows:
 - 7.5.1 Service cables to stands on the same side of the street as the cable trench
 - 7.5.2 Primary low voltage cables
 - 7.5.3 Pilot cables
 - 7.5.4 Streetlight and/or high-mast lighting cables
 - 7.5.5 Service cables to stands on the opposite side of the street as the cable trench
 - 7.5.6 Earth wires
 - 7.5.7 In case of only one cable, the cable shall be installed 1000 mm from the boundary to the centre of the trench
- 7.6 Where MV and LV cables are laid in the same trench, it shall be done as follow:
 - 7.6.1 MV cables on top of first 100 mm layer. (Clause 8.1.1.1)
 - 7.6.2 150 mm layer of slime or sand. (Clause 8.1.1.3)
 - 7.6.3 LV cables on layer 3. (Clause 8.1.1.3)
 - 7.6.4 Backfilling as per clause 8.1.1.4 to 8.1.1.6.

- 7.7 Cables shall be hauled into the cable trench on cable rollers that are positioned such that the cable will not touch the side or bottom of the trench anywhere. The cable rollers shall not have any sharp edges that may cause damage to the cables.

8 BACKFILLING OF CABLE TRENCHES

- 8.1 All backfilling shall be done as per attached drawing and this specification.

8.1.1 MV CABLES:

- | | |
|---------|--|
| 8.1.1.1 | 1st layer: 100 mm of slime or approved sand. |
| 8.1.1.2 | 2nd layer: MV Cables. |
| 8.1.1.3 | 3rd layer: 150 mm of slime or approved sand. |
| 8.1.1.4 | 4th layer: 150 mm backfilling as per clause 8.3. |
| 8.1.1.5 | 5th layer: Backfilling as per clause 8.4. |
| 8.1.1.6 | Danger tape (see clause 8.6) |

8.1.2 LV CABLES:

- | | |
|---------|--|
| 8.1.2.1 | 1st layer: 100 mm backfilling as per clause 8.3. |
| 8.1.2.2 | 2nd layer: LV Cables. |
| 8.1.2.3 | 3rd layer: 150 mm backfilling as per clause 8.3. |
| 8.1.2.4 | 5th layer: Backfilling as per clause 8.4. |
| 8.1.2.5 | Danger tape (see clause 8.6) |

- 8.2 The MV cables in the trench shall be covered with a layer of soft bedding soil with a minimum thickness of 150 mm, prior to backfilling.
- 8.3 Should the excavated soil not be suitable for the covering layers, the contractor shall either run it through a screen of which the hole diameter shall not exceed 12 mm, or else import suitable soil.
- 8.4 The soil used to backfill the cable trench shall not contain more than 40% rock or scale and has to be able to pass through a screen with 100 mm diameter holes. Should the excavated soil not be suitable for backfilling, the contractor shall import the necessary backfilling material.
- 8.5 Backfilling shall be done in layers of 150 mm, each of which shall be compacted before the next layer is backfilled. The contractor shall be responsible for refilling any cable trenches that subside at any stage until expiry of the retention period.
- 8.6 The contractor shall install 300 mm from the top of the cable trench a standard 200 mm wide yellow PVC danger tape with red wording, along the complete cable route. In cable trenches with a width of 700 mm and more, 2 sets of danger tape shall be laid 300 mm apart.
- 8.7 The sidewalk or ground level along the cable trench shall be levelled off and left tidy and clean after completion of the backfilling process. The contractor shall remove all surplus material from site and suitable disposed of. Cost hereof shall be included in his rates.

9. **ROAD CROSSINGS**

- 9.1 All tar roads shall be drilled. Where drilling cannot be done, the Council's representative must approve of breaking of tar and trenching.
- 9.2 Where tar roads needs to be excavated, the tar shall be broken not wider than 600mm.
- 9.3 The trenching depth shall be as per clause 3.2.
- 9.4 Backfilling must be done as follow:
 - 9.4.1 LV Cables – 1st layer of bedding sand 100 mm on top of cables.
 - 9.4.2 Norite in layers of 200 mm. Layers to be compacted to 93% NOD AA HSTD.
 - 9.4.3 MV Cables shall be installed in sleeves. Ends to be sealed. 1 Extra sleeve to be installed with draw wire-ends to be sealed. Backfilling as 9.4.2

10 **BARRICADING OF TRENCHES**

- a. Trenches left open or with no supervision shall be barricaded at all times in accordance with OHS Act. This includes trenches left open overnight or weekends. Strong action will be taken against the contractor if this clause is not adhered to.
- b. The barricading shall be by means of droppers too which two steel wires are fixed, 400mm apart. The yellow and black tape shall then be wound around the wires.
- c. Droppers shall be not more than 1.5 meters apart.
- d. The Contractor will be held responsible for all damages and claims against Council should injures or damages been occurred to the public.

END OF SPECIFICATION

RUSTENBURG LOCAL MUNICIPALITY

DIRECTORATE: TECHNICAL & INFRASTRUCTURAL SERVICES

UNIT: ELECTRICAL ENGINEERING SERVICES

STANDARD GUIDELINES: MV & LV OVERHEAD RETICULATION G 027/0

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1 SCOPE

This specification set out the minimum standards that shall be adhered to when overhead reticulation systems are installed in the RUSTENBURG LOCAL MUNICIPALITY (RLM) electricity supply area.

2 STANDARDS

The following standards and regulations shall be adhered to at all times

- 2.1 Occupational Health and Safety Act (Act 85 of 1993)
- 2.2 Electricity Act
- 2.3 SANS 0142

3 MATERIALS

All material shall comply with the relevant specification: Materials: MV & LV Overhead Line Reticulation of the Unit: Electrical Engineering Services.

4 COOPERATION AND PROGRAMMING OF CONSTRUCTION WORKS

- 4.2 Careful planning of construction work and co-operation with other parties involved in the installation of infrastructure is important.
- 4.3 The consultant or contractor must submit a program schedule of the works before construction of the works start.
- 4.4 The contractor shall plan his work in such a way that he can complete sections of the works as required by RLM.
- 4.5 The contractor or consultant shall arrange with the RLM's Unit: Electrical Engineering Services representative to meet on site at regular intervals, in order to discuss any problems that may develop and to report on the progress of construction work.

5 PEGGING OF THE WORKS

- 5.2 The contractor shall mark overhead line routes and placement of miniature substations and distribution-kiosks on site. The representative shall, prior to installation of cables, miniature substations and distribution kiosks, approve these routes on site.
- 5.3 Should the precise position, route, height above ground level of any part of the works or the equipment not be clearly indicated on the drawings or described in the specification, the matter shall be confirmed with the representative. No construction work for which there are not clear instructions shall be carried out.
- 5.4 The contractor shall take care not to remove any surveyor pegs on the construction site, as it may lead to prosecution. It will be the contractor's responsibility to locate surveyor's pegs required for marking out overhead line routes.
- 5.5 The contractor shall appoint a registered land surveyor to verify any peg where there is uncertainty of the exact location of the peg and, where Necessary, replace pegs along all cable routes that form part of the project. The land surveyor shall issue a certificate to this effect.

- 5.6 The contractor shall accept responsibility for the installation of electrical services in the correct position. The representative may be called upon to check the marking out of overhead line routes, etc prior to commencement of excavations or erection work. Should this not be done, the contractor shall be held responsible for rectifying any mistakes.

6 BUSH CLEARANCE

All trees, plants, rubble and surplus material removed by the contractor during excavations and which are not suitable for backfilling or compact material, shall be dumped at a rubbish dumping site and leveled.

7 EXISTING SERVICES

- 7.1 The contractor shall be responsible for locating all existing services, e.g. other overhead lines, cables, telephone services, sewage lines, water and storm-water pipes, along the routes of the project.
- 7.2 The owners of such services may assist the contractor in locating their services but will not be obliged to do so in any way.

8 EXCAVATIONS AND TRENCHING

All excavations, trenching, back filling and road crossings shall be done strictly in accordance with the Head: Electrical Engineering Service's standard specification number G-018/1; Cable trenching and laying of cables.

9 INSTALLATION OF CABLE SLEEVES

- 9.1 Where cable sleeves have to be installed to cross a road, which still has to be constructed, the sleeves shall be installed at least 1,5 m below the surface of the ground, in order to prevent damage to the sleeves during road construction works.
- 9.2 Under normal circumstances cable sleeves in road crossings shall be installed not less than 900 mm below kerb.
- 9.3 Cable sleeves installed in road or service crossings shall be straight and free from damage. No crooked or deformed sleeves shall be installed.
- 9.4 Cable sleeves shall be installed without any air pockets around them. The trench shall be backfilled in layers of 300 mm and compacted layer by layer to a density of at least 95% MOD AASHO.
- 9.5 The contractor shall obtain the services of an approved test laboratory to verify the grade of compaction at road crossings, if instructed to do so by RLM. The contractor shall bear the cost of any tests that prove that compaction has not been carried out according to the specification. All test certificates shall be handed to RLM before final acceptance of the installation.
- 9.6 A galvanized draw wire shall be installed in every sleeve, which is not used. The draw wire shall be at least 1 000 mm longer than the sleeve and 500 mm shall be rolled together at each

end and left just inside the sleeve end. The sleeve ends shall be sealed by means of tight-fitting PVC end caps.

- 9.7 Sleeves through which cables have been installed shall be sealed in an approved manner, preferably with a mixture of sand and cement.

10 MARKING AND LABELLING

- 10.1 Equipment shall be labelled as indicated on the layout drawings applicable to the electrical reticulation.

The name of the high voltage feeder overhead line shall be painted on a yellow nameplate with the name written in black letters. The nameplate shall be mounted on the appropriate cross arm. In the event where the line feeds from an isolator in the ring main unit in the miniature substation or high voltage distribution kiosk, the name of the high voltage feeder overhead line shall be engraved on the label mounted on the appropriate isolator in the ring main unit in the miniature substation or high voltage distribution kiosk.

The name of the high voltage overhead line shall be engraved on the label on the inside of the door of the high voltage compartment.

The names of all low voltage overhead line shall be engraved on the labels fitted underneath the circuit breakers in miniature substations/low voltage distribution kiosk.

The contractor shall provide numbers on all low-voltage distribution kiosks, painted in black with stencilled lettering with a minimum letter height of 50 mm. The numbers shall be provided on the pillars on the side facing the street. See Bill of Quantities for detail.

11 EARTHING

- 11.1 A bare copper earth wire (as specified in project specifications) shall be run with all overhead lines. All earthing joints shall be soldered. The representative shall approve the joints.
- 11.2 The complete electrical distribution system shall be earthed in accordance with the specific requirements indicated in the project specification, which accompanies this document. In the absence of any specific requirements, the general guidelines of this specification shall be followed.
- 11.3 Where applicable, the earthing installation shall be carried out in accordance with the Standard requirements of the SABS Code of Practice for the Wiring of Premises (SABS 0142), the AMEU Code of Practice for the Application of Neutral Earthing on Low Voltage Distribution Systems, as well as any other requirements laid down by the supply authority for the development to which this contract applies.

- 11.4 Unless it is specifically required or unavoidable, earthing for lighting protection, high voltage equipment and low voltage equipment, shall be kept separate, i.e. it shall not be bonded.
- 11.5 All earth resistance measurements specified, shall apply to dry weather conditions and where considered necessary, they shall be verified during the 12 month retention period.
- 11.6 Unless otherwise specified in the project specification, miniature substation shall be earthed by connecting the 50 mm² bare copper earth wire(s) installed with the high voltage overhead lines, to the earth busbar in the miniature substation.
- 11.7 Only where specifically required in the project specification, the contractor shall employ a specialist subcontractor for the design and installation of an earthing system for a miniature substation, in the same manner as for switching substations. The earth resistance in such cases shall not exceed 3 ohms.
- 11.8 The contractor shall ensure that the neutral on the low voltage or secondary side of the transformer is connected to the earth busbar in the miniature substation and also that all metal framework including the metal enclosure of the ring main unit, is properly bonded.
- 11.9 The neutral conductor of all low voltage primary feeder lines shall be bonded to earth at all distribution and/or meter boxes etc.
- 11.10 The contractor shall ensure that the framework and components of any metal enclosures as well as the armouring of low voltage connection cables are properly bonded to the earth terminal.
- 11.11 Where cables with the earth continuity conductor as part of the armouring is used (ECC type cables) all the copper strands shall be brought through the cable gland and terminated together by means of a crimped cable lug.
- 11.12 Earth readings shall be 10 ohms or less. Readings shall be taken at a ninety degree angle to the trench with a calibrated instrument. Calibration certificate must not be older than twelve months.

12 INSPECTIONS

- 12.1 The contractor or consultant shall allow for inspection of installation work by the representative. At least two (2) days notice is required for any inspections of the installation work and the contractor shall be responsible for paying directly to the client all re-inspection fees required in case of work presented for inspection which does not comply with the specification.

- 12.2 The contractor or consultant shall submit a pressure test certificate issued by an approved authority and covering the complete reticulation installation as specified in this contract before final handing-over will take place.
- 12.3 The contractor shall take note that the completed electrical reticulation installation shall be handed over to the RLM and all requirements as laid down by the RLM have to be complied with before final acceptance.
- 12.4 The handover shall be done by means of the official handover certificate available from the representative.

13 COMMISSIONING

13.1 Testing of cable installation

The following is the specific test requirements of the RLM. These test requirements are the same as those given in SABS Method 540. The following commissioning tests are applicable:

Pressure tests on MV Lines;
Functional tests on all switchgear;
Final earthing tests;
Phase rotation;
Megger all LV Lines;
Continuity test;
Visual inspection on miniature sub-station oil levels.

- 13.2 The High Voltage pressure test shall be performed in the manner as described in Appendix D of SABS 97 of 1970.
- 13.3 Serving test at 5 kV, to prove that the outer sheath of the cables was not damaged during installation.
- 13.4 Transformer oil dielectric strength.
- 13.5 The HV and LV connections onto the transformers shall comply with a uniform standard to ensure consistent phase rotation. Phase rotation and phasing checks across open links shall be done at the time of project commissioning.
- 13.6 Test on completion of the installation of overhead lines shall be carried out in the presence of the representative as detailed and test results properly recorded and submitted in triplicate.
- 13.7 LV cable tests:
 - a. Continuity tests on all cables cores.
 - b. Continuity tests on all cables to prove the earthing of cable armouring, screening and earth conductors.
 - c. All low voltage cables shall be megger-tested with the aid of a 500 V insulation-resistance tester to ensure a clean system, prior to commissioning. All circuit breakers shall be closed for the purpose of this test.

- d. Where parallel cables have been installed, or where ring feeds exist, the phase colours shall be verified to ensure correct connections.
 - e. Underground service connection cables shall be positively identified by means of a megger test, prior to commissioning of the low voltage system.
- 13.8 All tests shall be carried out in the presence of the representative and sufficient notice shall be given prior to any tests being carried out.
- 13.9 The contractor shall provide all the necessary test equipment and instruments required for the proper testing and commissioning of the complete installation, as specified elsewhere in this document. Calibration certificates of these instruments shall be available.
- 13.10 Should any part of the installation fail during a test, or should the equipment fail to meet the requirements of the specification, the contractor shall replace, repair or correct the faulty components to the satisfaction of the RLM.
- 13.11 Should the installation be accepted and commissioned with certain outstanding items, a list of these items (punch list) will be compiled and rectified before the handover certificate shall be issued.

14 DRAWINGS

- 14.1 Drawings which depict existing services, e.g. water pipes, sewerage, telecommunication cables, etc. will be obtained from the authority responsible for the service by the contractor or consultant. The correctness and accuracy of these drawings will however not be guaranteed and will be the contractor or consultants responsibility to establish the exact position of these services prior to commencement of excavations.
- 14.2 A complete set of updated drawings for the installation shall be available on site at all times, preferably displayed in the site office.
- 14.3 Before final acceptance of the completed installation, the contractor shall furnish all the necessary “as-built” information, marked up in red pen on paper prints of the construction drawings. The information shall include every detail required to establish the exact position of all lines, cables, cable joints and other equipment, which have been installed as part of this contract. Fixed references such as stand pegs or boundaries shall be used to locate the above items positively.

15. CLEANING OF SITE

After completion of construction activities, the contractor shall remove all his equipment and site facilities from the site and leave the site in a tidy condition.

END OF SPECIFICATION