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REFERENCE

REV

**TITLE    STANDARD FOR NEW SERVICE  
          CONNECTIONS AND METERING  
          LABOUR CONTRACTS**

**CP\_TSSTAN \_ 144**

**0**

**DATE:            May 2021**

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## **FOREWORD**

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## **INTRODUCTION**

City Power has embarked on a major process to upgrade, refurbish and maintain its network infrastructure on an as and when required basis. The labour contracts for the installation and maintenance of service connections and metering are therefore required.

### **1. SCOPE**

This standard covers City Power's requirements for the services of competent contractors to provide labour resources for the metering and service connections. All materials will be supplied by City Power.

The provision of new service connections up to 56kVA and specialised connections above 56kVA and the installation and maintenance of metering infrastructure services as stated in this document are required

City Power reserves the right to utilize the successful contractor(s) to undertake a limited amount of work anywhere within City Power's area of electricity supply. It is therefore not a requirement that all contracts or contractual values will be exhausted in full during the term of contract.

Details of the scope of work will be indicated at the time the work instruction (Purchase Order) is issued.

All equipment pre-commissioning testing shall be carried out as per relevant standards and specifications shall be witnessed and signed off by a City Power personal.

### **2. NORMATIVE REFERENCE**

The following documents contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

#### **2.1 Specifications**

<b>Document number</b>	<b>Document title</b>
CP_TSSTAN_009	City Power's Township Electrical Reticulation Standard for Underground Systems

Document number	Document title
CP_TSSTAN_030	Standard for Numbering of street light poles.
CP_TSSTAN_033	City Power's Operating Safety Precaution Standard
CP_TSSTAN_035	Standard for the planning of public lighting infrastructure
CP_TSSTAN_036	Standard for the installation of public lighting infrastructure
CP_TSSTAN_037	Standard for the maintenance of public lighting infrastructure
CP_TSSTAN_042	Standard for Technical requirements for labour contracts for systems rated up to and including 22 kV.
CP_TSSTAN_043	City Power's work standing instruction for the acquisition and payment procedures for contractors or service providers.
CP_TSSTAN_108	Electrification Standard
CP_TSSTAN_133	Standard for meter check and final reading
CP_TSSPEC_001	Medium Voltage (MV) Cables
CP_TSSPEC_002	Low Voltage (LV) Cables
CP_TSSPEC_005	Miniature Substations (MSS)
CP_TSSPEC_006	Ring Main Units (RMU) for MSS
CP_TSSPEC_008	2 and 4 way CMKs
CP_TSSPEC_010	LV ABC with neutral supporting conductor
CP_TSSPEC_011	Discharge Lamps
CP_TSSPEC_012	Photo Electric Control Units
CP_TSSPEC_013	Glass Reinforced Polyester Poles
CP_TSSPEC_231	Energy efficient street lighting Luminaires
CP_TSSPEC_015	Post top luminaires
CP_TSSPEC_016	Contactors
CP_TSSPEC_017	Miniature Circuit Breakers (MCB)
CP_TSSPEC_018	LV Moulded Case Circuit Breakers (MCCB)
CP_TSSPEC_019	Split concentric single phase aerial service cable
CP_TSSPEC_020	Current carrying connectors and joints for LV ABC
CP_TSSPEC_021	Cable ties for use with ABC
CP_TSSPEC_022	Crimped Lugs and Ferrules

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Document number	Document title
CP_TSSPEC_023	Mechanical Torque Shear Connectors
CP_TSSPEC_024	Fittings for use with LV ABC
CP_TSSPEC_025	Free standing 11kV metering kiosks
CP_TSSPEC_027	Concrete Plinths
CP_TSSPEC_028	Earth leakage units
CP_TSSPEC_029	Adjustable Cable Clamps
CP_TSSPEC_030	Metal Cable Glands
CP_TSSPEC_031	LV surge protection devices
CP_TSSPEC_032	Street lighting Poles
CP_TSSPEC_033	Steel distribution poles
CP_TSSPEC_034	Pilot cables
CP_TSSPEC_035	11kV metal clad switchgear
CP_TSSPEC_038	Pole mounted SDB
CP_TSSPEC_039	Free Standing RMU
CP_TSSPEC_040	Earth Fault Indicators
CP_TSSPEC_041	Single and three phase meter cabinets
CP_TSSPEC_042	Load management relay box
CP_TSSPEC_043	Meter cabinets for SPLV service connections
CP_TSSPEC_045	PVC Sleeves
CP_TSSPEC_046	PVC Adhesive Tapes
CP_TSSPEC_047	Insulating putty and self-fusing tape
CP_TSSPEC_051	Fittings for use with single phase aerial service cable
CP_TSSPEC_052	Concrete poles
CP_TSSPEC_053	MV joints and terminations
CP_TSSPEC_054	LV joints
CP_TSSPEC_055	Exothermic welding
CP_TSSPEC_056	Earth rods
CP_TSSPEC_057	Neutral blocks

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Document number	Document title
CP_TSSPEC_058	MV ABC
CP_TSSPEC_059	Nylon cable glands
CP_TSSPEC_061	Bare overhead aluminum conductors
CP_TSSPEC_062	Copper busbars
CP_TSSPEC_063	Electronic single and three phase meters
CP_TSSPEC_064	MV metering CT's
CP_TSSPEC_065	LV CT's
CP_TSSPEC_066	MV rackable VT's
CP_TSSPEC_068	LV fuses
CP_TSSPEC_069	Master padlocks
CP_TSSPEC_070	MV fuses
CP_TSSPEC_071	Timers
CP_TSSPEC_072	Streetlight SDB's
CP_TSSPEC_073	Control gear
CP_TSSPEC_075	Hardware
CP_TSSPEC_076	Galvanised cable clamps
CP_TSSPEC_077	Ground mounted distribution transformers
CP_TSSPEC_078	Notices, danger and warning signs
CP_TSSPEC_080	Pole fittings for use with LV ABC & ASC
CP_TSSPEC_081	Thermal indicator stickers
CP_TSSPEC_082	LV panels for vandal resistant 27 way steel SDB's
CP_TSSPEC_083	Danger and warning tapes
CP_TSSPEC_084	Cable route markers
CP_TSSPEC_085	Stays and associated components
CP_TSSPEC_086	LV Distribution Fuse Cabinet
CP_TSSPEC_087	Single and three phase prepayment meters
CP_TSSPEC_088	Portable notice, danger and warning signs

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Document number	Document title
CP_TSSPEC_091	Disposal of waste
CP_TSSPEC_092	Stainless steel strapping
CP_TSSPEC_093	LV fuse switch disconnecter pillars
CP_TSSPEC_094	LV MCCB cabinet
CP_TSSPEC_096	Pole mounted distribution transformer
CP_TSSPEC_099	High mast inspection
CP_TSSPEC_101	End connectors and insulating sleeves
CP_TSSPEC_103	Small power distribution boards (ready boards)
CP_TSSPEC_104	MV insulators
CP_TSSPEC_106	Electronic maximum demand meters
CP_TSSPEC_108	Portable earthing
CP_TSSPEC_111	Insulating rods for use with portable earthing equipment
CP_TSSPEC_116	Insulating oil
CP_TSSPEC_122	MV proximity tester
CP_TSSPEC_123	MV phase comparator
CP_TSSPEC_127	Insulating gloves
CP_TSSPEC_130	Steel 27 way SDB's (high risk areas)
CP_TSSPEC_134	Flexible protective sleeves for underground use
CP_TSSPEC_136	Termination kits for LV cables
CP_TSSPEC_138	Pole mounted auto recloser
CP_TSSPEC_139	Pole mounted sectionaliser
CP_TSSPEC_146	11kV BMK
CP_TSSPEC_150	Protective sleeve for fibre optic cables
CP_TSSPEC_164	New ground mounted transformers
CP_TSSPEC_168	1600A LV distribution fuse cabinet
CP_TSSPEC_208	Low voltage service protective distribution kiosk
CP_TSSPEC_232	Energy mix technologies equipments
CP_TSSPEC_271	split concentric tinned copper and coated steel 10mm <sup>2</sup> cable
CP_TSSPEC_202	Copper clad steel for earthing
CP_TSSPEC_259	Specification for Outage And Workforce Management System



Document number	Document title
CP_TSSPEC_260	Specification for control and monitoring of protective distribution KIOSK
CP_TSSPEC_316	Specification for single and three phase meters
OHS Act 1993	Occupational Health and Safety Act (Act 85 of 1993)
SANS 10198	The selection, handling and installation of electric power cables of rating not exceeding 33kV - Parts 1 to 14.
SANS 1200 D	Standardized specification for civil engineering construction Section D: Earthworks
SANS 1195	Busbars
SANS 1411-2	Materials of insulated electric cables and flexible cords - Part 2: Polyvinyl chloride (PVC)
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3000V)
SANS 60947-7-1	Low-voltage switchgear and control gear Part 7: Ancillary equipment Section 1: Terminal blocks for copper conductors
IEC 60898	Electrical accessories/circuit breakers for over current protection for household and similar installations
SANS/IEC 62055-31:	Electricity metering — Payment systems Part 31: Particular requirements — Static payment meters for active energy (classes 1 and 2)
SANS 1524-1:	Electricity payment systems Part 1: Payment meters
SANS 1799,	Watt-hour meters – AC electronic meters for active energy.
SANS 9001:	Quality Systems – Model For Quality Assurance In Design/Development, Production, Installation And Servicing.
SANS/IEC 62056-21:	Electricity metering — Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
SANS IEC 61036	Alternating-current static watt-hour meters for active energy (Classes 1 and 2).
NRS 057:2009:	Code of practice for electricity metering
NRS 055:2011	Revenue Protection
NRS 096:	Electricity metering – Ancillary specifications – Part 1: The sealing of electricity meters.

## **2.2 Drawings**

<b>Reference</b>	<b>Title</b>
CP_TSDRAW_001	MV XLPE single core heat shrink terminations
CP_TSDRAW_002	LV through wall busbar stubs in distribution chambers
CP_TSDRAW_003	CP6 type A meter cabinet for cluster development
CP_TSDRAW_004	Steel streetlight and distribution poles
CP_TSDRAW_005	Lighting bracket
CP_TSDRAW_006	Lighting bracket mounting arrangement
CP_TSDRAW_007	SDB 2 way CMK
CP_TSDRAW_008	SDB 4 way CMK
CP_TSDRAW_011	SDB 27 way steel
CP_TSDRAW_012	Standard notices, warning and danger signs
CP_TSDRAW_013	Wall and plinth mounted meter cabinets (CP1)
CP_TSDRAW_014	Wall and plinth mounted meter cabinet (CP3)
CP_TSDRAW_015	Typical arrangement of the consumer's medium and low voltage chambers (Sheets 1 to 7)
CP_TSDRAW_016	Standard symbols for area electrification (Sheet 1 of 1)
CP_TSDRAW_017	4 kN pre-stressed concrete pole
CP_TSDRAW_018	10 kN pre-stressed concrete pole
CP_TSDRAW_019	20 kN pre-stressed concrete pole
CP_TSDRAW_024	8 kN pre-stressed concrete pole
CP_TSDRAW_026	CP5 Load Management Relay Box
CP_TSDRAW_030	CP7 Typical details for metering and switch receptacle for SPLV boxes
CP_TSDRAW_036	MSS Earthing for MV system with continuous earthing conductor to source substation
CP_TSDRAW_048	Plinth details for type A long MSS
CP_TSDRAW_049	Free standing 11 kV metering unit

CP_TSSDRAW_063	9 way pole mounted low voltage distribution protective kiosk
CP_TSSDRAW_064	6 way ground mounted low voltage distribution protective kiosk
CP_TSSDRAW_065	9 way ground mounted low voltage distribution protective kiosk
CP_TSSDRAW_066	18 way ground mounted low voltage distribution protective kiosk
CP_TSSDRAW_068 SHEET 1	R.A.T meter wiring
CP_TSSDRAW_068 SHEET 2	R.A.T meter wiring

## **2.3 Inspection Checklists**

<b>Reference</b>	<b>Title</b>
CP_TSCHECK_026	Commissioning checklist for MV chamber (civil)
CP_TSCHECK_026	MSS Pre-commissioning planning checklist
CP_TSCHECK_026	Commissioning checklist for cable Installation
CP_TSCHECK_026	Commissioning checklist for outdoor RMU

## **2.4 Other applicable documents**

City Power Operating Regulations

The Standard System of Measurement of Civil Planning Engineering quantities for South Africa and Namibia

Johannesburg Roads Agency (Pty) Ltd: Public Roads and miscellaneous by-laws

Expanded Public Works Program Guidelines (2nd Edition July 2005)

Basic Conditions of Employment Act of 1997, Ministerial Determination No.4: Expanded Public Works Programmes of October 2010.

Any other Acts/Regulations/policies as applicable to the Industry.

### **3. GENERAL REQUIREMENTS FOR LABOUR CONTRACTS**

#### **3.1 General Statutory and technical requirements**

The compulsory requirements of the OHS Act of 1993 shall be complied with at all times when installing electrical equipment for City Power. Where clarity is required on subjects covered by this standard, the requirements of the OHS Act of 1993 shall be adhered to.

The technical requirements of SANS 0198 Parts 1 to 14 shall be adhered to, unless otherwise approved in writing by City Power. Any technical concessions to this standard shall be approved by the Technical Evaluation Committee before the successful contractor(s) is informed in writing.

The safety of all personal performing work for City Power shall be a key deliverable and adherence to City Power's Safety Operating Precaution Standard CP\_TSSTAN\_033 is compulsory at all times.

The electrical equipment standards and specifications of City Power's Township Electrical Reticulation Standard for Underground Systems CP\_TSSTAN\_009 shall be adhered to when installing electrical equipment for City Power. Any technical concessions to this standard shall be approved by the SANS 0198 before the successful contractor(s) is informed in writing.

All equipment shall comply with the relevant specifications as detailed in this standard and, if no City Power specification exists the SANS specification shall apply.

Generally, no equipment or cables shall be installed in common trenches where other services have been installed i.e. Telkom service and Water mains

The work standing instruction for the acquisition and payment procedures for contractors or service provider CP\_TSSTAN\_043 shall be applied when the services of a contractor or service provider is required with in City Power.

The City of Johannesburg Metropolitan Municipality: Public road and miscellaneous BY-LAWS shall be complied to when working in the road reserves of the City of Johannesburg.

#### **3.2 Extent of work**

The Contractor must take cognisance of the fact that this is an "as and when" contract and City Power cannot guarantee the extent of work to be carried out nor the amount of money to be spent.

Quantities given are provisional and are given only for the purpose of tender evaluation. The Contractor will be paid on actual work carried out at the agreed rates.

The estimated quantities have been obtained by summing various small and large individual projects and the Contractor must gear its operations and costs to enable it to undertake the said work at various sites.

The contractor shall ensure the use of local labour from communities where manual labour is needed in line with the requirements of the Expanded Public Works Program of National Government as well as guidelines set by City Power as part of this document.

The Contractor shall ensure safeguarding of the project and relevant network until such network is completely handed over to City Power.

### **3.3 City Power's Responsibilities.**

- 3.3.1 City Power's resources shall oversee and approve workmanship, ensure compliance and authorize payments.
- 3.3.2 City Power shall further provide identity cards, flyers, notices and drawings, seals and sealing wire to the Service Provider.
- 3.3.3 Information stickers detailing inspection information such as City Power's contact details, date of installation and etc., shall be supplied by City Power.
- 3.3.4 New and replacement meters including peripherals shall be provided by City Power as free issue subject to approval by the relevant Metering Department.
- 3.3.5 City Power shall ensure that stock of material is kept.
- 3.3.6 Replaced meters shall be returned to City Power for reverse logistics and asset retirement processes.

### **3.4 Service Provider's Responsibilities.**

- 3.4.1 The Service Provider shall install new equipment in areas that are without existing installations in line with the project plan.
- 3.4.2 The Service Provider shall install the supplied equipment in accordance with the above mentioned standards.
- 3.4.3 The Service Provider shall inspect existing connections and take corrective action where necessary (i.e. repair or replace).
- 3.4.4 Existing installations that do not comply with good practice or where the meters, network, and public lighting infrastructure have been tampered with shall be reported. Wiring shall be repaired, meters, public lights and network infrastructure shall be replaced and sealed where necessary.

- 3.4.5 The service provide shall capture readings before replacing the meters.
- 3.4.6 Replaced meters shall be returned to City Power for the purpose of reconciling invoiced replacements and for possible repair and re-cycling.
- 3.4.7 The Service Provider shall provide the following:
- a) Skills and labour
  - b) Transport to and from target areas
  - c) All tools and appropriate test equipment
  - d) Wiring, ferrules and terminals
- 3.4.8 Any sundry tool required to perform installation and maintenance of meters, connections, public lighting and associated equipment.
- 3.4.9 The Service Provider shall have more than one team and each team shall be comprised of at least two resources being an installer and a labourer
- 3.4.10 The Service Provider shall not claim overtime or additional costs after rates have been accepted by City Power as it shall be generally understood that the related costs will be factored into the pricing.
- 3.4.11 It is further intended that an Electrician (single phase tester minimum requirement) shall signs off on installations.
- 3.4.12 The Service Provider shall be held responsible for loss or damage to the new equipment from the time they are issued until they are installed and the handover documents have been signed off by all the various stakeholders.
- 3.4.13 The Service Provider shall capture data using the work force management tool and any other management tool requested by City Power.
- 3.4.14 The Service Provider shall ensure that each meter is adequately sealed and all relevant information is captured before leaving the premises.
- 3.4.15 The Service Provider shall ensure availability of resources for call outs during and after office hours as per service level agreement.
- 3.4.16 The Service Provider shall provide and operate all the necessary test instruments and equipment to perform all tests.
- 3.4.17 The Service Provider shall be responsible for all safety precautions prior commencement of duties which includes risk assessment and which includes testing.
- 3.4.18 Up to date certificates of accuracy for the testing apparatus by recognized regulatory bodies shall be provided as and when required.

- 3.4.19 The service provider shall ensure a safe state of all distribution kiosks by leaving them securely closed prior to leaving site.
- 3.4.20 All defects of deficiencies found during an inspection shall be repaired or corrected by a qualified person no cost to City Power.
- 3.4.21 Under no circumstances shall any contractor or his workmen perform any function that he or she is not authorized to perform. In any case of doubt the matter shall be referred to the Supervisor, Manager of operator.
- 3.4.22 Contractor's staff shall not retaliate when subjected to abuse by an irate customer. In the event of any abuse this shall be referred to the Operation Manager or Supervisor.

### **3.5 Contractor employee and subcontractor details**

The contractor shall provide a detailed business profile. If subcontractors are utilized by the contractor, then the subcontractor's business profile shall also be provided. City Power shall do the approval of subcontracting. No contractor shall be allowed to use any sub-contractor without approval of City Power. The contract shall provide the following employee and subcontractor details;

- a) A detailed list of all employees and subcontractors (electrically skilled staff),
- b) A detailed list of qualifications and experience of all employees and subcontractors who will perform work on City Power's electrical distribution network,
- c) A detailed list of each person's expertise for the above list of employees and subcontractors, i.e. MV jointing certification or cable laying Certification etc. and,
- d) A list of previous project references, i.e. contact persons, work completed, etc.

**NOTE:** The successful contractor shall ensure that the above information which has been supplied to City Power is continually updated monthly to ensure that City Power's record keeping is accurate and correct.

### **3.6 Contractor fleet, specialized tooling and premises details**

The contractor shall provide fleet, specialized tooling and premises details currently owned by the contractor's business and owned by the subcontractor respectively if applicable;

- a) A detailed list of all roadworthy vehicles (make, model, registration number, purpose of vehicle),
- b) A detailed list of all specialized tooling (make, model, serial number, purpose of specialized tool),
- c) A detailed list of address(s) premises (location, capability, number of staff at each premise).

City Power shall not lease any City Power vehicles or specialized tooling to any contractor. The successful contractor shall be fully equipped to perform the work awarded to him by City Power. If the contractor(s) arrives on site and is not equipped to perform the work awarded to him by City Power, shall have his labour contract terminated by City Power.

### **3.7 Contractor workmanship guarantees**

The contractor shall be liable for workmanship guarantees for a period of 12 months once the electrical equipment has been commissioned. If in this time period, it is proved by City Power that poor workmanship was the cause of the power failure; the 10% contract retention fee shall be used by City Power to repair the poor workmanship and a noncompliance certificate shall be issued to the contractor by City Power.

### **3.8 Work to be undertaken**

Contractors and subcontractors shall only undertake work on City Power's electrical network if they are in possession of an approved wayleave from City Power.

Any contractor caught working within City Power's area of supply without an approved wayleave, shall be fined R5000 by City Power. The contractor shall also be liable for any fines imposed on them by other MOE's and if any services are damaged they will have to pay for the repair of these services. The fines and repairs shall be paid for by the contractor at no cost to City Power.



### **3.9 Issuing of material**

All material shall be issued free by City Power as per the bill of material of the planning engineer.

Any contractor caught installing non-City Power issued material shall have their contract with City Power terminated.

All excess material not installed on the job shall be returned to City Power's warehouse with relevant documentation (i.e. Material Issue slip and Warehouse Credit Requisition form)

Contractors and subcontractors found with City Power's stock in their possession illegally, shall be prosecuted accordingly and will have their contract with City Power terminated.

## **4. SPECIFIC LABOUR STREAMS**

### **4.1. SERVICE CONNECTIONS LABOUR**

#### **4.1.1. Service Connection Requirements**

##### **4.1.1.1. Low voltage service connections**

All new low voltage service connection must be done using protective structures with remote access terminal (RAT) with a prepaid metering connection of ADMD of 5kVA per erf or per informal dwelling.

This low voltage design shall consist of the following;

Overhead mounted transformer complying with CP\_TSSPEC\_096 on concrete poles complying with CP\_TSSPEC\_052 supplying a set of three suitably rated outdoor type fuse carrier complying with CP\_TSSPEC\_068 the medium voltage overhead mains should be suitably protected by means of an autorecloser, sectionalizers, path finders, etc.

On all 11kV structures, the phase distances must be widened to the minimum of 600mm in order to prevent forced outages and vandals. This approval will be at the discretion of the Electrification engineer and the field service manager of that region.

Main ABC conductors complying with CP\_TSSPEC\_010, mounted on concrete poles complying with CP\_TSSPEC\_052 and utilizing ABC hardware compliant with CP\_TSSPEC\_024.

Protective structure service distribution boxes (PSSDB) complying with CP\_TSSPEC\_208 shall be used as a distribution point.

Split concentric or the mixed metal cable (tinned copper and coated steel) shall be used from the pole mounted low voltage distribution boxes to the dwelling.

kA, miniature circuit breakers compliant with and rated as per specification CP\_TSSPEC\_017, shall be installed in the pole mounted PSSDB, to protect each circuit.

Note: The fault levels at PSSDB's close to the transformer may exceed 6kA. In these cases, a circuit breaker with a suitable breaking capacity shall be used eg 10 kA.

A pre wired board complying with CP\_TSSPEC\_103 shall be installed in the consumers dwelling.

Metering shall be in accordance CP\_TSSPEC\_316 . The exact details of the split prepayment system shall be clarified with the relevant City Power engineer prior to approval.

#### **4.1.1.2. General**

- 4.1.1.2.1 All service connection infrastructure inspections shall be conducted in accordance with NRS 034 and the manufacturer's recommended procedures. The inspection frequency shall be communicated by City Power accordance and shall not be limited to either the manufacturer's recommended intervals or the equipment failure or faults.
- 4.1.1.2.2 All maintenance and repairs shall be executed by competent or qualified personnel in line with stipulated response times.
- 4.1.1.2.3 All tools required for installation shall be supplied by and remain the property of the service provider.
- 4.1.1.2.4 Network equipment shall be suitably accommodated and protected and be readily accessible to officials of the Service Provider at all reasonable times.

#### **4.1.1.3. Pre Installation Checks**

- 4.1.1.3.1 At the completion of the installation and prior to the commencement of the commissioning tests the contractor shall inspect all hardware and verify that the following tasks have been completed in accordance with the installation specifications
- 4.1.1.3.2 All hardware devices (e.g.: breakers) have been installed at the locations specified in the design documentation.
- 4.1.1.3.3 Electrical and communications cables have been appropriately sized and secured to protect against operational damage and ensure stability for continuous use.
- 4.1.1.3.4 Connections have been correctly terminated and insulated to ensure satisfactory connectivity and protection against faults and interference.
- 4.1.1.3.5 All devices have been provided with adequate protection against moisture and other environmental conditions

- 4.1.1.3.6 Communication network cables have been correctly connected to the designated points.
- 4.1.1.3.7 Associated equipment such as power supplies and switches have been connected correctly and secured appropriately.
- 4.1.1.3.8 Drawings have been updated accordingly.
- 4.1.1.3.9 Proper grounding or earthing on all devices.

#### **4.1.1.4. Commissioning Check**

- 4.1.1.4.1 The Service Provider shall be responsible for the configuration of any additional equipment that are added or replaced on the network.
- 4.1.1.4.2 They will be responsible for the commissioning of the new equipment. The Contractor will be an active participant in the testing and commissioning with City Power.

#### **4.1.1.5. Preventative Maintenance**

- 4.1.1.5.1 A large part of keeping a company running efficiently and profitably is ensuring that all equipment is functioning optimally. To do so, routine preventative maintenance needs to be conducted in accordance with the relevant regulatory standards.
- 4.1.1.5.2 Preventative maintenance shall be performed in accordance with relevant standards as stated in this document, to extend the life of assets and increasing equipment uptime, as well as increasing productivity and efficiency.
- 4.1.1.5.3 It is performed while the equipment is still working so that it does not break down unexpectedly
- 4.1.1.5.4 The service provider shall ensure safety by wearing appropriate personal protective equipment such as glasses and gloves, etc.)
- 4.1.1.5.5 Equipment must be installed in a level and perpendicular manner in accordance with manufacturer's specifications.
- 4.1.1.5.6 The overall condition of equipment shall be inspected which includes Terminals, seals, glass, and insulation.
- 4.1.1.5.7 Exposed non-current carrying metal parts of fixed equipment, metal boxes, cabinets, and fittings which are not electrically connected to grounded equipment, shall be grounded as required by National Electrical Code, Article
- 4.1.1.5.8 The terminals of the meter shall be arranged so that the possibility of short circuits in removing or replacing the cover, making connections and adjusting the meter is minimized.
- 4.1.1.5.9 The main circuit breaker or main switch and fuses and their auxiliary equipment shall be installed in the load service near its entrance as supplied which is intended to constitute the main control and means of cut-off

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- 4.1.1.5.10 Check for ground faults; verify customer being billed is the only customer served by each meter. Verify that common use areas such as street lights are not wired into the load side of the customer circuit.
- 4.1.1.5.11 Any associated photographs, diagrams, GPS coordinates and et, shall be uploaded via the workforce management tool

#### **4.1.2. Cables**

##### **4.1.2.1. Excavation, backfilling, compaction and reinstatement**

The Electrical Contractor shall be responsible for all earth works necessary to complete the electrical reticulation as specified. Unless otherwise specified, measurement of earth works shall be done according to "The Standard System of Measurement of Civil Planning Engineering quantities for South Africa and Namibia".

The Contractor must familiarise itself with the requirements as indicated in the Johannesburg Roads Agency (Pty) Ltd: Public Roads and miscellaneous by-laws. All conditions stipulated in this standard are to apply irrespective of whether the excavations are in the road reserve or not. The Contractor must ensure that it understands the full context of the codes of practice so that the administration costs of applying the codes can be built into the rates as tendered in the Bill of Rates.

Because it is not possible to estimate the financial transactions required for the Codes, the Contractor will be required to retain all receipts and all costs will be reimbursed by adding them to Contract Progress Payments.

All work shall be performed by means of manual labour in line with EPWP Labour Intensive Construction methods. Only under exceptional circumstances, with the written consent or approval by a City Power representative, will the use of plant and machinery be allowed for such works or similar. In instances where a contractor performs work by use of plant and machinery, without the relevant approval for such work by a City Power representative, City Power reserves the right to withhold payment for the work in question.

##### **4.1.2.2. Removal of rock**

Rock encountered in trenches is to be removed with the use of mechanical rock breakers such as a pneumatic hammer and wedge. The use of explosives will only be considered under special circumstances and blasting may only be undertaken with the written permission from City Power's relevant General Manager and provided all regulatory explosive and blasting permits and licenses.

Rock encountered in pole holes is to be removed with the use of either mechanical rock breakers such as pneumatic hammers or a rock drill with a minimum diameter of 450 mm.

The removal of rocks, that have been loosened by means of machinery, shall however by means of manual labour, employing the use of tools such as shovels or similar, whenever and wherever this is deemed technically practicable and safe.

#### **4.1.2.3. Classification of material to be excavated**

The classification of material in which excavations have to be carried out shall be classified as covered by the SANS 1200 D standardized classifications.

The material in which excavations have to be carried out shall be classified as follows:

- a) "Hard material" will be held to be under-composed boulders each exceeding a nominal diameter of 1 m and solid rock in bulk or banks or ledges, the practicable excavation of which would necessitate the use of explosives and/or drilling and wedging. Hard material can only be excavated by either pneumatic tools or by a "back actor" with a special mechanical ripper attached to it. Hard material shall include soil with loose boulders greater than 0,5 m<sup>3</sup> after excavation.
- b) "Soft material" will be held to be material more easily excavated and not falling into categories of "hard material" such as gravel, earth, turf, scale, sand, silt and clay.

#### **4.1.2.4. Dimensions of cable trenches**

All trenches shall be subject to and not limited to the following:

- a) The Contractor shall be responsible for all trench excavation.
- b) The Contractor shall, before trenching commences, familiarize himself with the routes and site conditions and the procedure and order of doing work shall be planned in conjunction with the general construction programme for other services and building requirements.
- c) The contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.
- d) The contractor shall take all necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and /or employees on site are not endangered.
- e) The Contractor shall ensure that the excavations will not endanger existing structures and roads.

Trenching shall be in accordance with SANS 10198. All cable trenching shall be in strict accordance with City Power standards and specifications CP\_TSSTAN\_009. All trenches are to be a minimum of 400 mm wide and must be excavated to the following depths below natural ground level:

**Medium Voltage cables** : 1000mm below final ground level.

**Low Voltage cables** : 600mm below final ground level.

**Medium Voltage cable spacing** : 150mm apart from each other.

**Sleeved Road Crossings** : To install the sleeves at a depth of 1 000 mm below the lower gutter level

The normal volumetric rates per linear metre of trench to meet these requirements are:

**Low Voltage Cables** : 0, 30 m<sup>3</sup>

**Road Crossings** : ± 0, 55 m<sup>3</sup>

Should the Contractor be required to excavate to a depth of greater than 1 000 mm, the width of such excavation as well as the appropriate shoring requirements must be in accordance with the Occupational Health and Safety Act (Act 85 of 1993).

#### **4.1.2.5. Installation of cables**

All cables shall be laid in accordance with the requirements of SANS 10198 and CP\_TSSTAN\_009.

Aluminium XLPE insulated MV cable shall be installed for all new projects. PILC are not to be used, only from XLPC to PILC transition joint may only be used for joining new cables to existing networks. Cable jointers shall be trained and certified to joint and terminate on both types of cables.

The contractor to ensure compliance shall inspect all trenches prior to installation. A cable inspection prior to the closing of the trench. An inspection to ensure the 75mm<sup>2</sup> layer has been filled and compacted correctly. Final inspection once the trench has been backfilled and compacted where the compaction certificates can be handed over.

Cable must only be laid in trenches having smooth flat bottom surfaces. Where these surfaces are irregular they must first be smoothed off before installing the cables. Where cables are installed in trenches cut in rock, a 75 mm layer of fine sieved earth must be placed on the bottom of the trench to serve as bedding for the cable. Maximum size of sieve mesh for sieved earth is 10 mm x 10 mm.

After the cable has been installed it must be covered with a 75 mm layer of hand compacted, fine riddled earth. Regardless of whether the trench has been cut in rock or not, the cable must be covered with a 75 mm layer.

Bedding and covering shall consist of sifted sand of plaster sand quality for all cables. The bedding and covering shall be approved by the Clerk of Works or relevant City Power official. Where only low voltage cables are installed, bedding can be sifted from the excavated material.

Where medium and low voltage cables are to be installed in a common trench, they must each be installed in accordance with the above requirements but the low voltage cables are to be installed 400 mm above the medium voltage cables.

At road crossings all cables are to cross at a common depth i.e. 1 000 mm below road surface and the low voltage cables must therefore be ramped up and down each side of these crossing points accordingly.

All cables must be installed in straight lines as far as possible and excessive distortion or weaving in the cable length will not be accepted.

Trenches shall be excavated so that the laid cable(s) is (are) laid in the positions shown on the drawings and shall be 1 000 mm from all stand boundaries.

All cables feeding overhead line circuits shall be secured to the pole by means of 20 mm stainless steel tape or wrapped with the appropriate material as at intervals not exceeding 1, 0 metre.

Where the cable needs to be placed inside concrete for cable theft prevention, concrete shall be in accordance with the City Power guideline for burying cables in concrete.

#### **4.1.2.5.1. Medium Voltage Cables**

All medium voltage cables shall comply with specification CP\_TSSPEC\_001 and only aluminum cables shall be used.

For main ring distributors, 300 mm<sup>2</sup> 3-core XLPE cables shall be installed on new installations.

For sub ring distributor, 185 mm<sup>2</sup> 3-core XLPE cables shall be installed on new installations

A sub ring distributor shall consist of no more than 6 load centres.

#### **4.1.2.5.2. Low Voltage Cables (underground)**

All low voltage cables shall comply with specification CP\_TSSPEC\_002.

For main underground LV distributors supplying low voltage distribution boxes or CMK's 120 mm<sup>2</sup> x4 core PVC aluminum equivalence cables shall be installed.

#### **4.1.2.5.3. LV Aerial Bundled Conductor**

All LV aerial bundled conductor shall comply with CP\_TSSPEC\_010, shall be suspended from concrete poles complying with CP\_TSSPEC\_52. Installation of ABC shall be in accordance with SANS 10198-14

**Table 1 : ABC for use at City Power**

<b>Items</b>	<b>Description</b>	<b>Application</b>
1	1 x 25 mm <sup>2</sup> street lighting core plus 1 x 54,6 mm <sup>2</sup> neutral / earth supporting conductor (aluminum alloy & insulated) 3x 25 mm <sup>2</sup> street lighting core plus	Street lighting
2	3 x 50 mm <sup>2</sup> phase cores plus 1 x 25 mm <sup>2</sup> street lighting core plus 1 x 54,6 mm <sup>2</sup> neutral / earth supporting conductor ( aluminum alloy & insulated)	Electrification
3	3 x 95 mm <sup>2</sup> phase cores plus 1 x 25 mm <sup>2</sup> street lighting core plus 1 x 54,6 mm <sup>2</sup> neutral / earth supporting conductor ( aluminum alloy & insulated)	Electrification
4	3 x 120 mm <sup>2</sup> phase cores plus 1 x 25 mm <sup>2</sup> street lighting core plus 1 x 70 mm <sup>2</sup> neutral / earth supporting conductor ( aluminum alloy & insulated)	Conversion from bare overhead system

LV ABC shall be installed in accordance with manufacturer's instructions.

#### **4.1.2.6. Sleeves**

##### **4.1.2.6.1. Sleeves installed at road crossings**

At all road crossings, the Contractor must install sleeve pipes, where these do not exist, prior to any cable being installed, at the City Power approved rates.



The Contractor must then install the cable through the buried sleeve pipes at the following rates:

- 1) The rate for the installation of cable laid in an open trench per metre installed, plus the rate per metre of sleeve pipe that the cable is drawn through, irrespective of the length of the cable pulled through the sleeve pipe.
- 2) A blanked-off spare sleeve shall also be installed per road crossing at the applicable approved rate.

#### **4.1.2.6.2. Sleeves installed across driveways, entrances and lanes**

At all driveways, entrances and lanes, the contractor may in agreement with Clerk of Works and relevant City Power official:

- a) Opt to install cable sleeves as required for any road crossing, or
- b) Provide steel plates across the said excavated driveways, entrances or vehicular lanes and pedestrian access prior to the cables being laid. Blanked-off spare sleeve pipes may be required to be installed adjacent to the cable as directed by the relevant City Power official or Clerk of Work at the applicable tendered rates. It must be noted that the provision of the steel plates will be at no cost to City Power.

#### **4.1.2.7. Backfilling**

Cable trenches shall be backfilled and compacted in 150 mm layers after the cables have been covered. Rocks removed from excavations must not be used for backfilling. Only suitable backfilling material shall be used. Suitable backfilling for all excavations shall be soil with a rock content of not more than 40%. The size of the rocks in the suitable backfilling shall not exceed a nominal diameter of 100 mm (the rock shall be able to go through a mesh with square holes of 100 mm x 100 mm). The Clerk of Works or relevant City Power official shall decide if material is suitable for backfilling or not and their decision shall be final.

The backfill shall be compacted to a minimum density of 98% of MOD AASHTO such that no subsidence will occur. The Contractor shall be held responsible for repairing subsiding trenches at no cost to City Power.

Rocks or solids which will not pass through a 100 mm diameter ring removed from excavations must not be used for backfilling. The cost of removal and disposal of such spoil and the supply and delivery to site of bedding soil is to be measured separately. The tenderer must price these items accordingly in the price schedule contained in Annex B.

All backfilling and compaction work shall be by means of manual labour, employing the use of handheld tools, whenever and wherever this is deemed technically practicable and safe.

#### **4.1.2.8. Dumping site**

The Contractor shall be responsible to make the necessary arrangements for dumping all rubbish at an official local government dumping site. No dumping of rubbish will be permitted on site.

All trees, plants, rubbish and structures which are found on the cable route shall be removed by the Contractor and shall be dumped at the approved dumping site.

All surplus excavated material which is not suitable for backfilling shall be removed by the Contractor and dumped at the approved dumping site.

If contractors staff have left the work site in an unacceptable state, a fine of R 50 000-00 shall be levied per location per project.

#### **4.1.2.9. Cable marker tape**

Continuous lengths of cable marker tape must be laid 200 mm below natural ground level in all LV cable trenches and for MV cable 700mm below the natural ground level.

#### **4.1.2.10. Inspection**

Cable trenches must be approved by City Power's representative assigned to the project before any cables are installed and the installation of the cables must be approved before backfilling is commenced.

#### **4.1.2.11. Reinstatement of paving, gardens etc.**

In order to preserve good relations with the public, the Contractor must minimise disturbances of gardens, driveways or pavements. Soil, lawns and gardens must be reinstated by the Contractor and payment for this will be agreed upon with City Power. The Contractor must inform City Power's representative assigned to the project of all paving, tarmac, brickwork etc. which has been disturbed in the execution of the work prior to the reinstatement of these items by the Contractor.

#### **4.1.2.12. Barricading**

All excavations performed by the Contractor must be barricaded at all times, in accordance with the OHS Act (Act 85 of 1993). The barricading shall be approved by City Power's representative for each project site.

#### **4.1.2.13. Sealing of cable ends**

All cable ends shall be sealed by means of heat shrink cable end caps until the permanent terminations can be made.

#### **4.1.2.14. Road crossings**

Where cables cross roads, cable protective pipes shall be installed for electrical services.

These pipes shall:

- 1) have a minimum internal diameter of 110 mm;
- 2) be of the High Density Polyethylene type complying with CP\_TSSPEC\_045;
- 3) be installed at a depth of 1,0 m below the finished road level;
- 4) be identified by means of an "E" not less than 100 mm high, embossed into the curb;
- 5) extend 0,5 m beyond the curb line at either end;
- 6) be equipped with suitable draw-wires and be plugged at either end; and
- 7) be protected against mechanical damage once installed.

A road crossing shall be repaired within 3 working days and backfilling shall be done on a daily basis until the road is permanently repaired.

The following apply to existing tar roads:

- a) the edges of the road crossing shall be machine cut; and
- b) material will be backfilled in road crossings to 200 mm below the road surface. The backfilling material shall be a gravel soil with a maximum P.I. of 12 and mixed with 5% cement by volume. Backfilling shall be done in maximum 150 mm layers compacted to a minimum density of 95% MOD AASHTO at optimum moisture content. The maximum size crusher run (25 mm) shall be mixed with 5% cement by volume and compacted to 98% MOD AASHTO density to 50 mm below road surface. The surface of the compacted crusher run and all side surfaces shall be sprayed with "30% stable grade emulsion" at a rate of 1 litre/m<sup>2</sup> as a tack coat. When tack coat has set, a layer of 50 mm thick "cold mix" with a

5,5% binder content that has been cut with a flux (all manufacturer's recommended specification) should be compacted with a BOMAG 90 or similar to road level.

#### **4.1.2.15. Concrete cable slabs (if required)**

Where the Clerk of Works or City Power Official so directs, concrete slabs shall be installed over the cables for protection. After the 75 mm layer of sifted sand has been installed over the cables, these concrete slabs shall be installed in an approved fashion.

Concrete cable slabs shall be at least 90MPa, 300 mm long x 300 mm wide x 50 mm deep and shall have internal reinforcement.

#### **4.1.2.16. Low voltage and supervisory cables**

Only aluminum cables with a cross sectional area shall be used except below 16 mm<sup>2</sup>

**Main Low Voltage Feeder Cables** : 185 mm<sup>2</sup> and 95 mm<sup>2</sup> x 4 core copper XLPE insulated steel wire armoured cable.

**Low Voltage Cables** : shall be in accordance with CP\_TSSPEC\_002

##### **4.1.2.16.1. Jointing of cables**

**Note:** Only mechanical torque shear connectors shall be installed on main (distributor) LV power cables.

##### **4.1.2.16.1.1. Low voltage joints**

Joints for LV cables will either be epoxy or polyurethane filled in accordance with CP\_TSSPEC\_054. These joints are to be made-off in accordance with instructions issued by the joint manufacturer.

##### **4.1.2.16.1.2. Location of joints**

All MV and LV joint locations shall be clearly indicated on the "as-built" drawings submitted to the Planning Engineer once the project has been completed.

#### **4.1.2.16.2. Termination of cables**

**Note:** Only mechanical torque shear connectors shall be installed on main (distributor) LV power cables as per CP\_TSPROC\_030.

Crimping connectors as per CP\_TSSPEC\_022 shall be used for cables up to 35mm<sup>2</sup> conductor, or mechanical torque shear connectors as per CO\_TSSPEC\_023 for cables greater than 35mm<sup>2</sup>.

##### **4.1.2.16.2.1. Low voltage terminations**

LV cable crutches on cables terminated on pole tops will be sealed with an appropriately sized heat shrink boot in accordance with CP\_TSSPEC\_136. All LV cables inside enclosures except inside Public lighting poles shall be glanded with the appropriate size LV gland.

Cable terminations inside Public lighting poles and high masts shall be made without glands. All steel wire armouring shall be collectively bound to the cable(s) with an 11.5mm line tap and then lugged to the earth stud. The crutch shall be sealed with a heat shrink boot. Neutral and phase conductors shall be looped with end connectors and insulating sleeves. A PEN conductor shall be installed between the neutral and the earth conductors.

##### **4.1.2.16.2.2. Inspection of joints and terminations**

The Contractor must notify City Power's representative assigned to the project at least 48 hours prior to executing any jointing or termination of cables so that arrangements may be made for inspections to be carried out during and on completion of these operations. Under no circumstances may a joint hole be backfilled until clearance is given by City Power's representative assigned to the project.

#### **4.2.2.1 Installation**

MSS or similar structure to be installed within the designated area (5m x 2,5m) with the major axis parallel and adjacent to the roadway boundary and on the City Power customer's stand boundary.

When installed on servitudes the MSS is to be positioned as indicated by the Clerk of Works or City Power Official assigned to the project on site.

When installed on pavements the distance between the back of the MSS and the stand boundary must be 150 mm or as directed by the Clerk of Works or City Power Official.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item, he must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

The concrete foundations are to be constructed as indicated or by means of precast base foundation (Drawing 32496) and the top of the concrete foundation must be 150 mm above finished ground level irrespective of the fall of the ground.

#### **4.2.2.2 Internal topping**

All material required for the internal topping of MV and LV compartments must be supplied by the Contractor.

To render the equipment vermin proof after all the cables have been installed, terminated and connected, the bottoms of the medium and low voltage compartments must be filled with river sand and topped with a layer of 4 to 1 river sand/cement mix with a minimum thickness of 25 mm. The surface of this topping layer is to be steel floated.

#### **4.1.2.17. Low voltage control pillar boxes**

Only low voltage distribution boxes (protective structures) complying with CP\_TSSPEC\_208 shall be used.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item he must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

The contractor will be required to install various sizes of MCBs and MCCBs in Miniature Substations, Transformer Substations, distribution boxes, Central Metering Kiosks (CMKs) and customer boundary meter boxes. All cables connected in the box shall be designated with the house and stand number.

#### **4.1.2.18. Installation of stays and poles**

##### **4.1.2.18.1. Concrete Poles**

All excavations, trenching, backfilling and compaction work shall be by means of manual labour, employing the use of handheld tools, whenever and wherever this is deemed technically practicable and safe.

Poles shall be pre-stressed pre-cast concrete and shall be supplied and installed by the contractor. Poles shall be manufactured in accordance with CP\_TSSPEC\_052.

The concrete poles are to be used as un-stayed or free-standing structures.

Poles must be installed 2m away from the edge of the road surface if no kerb is present. Poles must be installed between 1m to 1,5m if a mountable kerb is present and between 0,5m to 1m if an un-mountable kerb is present. Poles must be installed 5 m away from the edge of the road surface next to Provincial Roads.

The pole is of rectangular cross-section and it tapers in both directions from its designed ground line. The narrow face is the load-bearing face and the broad face is the non-load bearing face.

The strength of the non-load bearing face is at least 30% that of the load-bearing face. The concrete pole is reinforced with steel bars that extend from the tip of the pole to the butt and are positioned at a minimum depth of 20 mm below the concrete surface.

For the installation of poles, the Contractor must dig holes of the smallest practical diameter in positions approved by the engineer.

The excavated soil must be backfilled and compacted as detailed in the Code of Practice. Poles must be erected vertically and with the luminaires over the roadway at right angles to the pavement.

#### **4.1.2.18.1.1. Types of Poles and Planting Depths**

A concrete pole is designated by its length, followed by the tip strength of the load-bearing face. The types of pre-stressed concrete poles and their respective planting depths are shown in the table below.

**Table 2 : Concrete pole planting depths**

TYPE OF POLE	PLANTING DEPTHS
S7,0 m/ 4 kN	1,3 m
7,2 m/ 10 kN	1,5 m
7,5 m/ 20 kN	1,8 m
7,0 m/ 4 kN (not prestressed)	1,3 m
9,0 m/ 4 kN	1,5 m
9,0m/7kN	1,5m
9,3 m/ 17.5 kN	1,8 m

The strength of the broad face of the concrete pole is approximately 30% of that of the narrow face. Thus, the orientation in which the pole is planted is critical. The orientation of the pole should be such that the maximum applied force acts perpendicular to the narrow face as shown in Drawing no. 32288 (sheet 5).

#### **4.1.2.18.1.2. Un-stayed terminal structures**

For un-stayed or free-standing terminal structures, the pole shall be planted in an orientation where the resultant conductor loading acts perpendicular to the narrow face of the pole, as illustrated by poles A and E in Drawing no. 32288 (sheet 5).

#### **4.1.2.18.1.3. Intermediate structures with no deviation angle**

The poles shall be planted in an orientation where the resultant traverse wind loading on the conductors and pole acts perpendicular to the narrow face of the pole as illustrated by pole D in Drawing no. 32288 (sheet 5).

#### **4.1.2.18.1.4. Intermediate structures with deviation angle**

The poles shall be planted in an orientation where the resultant loading of the conductors acts perpendicular to the narrow face of the pole, as shown by poles B and C in Drawing no. 32288 (sheet 5).

#### **4.1.2.18.1.5. Soil Classification**

A standard 8 kg Dynamic Cone Penetrometer (DCP) is to be used to test the consistency of the soil. The instrument consists of a metal rod with a cone-shaped end with an anvil onto which a fixed weight falls through a set distance onto the anvil. The force of the blow will cause the rod to penetrate the soil. The number of blows required for the rod to penetrate to a distance of 100 mm into the soil indicates the consistency of the soil.

The DCP test should be applied at the following depths during the hole excavation and an average figure derived at for the hole. Start the test at a depth of 0,5 m below ground level and record the number of blows for every successive 100 mm, up to a maximum of 1,5 m below NGL. The average of this reading is then taken as the soil consistency over 100 mm. The results can be recorded in the PENETROMETER TEST RECORD sheet provided. Soil consistency can be determined with the aid of the table below.



**Table 3 : Soil Classification**

CONSISTENCY	DCP (blows/100 mm)
Soft	< 2
Firm	2 – 7
Stiff	> 7

#### **4.1.2.18.1.6. Soil Stabilisation**

The soil from all the pole holes must be stabilised by means of the addition of cement at a minimum ratio of 10:1. That is, one bag cement to be mixed with all the soil removed from the hole. Please note that the cement, soil and appropriate amount of water are to be mixed outside of the hole. It should be noted that baulking would still be required as per Table 4 below.

#### **4.1.2.18.1.7. Baulking of Concrete Poles**

Where concrete poles are to be used as free structures, baulking may be required. This is done by means of securing one or more 1.2 m concrete lintels to the pole base as shown in Drawing no. 32288 (sheet 6).

The number of lintels and additional cement required over and above that required for stabilisation would be set out in the below.

**Table 4 : Baulking of Concrete Poles**

Type of Soil						
Pole Size	Soft		Firm		Stiff	
	No. of Lintels	No of cement bags at pole base	No. of Lintels	No of cement bags at pole base	No. of Lintels	No of cement bags at pole base
7,0 m / 4 kN	0	0	0	0	0	0
7,0 m / 10 kN	1	0,5	1	0,5	1	0,5
7,3 m / 20 kN	3	1	2	1	1	0,5
9,0m/ 7kn	1	1	0	0	0	0
9,0 m / 4 kN	1	0,5	0	0	0	0
9,3 m / 17.5 kN	3	1	2	1	1	0,5
10,0 m / 8 kN	1	0,5	1	0,5	1	0,5

PLEASE NOTE:

- I. All lintels will be required at 1/3 below natural ground level in the standard hole position provided in the pole.
- II. The appropriate amount of cement required, as tabulated in the above, must be mixed with the first 300 mm of soil at the base of the pole over and above any other soil stabilisation that may be required and described in item 5.5 above.
- III. Where 7m/4kN poles are installed in soil classified as “Stiff”, the bag of cement required for stabilising the soil described above may be omitted at the discretion of the Engineer.
- IV. Where the soil is classified as soft, the engineer is to be notified prior to any installation.
- V. A 7 m pole that requires no baulking will require an excavation of approximately 0,87 cubic meters of soil.

#### **4.1.2.18.1.8. Raking Back of Terminal Poles**

In order to accommodate the dynamic compensation of the earth, all strain poles must be raked back such that the narrow face, furthest from the conductor, is perpendicular to the ground.

#### **4.1.2.18.1.9. Backfilling and Compaction of Pole Holes**

Rocks removed from excavations must not be used for backfilling.

When backfilling the holes, ensure that the backfill material is slightly damp. A test of dampness can be done by squeezing the soil in your hand. When the hand is opened the soil should remain in the squeezed state. This will indicate the optimum moisture content for good soil compaction.

Layers of backfill shall at no time exceed 150mm per layer. Each layer shall be compacted with a mechanical compactor or with a hand stamper with a mass of at least 25kg. Should hand compaction be decided on, then a minimum of 30 blows shall be applied to each 150mm layer of soil around the pole. The distance of drop for the hand stamper shall be more than 400mm per blow.

This method shall be repeated until the hole is filled up to natural ground level.

The backfill shall be compacted to a minimum density of 93% of MOD AASHTO as specified in SANS 1200 D.

Mechanical compaction is preferred as certain areas contain soil where hand compaction will not achieve the minimum required level of compaction.

#### **4.1.2.19. Staywire Assemblies**

All stays and struts must be in accordance with CP\_TSSPEC\_085.

##### **4.1.2.19.1. Stays**

Refer to the detail drawing in this regard for further details. Under no circumstances shall the stay rod be bent!

The base plate shall be covered with large stones there after backfilling can be done in stages of 150mm each with thorough compaction of the soil at each stage. Where necessary, the stay shall be concreted in with 6:3:1 concrete mix.

Strain insulators shall be provided in all stay wires. All stays shall be adjustable with adjusting nuts and threaded rods, where applicable.

LV stays shall be M16 size, where applicable.

##### **4.1.2.19.2. Struts**

Strut poles shall be used only where no other option exists. It is preferred that free-standing poles together with the necessary baulking be used as described previously under "Installation of Concrete Poles".

Where strut poles are approved, these shall be complete with an anti-climbing device consisting of two-strand double spiked barbed wire wrapped around the structure approximately 2500 mm from the ground to prevent the climbing of poles. The barbed wire shall be fixed in an approved manner and shall stretch over at least 1000 mm pole length.

### **4.1.3. Service connections greater than 56KVA**

City Power's business plan requires labour contracts for the installation of electrical equipment for new service connections.

#### **4.1.3.1. Scope**

This standard covers City Power's requirements for the services of competent Contractors to provide labour, machinery and plant resources for the installation of new service connections greater than 56kVA. The following equipment will need to be installed when installing new service connections:

- a) medium and low voltage cabling/conductors,
- b) miniature substations,
- c) medium voltage bulk metering units,
- d) low voltage distribution boxes (protective structures),
- e) equipping of transformer substation, and
- f) Jointing and termination of MV and LV cables.

The low voltage pre-commissions testing of the completed works and any other work associated with the medium and low voltage electrical networks.

All materials unless otherwise specified will be supplied by the City Power.

City Power reserves the right to utilize the successful contractor(s) to undertake a limited amount of work anywhere within City Power's area of electricity supply.

Details of the individual work site will be indicated at the time the work instruction (Purchase Order) is issued.

### **4.1.4. MV Bulk Kiosks for 11kV Service Connections Up To 4MVA**

#### **4.1.4.1. Description**

The outdoor bulk metering kiosk supplied will be rated at 11kV and will make provision for service connections up to and including 4MVA. It will be similar to the Type B MSS configuration, except it has MV metering in the place of the transformer of a MSS.

The bulk metering kiosk is pre-fitted with a 11 kV Ring Main Unit (RMU with no oil).

The consumer's medium voltage compartment makes provision for the termination of the consumer cable.

Earth bars are provided in both compartments for bonding all the relevant earths together by means of nuts and bolts and suitable terminal lugs.

Under no circumstances shall any putty and tape be used to shroud the MV termination connections in the SF6 RMU cable boxes. Only unscreened separable connectors shall be installed on all MV connection.

#### **4.1.4.2. Installation**

The bulk metering unit is to be normally installed within the designated area (5m x 2,5m) with the major axis parallel and adjacent to the roadway boundary and on City Power's customer's stand boundary.

When installed on servitudes the bulk metering unit is to be positioned as indicated by the Clerk of Works or City Power Official assigned to the project on site.

When installed on pavements the distance between the back of the bulk metering kiosk and the stand boundary must be 150 mm or as directed by the Clerk of Works or City Power Official.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item, he must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

The concrete foundations are to be constructed as indicated or by means of precast base foundation (Drawing 32496) and the top of the concrete foundation must be 150 mm above finished ground level irrespective of the fall of the ground.

#### **4.1.4.3. Internal topping**

All material required for the internal topping of MV and LV compartments must be supplied by the Contractor.

To render the equipment vermin proof after all the cables have been installed, terminated and connected, the bottoms of the medium and low voltage compartments must be filled with river sand and topped with a layer of 4 to 1 river sand/cement mix with a minimum thickness of 25 mm. The surface of this topping layer is to be steel floated.

#### **4.1.5. Service Connections Greater Than 4MVA at 11KV**

Service connections greater than 4 MVA are unique in design, as they often require many MV cables in parallel and metal clad switchgear. Such service connections will be installed on a special quotation basis.

#### **4.1.6. Medium Voltage Kiosk and Ring Main Units**

The Contractor must position medium voltage kiosks and ring main units adjacent to and at right angles to street boundaries in the positions indicated on the pertinent drawings. The kiosk must be installed such that the concrete foundation plinth base is 150 mm above the final pavement level.

Putty and tape connections to the any SF6 ring main unit shall be utilized. On provided unscreened or screened shrouds shall be installed.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item they must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

#### **4.1.7. Servitudes**

##### **4.1.7.1 General**

TSS doors shall face the road reserve. Clear access shall be available for the insertion and removal of City Power equipment. Doors shall be 2438 mm high and 1830 mm wide.

The servitude shall run parallel to the road from which access is to be obtained.

BMU, outdoor kiosk enclosed RMU's or miniature substations shall be installed on servitudes with the major axis parallel to and on the roadway stand boundary.

Dimensions of servitudes shall be in accordance with Table 5.

**Table 5 : Depth and width of servitudes**

<b>Equipment type</b>	<b>Relevant layout drawing</b>	<b>Depth</b>	<b>Width</b>
Transformer Substation	CP_TSDRAW_015	6000 mm	7000 mm
Bulk Metering unit	NA	2500 mm	5000 mm
Miniature Substation	NA	2500 mm	5000 mm
Outdoor kiosk enclosed RMU	NA	2500 mm	5000 mm

#### **4.1.7.2 Location of services within road reserves**

The location of services within road reserves shall comply with the approved drawings. Cognisance is taken of the fact that road reserves may not exist in some of the areas being electrified and aerial services are therefore the preferred option.

All cables shall be laid on either the North or West sides of the road reserves with respect to the direction of the road, at a distance of 1 metre from the stand boundary.

Depth of cables and dimension of trenches shall be in accordance with Table 6.

**Table 6 : Depth and width of cable trenches**

<b>Cable type</b>	<b>Depth below final ground level</b>	<b>Minimum width</b>	<b>Spacing between cables</b>
MV cables	1500 mm	500 mm	150 mm
LV cables	1000 mm	500 mm	150 mm
SL cables	800 mm	500 mm	150 mm

Where medium and low voltage cables are to be installed in a common trench they must each be installed in accordance with the above requirements. The low voltage cables would be installed 500 mm above the medium voltage cables.

Minimum trench width is 500 mm. It is permissible to exceed this dimension if justified by the number of cables.

The minimum requirements of SANS 10198 shall be complied with, when back filling cable trenches.

At road crossings, both medium and low voltage cables shall be laid at a depth of 1 metre, below the road surface. These cables shall be laid in 110 mm diameter by 6m long black corrugated PVC sleeves and the exact number of pipes to be laid shall be approved by the planning engineer, as spare pipes may be required for future network extensions.

Sleeves must protrude 500 mm beyond the kerb line. All laid sleeves shall have a draw wire and a suitable sealer plug at both ends.

The location of laid sleeves shall not be marked instead the location should be registered on GIS.

#### **4.1.8. Luminaires for general street lighting**

All luminaires for general street lighting shall comply with specification CP\_TSSPEC\_231.

#### **4.1.9. LV Fuse Assembly unit**

The ABC overhead conductor shall be protected by a suitably rated fuse switch disconnecter (sometimes referred to as a fuse unit). The unit shall consist of three fuse carriers mounted on an L bracket which shall be bolted to the pole. Banded strapping is not acceptable as a means of securing a fuse switch disconnecter.

The unit shall utilize standard NH fuses.

#### **4.1.10. Small Power Distribution Units (Readyboards)**

Small power distribution boards, complying with CP\_TSSPEC\_103 shall be permanently fixed to the inside walls of the dwelling. The readyboard shall be mounted as high above ground level as is practicable whilst leaving circuit breakers within reach of an average sized adult.

#### **4.1.11. Auto recloser**

All auto reclosers for use on City Power MV networks shall comply with specification CP\_TSSPEC\_138.

Auto reclosers shall be installed as standard protection at the start of an MV line.

#### **4.1.12. Drop out fuse Assembly (MV)**

Drop out fuse assemblies for use on City Power 11 and 22kV overhead networks shall be rated at 22kV. Any overhead spur or conversion to underground cable network shall be protected by a suitably rated drop out fuse assembly complying with specification CP\_TSSPEC\_068.

### **4.2. METERING SERVICES LABOUR**

Metering is an important tool that enables City Power as an electricity distributor to do revenue collection. The company continues to invest in innovative techniques and technologies to extend the life of assets, increase productivity and efficiency, as well as improve audit compliance. Furthermore, the company seeks



to provide its customers with accurate energy consumption data, leading to accurate billing and ensuring efficient collection of revenue.

All meters shall be installed and maintained in accordance to all relevant City Power metering specifications and standards. All workmanship shall adhere to and be in compliance with City Power's specifications and standards which includes all recognized and applicable legislation. (CP\_TSSTAN\_133 and CP\_TSSPEC\_316).

The meters shall provide all the functions of measurement, registration and multiphase recording required for the metering of a balanced and unbalanced, single or polyphase feeder.

It shall be possible to extract all billing, load profile, programmable set-up data, and instantaneous values from the meter via the optical port by using a hand held unit or a personal computer, as well as remotely.

In the case of downloading load profile, it shall be possible to select downloading of all load profile data stored in the meter at the time, or only that part of the load profile that has not been downloaded previously.

It shall be possible to extract all billing, load profile, programmable set-up data and instantaneous values from the meter, irrespective of which data has been programmed to be displayed on the meter.

The contractor shall be required to install and replace the following types of metering systems supplied by city Power:

- 1) Max demand electronic meters,
- 2) Non domestic credit meter,
- 3) Domestic meters, and
- 4) Prepaid or Smart meters.

#### **4.2.1. Metering Services Requirements**

##### **4.2.1.1. General**

- 4.2.1.1.1 All metering hardware inspections shall be conducted in accordance with NRS 057 and the manufacturer's recommended procedures. The meters' inspection frequency shall be in accordance with NRS047 and shall not be limited to either the manufacturer's recommended intervals or the equipment failure or faults.
- 4.2.1.1.2 All maintenance and repairs shall be executed by competent or qualified personnel in line with stipulated response times.
- 4.2.1.1.3 All tools required to perform repairs and maintenance shall be supplied by and remain the property of the service provider.
- 4.2.1.1.4 Metering equipment shall be suitably accommodated and protected and be readily accessible to officials of the Service Provider. at all reasonable times.

#### **4.2.1.2. Prerequisites**

The following specialised equipment/tools shall be used so as to achieve required results:

- a) Verification Instrument (e.g. Metes 320),
- b) Clamp On CTs with a range of at least 0 - 800 Amp,
- c) Phase Load Box (minimum 20 Amps per phase) and
- d) HV Current Probe (Only required for HV-MV Installations) with an insulation level up to 132kV.

#### **4.2.1.3. Resource qualifications.**

Minimum competencies shall be categorized as follows;

##### **4.2.1.3.1. (Level 1)**

A Revenue Protection auditor shall;

- a) Be familiar with different types of meters and have the ability to educate investigators.
- b) Have knowledge of City Power's Infrastructure.
- c) Be familiar with test instruments,
- d) Be computer literate,
- e) Have the ability to identify tampering methods and
- f) Have knowledge of billing and equipment register databases.

##### **4.2.1.3.2. (Level 2)**

A Revenue Protection operator shall have;

- a) Passed a Revenue Protection course in auditing (minimum qualification: qualified Electrician),
- b) Experience in the removal of tampers on meters,
- c) Experience in meter removal and replacement,
- d) Knowledge of cut-off procedures,
- e) Knowledge of switching,
- f) Knowledge of utility plumbing,
- g) Knowledge of safety procedures, and
- h) Knowledge of first aid.

#### **4.2.1.3.3. RP investigator (level 3)**

A Revenue Protection investigator shall have;

- a) Passed a Revenue Protection Auditor Course and a Revenue Protection Operator Course,
- b) Knowledge of by-laws and credit control procedures,
- c) Knowledge of relevant legislation (see foreword),
- d) Experience in evidence collection, and
- e) Experience in case preparation and court procedures.

#### **4.2.1.3.4. Common courses**

All Revenue Protection officers shall have successfully passed courses in;

- a) Customer relations,
- b) Problem solving,
- c) Negotiating skills, and
- d) Emergency handling and self-defence.

#### **4.2.1.4. Meter Audits and associated equipment.**

- 4.2.1.4.1 The meter auditing process has been found to be an effective revenue protection method that reduces non-technical losses.
- 4.2.1.4.2 There are different methods that could be utilized to audit meters. Each one could be used effectively to reach a specific goal.
- 4.2.1.4.3 Meter audit shall be carried out by City Power's authorized personnel as detailed under resource qualification.
- 4.2.1.4.4 A list of meters to be audited shall uploaded on workforce management tool for the service provider to download.
- 4.2.1.4.5 The Audit process shall be conducted in accordance with job cards or spread sheets loaded on work force management tool.
- 4.2.1.4.6 Meter tripping mechanisms shall be tested by using tamper pin codes or any other specific test as and when required
- 4.2.1.4.7 Usage rate shall be tested by switching on an appliance in the house.
- 4.2.1.4.8 Meters shall be checked for tampering and open meters that hare found to be tampered with shall fail the above test.

- 4.2.1.4.9 Supply shall be disconnected if the meter is found to have been opened or tampered with and the customer shall be issued with an attached disconnection form.
- 4.2.1.4.10 The installation shall be normalized for safety reasons and the anti-tamper seal shall be left in place and secured before leaving.
- 4.2.1.4.11 The Audit Form shall be populated with the customer's and installation data (as detailed in the template which includes customer details, record of findings and type of property).
- 4.2.1.4.12 In the absence of holes, the service provider shall switch off power in the service distribution box (stubby) remove meter, drill holes, attach the seal and record number.
- 4.2.1.4.13 The power shall be restored once everything is in place.
- 4.2.1.4.14 Faulty meters and tampers shall be escalated to City Power's Revenue Protection Management using appropriate channels.
- 4.2.1.4.15 The checklist template for the meter Audit shall also be populated using City Power's workforce management tool which includes Work Completion Certificates.
- 4.2.1.4.16 Any associated photographs, diagrams, GPS coordinates and related documents shall also be uploaded.
- 4.2.1.4.17 Once the Audit has been completed, the service provider shall close the call which will allow finalization of the process.
- 4.2.1.4.18 A list of skills required to complete work
- 4.2.1.4.19 Step by step audit process
- 4.2.1.4.20 The service provider shall revisit sites where the audit could not be completed due to lack of access or inadequate information.
- 4.2.1.4.21 Unavailable customers shall be notified of the need to audit their premises.
- 4.2.1.4.22 Audit reports shall be submitted to City Power's management at stipulated intervals to be agreed upon.

#### **4.2.1.5. Pre Installation Checks**

- 4.2.1.5.1 At the completion of the installation and prior to the commencement of the commissioning tests the contractor shall inspect all hardware and verify that the following tasks have been completed in accordance with the installation specification in all relevant City Power standards and specifications. (CP\_TSSTAN\_133 and CP\_TSSPEC\_316)
- 4.2.1.5.2 All hardware devices (e.g.: meter/breakers) have been installed at the locations specified in the design documentation.
- 4.2.1.5.3 Electrical and communications cables have been appropriately sized and secured to protect against operational damage and ensure stability for continuous use.
- 4.2.1.5.4 Connections have been correctly terminated and insulated to ensure satisfactory connectivity and protection against faults and interference.

- 4.2.1.5.5 All devices have been provided with adequate protection against moisture and other environmental conditions
- 4.2.1.5.6 Communication network cables have been correctly connected to the designated points.
- 4.2.1.5.7 Associated equipment such as power supplies and switches have been connected correctly and secured appropriately.
- 4.2.1.5.8 Drawings have been updated accordingly.
- 4.2.1.5.9 Proper grounding or earthing on all devices.

#### **4.2.1.6. Commissioning Check**

- 4.2.1.6.1 The Service Provider shall be responsible for the configuration of any additional meters that are added or replaced on the network.
- 4.2.1.6.2 They will be responsible for the commissioning of the new meter. The Contractor will be an active participant in the testing and commissioning with City Power.
- 4.2.1.6.3 As a minimum, the contractor shall confirm the following using all the relevant City Power metering commissioning form and documents.
  - a) All software modules specified in the design documentation or the modules required to perform all specified operation functions have been installed and configured to meet City Power's system requirements.
  - b) The appropriate release version of all software including drivers and upgrades shall be used for commissioning.
  - c) The meter protocols, system reports, screens and menus have been correctly configured.
  - d) The meters communication back to City Power's APN and back- end has been confirmed.

#### **4.2.1.7. Preventative Maintenance**

- 4.2.1.7.1 A large part of keeping a company running efficiently and profitably is ensuring that all equipment is functioning optimally. To do so, routine preventative maintenance needs to be conducted in accordance with the relevant regulatory standards.
- 4.2.1.7.2 Preventative maintenance shall be performed in accordance with NRS047, to extend the life of assets and increasing equipment uptime, as well as increasing productivity and efficiency.
- 4.2.1.7.3 It is performed while the equipment is still working so that it does not break down unexpectedly
- 4.2.1.7.4 The service provider shall ensure safety by wearing appropriate personal protective equipment such as glasses and gloves, etc.)
- 4.2.1.7.5 Each meter shall have the following information legibly marked on the front of the:
  - a) nameplate or register: 4027.1, S.6
  - b) Manufacturers' name or trademark, type designation, and serial number.
  - c) Voltage rating.

- d) Test amperes (TA).
- e) (Maximum amperes (CL) {meter class}.
- f) (Watt-hour or disk constant (Kh) {expressed as watt-hours per revolution}.
- g) Register ratio (Rr) and multiplier (if 10 or larger).
- h) Frequency rating (Hz).
- i) Number of meter stator(s) or elements (poly-phase).
- j) Ratio or rating of auxiliary devices.
- k) Type approval.

- 4.2.1.7.6 Meters must be installed in a level and perpendicular manner in accordance with manufacturer's specifications.
- 4.2.1.7.7 The overall condition of meter shall be inspected which includes Terminals, seals, glass, and insulation.
- 4.2.1.7.8 Exposed non-current carrying metal parts of fixed equipment, metal boxes, cabinets, and fittings which are not electrically connected to grounded equipment, shall be grounded as required by National Electrical Code, Article
- 4.2.1.7.9 The terminals of the meter shall be arranged so that the possibility of short circuits in removing or replacing the cover, making connections and adjusting the meter is minimized.
- 4.2.1.7.10 The main circuit breaker or main switch and fuses and their auxiliary equipment shall be installed in the load service near its entrance as supplied which is intended to constitute the main control and means of cut-off
- 4.2.1.7.11 Check for ground faults; verify customer being billed is the only customer served by each meter. Verify that common use areas such as street lights are not wired into the load side of the customer circuit.
- 4.2.1.7.12 Any associated photographs, diagrams, GPS coordinates and et, shall be uploaded via the workforce management tool

#### **4.2.1.8. Reactive Maintenance**

##### **4.2.1.8.1 FIRST LINE VERIFICATION FUNCTION**

- 4.2.1.8.1.1 The first line verification function shall be conducted remotely from a quality check platform soon after the field activities related to audits & maintenance have been completed to establish the following 1st line quality checks from the meter in the field:
  - a) Establishment of communication
  - b) Retrieval of configuration data
  - c) Analysis of retrieved meter instantaneous parameters and data
- 4.2.1.8.1.2 The function is required to ensure that the meter data management system used to retrieve meter recorded data is aligned to the field configuration. The required verification shall be

conducted online through a Back office infrastructure used to reach out to the meter in the field, before submission on City Power's workforce management system.

- 4.2.1.8.1.3 The next level quality checks shall be based on the Commissioning Sheets or Audit results submitted to the back-office before submitting to the utility.
- 4.2.1.8.1.4 Faults shall be referred to Service Provider by City Power's dispatchers using the workforce management tool.
- 4.2.1.8.1.5 Maintenance shall be undertaken by a qualified Electrician as authorized by City Power's management.
- 4.2.1.8.1.6 The job card shall include customer details, time and location of fault and the nature of the fault.
- 4.2.1.8.1.7 The service provider shall acknowledge and action fault using same platform.
- 4.2.1.8.1.8 Faults shall be resolved and supply shall be restored timeously in accordance with NRS 047 and NRS 048.
- 4.2.1.8.1.9 Once the supply has been resolved, the job card shall be closed via work force management tool with details of Service Provider and what was done to resolve the fault.
- 4.2.1.8.1.10 Any associated photographs, diagrams, shall also be uploaded on the workforce management tool.

#### **4.2.2. Data Capturing/Submission of Documentation**

Data shall be captured using the workforce management tool and any other management tool requested by City Power and shall be made available to Service Providers. (CP\_TSSTAN\_133 and CP\_TSSPEC\_316)

The format of the information shall be agreed prior to commencement of the work.

The service provider shall action and update the commissioning online with the required details.

The captured data shall be used by the responsible team leader to process payments.

It shall therefore be necessary for the Service Provider to have a mobile smart device with the workforce management tool installed to decreasing paperwork with mobile maintenance capability

No data recorded on paper shall be accepted by City Power.

#### **4.2.3. Cables**

##### **4.2.3.1. Excavation, backfilling, compaction and reinstatement**

The Electrical Contractor shall be responsible for all earth works necessary to complete the electrical reticulation as specified. Unless otherwise specified, measurement of earth works shall be done according

to "The Standard System of Measurement of Civil Planning Engineering quantities for South Africa and Namibia".

The Contractor must familiarise itself with the requirements as indicated in the Johannesburg Roads Agency (Pty) Ltd: Public Roads and miscellaneous by-laws. All conditions stipulated in this standard are to apply irrespective of whether the excavations are in the road reserve or not. The Contractor must ensure that it understands the full context of the codes of practice so that the administration costs of applying the codes can be built into the rates as tendered in the Bill of Rates.

Because it is not possible to estimate the financial transactions required for the Codes, the Contractor will be required to retain all receipts and all costs will be reimbursed by adding them to Contract Progress Payments.

All work shall be performed by means of manual labour in line with EPWP Labour Intensive Construction methods. Only under exceptional circumstances, with the written consent or approval by a City Power representative, will the use of plant and machinery be allowed for such works or similar. In instances where a contractor performs work by use of plant and machinery, without the relevant approval for such work by a City Power representative, City Power reserves the right to withhold payment for the work in question.

#### **4.2.3.2. Removal of rock**

Rock encountered in trenches is to be removed with the use of mechanical rock breakers such as a pneumatic hammer and wedge. The use of explosives will only be considered under special circumstances and blasting may only be undertaken with the written permission from City Power's relevant General Manager and provided all regulatory explosive and blasting permits and licenses.

Rock encountered in pole holes is to be removed with the use of either mechanical rock breakers such as pneumatic hammers or a rock drill with a minimum diameter of 450 mm.

The removal of rocks, that have been loosened by means of machinery, shall however by means of manual labour, employing the use of tools such as shovels or similar, whenever and wherever this is deemed technically practicable and safe.

#### **4.2.3.3. Classification of material to be excavated**

The classification of material in which excavations have to be carried out shall be classified as covered by the SANS 1200 D standardized classifications.



The material in which excavations have to be carried out shall be classified as follows:

- a) "Hard material" will be held to be under-composed boulders each exceeding a nominal diameter of 1 m and solid rock in bulk or banks or ledges, the practicable excavation of which would necessitate the use of explosives and/or drilling and wedging. Hard material can only be excavated by either pneumatic tools or by a "back actor" with a special mechanical ripper attached to it. Hard material shall include soil with loose boulders greater than 0, 5 m<sup>3</sup> after excavation.
- b) "Soft material" will be held to be material more easily excavated and not falling into categories of "hard material" such as gravel, earth, turf, scale, sand, silt and clay.

#### **4.2.3.4. Dimensions of cable trenches**

All trenches shall be subject to and not limited to the following:

- a) The Contractor shall be responsible for all trench excavation.
- b) The Contractor shall, before trenching commences, familiarize himself with the routes and site conditions and the procedure and order of doing work shall be planned in conjunction with the general construction programme for other services and building requirements.
- c) The contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.
- d) The contractor shall take all necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and /or employees on site are not endangered.
- e) The Contractor shall ensure that the excavations will not endanger existing structures and roads.

Trenching shall be in accordance with SANS 10198. All cable trenching shall be in strict accordance with City Power standards and specifications CP\_TSSTAN\_009. All trenches are to be a minimum of 400 mm wide and must be excavated to the following depths below natural ground level:

**Medium Voltage cables** : 1000mm below final ground level.

**Low Voltage cables** : 600mm below final ground level.

**Medium Voltage cable spacing** : 150mm apart from each other.

**Sleeved Road Crossings** : To install the sleeves at a depth of 1 000 mm below the lower gutter level

The normal volumetric rates per linear metre of trench to meet these requirements are:

**Low Voltage Cables** : 0, 30 m<sup>3</sup>

**Road Crossings** : ± 0, 55 m<sup>3</sup>

Should the Contractor be required to excavate to a depth of greater than 1 000 mm, the width of such excavation as well as the appropriate shoring requirements must be in accordance with the Occupational Health and Safety Act (Act 85 of 1993).

#### **4.2.3.5. Installation of cables**

All cables shall be laid in accordance with the requirements of SANS 10198 and CP\_TSSTAN\_009.

Aluminium XLPE insulated MV cable shall be installed for all new projects. PILC are not to be used, only from XLPC to PILC transition joint may only be used for joining new cables to existing networks. Cable jointers shall be trained and certified to joint and terminate on both types of cables.

The contractor to ensure compliance shall inspect all trenches prior to installation. A cable inspection prior to the closing of the trench. An inspection to ensure the 75mm layer has been filled and compacted correctly. Final inspection once the trench has been backfilled and compacted where the compaction certificates can be handed over.

Cable must only be laid in trenches having smooth flat bottom surfaces. Where these surfaces are irregular they must first be smoothed off before installing the cables. Where cables are installed in trenches cut in rock, a 75 mm layer of fine sieved earth must be placed on the bottom of the trench to serve as bedding for the cable. Maximum size of sieve mesh for sieved earth is 10 mm x 10 mm.

After the cable has been installed it must be covered with a 75 mm layer of hand compacted, fine riddled earth. Regardless of whether the trench has been cut in rock or not, the cable must be covered with a 75 mm layer.

Bedding and covering shall consist of sifted sand of plaster sand quality for all cables. The bedding and covering shall be approved by the Clerk of Works or relevant City Power official. Where only low voltage cables are installed, bedding can be sifted from the excavated material.

Where medium and low voltage cables are to be installed in a common trench, they must each be installed in accordance with the above requirements but the low voltage cables are to be installed 400 mm above the medium voltage cables.

At road crossings all cables are to cross at a common depth i.e. 1 000 mm below road surface and the low voltage cables must therefore be ramped up and down each side of these crossing points accordingly.

All cables must be installed in straight lines as far as possible and excessive distortion or weaving in the cable length will not be accepted.

Trenches shall be excavated so that the laid cable(s) is (are) laid in the positions shown on the drawings and shall be 1 000 mm from all stand boundaries.

All cables feeding overhead line circuits shall be secured to the pole by means of 20 mm stainless steel tape or wrapped with the appropriate material as at intervals not exceeding 1, 0 metre.

Where the cable needs to be placed inside concrete for cable theft prevention, concrete shall be in accordance with the City Power guideline for burying cables in concrete.

#### **4.2.3.5.1. Medium Voltage Cables**

All medium voltage cables shall comply with specification CP\_TSSPEC\_001 and only aluminum cables shall be used.

For main ring distributors, 300 mm<sup>2</sup> 3-core XLPE cables shall be installed on new installations.

For sub ring distributor, 185 mm<sup>2</sup> 3-core XLPE cables shall be installed on new installations

A sub ring distributor shall consist of no more than 6 load centres.

#### **4.2.3.5.2. Low Voltage Cables (underground)**

All low voltage cables shall comply with specification CP\_TSSPEC\_002.

For main underground LV distributors supplying low voltage distribution boxes or CMK's 120 mm<sup>2</sup> x4 core PVC aluminum equivalence cables shall be installed.

#### **4.2.3.5.3. LV Aerial Bundled Conductor**

All LV aerial bundled conductor shall comply with CP\_TSSPEC\_010, shall be suspended from concrete poles complying with CP\_TSSPEC\_52. Installation of ABC shall be in accordance with SANS 10198-14

**Table 7 : ABC for use at City Power**

Items	Description	Application
1.	3 x 50 mm <sup>2</sup> phase cores plus 1 x 25 mm <sup>2</sup> street lighting core plus 1 x 54,6 mm <sup>2</sup> neutral / earth supporting conductor ( aluminum alloy & insulated)	Electrification
2.	3 x 95 mm <sup>2</sup> phase cores plus 1 x 25 mm <sup>2</sup> street lighting core plus 1 x 54,6 mm <sup>2</sup> neutral / earth supporting conductor ( aluminum alloy & insulated)	Electrification

LV ABC shall be installed in accordance with manufacturer's instructions.

#### **4.2.3.5.4. General (Aerial Bundle conductor)**

The 50/95/120mm<sup>2</sup> ABC shall have a separate 25mm<sup>2</sup> aluminium core for Street lighting. Alternatively, a 25mm<sup>2</sup> x 2c ABC can be used for street lighting where no provision has been made in the LV overheads or ABC.

All ABC is to be pulled with the aid of a Dyno Meter to the correct tension.

Strain and suspension brackets shall be secured either with stainless steel strapping or bolted with a M12 bolts. Drilling of wooden or steel poles is not allowed. Pre-cast holes in concrete poles may be used to bolt suspension and strain clamps.

The power shall be controlled by a photocell complaint with CP\_TSSPEC\_012 and in a pole box top compliant with CP\_TSSPEC\_072 control circuit mounted in a pole-top box on the first pole of every LV feeder, where applicable.

The supply to the Public lightings shall be via a separate core of the ABC (25mm<sup>2</sup> aluminium) twisted with the rest of the phase cores. Connection of the Public lighting to the ABC shall be by means of AERIAL SERVICE CABLE (ASC) or similar connected with suitable Insulation Piercing Clamps (IPC) of the bimetal type ABC- to - service tap-off.

Where underground network is considered for public lighting only aluminium cables shall be used.

#### **4.2.3.6. Sleeves**

##### **4.2.3.6.1. Sleeves installed at road crossings**

At all road crossings, the Contractor must install sleeve pipes, where these do not exist, prior to any cable being installed, at the City Power approved rates.

The Contractor must then install the cable through the buried sleeve pipes at the following rates:

- 1) The rate for the installation of cable laid in an open trench per metre installed, plus the rate per metre of sleeve pipe that the cable is drawn through, irrespective of the length of the cable pulled through the sleeve pipe.
- 2) A blanked-off spare sleeve shall also be installed per road crossing at the applicable approved rate.

##### **4.2.3.6.2. Sleeves installed across driveways, entrances and lanes**

At all driveways, entrances and lanes, the contractor may in agreement with Clerk of Works and relevant City Power official:

- a) Opt to install cable sleeves as required for any road crossing, or
- b) Provide steel plates across the said excavated driveways, entrances or vehicular lanes and pedestrian access prior to the cables being laid. Blanked-off spare sleeve pipes may be required to be installed adjacent to the cable as directed by the relevant City Power official or Clerk of Work at the applicable tendered rates. It must be noted that the provision of the steel plates will be at no cost to City Power.

#### **4.2.3.7. Backfilling**

Cable trenches shall be backfilled and compacted in 150 mm layers after the cables have been covered. Rocks removed from excavations must not be used for backfilling. Only suitable backfilling material shall be used. Suitable backfilling for all excavations shall be soil with a rock content of not more than 40%. The size of the rocks in the suitable backfilling shall not exceed a nominal diameter of 100 mm (the rock shall be able to go through a mesh with square holes of 100 mm x 100 mm). The Clerk of Works or relevant City Power official shall decide if material is suitable for backfilling or not and their decision shall be final.

The backfill shall be compacted to a minimum density of 98% of MOD AASHTO such that no subsidence will occur. The Contractor shall be held responsible for repairing subsiding trenches at no cost to City Power.

Rocks or solids which will not pass through a 100 mm diameter ring removed from excavations must not be used for backfilling. The cost of removal and disposal of such spoil and the supply and delivery to site of bedding soil is to be measured separately.

All backfilling and compaction work shall be by means of manual labour, employing the use of handheld tools, whenever and wherever this is deemed technically practicable and safe.

#### **4.2.3.8. Dumping site**

The Contractor shall be responsible to make the necessary arrangements for dumping all rubbish at an official local government dumping site. No dumping of rubbish will be permitted on site.

All trees, plants, rubbish and structures which are found on the cable route shall be removed by the Contractor and shall be dumped at the approved dumping site.

All surplus excavated material which is not suitable for backfilling shall be removed by the Contractor and dumped at the approved dumping site.

If contractors staff have left the work site in an unacceptable state, a fine of R 50 000-00 shall be levied per location per project.

#### **4.2.3.9. Cable marker tape**

Continuous lengths of cable marker tape must be laid 200 mm below natural ground level in all LV cable trenches and for MV cable 700mm below the natural ground level.

#### **4.2.3.10. Inspection**

Cable trenches must be approved by City Power's representative assigned to the project before any cables are installed and the installation of the cables must be approved before backfilling is commenced.

#### **4.2.3.11. Reinstatement of paving, gardens etc.**

In order to preserve good relations with the public, the Contractor must minimise disturbances of gardens, driveways or pavements. Soil, lawns and gardens must be reinstated by the Contractor and payment for this

will be agreed upon with City Power. The Contractor must inform City Power's representative assigned to the project of all paving, tarmac, brickwork etc. which has been disturbed in the execution of the work prior to the reinstatement of these items by the Contractor.

#### **4.2.3.12. Barricading**

All excavations performed by the Contractor must be barricaded at all times, in accordance with the OHS Act (Act 85 of 1993). The barricading shall be approved by City Power's representative for each project site.

#### **4.2.3.13. Sealing of cable ends**

All cable ends shall be sealed by means of heat shrink cable end caps until the permanent terminations can be made.

#### **4.2.3.14. Road crossings**

Where cables cross roads, cable protective pipes shall be installed for electrical services.

These pipes shall:

- 1) have a minimum internal diameter of 110 mm;
- 2) be of the High Density Polyethylene type complying with CP\_TSSPEC\_045;
- 3) be installed at a depth of 1,0 m below the finished road level;
- 4) be identified by means of an "E" not less than 100 mm high, embossed into the curb;
- 5) extend 0,5 m beyond the curb line at either end;
- 6) be equipped with suitable draw-wires and be plugged at either end; and
- 7) be protected against mechanical damage once installed.

A road crossing shall be repaired within 3 working days and backfilling shall be done on a daily basis until the road is permanently repaired.

The following apply to existing tar roads:

- a) the edges of the road crossing shall be machine cut; and
- b) material will be backfilled in road crossings to 200 mm below the road surface. The backfilling material shall be a gravel soil with a maximum P.I. of 12 and mixed with 5% cement by volume. Backfilling shall be done in maximum 150 mm layers compacted to a minimum density of 95% MOD AASHTO at optimum moisture content. The maximum size

crusher run (25 mm) shall be mixed with 5% cement by volume and compacted to 98% MOD AASHTO density to 50 mm below road surface. The surface of the compacted crusher run and all side surfaces shall be sprayed with “30% stable grade emulsion” at a rate of 1 litre/m<sup>2</sup> as a tack coat. When tack coat has set, a layer of 50 mm thick “cold mix” with a 5,5% binder content that has been cut with a flux (all manufacturer’s recommended specification) should be compacted with a BOMAG 90 or similar to road level.

#### **4.2.3.15. Concrete cable slabs (if required)**

Where the Clerk of Works or City Power Official so directs, concrete slabs shall be installed over the cables for protection. After the 75 mm layer of sifted sand has been installed over the cables, these concrete slabs shall be installed in an approved fashion.

Concrete cable slabs shall be at least 90 MPa, 300 mm long x 300 mm wide x 50 mm deep and shall have internal reinforcement.

#### **4.2.3.16. Low voltage and supervisory cables**

Only aluminum cables with a cross sectional area shall be used except below 16 mm<sup>2</sup>

**Main Low Voltage Feeder Cables** : 185 mm<sup>2</sup> and 95 mm<sup>2</sup> x 4 core copper XLPE insulated steel wire armoured cable.

**Low Voltage Cables** : shall be in accordance with CP\_TSSPEC\_002

#### **4.2.3.17. Jointing of cables**

Note: Only mechanical torque shear connectors shall be installed on main (distributor) LV power cables.

##### **4.2.3.17.1. Low voltage joints**

Joints for LV cables will either be epoxy or polyurethane filled in accordance with CP\_TSSPEC\_054. These joints are to be made-off in accordance with instructions issued by the joint manufacturer.

##### **4.2.3.17.2. Location of joints**

All MV and LV joint locations shall be clearly indicated on the “as-built” drawings submitted to the Planning Engineer once the project has been completed.



#### **4.2.3.18. Termination of cables**

**Note:** Only mechanical torque shear connectors shall be installed on main (distributor) LV power cables as per CP\_TSPROC\_030.

Crimping connectors as per CP\_TSSPEC\_022 shall be used for cables up to 35mm<sup>2</sup> conductor, or mechanical torque shear connectors as per CO\_TSSPEC\_023 for cables greater than 35mm<sup>2</sup>.

##### **4.2.3.18.1. Low voltage terminations**

LV cable crutches on cables terminated on pole tops will be sealed with an appropriately sized heat shrink boot in accordance with CP\_TSSPEC\_136. All LV cables inside enclosures except inside Public lighting poles shall be glanded with the appropriate size LV gland.

Cable terminations inside Public lighting poles and high masts shall be made without glands. All steel wire armouring shall be collectively bound to the cable(s) with an 11.5mm line tap and then lugged to the earth stud. The crutch shall be sealed with a heat shrink boot. Neutral and phase conductors shall be looped with end connectors and insulating sleeves. A PEN conductor shall be installed between the neutral and the earth conductors.

##### **4.2.3.18.2. Inspection of joints and terminations**

The Contractor must notify City Power's representative assigned to the project at least 48 hours prior to executing any jointing or termination of cables so that arrangements may be made for inspections to be carried out during and on completion of these operations. Under no circumstances may a joint hole be backfilled until clearance is given by City Power's representative assigned to the project.

##### **4.2.3.18.3. Installation**

MSS or similar structure to be installed within the designated area (5m x 2,5m) with the major axis parallel and adjacent to the roadway boundary and on the City Power customer's stand boundary.

When installed on servitudes the MSS is to be positioned as indicated by the Clerk of Works or City Power Official assigned to the project on site.

When installed on pavements the distance between the back of the MSS and the stand boundary must be 150 mm or as directed by the Clerk of Works or City Power Official.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item, he must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

The concrete foundations are to be constructed as indicated or by means of precast base foundation (Drawing 32496) and the top of the concrete foundation must be 150 mm above finished ground level irrespective of the fall of the ground.

#### **4.2.3.19. Internal topping**

All material required for the internal topping of MV and LV compartments must be supplied by the Contractor.

To render the equipment vermin proof after all the cables have been installed, terminated and connected, the bottoms of the medium and low voltage compartments must be filled with river sand and topped with a layer of 4 to 1 river sand/cement mix with a minimum thickness of 25 mm. The surface of this topping layer is to be steel floated.

#### **4.2.4. Low Voltage Control Pillar Boxes**

Only low voltage distribution boxes (protective structures) complying with CP\_TSSPEC\_208 shall be used.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item he must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

The contractor will be required to install various sizes of MCBs and MCCBs in Miniature Substations, Transformer Substations, distribution boxes, Central Metering Kiosks (CMKs) and customer boundary meter boxes. All cables connected in the box shall be designated with the house and stand number.

#### **4.2.5. Documentation**

##### **4.2.5.1. Standard report/ Hand Over**

The Contractor shall prepare a functional performance test report covering all information, data sheets and a comprehensive summary describing system operation at the time of the functional performance tests. The test report shall be submitted to City Power. City Power will then accept responsibility for operating the meter.

A City Power approved Audit Form (Hard Copy) shall be used and signed by both the Contractor and the Responsible person. Standard reports for any inspection or repairs being done to be provided in hard copy (Signed) and softcopy.

##### **4.2.5.2. Photographs**

A photograph of before and after each installation shall be taken to determine the correctness and neatness as well as close-ups of strategic equipment (e.g. Meters to show sealing, Test Blocks, Customer cable connections and Current transformers).

#### **4.2.6. Normalisation**

Electrical Network normalisation is to improve safety, network performance and the quality of supply. It addresses issues of non-technical losses by removing any bridged meters.

4.2.6.1 The installation shall be normalised;

- a) If MCB's on metering circuits found in the off position, wiring shall be checked to ensure no fault exists before switching on
- b) If polarity swapped, normalise as per meter connections.

4.2.6.2 The work performed shall be included in the comments field of the first page of the standard report.

4.2.6.3 All work shall be performed as per the relevant City Power Procedure unless specifically stated.

#### **4.6.7 Sealing**

Standard City Power sealing shall be adhered to so as to clearly denote: Installation; Audit inspection and Cut-Off levels. The use of an acceptable safety seal on cover screws shall be a manner that prevents tampering or indicate no tampering has taken place without breaking the seal.

#### **4.6.8 Performance**

##### **4.6.8.1 Audit, Inspection and Testing Performance**

City Power may inspect and test the various portions of the work at all times and shall have full power to reject all or any portion of the work that they may consider to be defective or inferior in quality of material and workmanship with respect to the original design. Any portion of the work so rejected shall be corrected immediately by the Contractor, unless in the opinion of City Power the work rejected can be so treated and repaired as to render it fit for incorporation in the contract. In this event the Contractor shall, at his own risk and expense be at liberty to repair the work to the satisfaction of City Power.

The Contractor shall carry out such work/tests as are necessary in the opinion of City Power to prove that the contract requirements are being complied with.

The cost of all tests and/or analyses shall be borne by the Contractor.

##### **4.6.8.2 Response and repair time to performance**

It shall be expected of the Contractor to relate his actions in respect of call-outs, repairs and general maintenance to specific prescribed response and repair times.

Depending on the criticality of the site and the urgency of the call-out the response times may vary and the table below indicates maximum time-spans.

**Table 8: Response and repair time to performance**

<b>Call-out Type</b>	<b>Response Time</b>	<b>Repair Time</b>
Emergency Corrective Maintenance	1 hour	Refer definition below
Planned Corrective Maintenance	8 hours	
Routine Preventive Maintenance	As per agreed schedule	

Response Time shall mean the time lapsed from the time the call-out is logged by the system operator or person making the call, until the Contractor responds on site. A record will be kept in the control logbook.

Repair Time shall mean the maximum time taken by the Contractor to repair the fault in order to limit the downtime of the system to a minimum. Repair time will be measured from the time the Contractor's response on site is logged until such time as the fault is rectified and signed off in the control logbook.

Downtime with respect to call-outs shall mean the total time for which the system is not 100% operational, i.e. Response time plus Repair time.

## **4.6.9 Description of Inspections and Tests**

**Table 9 : Description of inspections and tests**

Description of the service	Inspection and Maintenance
DIN Rail ( LV ) metering installations	50kVA (No CTs)
Domestic Pre or Post paid (LV) metering installations	100-500kVA
Bulk metering installations (MV and HV)	On Load

### **4.6.9.1 Customer information**

The below Installation Information shall be provided by City Power

- 4.6.9.1.1 Customer Name
- 4.6.9.1.2 Account Number
- 4.6.9.1.3 Premise ID
- 4.6.9.1.4 Pole No
- 4.6.9.1.5 GPS Coordinates
- 4.6.9.1.6 Size of installation (NMD)
- 4.6.9.1.7 Tariff

These are the items from the applicable procedures that need to be performed.

### **4.6.9.2 LV (Domestic) metering installations**

Applicable procedure:

- 4.6.9.2.1 Voltage circuit functionality check
- 4.6.9.2.2 Cabling connections
- 4.6.9.2.3 Meter panel functional tests:
  - a) Equipment with batteries – Only Check for alarm on display (where applicable)
  - b) Accuracy verification (on load testing)
    - I. No Meter Replacement (as part of the Meter Verification) will be required.

II. If the Customer is not taking load, a three phase load box will be used.

- c) Test
- d) Installation verification check
  - I. Power Calculations
  - II. Time accuracy on meters – Should be noted on the Report
- e) Meter configuration and programming

4.6.9.2.4 Meter data verification required. (Will be performed by SAP or Meter Vending)

4.6.9.2.5 Sealing

### **4.6.9.3 MV and HV metering installations**

Applicable Procedure:

- 4.6.9.3.1 Voltage circuit functionality check. Due to live installation, CT/VT Unit Specifications shall be obtained where possible, by means of binoculars.
- 4.6.9.3.2 Current instrument transformer ratio check. Perform on-load CT ratio verification – If there is no load, it should be noted on the report.
- 4.6.9.3.3 The checking of summation CT's where applicable shall be noted under comments of report.
- 4.6.9.3.4 Checking of Cabling connections
- 4.6.9.3.5 Measurement of instrument voltage and current transformer installed circuit burdens and volt drop measurement – Required for customers with greater than 10MVA.
- 4.6.9.3.6 Meter panel functional tests
- 4.6.9.3.7 Equipment with batteries – Only check for alarm on display (where applicable)
- 4.6.9.3.8 Accuracy verification (on load testing).
- 4.6.9.3.9 Phasor test
- 4.6.9.3.10 Installation verification check
- 4.6.9.3.11 Power Calculations
- 4.6.9.3.12 Time accuracy on meters – Should be noted on Report
- 4.6.9.3.13 Meter configuration and programming
- 4.6.9.3.14 Display sequence
- 4.6.9.3.15 Meter data verification required. (Will be performed by SAP or Meter Vending).
- 4.6.9.3.16 Sealing

#### **4.6.10 Low Voltage Distribution Boxes (Protective Structure) And Isolating Pillars**

The Contractor must position low voltage pillar boxes and isolating pillars adjacent to and at right angles to street boundaries in the positions indicated on the pertinent drawings. The pillar boxes must be installed such that the concrete foundation plinth base is between 250 and 300 mm proud of the final pavement level and such that free access may be obtained to both sides of the pillar through the appropriate access doors – the fibreglass base shall be 150 mm above the final pavement level.

Where it is apparent to the Contractor that the installation of an item of equipment in the position indicated on the relevant plans will obstruct or interfere with an existing service, driveway or other item they must refer this matter back to the Clerk of Works or City Power Official for attention and possible relocation of the item.

### **5. SYSTEM EARTHING**

The substation MV system earthing and the LV neutral system earthing may be combined, provided that their overall resistance to the general mass of the earth does not exceed one ohm (1  $\Omega$ ).

If the overall resistance to earth exceeds 1  $\Omega$ , the MV earth electrode and LV neutral earth electrode must be kept separate. The Contractor shall install the complete earthing system at the locations as detailed on the various layout drawings and the standard SANS 0292 assembly drawings. On completion of the earthing installation, the earth resistance shall be measured and additional earthing shall be provided if required to SANS 0199.

The maximum allowable resistance of the MV transformer electrode is 30 ohms for 11kV. This limit will ensure that no dangerous voltages are experienced on the LV neutral and that the LV neutral surge arrester energy absorption limits are maintained in the event of a MV line to transformer tank fault.

Maximum earth resistance values at the transformer LV electrode are given in the table below for various transformer primary voltages as per SANS 0292.

**Table 10 : Maximum earth resistance values at the transformer LV electrode**

<b>1</b>	<b>2</b>
<b>Transformer Primary Voltage [kV]</b>	<b>Maximum MV earth resistance value [Ohm]</b>
6,6	15
11	30
22	70

**Note:** The resistance values given in column 2 are based on the following assumptions:

- 1) That medium-voltage earth fault protection is set at 40 % of primary current,
- 2) That a factor of safety of approximately four is used to ensure acceptable protection operation under,
- 3) Seasonal variations in soil resistivity, and
- 4) Variations in the effectiveness of the medium voltage source earthing.

## **5.1 MV network earthing**

The MV earth shall be via the lead sheath of the MV cable from the main step down substation (88kV/11kV). This main earth shall be connected to the main earth bar of the MSS or TSS.

## **5.2 LV network earthing**

LV earthing shall be in accordance with the TN-C-S Earthing System as described in the latest revision of the SANS\_ 0292.

The neutral core of the low voltage conductor or Protective Earth conductor is to be earthed at the following points for the TN-C-S system at or close to the star point of the transformer.

The armour wires of all LV cables shall be glanded and the gland plate shall be connected to the Neutral bar.



## **6. PRE-COMMISSIONING TESTING**

Prior to commencement of any work, upon completion of the installation and prior to handing it over to City Power, the Contractor will be required to test the low voltage installation and prove that it is in good order.

### **6.1 Low voltage cables and switchgear**

Phase to earth : 2 kV ac for 1 minute or 3 kV DC for 1 minute.

Phase to phase : 2 kV ac for 1 minute or 3 kV DC for 1 minute.

The above tests must be carried out with internal wiring to poles, phase and neutral disconnected.

A 500 volt insulation resistance test must be carried out on the internal phase conductor to earth before the internal wiring to each pole is reconnected to the main circuit.

An earth loop impedance test must be carried out at the last pole of each circuit and branch circuit for street lighting circuits and at the last point of all other low voltage circuits.

Continuity of the neutral/ earth system must be tested. Voltage level tests must be carried out.

Records of each test must be taken by the Contractor and handed to the Clerk of Works or City Power Official during the commissioning period.

### **6.2 Testing apparatus**

The Contractor must provide and operate all the necessary test plant and equipment to perform the above-mentioned tests. The Contractor will also be responsible for all safety precautions during testing and provide up to date certificates of accuracy for the testing apparatus from an independent standards authority when required by the Clerk of Works or City Power Official. Where possible City Power will provide, free of charge, a single phase 230 V 50 Hz supply for test purposes but where this is not feasible the Contractor will be responsible for providing the necessary portable generating plant for this purpose.

## **7. COMMISSIONING**

The contractor shall submit a commissioning form for each project for all new service connections and metering infrastructure installations before hand over and final payments are signed off as City Power requirements.

Commissioning form is to be signed by City Power representative depot manager and General Manager.

The "AS BUILT" drawing should accompany the commissioning form.

All respective checklists shall be completed and file accordingly on the project file.

## **8. "AS-BUILT" DRAWINGS**

A complete set of "as-built" drawings of the work as it progresses shall be kept by the Contractor in his site office. A paper drawing(s) showing only the general layout of the area shall be furnished to the Contractor for this purpose. The Contractor shall indicate on this drawing(s) all work completed as well as all the required dimensions.

The Project Engineer shall inspect and certify the drawing on a weekly basis.

Progress payments shall be made only for the portions of the work certified on the drawing.

On completion of the reticulation installation, the Contractor shall furnish the Project Engineer with two complete sets of transparencies, indicating the installation as actually installed. These drawings shall indicate the actual positions of all cables, cable joints, cable crossings, etc. taken from the weekly certified drawing.

The final approval shall not be given before the aforementioned drawings have been handed to and verified by the Clerk of Works or City Power Official.

## **9. SKILLS**

The contractor shall utilise staff who are qualified electricians i.e. have passed a recognised trade test. In addition, the contractor shall be registered with the Department of Labour. At any stage during the contract term, City Power may request details of all qualified electricians that are employed by the Contractor. The contractor should also run regular in-house training courses for all of their staff to ensure the proper skilled staff are utilized on this contract.

All jointers utilized to do medium voltage joints and terminations shall be registered with City Power. They shall also be trained and certified by a reputable supplier of cable accessories. A valid jointer accreditation certificate shall be produced at tendering stages for all jointers and when so required during the contract in the field. City Power will also conduct in house training for all jointers during the course of the contract.

The training attended by the jointer shall be E-SETA accredited and must be in accordance with SANS 10198. The jointer shall be trained on both PILC and XLPE cable systems. All cable accessories installed shall be in accordance with NRS 012 and NRS 053 requirements.

The jointer shall be equipped with all the necessary tools as per the training received when working on City Power's network.

If poor workmanship can be proved before the end of the guarantee, the jointer shall replace the affected joint or termination at their cost.

Failure to perform a presence of moisture test on a PILC cable prior to jointing or terminating should also be regarded as poor workmanship and the above clause will apply.

The jointer shall always put their name on the finished joint or terminations as per the installation instruction of the respective cable accessory.

## **9.1 Expanded Public Works Program (EPWP) requirements**

All City Power projects shall be treated as EPWP projects and it is a requirement that these projects be implemented as such. The Contractor shall not be permitted to employ unskilled and semi-skilled labour outside of the City Power EPWP guidelines. City Power will prescribe the EPWP requirements with regards to the number of work opportunities to be created as well as the nature of work to be performed by means of labour on each project site.

All labour shall therefore be sourced via City Power in line with City of Joburg's Job Pathways, unless City Power grants the Contractor permission to source local labour through the Ward Governance structures. The rate of pay, be it daily rate or task rate, for all labour work shall be stipulated in the contract and shall be in line with National Department of Public Works or City of Joburg's EPWP Guidelines. The Department of Labour's Ministerial Determination 4: Expanded Public Works Programmes, as part of the Basic Conditions of Employment Act of 1997, as published in Government Notice No.949 on 22 October 2010, a copy of which will be made available to all contractors.

Every project will be expected to create work opportunities for local communities and as a guide, for every R 20 000.00 (twenty thousand Rand) of labour cost the Contractor should create a minimum of one job opportunity. All projects shall be executed labour intensively in line with the requirements of Labour Intensive Construction (LIC) Methods. In instances where the Contractor does not comply with the requirements, City Power reserves the right to institute penalties, amend or terminate the contract. City Power shall arrange induction training in LIC methods for all contractors at dates to be confirmed and communicated, and all contractors shall ensure that their representatives attend such training. It may be a requirement, at the

discretion of City Power, that contractors send representatives to attend the formal Labour Intensive Construction (LIC) Methods course which is accredited at National Qualifications Framework (NQF) Level 5. Payment for such training shall be to the cost of the Contractor.

The Contractor shall implement City Power's EPWP requirements as follows, unless stipulated otherwise on a particular project:

## **9.2 Service Connections**

### **9.2.1 Labour contractors compliance**

<b>P O Value</b>	<b>Description</b>	<b>Min. Staffing</b>	<b>Rate(Rands per day)</b>	<b>Cost per Month (30 days)</b>	<b>Branding Req.</b>	<b>Tools Req.</b>
R400 000	Unskilled	<b>20</b>	250	R 150 000	Yes	Yes
	Semi-Skilled	<b>16</b>	270	R129 600	Yes	Yes
	Skilled	<b>4</b>	300	R36 000	Yes	Yes

#### **9.2.1.1 Unskilled Labour**

<b>P O Value</b>	<b>Duration</b>	<b>Description</b>	<b>Min. Staffing</b>	<b>Branding Req.</b>	<b>Tools Req.</b>
<b>R100 000</b>	N/A	Unskilled	<b>5</b>	Yes	Yes

### **9.2.2 Labour**

Contractors will be required to employ a minimum of five (EPWP) unskilled people per every R100, 000.00 Labour Purchase Order received from City Power as and when required. Contractors will be required to employ a minimum of twenty (EPWP) unskilled, 16 Semi-Skilled and 4 Skilled people per every work instruction (Purchase Order) worth R400, 000.00 Labour received from City Power as and when required. The CLO amount of R9000 excluding VAT per month or more if possible and includes R500 excluding VAT phoning allowance that totals to an amount of R9500 excluding VAT.

Contractors will be required to spend a minimum of 5% of the total value of the project on City Power's EPWP program and this will be included in the contract. The rates for various skill levels shall be as follows:

P O Value	Description	Min. Staffing	Rate(Rands per day)	Branding Req.	Tools Req.
<b>5% of Total PO Value</b>	Unskilled	<b>Agreed per project</b>	250	Yes	Yes
	Semi Skilled	<b>Agreed per project</b>	270	Yes	Yes
	Skilled	<b>Agreed per project</b>	300	Yes	Yes

\*Rates are adjustable as per EPWP office

### **9.2.3 Training**

The Contractor will also be required to provide the accredited and non- accredited training (On job training) to the relevant EPWP incumbents. The supporting documents and progress report to be forwarded to City Power on monthly basis with details of identification numbers, address of employees as shall be required by City Power. The submission of support documents will be included in the conditions of payment.

### **9.2.4 Skilled and Semi Skilled Labour**

P O Value	Duration	Description	Minimum Staffing	Branding Req.	Tools Req.
N/A	3 Yrs	Semi Skilled	20	Yes	Yes
N/A	3 Yrs	Skilled	8	Yes	Yes

### **9.2.5 Semi-Skilled Labour**

A minimum of 20 (EPWP) Semi-Skilled people should be trained by the contractor within the three-year contract duration and proof of documents and progress must be submitted to City Power on monthly basis. It should also be noted that the EPWP figures or number of employees required are subject to change and possible increase as and when City Power see necessary. Failure by the Contractor to submit proof and details of such training may lead to City Power reviewing the contract as it deems fit.

### **9.2.6 Skilled Labour**

A minimum of four (EPWP) Skilled people should be trained by the contractor during the three-year contract duration. The progress and proof of documents should be submitted to City Power on regular intervals. Failure by the Contractor to submit proof and details of such training may lead to City Power having to review the contract as and when the Company deems fit.

### **9.2.7 Stipend**

The Contactor will be required to pay the incumbents a stipend as stipulated on the bill of rates and subject to annual increases.

### **9.2.8 Personal Protective Equipment (PPE) and Branding**

The contractor will be required to ensure that all the EPWP employees have the EPWP and other City Power required PPE and branding which include signage and others. EPWP branded PPE shall include, but not be limited to yellow overalls and matching hardhats. Contractors shall procure PPE from city power on the rates reflecting on sap.

## **9.3 Distribution Projects, DSM, Protection, Metering, Maintenance Work and Electrification**

### **9.3.1 Labour contractor's compliance**

<b>P Value</b>	<b>O Description</b>	<b>Min. Staffing</b>	<b>Rate(Rands per day)</b>	<b>Cost per Month (30 days)</b>	<b>Branding Req.</b>	<b>Tools Req.</b>
R400 000	Unskilled	<b>20</b>	250	R 150 000	Yes	Yes
	Semi-Skilled	<b>16</b>	270	R129 600	Yes	Yes
	Skilled	<b>4</b>	300	R36 000	Yes	Yes

#### **9.3.1.1 Labour**

Contractors will be required to employ a minimum of twenty (EPWP) unskilled, 16 Semi-Skilled and 4 Skilled people per every work instruction (Purchase Order) worth R400, 000.00 Labour received from City Power as and when required. The CLO amount of R9000 excluding VAT per month or more if possible and includes R500 excluding VAT phoning allowance that totals to an amount of R9500 excluding VAT.

Contractors will be required to spend a minimum of 5% of the total value of the project on City Power's EPWP program and this will be included in the contract. The rates for various skill levels shall be as follows:

P O Value	Description	Min. Staffing	Rate(Rands per day)	Branding Req.	Tools Req.
<b>5% of Total PO Value</b>	Unskilled	<b>Agreed per project</b>	250	Yes	Yes
	Semi Skilled	<b>Agreed per project</b>	270	Yes	Yes
	Skilled	<b>Agreed per project</b>	300	Yes	Yes

\*Rates are adjustable as per EPWP office

### **9.3.2 Training**

The Contractor will also be required to provide the accredited and non- accredited training (On job training) to the relevant EPWP incumbents. The supporting documents and progress report to be forwarded to City Power on monthly basis. Failure by the Contractor to submit proof and details of such training may lead to City Power having to review the contract as and when the Company deems fit.

### **9.3.3 Stipend**

The Contractor will be required to pay the incumbents a stipend as stipulated on the bill of rates and subject to annual increases. Contractors shall procure PPE from city power on the rates reflecting on sap.

### **9.3.4 Personal Protective Equipment (PPE) and Branding**

The contractor will be required to ensure that all their staff and the EPWP employees shall have the right PPE and branding which include signage and others. EPWP branded PPE shall include, but not be limited to reflective yellow reflective vests, FR overalls and matching hardhats.

## **10. CONTRACT LIABILITIES**

**The contactor shall take note of the following:**

- Any damage to City Power's or any customer property
- Damage to City Power's or any other Services

That they will be held liable to rectify or fix such damage at reasonable time frames given by Clerk of Works or relevant City Power Official. Failing to comply with this shall lead to City acquiring services of another service provider or contractor and payment of such being the responsibility of original contractor.

## **11. TRANSPORTATION OF CITY POWER EQUIPMENT**

The contractor shall ensure that the transportation of all equipment and free issued material complies with all Transportation and Safety Standards. City Power officials including City Power Manager: Logistics & Warehouse has a right to refuse entry or loading of City Power equipment and material to unsafe transportation and or contractor's trucks. Security Risk Management shall ensure that compliance takes place before the contractor enters City Power premises.

## **12. PROJECT MANAGEMENT**

The contractor shall provide a competent Project Manager or Project Co-ordinator for each project. This person shall be responsible for all project management roles together with the related accountability and responsibility for each project; and these shall include but not limited to, allocation of resources; scheduling of works; communication with project stakeholders; quality assurance; scope management; SHEQ management and managing project deliverables.

City Power may request details of the appointed Project Manager or Project Co-ordinator as and when required during the contract term. The same shall apply to other project related resources such as vehicles, human resources, storage facilities, tools or equipment as well as plant and machinery.

City Power reserves the right to allocate work in line with the Contractor's resource capabilities, at any stage of the contract term.

## **13. DISPUTE RESOLUTION**

If at any stage a disagreement exists between the Relevant Manager or his representative and the Contractor, the matter shall be reported to the Engineering Services Contracts Manager for resolution and a way forward. If the matter requires further mediation, a mediator shall be mutually agreed upon to mediate and the decision of this party shall be final. The details of dispute resolution will be covered on the actual contract between City Power (Legal Department) and appointed contractor.



## **14. QUALITY MANAGEMENT**

A quality management system shall be set up in order to assure quality work during development, production and servicing of the City Power Infrastructure. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between City Power and supplier.

## **15. HEALTH AND SAFETY**

A health and safety plan shall be set up in order to ensure proper management and compliance of the meters and service connections during installation, operation, maintenance and decommissioning phases. Guidance on the requirements of a health and safety plan shall be found in OHSAS 18001:2007 standards. The details shall be subject to agreement between City Power and the Supplier.

## **16. ENVIRONMENTAL MANAGEMENT**

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance of the City Power Infrastructure during their entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning as well as disposal phases). Guidance on the requirements for an environmental management system shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHEQ Policy.

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**ANNEX A - BIBLIOGRAPHY**

None

**ANNEX B - REVISION INFORMATION**

<b>DATE</b>	<b>REV. NO.</b>	<b>NOTES</b>
May 2021	0	First issue