

PROJECT SPECIFICATION

INTEGRATED SECURITY SYSTEMS ROLL-OUT



CITY POWER (SOC) LIMITED
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BOOYSENS
2016

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SECTION II PROJECT DETAIL SPECIFICATION

1. WORKS INFORMATION AND CONTRACTUAL REQUIREMENTS

1.1. GENERAL

This specification deals with the technical installation aspects relating to this project. Any discrepancy between the Project Specification, Bill of Quantities and Drawings must be reported to the Engineer who will clarify such contradiction before the tender closing.

NOTE: There are stringent requirements applicable to the entry into sites and the work on sites:

- a) The contractor shall not enter a substation area or office building without the special written permission of City Power. The contractor shall obtain permits from City Power to carry out any work on Substation sites.
- b) Entry into substations, indoor and outdoor, shall only take place in the presence of the authorized representative of City Power and/or the Engineer responsible for Safety and Security. The contractor shall employ an HV Registered person to take responsibility of all substation sites.
- c) Work near open HV/MV bushings of transformers or overhead lines are strictly forbidden.
- d) No excavations with machines will be allowed in outdoor switchyards or substations.
- e) Excavations on any site shall also only be done once existing cable positions have been determined in the presence of a City Power representative.
- f) Poles planted for cameras in outdoor substations or switchyards shall only be done in accordance with the instructions of, and in the presence of the Engineer or the authorized representative of City Power and/or the Engineer responsible for Safety and Security.
- g) The same applies to the digging of trenches in outdoor substations or switchyards.
- h) Some of the work in buildings will take place in areas where ceilings are old and in a poor condition. The Contractor must carry out an inspection together with the Engineer before any work is undertaken near, in or on ceilings to ensure that un-repairable damage is not done to ceilings.
- i) Work in office buildings must be done with the minimum of noise and dust generation and shall be of minimum disturbance to staff.

This document describes the requirements for Integrated Security Contract Works.

This document must be read together with all Conditions of Tender, Conditions of Contract, Special Conditions of Contract, Security Specifications and Standard of City Power, Bill of Quantities and Drawings as issued for the Works.

The stipulations of this document must be seen as forming part or being complementary to any Conditions of Tender, Conditions of Contract, Special Conditions of Contract, and Schedule of Quantities, must be read together, and shall be regarded as forming part of such documentation for the Works.

If any discrepancies exist between parts of this document, the following order of preference will take place:

- i. Drawings
- ii. Bill of Quantities
- iii. Technical Specifications

Regarding the conditions of the contract, the order of priority is as follows:

- i. Special conditions of contract
- ii. General conditions of contract for Electrical & Mechanical Works
- iii. Tender requirements
- iv. Common Law

Any such conflict shall, however, be brought to the attention of the Engineer, before the closing date of tenders.

The Contractor shall further evaluate the works and services required in terms of these requirements during the Tender period, with the purpose of determining whether the requirements herein will have an influence on his contract price, and if so, the Contractor shall allow for any costs arising from this document in his contract price.

The Contractor shall be deemed to have carefully examined all the constituent parts of this document and all other documentation issued to him/her by the Engineer before the Tender is submitted. Any doubts as to the meaning of any terms, phrases or clauses of the document or any other document, or any missing pages, shall be submitted to the Engineer in writing before a Tender is submitted.

No claims traceable to no compliance with this requirement will be considered after the closing date of Tenders.

If it is found at any stage of a Contract that the Contractor has deviated from the requirements of this document without the written consent of the Engineer, then the Engineer shall have the right to order the Contractor to carry out the actions required by this document without any adjustment in the Contract price.

The successful tenderer shall within 14 days after being informed of acceptance of the offer provide the following information:

- i. Project Programme (in Microsoft Projects format – version 2010 or later)
- ii. Material and supplier Schedule
- iii. Plant and workforce schedule
- iv. Cable Block diagrams
- v. SHEQ file
- vi. Drawings for approval

The Contractor shall indicate the lead times for his working drawings in the Tender. The program of works in the factories or on site will be determined after due consultation with the Engineer.

Contractors who wish to submit alternatives for the specified installations or items must submit complete documents, including all technical data, for such alternative offers.

Calculations, drawings and all other pertinent technical information and characteristics, as well as modified or proposed Pricing Data for such alternatives must be submitted as an alternative Tender offer to enable the Employer to evaluate the efficacy of the alternative and its principal elements, to take a view on the degree to which the alternative complies with the Employer's standards and requirements and to evaluate the acceptability of the pricing proposals. Calculations must be set out in a clear and logical sequence and must clearly reflect all design assumptions. Pricing data must reflect all assumptions in the development of the pricing proposal.

The installing and servicing company will be certified or authorized by the Original Equipment Manufacturer (OEM) or its authorized agency for the respective equipment installations, and the installing company shall be a fully qualified System Integrator who employs staff who are fully trained to install open source network equipment and cabling systems. The contractor with their bids shall submit proof of OEM certification or authorization.

The installing and servicing company offering their equipment will thus utilize only certified technicians for the purpose of installing access control hardware to include access control equipment, software and wiring, unless otherwise directed or instructed by City Power.

Tenderers shall note that the information shared as part of this tender is highly confidential of nature and shall under no circumstances be reproduced, shared, distributed or be used to the detriment of City Power of Johannesburg or the Consulting Engineers. By obtaining this document and initialling of this page the tenderer agrees to the above confidentiality terms.

City Power of Johannesburg reserves the right to appoint a single or multiple Implementing Agents or Contractors for this project as is so decided following the tender adjudication process. Each site shall therefore be priced individually and unit rate prices shall not be dependent on order quantities. Minimum order quantities for a fixed price shall therefore not apply to this project.

1.2. DESCRIPTION AND SCOPE OF WORKS

The description for equipment used in the Works is listed in the General Specification and Bills of Quantities. Should the Contractor require any further information in this regard, this shall be referred to the Engineer in writing before the closing date of Tenders.

The scope of services to be installed varies between sites and consists of the following:

- a) CCTV Systems
- b) Intrusion Alarm Detection Systems
- c) Access Control Systems
- d) Fire Detection Systems
- e) Fire Suppression Systems
- f) Public Address Systems
- g) Visitors Management System
- h) Civil work – guardhouse construction, perimeter fence, repairs, trenching, backfill and paving or Fence & security lights
- i) Systems Integration
- j) Local Fibre Optic Cable installations
- k) Low Voltage Power distribution
- l) UPS and Control Panel Installations
- m) Testing of installations
- n) Local System Commissioning and Commissioning at the Reuven Central Control Centre
- o) Thermal Imaging/camera technology
- p) Intercom Systems
- q) Metal detectors and X ray machines

The scope of services to be rendered at various sites, which includes design, supply, install, commission and handover of integrated security system to all City Power sites and properties:

It shall be noted by the tenderer that City Power reserves the right to create a purchase order for any site consisting only of a reduced portion of the works detailed in this document and the relevant bill of quantities.

It is the responsibility of the Contractor appointed in terms of this contract, to ensure that all the associated equipment called for in this Specification, shall be suitable for safe operation, under all the climatic conditions specified in this document.

The Bill of Quantities contain the materials required for the entire duration of this contract and cannot be regarded as the full and final quantities of material for this Contract. The Quantities in this document, however, cannot be considered as being the final and full Scope of Works and fixed orders for quantities of small materials shall not be placed forthwith, neither for imported items nor for locally available items. A meeting shall take place between the Contractor and the Engineer to discuss the final Bill of Quantities before procurement of all material and equipment take place. This meeting will take place immediately after award of the Tender and will serve to discuss all technical questions regarding specified or offered equipment, to enable the Contractor to proceed with ordering of equipment.

The Tender Drawings or Bills of Quantities issued with this specification are not to be used for construction or ordering of materials. Exact measurements must be taken on site for the ordering of equipment, as the Contractor will not be paid for un-used materials on sites.

It is a specific requirement of this Contract that the Contractor submits his own general arrangement and equipment layout complete with overall dimensions and finishes of the equipment offered by him, after being awarded the Tender.

It is a further requirement of this Contract that the Employer approve in principle and/or in detail the Contractor's drawings and data before manufacture of any equipment may proceed.

Where the Contractor's Equipment may have an effect or impose forces or restrictions on any part of the buildings or structures of the Employer, the Contractor shall timeously submit details of such items, Works, Plant or designs to the Engineer for incorporation into the detailed design of the Works.

NOTE: There are stringent requirements for the type of equipment for this Contract, as the Employer maintains certain standards for their security equipment installations.

Whenever it becomes necessary for the Contractor to propose revisions to his construction programme, due to circumstances beyond his control of, work which may affect the overall works programme, the Contractor shall give adequate advance notice in writing of the revisions to allow the Engineer to similarly modify the overall program.

All small components- and subsystems required by the Contractor, for the equipment offered by him or specifically for the Works offered by him, shall be included in his Tender Price whether or not specifically called for.

1.3. DEFINITIONS

For the purposes of this document, terms used herein or in enclosed documents shall have the following meaning:

“Agreement” shall mean the agreement entered into between the Employer and the Contractor for the execution of the accepted Tender Price or accepted quotation;

“Schedule of Quantities” or **“Pricing Schedules”** or **“Bills of Quantities”** shall mean the document attached to a Tender Document or Quotation in which are entered the quantities of work, labour, materials and articles required for the execution of the Contract, together with the rates or prices for such items;

“Schedule of Prices for Variations” shall mean the schedules attached to a Contract Document or Quotation in which are entered the amounts to be added to, or deducted from the Contract Amounts according to whether the items mentioned in the said schedule are extra to or omitted from the Contract as may be provided for in the General Conditions of Contract;

“Contract” or **“Contract Documents”** shall mean and include the Conditions of Tender, General Conditions of Contract, Special Conditions of Contract, Project Specifications, Schedules of Quantities or Pricing Schedules or Bills of Quantities, Schedule of Prices for Variations, Drawings, Form of Tender, Letter of Acceptance and the Agreement to follow there on and shall include such printed matter or explanatory memorandum submitted by a Tenderer with his tender as may be acceptable to the Employer;

“Contract Price” or **“Contract Sum”** shall mean the amount entered in the Form of Tender for the whole of the Works done or materials supplied for the Works, subject to additions or deductions as may be made in terms of the Contract;

“Contractor” shall mean the person or persons, partnership, firm or company, whose tender for the work referred to in the Contract has been accepted by the Employer or who has or have signed the Contract, and shall include his or their heirs, executors, administrators, judicial managers, trustees, successors in title and duly appointed representatives;

“Employer” or the **“Client”** shall mean the Owner of the completed Works or the official body who acts as the representative of the Owner and shall include their duly appointed representatives.

“Drawings” shall mean the drawings, sketches, diagrams, maps, plans, sections and other delineations which accompany or are referred to in the Contract Documents, and which have been signed by the Engineer and such further drawings as may be issued or approved by the Engineer in connection with the works, whether such further drawings indicate variations of the Works, whether by way of addition, alteration or omission, or merely elaborate in greater detail the signed Drawings;

“Engineer” shall mean the Engineer duly appointed by the Employer to act on its behalf for the purpose of a Contract.

“Order in Writing” shall mean any printed, typewritten or written document or letter signed by the Engineer and addressed to the Contractor for the purpose of his guidance and directions.

“Site” shall mean the land and/or place to which Works is to be delivered or where work is to be executed or carried out under a Contract and any other land and/or place acquired or used by the Contractor in connection therewith, and includes any place wherever anything is made, manufactured, excavated or stored for the purpose of carrying out a Contract, together with so much of the area surroundings the said place or places as the Contractor shall with the consent of the Engineer actually use in connection with the Works otherwise than merely for the purpose of access to the said place or places;

“Specification” shall mean the section in the Contract document in which the detail method and standard of executing the Work and the nature of the materials to be used or supplied are described;

“Plant”, “Work” or “Works” shall mean all equipment, plant, materials, articles, matters and things comprised by, described in, or referred to in the Contract Documents and which are to be manufactured and/or delivered, constructed, erected and completed. These shall include all those details which are not particularly mentioned in the aforesaid Documents, nor shown upon the Drawings, but which are requisite for the perfect completion of each and every one of the several parts, and all additional Works that may be ordered to be executed according to the true intent and meaning of the Contract plus the maintenance for the prescribed period;

“Standard Practice” shall mean the methods and means of working normally as employed by the Employer;

“Sub-Contractor” shall mean the person or persons, partnership, firm or company named in the Contract for any part of the Work or to whom any part of the Contract has been sublet with the consent in writing of the Engineer and the legal representatives, successors and assigns of such person or persons, partnership, firm or company and all specialists, merchants, tradesmen or others executing any Work or supplying any goods for which prime cost prices or provisional sums are included in the Specification or Bill of Quantities and Prices who may at any time be nominated, selected or approved by the Engineer;

“Tests on Completion” shall mean such tests as are prescribed by the Specification to be made by the Contractor before the Works is taken over by the Employer;

“Construction Equipment” shall mean all the materials, machinery, implements, tackle, vehicles, barrows, tools, etc. provided by the Contractor, for the due performance of the Contract, but not essentially forming part of the Contract.

Words imparting the singular only shall also include the plural and vice versa where the context so requires. The headings or notes in these General Requirements shall not be deemed to be part thereof, or be taken into consideration in the interpretation or construction thereof or of the Contract.

“In writing” shall mean type written script or printed communication matter transmitted via land mail or via e-mail, or delivered by hand, to the Engineer.

1.4. TECHNICAL SPECIFICATIONS AND GENERAL DRAWINGS

Note: Unless otherwise specified the material shall be in accordance to the specifications listed in the section of this document containing all General and Equipment Specifications.

REV 0

CP_TSSPEC_237	Specification for integrated security systems	REV 1
CP_TSGUID_005	Guideline for fibre optic installation	REV 1
CP_TSSPEC_002	Specification for low voltage insulated wire, power and multi core control cables	REV 5
CP_TSSPEC_045	Specification for protective uPVC sleeves	REV 2
CP_TSSPEC_134	Flexible protective sleeves for underground drilling	REV 1

The following but not limited to National or International specifications will be applicable to this project:

SANS 1019	Standard voltages, currents and insulation levels for electricity supply
SANS 10139	Fire detection and alarm systems for buildings – System design, installation and servicing
SANS 1091	National colour standard
SANS 1186	Symbolic safety signs
SANS 1507	Electrical cables with extruded solid dielectric insulation for fixed installation (300/500 V to 1900/3300 V
SANS 10142	The Wiring of premises
SANS 10142-1	Low Voltage Installations
SANS 50054	Requirements and laboratory test for every component of fire detection and fire alarm system
SANS 50054-11	Fire detection and fire alarm systems. Manual call points
SANS 50054-16	Fire detection and fire alarm systems. Components for fire alarm voice alarm systems. Voice alarm control and indicating equipment
SANS 50054-2	Fire detection and fire alarm systems. Control and indicating equipment
SANS 50054-4	Fire detection and fire alarm systems. Power supply equipment
SANS 50054-5	Fire detection and fire alarm systems. Heat detectors. Point detectors
SANS 50054-7	Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light, transmitted light or ionization
IEC 34-1	Rotating electrical machines: Rating and performance
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 60332-1	Test on electric and optical fibre cables under fire conditions
IEC 60332-3	Test on electric and optical fibre cables under fire conditions
IEEE 802.3af	Refers to IEEE standard for Information Technology - IEEE STD 802.3af
IEEE 802.3at	Refers to IEEE standard for Information Technology - IEEE STD 802.3at
Machinery and Occupational Safety Act	Republic of South Africa - Machinery and Occupational Safety Act 85 of 1993 with special reference to Section 1 (Act & Regulations), Section 2 (Administrative Regulations), Section 6 (Electrical Installation Regulations) and Section 16 (General Safety Regulations)
IEC 60794-1-E4	Optical fibre cables
IEC 60794-1-F4	Optical fibre cables
IEC 60455-3-11	Specification for solventless polymerisable resinous compounds used for electrical insulation
IEC 60332-1	Flame Propagation Test for a Single Insulated Cable
IEC 60332-3	Burning Behaviour of Bunched Cables
IEC 60455-3-11	Specification for solventless polymerisable resinous compounds used for electrical insulation. Part 3: Specifications for individual materials. Sheet 11: Epoxy resin-based coating powders
IEC 60794-1-E4	Fibre optic Cable Testing Methods

BS 5839 - part 1	Fire detection and fire alarm systems for buildings: Code of practice For design, installation, commissioning and maintenance of systems in non-domestic premises.
BS 5839 - part 4	Fire detection and alarm systems for buildings: Specification for Control and indicating equipment
BS5839 - part 8	Fire detection and fire alarm systems for buildings: Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.
EN50131, Grade 2	European Standards Series for Intruder Alarm Systems
EN54	Requirements and laboratory test for every component of fire detection and fire alarm system
EN54-11	Fire detection and fire alarm systems. Manual call points
EN54-16	Fire detection and fire alarm systems. Components for fire alarm voice alarm systems. Voice alarm control and indicating equipment
EN54-2	Fire detection and fire alarm systems. Control and indicating equipment
EN54-4	Fire detection and fire alarm systems. Power supply equipment
EN54-5	Fire detection and fire alarm systems. Heat detectors. Point
EN54-7	Fire detection and fire alarm systems. Smoke detectors. Point detectors using scattered light, transmitted light, transmitted light or ionization
EN60529	Degrees of protection provided by enclosures (IP code)
FIPS 201-1:	National Institute of Standards and Technologies Personal Identity Verification (PIV) of Federal Employees and Contractors
ISO 15693	ISO standard for vicinity cards
ISO7240-16	Fire detection and alarm systems - Sound system control and indicating Equipment
UL 1076	Standard for Proprietary Burglar Alarm Units and Systems
UL 294	Standard for Access Control System Units
UL1076	Standard for Proprietary Burglar Alarm Units and Systems
ULC-S319-05	Electronic Access Control Systems
The Electricity Act	Republic of South Africa - The Electricity Act, No. 40 of 1958

1.5. SITE INFORMATION

The sites are the premises of City Power. Space within most of the site are extremely restricted and access to and from sites are difficult due to high volumes of vehicular traffic.

Unless otherwise specified in the technical data sheets of this enquiry, all equipment offered against this contract, shall be suitable for use under the following climatic and service conditions:

- Altitude 1,600 to 1,800 meters
- Ambient temperature -10° C to 40 °C
- Average humidity Not exceeding 95 %
- Wind pressure Not exceeding 1050 Pascal (Equivalent 40 m/s)
- Level of atmospheric pollution High (Indoor application 31 mm/kV)
- Lightning ground flash density Up to 8 flashes per km²/year

Contractors shall note that due to the space limitations on the substation sites, there is not sufficient space for storing of equipment for extended periods. The Contractors shall plan and allow sufficiently to ensure that equipment is delivered just in time for installation.

Dumping receipts shall be presented for all equipment, rubble and scrap removed from site. The appointed Contractor shall be responsible to investigate the availability of nearby dumping site for disposal of material in order to claim for limited or free haul depending on the dumping volumes.

1.6. ENVIRONMENTAL CONDITIONS

Except when otherwise specified, all equipment and materials shall be designed and selected for the following climatic and environmental conditions:

- a) Operating temperature range: -10°C to $+55^{\circ}\text{C}$.
- b) Relative humidity: maximum 95% below 35°C and maximum 75% above 35°C
- c) Height above sea level: 1500 meters.
- d) Wind borne and air borne dust

Corrodible metal parts of installations installed indoors in humid conditions or outdoors shall be manufactured from brass, aluminium, stainless steel, powder coated 3CR12 steel. Other steel and alloy materials used for commercial equipment such as camera brackets shall be powder coated

Samples shall be submitted for approval before manufacture takes place.

Cable ladders, trays or wiring trunking and brackets for the mounting of such equipment shall be hot dipped galvanized or power coated to SANS specifications.

No drilling, cutting or welding will be permitted after galvanizing of steel. All bolts, nuts, washers, thimbles, turnbuckles and similar small parts shall be hot-dip galvanized, electro galvanised or stainless steel.

Contact between dissimilar metals shall be avoided wherever possible. The following electrode potentials shall not be exceeded:

- a) For connections of interior parts exposed to condensation but not contaminated by salt: 0.5 V.
- b) For connections exposed to the weather: 0.25 V.

All housings containing electrical equipment, electronics or electrical wiring shall be completely rat- and vermin proof.

All housings containing electrical equipment or electronics and which will be installed indoors in humid conditions or outdoors shall be IP55 rated in accordance with IEC 60529 specifications, unless stated otherwise.

All outdoor housings with external hinged doors shall have seals between the doors and the frame of the housing and shall further have "drip lip" edges around the frame opening. Such housings shall further have overhang roofs over external doors.

In addition to the normal operating conditions specified above, the equipment shall also be capable of operating under the temporary adverse conditions that would prevail on site during

the construction periods. If additional protection is required for the equipment and installation under these conditions, then the Contractor at his cost shall provide such protection until conditions have improved to the point where additional protection is no longer required.

The Contractor for this Contract shall protect his equipment on site against physical damage, dust and rubbish, paint smears by others and theft. The necessary insurance shall be taken out by the Contractor in case of damage to, or theft of equipment on site, before such equipment has been handed over to the Employer and the Engineer has issued the Practical Completion Certificate.

1.7. INSULATION LEVELS

Due to some work to be carried out in high voltage environments, the appointed contractor(s) shall have in its employment at least one person with ORHVS certification, who will supervise all work being carried in in or near live chambers or yards. It shall be the responsibility of the contractor to ensure safe working clearance of all people on site during construction/installation as well as statutory clearance after installations are completed. Any possible violations shall immediately be brought to the attention of the Engineer for instructions to be issued.

Table 1: Electrical Clearance

1	2	3	4	5	6	7	8	9	10
Rated voltage, kV	<1,1	7,2	12	24	36	48	72	100	145
Electrical clearance, m	–	0,15	0,2	0,32	0,43	0,54	0,77	1,00	1,45

NOTE 1 The safety electrical clearance is referred to as the "M value".

NOTE 2 No electrical clearance is specified for voltages below 1,1 kV because exposed live LV parts are considered safe if there is no direct contact with the live part.

Table 2: Working Clearance

1	2	3
Rated voltage kV	Working clearance m	
	Vertical (2,40 + M)	Horizontal (1,40 + M)
≤ 1,10	–	–
3,60	2,55	1,55
7,20	2,55	1,55
12	2,60	1,60
24	2,72	1,72
36	2,83	1,83
48	2,94	1,94
72	3,17	2,17
100	3,40	2,40
145	3,85	2,85

NOTE 1 The working clearances do not include any provision for additional object clearances (see 4.7). Where screens or barriers are interposed, the clearance should be taken as a taut-string measurement around the edge of the screen or barrier.

NOTE 2 This table does not apply to compact tower clearances. Live line techniques should be applied in respect of compact towers.

All equipment offered shall be properly screened or insulated and shall not be susceptible to any electrical or magnetic interference for voltage levels up to 400kV.

All equipment installations and working procedures shall be in accordance with NRS 060: "Code of practice for clearances for electrical systems with rated voltages up to and including 145 kV, for the safety of persons".

1.8. VISIT TO SITE

Contractors are advised to visit the sites to acquaint themselves with the local conditions, distance to the site(s) from their offices or domicilium citandi, access to the site(s) for equipment and personnel, etc., before tenders are submitted. Upon submission of a tender, Contractors acknowledge that they are fully satisfied with site conditions and site requirements and further acknowledge that they will not have any claims against the Employer or the Engineer or their legal representatives after the closing date of tender or throughout the duration of this Contract. Any claims, which may arise later because of lack of site information, will not be considered by the Employer or the Engineer.

Contractors shall make the necessary arrangement with the Engineer, before the site is visited. If Contract work is to be carried out in phases in accordance with the specifications or other stipulations by the Employer, then the Contractor will not be paid for intermediate or unscheduled visits to site. Contractors shall communicate with the Engineer, in the case of work to be done in phases, to ensure that he is present on site, when required, for continuation of the next phase of work.

1.9. RESPONSIBILITY OF CONTRACTOR

Until the Contract Works have been completed, or deemed to have been completed, the Contractor shall be responsible (subject to the Memorandum of Agreement and the Conditions of Contract) for the Contract Works whether under construction, during tests, or in use for City Power's service.

The handling and storage of materials and equipment near the erection site prior to installation shall be done in a tidy and safe manner. The Contractor shall at his own expense, keep the site area allocated to him and the erection area of the Contract Works, reasonably clean and shall remove all waste material as it accumulates, and as directed by the Engineer from time to time. There shall be no Safety, Health or Environmental Impact due to the installations carried out and the contractor shall take full responsibility for all construction methodologies.

Storage of materials shall not be permitted without prior approval, and the Contractor shall take all necessary steps to protect any materials stored on the site. ***City Power of Johannesburg reserves the right to be under no obligation to pay for material delivered to or off site, and shall take preference for payment to the contractor after commissioning of the works.*** When the work is completed, the Contractor shall remove all rubbish and debris, unused materials, temporary erections and plant and shall leave the site of the work clear. The Contractor shall also make good at his expense any damage done to buildings, plant or property belonging to City Power.

Contractors must assess and take precaution when undertaking installation of conduit and wiring for fire detection systems in ceilings as some of the buildings in this project are old and ceilings are not in good condition. Damage to such ceilings will result in major building repairs for which City Power did not allow in their budgets for this Contract.

1.10. RE-LABELLING

The contractor shall be responsible to attend to all labelling requirements that arises with any system installation. All labelling requirements shall be allowed for in the unit rates of the contractors priced bill of quantities. A schedule of labels shall be compiled by the contractor and submitted for approval to the engineer.

1.11. SUB-CONTRACT WORK

All work specified in tender documentation shall only be performed by the Contractors own personnel and shall under no circumstances be sub-contracted without the written consent of the Engineer.

The names of all specialist Sub-contractors that will be employed on any site shall be submitted with the Tender for formal acceptance.

1.12. ORDERING OF MATERIAL AND EQUIPMENT

Contractors must note that materials and equipment on long delivery shall be ordered well in advance, as late deliveries will be their sole responsibility. Any applicable escalation on equipment or materials ordered late will be calculated using indices suitable to the Employer. If for some reason late deliveries are found to be to the advantage of the Employer, the Contractor will be instructed in writing regarding the delay in ordering of such materials.

The successful Tenderer shall attend meetings at venues and at times, as may be arranged by the Engineer, after having been advised that his/her Tender has been accepted, for the purpose of coordinating the technical requirements and the period of the project, so that orders can be placed for the correct materials.

Unless otherwise indicated or stated, all units of measurement indicated in the Pricing Schedules, Schedule of Quantities or Bills of Quantities are metric units.

The linear quantities of wire, conduit, trunking, cables, etc. as given in the Pricing Schedules, Schedule of Quantities or Bills of Quantities are normally measured from scaled drawings for Contract document compiling purposes. Contractors can thus not accept that such quantities are accurate when materials are ordered and Contractors shall measure such quantities on site before orders are placed, as they will not be paid for excess material on site after the completion of the Contract.

If such measurements cannot be taken at the onset of the Contract, the Contractor shall obtain approval from the Engineer to order the required materials that may cause delays or additional cost due to escalation before ordering such materials as allowed for in the Pricing Schedules, Schedule of Quantities or Bills of Quantities.

1.13. DELIVERY OF EQUIPMENT

The Contractor shall make the necessary arrangements to get all equipment delivered to site in accordance with the Programme of the Works and in an undamaged condition. The Contractor shall pack equipment and material for transport and delivery in soundly constructed crates or other packages fitted with removable lids or openings for inspection. All parts of the equipment prior to packaging shall have been thoroughly protected to preclude damage during transportation and storage.

Any damage that may occur in transit or storage must be repaired, corrected or replaced by the Contractor before such materials or equipment are installed. Any parts of items found to be defective after installation on site shall be replaced or repaired at the Contractor's expense, to the Engineer's approval. The Contractor shall be responsible for the acquisition of any insurance cover that may be required for equipment in transit and temporary storage on- and off site.

All the lifting and erection equipment required by the Contractor to off-load, install or erect equipment on site is deemed to have been allowed for by the Contractor in the Contract price, as no assistance in this regard will be provided by the Employer or other Contractors. If no item has been measured in the Pricing Schedules, Schedule of Quantities or Bills of Quantities for such handling equipment, the rate of the item to be handled shall include such handling costs.

Materials stored off-site must be repacked or protected, after inspection, to provide the necessary protection thereof for transport to site.

1.14. PAYMENT FOR STORED MATERIALS

The Engineer will not issue any certificate for interim payment of any equipment and material that are stored on site or off site in such a way as to hinder inspection thereof.

City Power of Johannesburg reserves the right to be under no obligation to pay for material delivered to or off site, and shall take preference for payment to the contractor after commissioning of the works.

Materials or equipment stored on site or off site and packed in crates or boxes must be opened for inspection and the serial numbers, types or quantities must be easily identifiable by the Engineer before payment for such materials will be processed.

Payment will further not be certified for small materials such as short pieces of cable, conduit, wire, conduit boxes, saddles, screws, etc., that are stored **on or off site**. Payment for such materials will only be certified once the materials have been built in, installed or commissioned.

Interim payment will only be considered subject to the following conditions:

- a) The equipment must be complete and in a ready state for installation or commissioning. Loose components which are not yet built into or which will form part of the large materials mentioned in the previous paragraph, will not be considered for payment. (An example hereof is, for instance, are instruments that must be fitted in a cabinet and is still in separate storage.)
- b) The materials, which are to be type tested, performance tested or safety tested should have already passed inspections and/ or tests by the Contractor and/or the supplier of the equipment.
- c) The Contractor shall, prior to submitting interim payment claims, procure financial assurance by means of the guarantee of a registered bank, on the form provided by the Engineer, and equal to the total amount of payments to be made to the Contractor.
- d) The total value of such guarantee, provided by the Contractor to the Employer, may be varied by the Contractor, with the consent of the Employer, from time to time provided that the Employer will be covered at all times to the total amount paid by the Employer to the Contractor for items not yet built into the Works.

The guarantee will lapse 12 months after all the said equipment and/or materials have been built into the permanent Works.

The material must be stored in a cordoned off area in the stores of the Contractor and a notice must be affixed to this area, which states that the materials stored in that area are the property of the Employer.

The area must be safe and not near flammable liquids or explosive equipment and must be kept clean and dry.

1.15. WORKSHOP ASSEMBLY AND ID OF SUB-SECTIONS AND COMPONENTS

To avoid problems with the erection and installation activities on site, components, equipment and sub-assemblies must be pre-assembled in the place of manufacture to ensure proper fitting and operation on site. Such pre-assemblies, which are to be tested in the place of manufacture, shall be set up in a simulated mode, using the specified peripheral equipment as far as possible in a temporary connected condition to simulate site conditions as accurately as possible. This requirement is, in particular, applicable to field equipment for electronic installations.

The purpose of such preliminary test shall further be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results,

as set out in the various parts of the document. Measurements of equipment shall be taken into consideration to ensure that such equipment and materials can be handled on site and can be placed into the specified positions. Additional costs or delays resulting from failure on the part of the Contractor to check access conditions, positions, openings, etc., will be for the Contractors account.

Individual units of equipment shall be clearly marked by employing an identification code in such a manner that actual re-assembly, erection and installation on site can be done in a minimum of time with a minimum of fitting and adjusting on site. Equipment should be delivered to site in the largest sub-assemblies that are practical.

Equipment of the same type shall all be obtained from one manufacturer and sub-components shall be changeable. Prior to manufacture, the Contractor shall ascertain the critical dimensions of points of entry to the building.

The Engineer may, upon request by the Contractor, inspect existing installations of prototype assemblies in the factory to determine whether the extent and workmanship of such units are of the required standard for the particular Contract. This may be done to obviate the possibility of having to replace unacceptable equipment already installed.

1.16. CONSTRUCTION METHODS

Before initiating any construction, the contractor shall compile a list of all defects per site and verify such defects alongside a duly authorized City Power representative. The repair of any damage not listed shall be the full responsibility of the contractor, the Employer shall under no circumstances be held responsible for payment of damages done by the contractor or damages not listed prior to initiating construction. Where the contractor will perform trench work, it shall be the contractor's responsibility to request that the employer scans the trench for any existing services, especially cables at substations. The contractor shall clearly mark the trench positions by means of chalking.

1.16.1. BUILDING WORK

The Contractor must take care that no unnecessary damage is caused to building structures during the installation of equipment and that other contractors are not delayed by him.

The installations of electronic equipment in this contract will be mainly on surface of brick walls and concrete ceilings. Some parts of the installation such as smoke detectors, sounders, strobes, loudspeakers, etc., may require the installation of conduits or trunking or cabling in ceilings voids in single story buildings or in false ceilings of multi- floor buildings.

No finished surfaces may be chased for the installation of cables or any other equipment without the written permission of the Engineer. Where it becomes necessary to cut into finished surfaces, the permission of the Engineer shall be obtained in writing. The Contractor will be held responsible for any damage to a building structure due to unauthorised cutting of building surfaces.

1.16.2. FIXING OF MATERIALS IN BUILDINGS AND ON STRUCTURES

The Contractor shall fix cabinets and wire ways for cabling, saddles, conduit accessories, brackets, braces, wiring channels and all other metal and non-metal surface mounted material and equipment as described hereunder, unless otherwise stated in the Site Specifications:

- Into Concrete:** Expanding type bolts, or gun-bolted with sizes and lengths as permitted by the Engineer or as specified.
- Into Brickwork:** Expanding type bolts or built-in metal fixings of size as approved by the Engineer or as specified.
- Onto Steelwork:** Drilled, tapped and screwed with specified or approved sizes of machine screws or by means of welding where so permitted by the Engineer.
- Onto woodwork:** Fixed by means of wood screws of quantity and sizes as specified or approved by the Engineer.
- Into Hollow Tiles:** Spring toggles of not less than 6 mm diameter and then only upon specification or approval by the Engineer.
- Onto ceiling board:** Spring toggles of not less than 6 mm diameter.
- Onto false ceilings:** Spring toggles of not less than 6 mm diameter and only when the false ceiling tiles can support the weight of the equipment.

Where any equipment or material is to be mounted on surface of ceilings, such equipment or material shall only be mounted as specified by the Engineer or as permitted by the Engineer in writing.

Gun bolting into concrete will only be allowed into cast concrete and then only after written permission has been obtained from the Engineer. No gun bolting shall be undertaken into ash-bricks, brickwork, gas concrete or pre-cast concrete except where written permission has been granted by the Engineer. The Contractor will be held responsible for any damage to builder's work due to unauthorised gun bolting.

Note: The use of plastic plugs, wooden plugs or any other soft substance type fixing plugs is **strictly prohibited** and the use of these materials will not be approved by the Engineer.

All cable ladders, cable trays, power skirting, brackets, etc., shall be fixed in a neat manner, and shall be fixed vertically or horizontally, following building structure lines. Fixings of such items that will carry heavy loads must be fixed in accordance with the requirements of the manufacturer thereof. Sufficient space must be allowed for on cable ladders and trays as multi layers of cables on cable trays are not acceptable.

Cables on outdoor cable ladders shall be fixed with UV resistant fixing materials or stainless steel banding straps in such a way that cables are not damaged. Outdoor cable shall, as far as possible, be protected from direct sunlight. Underground sleeves and cables shall be installed at specified depths and in approved bedding materials. Sleeves for cable entry in buildings shall be placed in position before foundations are cast to ensure proper entry depths of cables. Appropriate matching of cables with cable sleeves shall be determined with the Engineer prior to construction.

1.16.3. HANDLING OF MATERIALS AND SAFETY

1.16.3.1. OFF-SITE HANDLING

- a) Equipment and materials stored off site for a Contract shall be stored in a clean and safe areas. Damaged equipment and materials, stored in factories or stores of the Contractor, will be rejected upon inspection. Electronic equipment shall not be assembled, stored or tested in areas where grinding, welding or painting work takes place.
- b) Areas in stores or places of manufacture for testing or inspections of equipment and materials by the Engineer shall be clean and safe for the purpose of testing or inspections. Floors must be free of loose materials, dirt and debris.
- c) Equipment and materials will not be inspected in noisy or dirty environments and also not in areas where welding, grinding, and painting or such other manufacturing processes are underway. Testing or inspections will also not be undertaken in hazardous or explosive atmospheres.
- e) Materials stored in the stores of the Contractor or in another storage space, and which is acceptable to the Engineer for off-site certification for payment, shall only be certified for payment under the conditions as laid down in this document.

1.16.3.2.ON-SITE HANDLING

- a) Equipment and materials stored on site shall be stored in a safe, dry and clean environment and shall be protected against damage and from the elements.
- b) Heavy materials shall be stored in a manner as not to create a danger to other contractors or to the Employer or the Engineer.
- c) Small materials shall not be left lying around on site. Expensive small items such as instrumentation or electronic components shall be kept under lock and key until the installation thereof.
- d) Store rooms used by the Contractor shall be kept locked to prevent unnecessary loss of materials.
- e) Redundant material which is the property of the Employer shall be removed from site and the Contractor shall obtain instructions for the removal of the equipment from the Engineer. No redundant material shall become the property of the Contractor or any other party and shall remain the property of the Employer unless decided otherwise by the Employer.
- f) The Contractor will be responsible for the transport of all materials and equipment to the site and on the site and will provide the off-loading, rigging, lifting, handling and placement thereof into the permanent position as planned for the equipment. The Employer will not provide any assistance or equipment for the placing into position of equipment or materials.

1.16.3.3.SITE SAFETY

NOTE: Tenderer's and Contractors must ensure that they have read and understood the requirements at the beginning of clause 1.0 of this document.

- a) The requirements of the Occupational Health and Safety Act, Act 85 of 1993 and the requirements of SANS 10142-1 (or the latest edition thereof) shall be complied with as far as site safety is concerned.
- b) Excavations shall be barricaded and shall be backfilled and compacted as soon as possible after excavating to allow safe passage of persons and traffic on site. Contractors shall not allow any workers to work in excavations deeper than 1m unless the sides of the excavation are properly shored and supported, especially in sandy or wet soil conditions.
- c) Open manholes shall be barricaded.
- d) Deep waterlogged excavations shall be pumped empty as soon as possible after flooding or shall be solidly barricaded until pumped dry.

- e) Open, live or unsafe power connections shall not be left unguarded or unprotected.
- f) The construction site shall be kept clean and tidy on a daily basis.
- g) Off-cuts and rubbish shall be removed from the site and deposited in the designated dumping place on a daily basis.
- h) The Contractor shall adhere to all safety rules and regulations as may be in existence on a site or as may be required by the Employer or the Engineer. The Contractor shall also ensure that their workforce on site adhere to safety rules.
- i) Contractor shall not drive or allow a vehicle or machine to be driven close to excavations.
- j) Contractor shall keep all power connections and/or live equipment with voltages above 50V, temporary or permanent, in good and safe condition and shall keep all doors, shutters and covers closed on such equipment, during construction and during testing and commissioning and shall take all steps to prevent accidental contact of live equipment by any person.
- k) A Contractor shall take control over any power cable or power circuit connected from equipment installed by him, or under his control and which operates at a voltage higher than 50V. The Contractor shall not cause such a cable or circuit to be made alive and shall not grant permission to any other person on the site to make such a cable or circuit alive without first having made sure that such action does not create a dangerous situation.
- l) A Contractor shall not connect any portion of an installation to the point of supply of a Supply Authority without first having complied with the requirements and regulations of such an Authority as far as tests, certification or clearance from the Authority is concerned and also not until permission is obtained from the Engineer in this regard. Any damage to equipment of other contractors or the Employer due to equipment being supplied by such an un-authorized power connection shall be for the account of the Contractor for this Contract.
- g) A Contractor shall not make alive any portion of an installation until the earth points of power equipment in such installation has been properly bonded and earthed to a known good earth point with a value of 5 ohm or less, referred to zero, as tested with a null balance megger.

1.17. MANUALS AND DATA RECORDS

All data pamphlets packed with equipment and other pamphlets, handbooks of equipment, operating instructions of equipment, drawings, etc., shall be kept in safe storage by the Contractor during the Contract period.

The Contractor shall also keep accurate records of all tests carried out on equipment and cables and of the test results so achieved. Records shall be kept of setting values of instrumentation and all readings taken during testing and commissioning, as well as records of all final adjustment readings.

A comprehensive operational- and maintenance **hard copy manual** shall be built up by the Contractor, using the data mentioned in the first two paragraphs of "Manuals and Drawings", as well as other data and descriptions as specified further herein.

Also refer to "*1.18 DOCUMENTATION AND DRAWINGS*" hereof for electronic copies of all data.

All drawings and diagrams shall be done in AUTOCAD 2010 (or later) format and all text shall be submitted in the latest edition of Microsoft Word format. All tabular data shall be submitted in the latest edition of Microsoft Excel format. All pamphlet and brochure data shall be submitted in PDF format.

DXF files of other CAD programs can also be submitted, if these are suitable for conversion to AutoCAD format, without scrambling of text or graphics upon conversion.

The number of copies as scheduled in the Pricing Schedules or Bill of Quantities or Bills of Quantities, of the manuals described herein, shall be made up by the Contractor. The quantity of copies required is normally not less than five (5).

The manuals shall be presented to the Engineer on the first day of "wet commissioning", if handover of the Works is done on that day. (Refer to "1.21 COMMISSIONING & 1.24 CERTIFICATION BY THE ENGINEER."). The manuals shall be neatly housed in lever arch files and shall be in typewritten and/or printed format, properly indexed, with appropriate 2 or 3-layer card dividers between each section to facilitate ready reference.

A main index shall be placed in the beginning of each manual. The project name and project description shall appear at the top on the main index of the manual. Coloured dividers shall preferably be used.

The manuals and drawings shall cover all installation, operation, and maintenance schedule aspects of each item of equipment and all circuitry provided under this Contract, as specified in par. "1.18.3 FINAL DRAWINGS & 1.19 OPERATIONAL - AND MAINTENANCE MANUALS" hereof.

The manuals, if approved, will be handed to the Employer or the representative of the Employer, so that the Works can be operated correctly and safely. (Also refer to "1.22 TRAINING OF PERSONNEL" herein.)

Any changes which may be necessary to the contents of the manual after the commissioning of the Works shall be done by the Contractor and sufficient copies of the altered data shall again be submitted to the Engineer for binding into the manuals. This process shall be repeated for the duration of the Contract period or until the final certificate is issued by the Engineer for the project.

A "Practical Completion Certificate" and subsequent "Certificate of Commissioning" will only be issued on receipt of accurate and final "as-built" drawings and documentation to the approval of the Engineer. Such documentation shall be presented to the Engineer on the first day of commissioning of the works. Any certification of "Practical Completion" or "Commissioning" of the works is subject to final approval of such documents and drawings by the Engineer.

Wherever manufacturer's manuals refer to types of equipment other than the exact type as installed, the exact type shall be highlighted throughout such manuals.

1.18. DOCUMENTATION AND DRAWINGS

All documentation and drawings as specified in the general or equipment specification shall apply to this contract.

1.18.1. GENERAL

A stringent requirement of a Contract is to have "as built" data when a contract is complete to ensure that:

- The Employer knows where all the equipment and materials are installed
- Fault finding in the system can be done in future
- Alterations and additions can be undertaken in future by referring to the drawings to determine the built in capacity of the system without having to determine this data on site.

It is therefore imperative for the Contractor to produce acceptable manufacturing drawings at the onset of a project so that equipment can be manufactured and ordered. Drawings such as layout drawings, single line diagrams, block diagrams, typical control diagrams, etc. are normally issued by the Engineer together with documents for tender purposes.

If no drawings or limited drawings are issued by the Engineer at tender stage or thereafter, the Contractor shall arrange a technical meeting or meetings with the Engineer to determine the exact scope of the work, shall then prepare the necessary drawings to enable him to manufacture the specified equipment. This shall include “shop” drawings, diagrams and/or constructional detail drawings.

The drawing or drawings so prepared by the Contractor shall obviously make provision or include the drawings or standards normally used by the Contractor to produce acceptable quality of work. The Contractor shall further keep all drawings and diagrams prepared during the course of production and installation of the Works and shall present this to the Engineer on completion of the Contract. Such drawing shall at least consist of all the drawings the Contractor used for construction and installation work as well as all data of final positions and final settings of equipment.

All cable positions on the site of the Works shall be shown on layout drawings, together with dimensions taken on site from fixed points to show exact location of underground cables. Any diagrams (standards or specific) issued by the Engineer shall not be used by the Contractor for making up his own design drawings by adding data or wiring- and terminal numbers to such diagrams.

The Contractor shall draw up and submit his own diagrams and general arrangement drawings in the formats and quantities as required by the Engineer. Hand drawn drawings will not be acceptable, except in the case where formal site layout plans are not available to mark-up equipment and cable positions. Drawings shall preferably be done in A3 format and on the standard border and title block sheets of the Employer or the Engineer, unless permission is granted in writing by the Engineer for other formats of title blocks.

All drawings shall be properly numbered with the numbering system required by the Employer or the Engineer and the number of the particular sheet and the total number of sheets shall be shown on each drawing. The Contractor may use his own reference number in a separate block if the Engineer requires a special drawing numbering system. Standard drawing sheets in electronic format can be obtained from the Engineer, if available.

Electronic copies, on disc or CD, of all “as built” drawings prepared by the Contractor during the course of the Contract, as well as all electronic copies of software and descriptions of equipment, handbooks or sales data shall also be handed to the Engineer, together with the hard copy “as built” drawings and manuals, in quantities and formats as specified in this document.

1.18.2. DRAWINGS FOR APPROVAL

A set of three (3) prints of the shop drawings for all the panels, electronic cabinets and 19" racks shall be submitted for approval before any of the aforementioned panels are manufactured.

The following information shall be presented:

- a) Single line diagrams for electronic and power circuits, showing rating of wiring, cables, push buttons, fire break glass, door closers, magnetic locks, door monitor, gator motor, boom gate, video recorders, cameras, card and biometric readers, magnetic readers, fire detectors, call points, sounders and strobes, passive infrared sensors, specifications and quantities of power and communication cables and cable cores with:

- 1) the rating, type number, catalogue number, ratio, class, IP addresses, etc. next to each component with the abbreviated reference number such as "R1", "KM1", etc., next to or on the component symbol.

(Note: If space for descriptions is limited on diagrams, letters and figures shall be shown next to equipment and tabulated data shall then be submitted with columns showing the reference number or letter together with the corresponding rating, type number, catalogue number, ratio, class, etc., next to the reference)

- 2) the functions of each control circuit or section of control circuit, above each control group of components, such as "Alarm circuit", "Interface card", "Auto/Off/Manual", "IP switch", etc.

- 3) the functions of each component on control diagrams below the component.

- 4) wire and cable numbers for all control and power wiring together with the colours of all wires.

- b) A general arrangement block diagram of the whole of the Works. Overall dimensions of panels together with material type and thickness used for the framework, doors and covers as well as the type and colour of finish of the material.

- 1) front elevations and sections for all the panels and devices.

- 2) positions of door locks, hinges, handles, vermin proofing, ventilation facilities, seals on doors and covers, etc.

- 3) the IP rating of all panels and cubicles.

- 4) placement positions of all front panel components on panels. All labelling information for each component shall be shown in tabulated form on general arrangement drawings.
- 5) all internal panel dimensions, clearances, fixings, ventilation arrangements and detailed connection terminals.
- c) The source code for the systems integration shall be submitted for approval by the contractor alongside all above required drawings. All programming shall be subject to the comments and approval of the Engineer.

All drawings shall be done using NRS symbols and the applicable **SANS** standards for drawings plus any further requirements for drawings which may be bound into this document and which may be required by the end user of the equipment.

The approval of drawings shall not relieve the Contractor of his responsibility to supply the works in according to the requirements of this specification and/or Project Specifications.

1.18.3. FINAL DRAWINGS

At least five (5) complete sets of “as built” drawings of all panels shall be submitted to the Engineer prior to the installation being handed over to the Employer.

The drawings shall preferably be in A3 format (in hard copy and on CD) and shall also be bound into the “Operational and Maintenance Manuals” as specified herein.

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The following information shall be presented:

- a) All the information as described in the section “Drawings for Approval”, hereinbefore.
- b) The final and updated drawings and diagrams specified showing the latest revisions after commissioning of the Works.
- c) All final terminal strip numbers, numbers and colours of conductors connected to the terminal strips and numbers and colours of the conductors utilized for the internal wiring.
- d) A separate schedule of all equipment with the name-, manufacture-, type-, model-, catalogue number of equipment, as well as the name, address and telephone number of the supplier of each component in each panel.
- e) All site and building layout drawings, showing sizes and positions of cables and equipment.
- f) The site layout drawings showing underground cables shall be dimensioned using fixed points on site such as buildings, beacons, boundary walls, canals, sumps, etc.

All further information and data shall also be submitted as may be specified in this document..

1.19. OPERATIONAL - AND MAINTENANCE MANUALS

1.19.1. SCOPE

A minimum of five (5) complete sets (or as scheduled in the Schedules of Quantities) of operational- and maintenance manuals for all specified Works.

Also refer to the section “Final Drawings” herein, regarding binding in of “as built” drawings into the required manuals.

1.19.2.DETAILED OPERATIONAL- AND DESCRIPTIVE MANUAL

This manual shall contain the detailed descriptions of all electronic equipment, PS equipment, i.e. All proprietary assemblies, shall be provided to assist the user personnel of the Employer with advanced knowledge of the equipment for short, medium and long term maintenance- and operations of Works.

The descriptions must be complete in all respects and the Contractor shall also ensure that these manuals are prepared in such a manner that, in the opinion of the Engineer, a competent and qualified technician can trace any fault, identify any defective component, replace it with the correct spare part and follow, without difficulty, the exact function of every component.

To this end, care must be exercised to correlate the text with the circuit diagrams, to relate the diagrams one with another and to provide a simple method of diagnosis and test to be used wherever breakdowns occur. The manuals shall also include block diagrams giving the layout of equipment as well as a description of the function and operation of every unit in the system.

The manuals shall be neatly prepared, in typewritten and/or printed format, indexed, with appropriate dividers between each section to facilitate ready reference. All documentation shall be presented in the English language.

The description shall, as a minimum requirement, include:

- a) Operational and maintenance data and details of all assemblies or components of electrical and electronic equipment installed in the Works. Copies of operational manuals of manufacturers can be inserted in these descriptions. In the case of insufficient descriptions in manuals of manufacturers, the Contractor shall provide additional descriptions to enable maintenance of the equipment.

The descriptions shall include:

- a) Technical details of all equipment installed
- b) A complete description of the operation of all equipment.
- c) A parts and spares list of every item of equipment together with a description of the item, the name, address and telephone number of the original supplier or wholesaler of the equipment. Brochures may be added as additional information but must not replace the data required.
- d) Complete equipment schematics
- e) All manufacturers' handbooks having reference to the equipment
- f) Installation test and alignment procedures
- g) All circuit diagrams
- h) All interconnection and inter cabling diagrams
- i) Complete trouble shooting procedures and any other information deemed necessary to permit rapid and efficient maintenance of any part of the equipment by a qualified technician.

The operating procedures contained in the manuals shall contain the following detailed features in fully descriptive format:

- a) Operating Procedures
 - 1) Pre power-up checks of all equipment
 - 2) Routine running attention
 - 3) Shutting down the works or parts thereof
 - 4) Prolonged shut-down of the works
 - 5) Re-commissioning of the works after repairs, maintenance or prolonged shut-down.
- b) Maintenance
 - 1) Routine maintenance procedures
 - Description
 - Schedule
 - 2) Preventative maintenance
- c) Fault Finding Procedures
 - 1) Power supply faults
 - 2) Control faults
 - 3) Investigation procedure for detection of faults and remedies:
 - Symptom
 - Probable fault
 - Remedy
 - Safety Precautions
 - 4) The nature of each hazard
 - 5) The level of seriousness
 - 6) How to avoid the hazard
 - 7) The possible consequences of not avoiding the hazard

In the case of sealed assemblies or advanced assemblies of equipment that cannot be opened or maintained or repaired onsite, the Contractor shall provide sufficient data and instructions for the replacement of the assembly and shall further describe the measures which the user or operator of the works can follow to operate the Works in an emergency and, if necessary, operate the works manually, to overcome total shut-down or non-operation of the Works until a new replacement can be installed.

The descriptions for operational measures shall be of sufficient nature to enable **safe operating conditions** of the works and shall further not be of a nature which shall cause damage to other parts or sections of the Works.

- a) A schedule of every item of equipment in the Works or panels together with a description of the item, part number, catalogue number, etc., as well as the name, address and telephone number of the original supplier or wholesaler of the equipment. Brochures may be added as additional information but must not replace the data required.
- b) All as-built record drawings, including AC and DC schematic- and wiring diagram drawings for the equipment. The wiring diagrams shall contain all the terminal numbers and wire numbers of all wiring in the Works. Also refer to “1.18.3 FINAL DRAWINGS”

hereof. A4 drawings may be used in manuals but all text must be clearly legible. A3 drawing sizes are preferred.

- c) Technical brochures and pamphlets of equipment as additional information. This shall, however, not serve for the fulfilment of clauses in par. (a) & (b) in 1.19.2 "Detailed Operational Descriptions and Data".
- d) Routine and type test certificates issued by factories for all electronics and all test data of cables, including OTDR testing data of fibre optic cable. (certificates shall indicate the instrument number as well as the calibration certificate number).

All calibration and setting data of electronics and instrumentation. This data shall also contain all the embedded software, on disc or CD, issued together with the instruments as part and parcel of the selling price of instruments where the instruments cannot be purchased without the embedded software.

1.20. TESTING AND TEST EQUIPMENT

1.20.1. GENERAL

All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected from time to time to such tests and by such persons as the Engineer may direct at the place of manufacture or fabrication or on the site or at all or any of such places. Except as otherwise provided in the Specification the Contractor shall supply such assistance, accommodation, instruments, machines, labour and materials as are normally required for examining, measuring and testing of any work and the quality, mass or quantity of any materials used and shall supply samples of materials before incorporation in the works for testing as may be selected and required by the Engineer.

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Specification but if not, then at the cost of the Employer. For this contract samples shall be provided of all equipment that does not have a proven integration track record with the existing City Power Lenel system.

The cost of making any test shall be borne by the Contractor if such test is clearly intended by or provided for in the Specification and (in the case of a test under load or a test to ascertain whether the design of any finished or partly finished work is appropriate for the purposes which it was intended to full fill if such is particularised in the Specification in sufficient detail to enable the Contractor to price or allow for the same in his Contract Price.

If any test is ordered by the Engineer which is either -

- a) not so intended by or provided for; or
- b) not so particularised; or
- c) though so intended by or provided for is ordered by the Engineer to be carried out by an independent person or body at any other place than the site or the place of manufacture or fabrication of the materials or equipment tested;

Then the cost of such test shall be borne by the Contractor if the test shows the workmanship or materials not to be in accordance with the provisions of the Contract or the Engineer's instructions, but otherwise by the Employer.

The Contractor shall keep records of all the data of tests and shall submit this data to the Engineer upon completion of all tests. Tests carried out in the factory of the manufacturer or at a testing facility shall be done in accordance with the prescribed standards for such tests.

The applicable standards for such tests shall be SANS, BSI, IEC, DIN, NEMA or such acceptable standard as may be applicable to the product or equipment or assembly.

The Engineer will have the right to obtain a quotation from the Contractor for any special tests which are required by him and to instruct the Contractor to carry out such tests.

If equipment should fail a standard or prescribed standard test by a testing authority, the cost thereof shall be for the account of the Contractor.

1.20.2. FACTORY TESTS AND INSPECTIONS

The Contractor shall inform the Engineer of equipment tests or any part of an installation in the place of manufacture or on site is ready for inspections or tests. The Engineer shall be given sufficient notice in advance of inspections or tests and final dates and times of such inspection will then be confirmed with the Contractor by the Engineer. The inspection or testing of manufactured equipment in a factory by the Contractor or by any other test facility in the presence of the Engineer must not be regarded as acceptance of responsibility by the Engineer for the correct performance of such equipment on site.

The Contractor shall provide a clean and safe testing area in the place of manufacture of any equipment to be tested and inspected by the Engineer. The area shall be open and accessible and tests or inspection will not be carried out in cramped or dangerous areas. No tests or inspections will be carried out in areas where overhead cranes or hoists are in operation.

All live equipment shall either be screened off or enclosed so that inspecting persons are not endangered during such tests or inspections. Inspections or tests will not be carried out near paint areas, paint booths, ovens, grinding or polishing areas or on equipment which are still under construction.

Tests will not be done by the Engineer in areas where a normal conversation cannot take place due to background noise. Test equipment, test leads, clean writing top space and all other facilities shall be provided for the Engineer during such tests. The Engineer reserves the right to instruct the Contractor to carry out the re-testing of any equipment which does not pass the first inspection or test.

The time and travelling cost of the Engineer for the purpose of any re-testing of equipment which did not pass the first or a previous test will be for the account of the Contractor. Any delays in Contract time caused by failures of inspections or tests will also be for the account of the Contractor

The factory tests shall be done as far as possible with full control conditions as may be experienced on site. All remote controls of equipment must be simulated during these tests by using temporary connected toggle switches to replace remote field devices such as sensors, switches, contacts, etc. Temporary simulated signals for the future field instrumentation or signals for future controls and field instrumentation must be available during the factory tests and must be fully operative and all field signals must be simulated during these tests by using appropriate signal generators or signal sources.

1.20.3. SITE TESTS AND INSPECTIONS

The inspections of the Engineer of any part of an installation or Works on site does not exempt the Contractor from his responsibilities in terms of the Contract. The Engineer will only accept the completed installation work after having received all test results, commissioning results and certificates of compliance or test certificates on completion of the whole of the Works.

Any abnormal condition, beyond the control of the Contractor, which may come to the attention of the Contractor during any preliminary or final tests or commissioning procedures shall immediately be reported to the Engineer.

The Contractor shall not allow equipment of other contractors to stay connected to, or operate with electric power from his installation if any equipment of other contractors do not operate normally or within the limits laid down by the manufacturer of equipment for other contractors.

1.21. COMMISSIONING

Commissioning on site shall include the following actions and shall be done with the Engineer present and shall require the presence of the Contractor for as long as it is necessary to carry out all the actions hereunder or as may be further required by the Engineer or the Client.

- a) The system shall be connected to the power supplies and shall operate and communicate as specified in the Site Specification.
- b)
- c) All earthing installation work must be completed.
- d) Communication signals and/or remote control signals shall be tested to ensure that Works are integrated as a complete system and functioning correctly. The communication of signals between the site Works and a remote control room or station shall be verified.
- e) All safety checks and tests of power equipment must be completed.
- f) All cameras shall be properly adjusted and focused and the images of camera shall be proven on a monitor on site.
- g) Card readers shall be in operation and shall be tested for correct function with the cards issued by the security department of the User.
- h) Magnetic hold (door magnets) –in equipment shall be tested and proven to be in working correctly.
- i) REX buttons shall be tested for correct functioning.
- j) Each PIR shall be tested and proven to operate correctly.
- k) All smoke detectors shall be tested with smoke bombs and the registration of the resulting alarm shall be verified on the fire detection panel.
- l) The number of required maintenance and operational manuals (complete in all respects) shall be handed over to the Engineer.
- m) The spares and tools (if applicable), shall be on site together with inventory sheets, ready for signature of the recipient party.
- n) All panels and electronic equipment shall be clean and neat and wiring shall be neat and strapped. No loose hanging wiring will be acceptable.
- o) All labelling shall be complete.
- p) All cable trunking lids or covers shall be in place and all draw box covers and lids shall be screwed down.
- q) A Certificate of Compliance for all 230V work shall have been handed to the power supply authority with a copy on site for the Engineer.
- r) The Contractor shall hand to the Engineer all the test results of equipment which was logged by him together with the settings of such equipment. This information shall be made available on properly structured test sheets and log sheets and shall be dated and signed by the Contractor.
- s) Any small items such as alterations to labels, faulty electronic equipment, etc. shall be recorded for repairs.
- t) The Contractor shall then proceed with training of the operating personnel of the Employer as may be required in this document.

No last minute repairs or installation work shall be done by the Contractor on the day of commissioning of the Works:

The successful completion of all the above shall be regarded as the “first hand over day” of the Works to the User or Owner of the installation. The retention period of the Works normally starts on that day, unless abnormal conditions prevent the handing over of the Works to the Client.

An abnormal occurrence that prevents handing over will not be seen as failure of the Contractor in this respect. If the commissioning should have to be stopped or abandoned due to the failure of the Contractor to complete the Works and have the Works ready for inspection or as stated in (a) to (n) above, then the further costs for re-commissioning later will be for account of the Contractor. Such costs will include all the travelling, accommodation and time rate costs of the Engineer or the Client.

The Works will not be regarded as being commissioned if all of the above requirements in (a) to (t) above are not met on the day of commissioning of the Works.

1.22. TRAINING OF PERSONNEL

The training of personnel of the Employer or User of the Works shall only be applicable to the Contract. Training provided by the Contractor and OEM shall be directly applicable to the actual equipment to be used at the installation. Training shall be carried out on site and at the OEM's works.

The categories of training are normally required viz.:

- a) Training of operators.
- b) Maintenance training of technical staff

All of the above training shall be presented by the OEM and allowed for by the contractor in the bill of quantity's unit rates.

Operators of the installed equipment shall, with the brief description specified in par. “1.19.2 DETAILED OPERATIONAL- AND DESCRIPTIVE MANUAL” at hand, be trained by The Contractor to safely and successfully operate the equipment and controls.

This training shall not be in depth training and no advanced software or technical training shall be presented in this training session.

This training course shall include the training of technical personnel of the Employer during the installation period and commissioning stages of equipment on site to make the technical staff and or skilled operators completely conversant with the installed equipment and the use thereof.

The Employer thus reserves the right to appoint certain staff to the Contractor's team during the installation and commissioning phase of the work for training as described in the previous paragraph. The Employer will bear the cost of traveling expenses of its personnel.

The Employer may also decide to request the Contractor to make use of the ability of the staff of the Employer to assist with physical installation and commissioning work, and in such instance the Engineer will instruct the Contractor accordingly.

1.23. SPARES

If so specified, the Contractor shall present the Engineer with a recommended spares list and/or a list of special maintenance equipment or instruments at the end of the Contract.

1.24. CERTIFICATION BY THE ENGINEER.

The Certificate of Practical Completion will be issued by the Engineer when the Works have been practically completed and are in operation. The Certificate of Commissioning will only be issued after successful commissioning of the Works has been attained.

The Certificate of Final approval of the Works will be issued at the beginning of the guarantee and retention period. The date of Issue of this certificate may be the same date of the "Certificate of Commissioning", depending on the particular Contract and the Works on site.

1.25. CERTIFICATION BY THE CONTRACTOR

The Contractor shall issue the necessary completion certificates and Certificate of Compliancy to the Engineer and the applicable Authorities as contained herein or in SANS 10142 :Part 1: Low Voltage Installations, or as required in terms of the Occupational Health and Safety Act, Act 85 of 1993, as and when required by the Engineer or the Authorities. The certificates shall include the Certificate of Compliance as would be required by SANS 10142(latest amendment) where any 231/400 Volt work is carried out by the Contractor.

None of the certificates of the Engineer, as specified hereinbefore will be issued if the Contractor does not comply with the requirements of this clause. Until the Certificate of Compliancy is issued by the Contractor, the Engineer will not consider issuing of a Certificate of Completion

The original Certificate of Compliancy for every separate site or installation shall be handed to the Employer. Copies must be issued to the Engineer and the Supply Authority and copies can further be included in the Operational and Maintenance manuals.

2. SITE SPECIFICATIONS FOR SECURITY SYSTEMS

2.1. INTRODUCTION

The Integrated Security Systems and accompanying equipment forms a strategic part of City Power Risk and Security management. The purpose of the equipment is to control and monitor and control activities at various City Power sites and to assist with emergency evacuation procedures.

2.2. CCTV

- a) Refer to CP_TSSPEC_237 Section 17 for CCTV details

2.3. ACCESS CONTROL

- a) Refer to CP_TSSPEC_237 Section 16 for Access Control details

2.4. VISITOR MANAGEMENT

- a) Refer to CP_TSSPEC_237 Section 16.10 for visitor Management details.
- b) Visitor Management of vehicles will be done via a handheld scanner. This will be used to scan the visitors driver's license as well as the vehicle license.

2.5. PUBLIC ADDRESS / EVACUATION SYSTEM

- a) Refer to CP_TSSPEC_237 Section 21 for Public Address and Evacuation System details.
- b) The Evacuation system shall be linked to the Fire Control Panel, to initiate fire evacuation messages.
- c) The PA shall link back to the central PA system in Reuven via the IT Network.
- d) A local microphone will be provided at the main reception desk to allow local announcements to be made.

2.6. IT NETWORK

- a) Refer to CP_TSSPEC_237 Section 20 for Networking and Data Cable details.
- b) All the above systems shall be linked onto the common City Power IT Network.

2.7. CCTV

- a) Refer to CP_TSSPEC_237 Section 17 for CCTV details
- b) All access-controlled doors will have a camera installed above the door to identify the person entering the building.
- c) PTZ cameras will be utilized to monitor the main gate of the site to give a general overview of movement of personnel and vehicles.
- d) Cameras will be installed in the control room. The cameras should be able to identify people.
- e) External PTZ cameras will be installed on the 5m to cover open areas within the premises.
- f) Thermographic cameras will be installed on the buildings for condition monitoring of the outdoor HV yards. These cameras will be connected to the Condition Monitoring headend at the control centre

2.8. ACCESS CONTROL

- a) Refer to CP_TSSPEC_237 Section 16 for Access Control details

2.9. INTRUSION DETECTION

- a) Refer to CP_TSSPEC_237 Section 19 for Intrusion Detection details

- b) Each indoor room will be fitted with a 360° ceiling mounted Passive Infra-Red (PIR) detector.
- c) Main entrance gate shall consist of door monitor installed to detect when the gate has been opened.

2.10. FIRE DETECTION

- a) Refer to CP_TSSPEC_237 Section 11 for Fire Detection details
- b) Each room will have a ceiling mounted smoke detector, and sounders as indicated on the drawing.
- c) If there is existing Fire Control Panel installed in the Control Room should be removed. The existing conduits may be reused.
- d) The new fire detection equipment will be linked to this existing panel. The existing panel shall be linked back to the main control room.

2.11. FIRE SUPPRESSION

Where existing fire suppression is installed, at any site, the alarms generated shall be integrated into the fire control panel. Where valve operated systems are existing, the contractor shall allow for all equipment required such as: solenoids, wiring, conduit etc. to generate and relay alarm signals to the main fire panel.

For the sites to be equipped with new fire suppression installations or where existing installations are marked to be replaced, the system and system alarms shall be fully integrated into the main fire panel. The new fire suppression equipment to be provided by the contractor shall be in accordance with the general specification provided by City Power. It shall be the contractor's responsibility to obtain these specifications and information pertaining to the fire suppression quality requirements during the tender period.

The fire suppression systems shall adhere to the following requirements:

- a) System activation shall not rely on an electrical supply for sensors. The system shall be heat activated only.
- b) Shall not cause flooding, all water required shall be stored in pressurized cylinders. No pumps or motors shall be accepted.
- c) Sealing of the floor shall be included in the contractor's unit rates. Allow per transformer bay for sealing and bunding of:
 - i. Set of Medium Voltage cables
 - ii. Bundled set of transformer control cables
 - iii. Set of High Voltage cables
 - iv. Set of Low Voltage cables
- d) System activation pick-up temperature shall be adjustable. Exact value to be confirmed during construction.
- e) Statutory requirements such as min. air clearance and working clearance to be maintained.
- f) All piping shall be effectively earthed
- g) Non-metallic piping to be used near energized equipment to prevent any induced eddy-currents.
- h) A separate system per bay shall be installed for the auxiliary transformers.
- i) No piping or nozzles may be fixed, suspended or attached to the roof.

2.12. CONDITION MONITORING (THERMOGRAPHIC CAMERAS)

Condition monitoring by means of thermographic cameras will form part of the integrated security systems project. These cameras will be strategically placed at substations to monitor the HV equipment – typically 66kV and higher voltages. At time of compiling this specification most specialist cameras with the required temperature sensing and monitoring capabilities are limited with unproven interfacing functionality to the existing City Power integration platform. In order to still integrate the video feeds with all functionality from the condition monitoring cameras into the existing integration platform, a separate PC workstation will be required at Reuven for condition monitoring purposes. This will enable City Power Business's (i.e. Risk and Condition Monitoring) to function in cooperation with each other but still perform their respective tasks.

In order to integrate the condition monitoring system into the security system, standalone NVR will be required to interface with the condition monitoring thermographic cameras. All the recording and alarming for condition monitoring will be on a separate system. It will be the contractor's responsibility to evaluate the camera requirements during tender stage and ensure that a workable solution is priced and catered for with the submission of tenders.

The thermal camera used for condition monitoring system shall be positioned for opt. The contractor shall therefore allow in the priced unit rates for "worst case" installation assumptions in terms of the required conductor lengths, fixing of the cameras to support structures etc. The cameras will require fixing to lattice structures, steel poles, brick walls or cement poles. All positions of the temperature sensing cameras will be determined on site once construction is initiated.

The following requirements shall be adhered to for the video workstation for condition monitoring as allowed for the Bill of Quantities:
Condition monitoring :

Video Client PC:

Intel Xeon Processor E5-1620, Quad Core
HT, 3.7 GHz Processor
8 GB DDR3 non-ECC RAM
8 x DVD +/-RW
256 GB 2.5 inch Serial ATA Solid State
Drive
4 GB AMD FirePro™ W7000 (4 DP)
Windows 10 Professional 64-bit
RJ45 Ethernet port
(6) USB 3.0 ports
(1) RS232 serial port
USB keyboard/mouse
21" 1920x1080 resolution

3. GENERAL REQUIREMENT FOR THE GAURDHOUSE BUILDING

3.1. GENERAL

3.1.1. DESCRIPTION:

This specification is for the erection of a Guardhouse Building where required. This section of the specification shall apply to all sites where a new guardhouse building is allowed for in the bill of quantities

3.1.2. ACCURACY IN BUILDING:

Unless otherwise specified SANS 0155 is applicable in respect of permissible deviations in building work.

3.1.3. CONTRACT DRAWINGS:

All drawings forming part of this document and relating to building works shall form part of the works.

3.1.4. REGULATIONS

The National Building Regulations: Act 103 of 1977 and the relevant regulations shall apply to this contract.

The Building contractor shall take full responsibility for the prevention of any unsafe conditions or practices and shall meet all requirements as stipulated in the Occupational Health and Safety Act 85 as amended.

3.1.5. SITE & SETTING OUT OF WORKS

It shall be the responsibility of the contractor to obtain the relevant Surveyor General Drawings for the site on which the building is to be constructed. The building and fence position shall be set out by a suitably qualified land surveyor to be appointed by the Contractor. After setting out the pegs the site must be signed over to the contractor and the position of the pegs set out shall be submitted to the Engineer in .dgn or .dwg format for approval.

3.1.6. SITE FACILITIES

3.1.6.1. WATER:

The contractor shall be responsible for any water connection or water requirements.

3.1.6.2. ELECTRICITY:

The contractor shall be responsible for any power connection or electricity requirements.

3.1.6.3. TELEPHONE:

No telephone facilities will be available.

3.1.7. ACCESS TO SITE:

Tenderers shall fully acquaint themselves regarding access to and all conditions on site prior to submitting a tender.

3.1.8. SITE OFFICE, ACCOMMODATION AND STORAGE FACILITIES:

The building contractor shall supply all site offices, accommodation, storage facilities and protection required.

3.1.9. NAME BOARD:

No name board is required under a subcontract.

3.2. EARTH WORKS

3.2.1. GROUND CLEARING:

The site shall be cleared of vegetation and material.

3.2.2. EXCAVATION AND FILLING

Level and grade the ground as required, reduce levels, dig trenches for foundations and cable ducts, all to the lengths, widths and depths shown on drawing or to such other depths as may be directed by the Engineer for a sound foundation.

Fill into foundations and under floors all as required.

3.2.3. PROTECTION AGAINST TERMITES:

Provide protection against termites under all floors.

3.2.4. SURPLUS EARTH:

All surplus earth and other materials resulting from the excavations shall be deposited and levelled on site or carted away as directed by the Engineer.

3.3. CONCRETE FORM WORK AND REINFORCEMENT

3.3.1. FORM WORK:

All necessary form work shall be supplied.

3.3.2. CONCRETE FOOTINGS:

Lay 600 deep x 300 wide, 25 MPa / 28-day foundation beams under all foundation walling as per the Building Regulations.

3.3.3. REINFORCING

Reinforcing to comply with SANS920, all mesh reinforcement shall be high yield steel. Rate for mesh reinforcement must allow for lap lengths of at least 300mm.

3.3.4. CONCRETE SURFACE BED:

The floor to be powder floated in sections with 20 MPa / 28 day concrete laid at the proper level and carried through door openings to form thresholds as shown. The maximum allowable tolerance on the surface bed will be 0,5 mm per 1 m in length.

3.3.5. CONCRETE CABLE DUCT:

Build cable ducts as per the relevant construction drawings. The bottom of the cable duct is to be screened to a fall towards the external walls. Corners of cable trenches shall be levelled or angles of 45° with splays at least 100 mm. For the installation of cables, the use of core drilled cable seals shall be implemented, same as or similar to Roxtec cable seals complete with framing.

3.3.6. CONCRETE RAMPS AND SKIRTING:

Form concrete ramps in front of all doors to the extent shown on drawings. Form step under doors and cast in water barrier.

Finish exposed surfaces with wooden trowel.

3.3.7. EXPANSION JOINTS AROUND SURFACE BEDS:

Form expansion joints around surface beds using 12 mm soft board.

3.3.8. CONCRETE STRIP FOR SECURITY FENCE:

Not applicable

3.4. BRICK WORK**3.4.1. BRICKS TO BE USED:****3.4.1.1. GENERAL**

All rough and fair cutting, and cutting of splays, skewbacks, chamfers, etc., shall be properly performed. Form or leave all necessary openings for pipes, etc., and make good after pipes, etc., are fixed in position. Use bonding liquid in mortar to fill around pipes and sleeves.

Built in 2,8mm dia. Brick force as follow:

- Double layer in 2 courses above foundations.
- Double layer in 2 courses above concrete slabs.
- Double layer in 2 courses above doors.
- Double layer in 2 courses below slabs and roof.
- 1 Layer every 5th course generally.
- Wall wire ties at 2/m² in solid walls.
- Wall wire ties at 5/m² in cavity walls.
- Brick force shall be continuous from wall to wall to form rings around corners.

Cavity walls shall have brick piers inside cavity linking skins at 3,0m c/c. All mortar joints shall be fully filled. All load bearing brickwork to be erected according to SANS 0164 requirements. Brick walls shall be tied to concrete with hoop-iron ties shot fixed to walls/columns every 5th layer.

3.4.1.2. GENERAL PURPOSE BRICKS

Samples of all bricks shall be submitted to the Engineer prior to the placing of orders. A sample wall is to be built for approval before initiating brickwork.

To be good, hard, sound, well burnt, machine made clay bricks, even in size and shape to SANS specification shall be used.

3.4.1.3. BRICKS FOR FOUNDATION

See "General purpose bricks" above.

3.4.1.4. FACING BRICKS

Blue Barley face bricks or similar shall be used and to be obtained from a local dealer in the area. Sample face bricks must be submitted for approval.

Facing bricks shall be to a good, hard, sound, well burnt, machine made facing clay bricks even in size and shape.

3.4.2. FOUNDATION WALLS:

Build all foundation walls with extra hard burnt bricks as described to the lengths and thicknesses shown, from top of concrete footings up to damp proof course level in cement mortar. Foundation walls under 230 mm thick superstructure walls are to be built in two thicknesses in stretcher bond and the two leaves tied together with wire ties.

3.4.3. SUPER STRUCTURE WALLS:

Build all super structure walls to the lengths, height and thickness shown in cement mortar, in two thicknesses tied together with wire ties as before.

3.4.4. REINFORCED BRICK LINTELS:

Over all openings in walls build reinforced brick lintels.

3.4.5. FACING AND POINTING:

All external faces of walls indicated on drawings to be finished with facing bricks are to be faced for the full height, with facing bricks as described and 15 mm recessed joint and Steel Square pointed.

3.4.6. LOUVRE SILLS:

No louvre sill shall be formed in brick or tiles, since louvre sub-frames shall be installed as specified.

3.4.7. GENERAL:

Build in frame ends of timbers, holdfasts, cramps, gratings, dowels etc., bed and point door and window frames, rake out and point flashings protect brick work and clean down faced brick work, sills, etc.

3.5. PLASTERING

Finish all internal brick walls with one coat of cement plaster. Prior to the ceiling being erected one coat of plaster key to be painted to ceiling height.

3.6. WATERPROOFING

3.6.1. DAMP PROOF COURSE:

Lay under all super structure walls a damp proof course with embossed surfaces and of 0.38 mm thickness.

3.6.2. DAMP PROOF MEMBRANE:

Provide under each surface bed and around cable duct as shown on drawings a damp proof membrane 0,25 mm thick.

3.7. METAL WORK

3.7.1. STEEL DOORS AND FRAMES:

The door shall be a standard weather proof steel door without louvres and equipped with cabin hook and eye as well as a suitable pad lock locking mechanism. To prevent water ingress a weather board must be fitted at the footing of the door.

3.7.2. WATER BAR:

Provide foot of each door with water bar formed with 50 x 50 x 5 mm thick mild steel angle section fitted with not less than four equally spaced mild steel building in lugs, each welded to back of angle with other end split and spread for building in.

3.8. GLAZING AND PAINTING

3.8.1. PAINTING TO WOOD WORK:

Knot, prime, stop and paint with two undercoats (Woodcare sanding sealer) and one finishing coat of paint on all softwood exposed externally. (exterior Woodcare FPR).

3.8.2. PAINTING TO METAL WORK:

Clean down, touch up with zinc-chromate primer and paint with two undercoats and one finishing coat of high gloss paint on all metal doors and door frames, steel window and louvers.

3.8.3. PAINTING TO INTERNAL WALLS AND CEILINGS

Paint all plastered wall surfaces with two coats, white emulsion paint. The final coat to be applied after the installation of equipment.

3.8.4. KERBING AND DUCT COVERS:

Clean down, prepare and apply two coats of approved bituminous paint to all pressed steel kerbing and chequer plate duct covers including the underside of covers.

3.9. FITTINGS

3.9.1. DOORS:

All doors shall be fitted with door-handles and bolts for padlocks as well as hook catches to hold the door in an open position.

3.9.2. PADLOCKS:

Padlocks will be supplied by the building contractor.

3.10. CEILINGS

6mm Fibre Cement, non-combustible boards shall be provided and installed. The boards shall be fixed to a light weight metal or wooden bracing support system.

3.11. SECURITY FENCE

If specified a welded mesh fence shall be used. The fence coating shall be of the galvanized type. The 2.4m high fence shall be topped with "Razor" or "Shark Tooth" spikes.

3.12. SIGNS AND NOTICES

All notices as required by the Occupational Health and Safety Act 85 of 1993 shall be supplied and positioned as required. A notice board consisting of soft board with a wooden frame must be of sufficient size to accommodate 2 x A0 size drawings. The Contractor must also provide a wall mounted writing desk to house a notice book, in which all switching are to be recorded. The tool rack housing all the loose equipment must also be mounted on the wall.

3.12.1. EXTERNAL DOORS:

Provide the following signs:

"Unauthorised Entrance Prohibited".

3.12.2. INSIDE EACH ROOM:

Provide and install on the inside of each door or on more convenient place, against a wall: "First Aid Treatment" as well as "Procedure in case of fire".

3.13. DRAWING FRAME AND LOGBOOK TABLE

1 x 800 x 2 400 mm drawing frame fitted with soft board shall be mounted against the wall for all relevant drawings.

A desk and chair and a steel filing cabinet shall be provided. The measurements of the desk shall be 1500 mm wide and 800 mm deep, the filing shall be 1800 mm high and 900 mm wide and 450 mm deep.

3.14. FIRST AID KIT

Supply and install a first aid kit mounted in a sheet metal box which meets the requirements of the Occupational Health and Safety Act 85 of 1993 Regulations, against the internal wall of the control room next to the door.

3.15. FIRE EXTINGUISHERS

Install against the wall next to the door a 9 kg fire extinguisher.

3.16. FLOOR SKIRTING

100x28 skirting to be installed.

3.17. GENERAL BUILDING ELECTRICAL INSTALLATION

3.17.1. GENERAL:

The complete electrical installation for lights and small power shall be provided as part of the Building Subcontract.

The electrical installation shall be installed by a qualified and approved Electrical Contractor, in accordance with SANS 10142 as amended. The layout of the installation is shown on an attached drawing. All conduit work is to be flush mounted in an acceptable manner.

The contractor shall make provision for the supply, installation and commissioning of the electrical installation of the building complete with distribution board, light-fittings, photocell, plug sockets, isolators, light-switches, conduit work etc. The Contractor must submit a COC after all tests are carried out by an accredited electrician.

3.17.2.WIRING

Wire to be used shall be 600/1000V PVC insulated, single core multi stranded copper conductors and green insulated copper conductors for earth continuity to SANS 175.

Light circuits = 2,5mm² power & 2,5mm² Earth

Power circuits = 4mm² power & 2,5mm² Earth

No joints in conduits will be accepted.

3.17.3.POWER SUPPLY:

The distribution board for the building electrical installation will be supplied from the nearest electrical supply point as part of the electrical installation to be provided by the Building Contractor. The cable shall be a 3 core x 25 mm², PVC cable fed from the nearest mini-sub or transformer.

The supply will be a single phase 230 V, 50 Hz supply.

3.17.4.DISTRIBUTION BOARD:

Supply and install a flush mounted distribution board in the position shown on the relevant drawings.

The board shall be equipped with minimum 5 kA rated equipment. At least 25% spare capacity shall be allowed in the distribution board with a minimum of the following equipment:

- 1 x 40 A double pole circuit breaker
- 1 x 20 A earth leakage unit
- 1 x 20 A, 1 pole, mcb, (plugs)
- 1 x 10 A, 1 pole, mcb, (lights)
- 1 x 10 A, 1 pole, mcb, feeding the photocell and outdoor lights
- 2 x 20 A, double pole, mcb,
- 1 x 3 pole contactor
- 2 x lightning arrestors

3.17.5.SCHEDULE OF LIGHT FITTINGS:

Type A: 2x58W (LED Equivalent) Open channel 1570 mm fluorescent single tube light fitting.

Type E: 11 W CFL (LED Equivalent) Emergency Bulkhead c/w inverter, charger, NiCad Batteries and controller in the remote box or bulkhead. The Bulkhead shall be non-maintained with a self-test facility and 3 hours emergency capacity. (One remote controller box per bulkhead).

Type BH: Bulkhead with 2 x 11 W lamps (LED Equivalent), IP66 rating equal or similar to Beka Series 31 with die cast aluminium base and high impact acrylic diffuser.

It required that all lamps are supplied together with the lighting, only LED lamps shall be accepted.

3.17.6. VENTILATION

No Air Conditioning shall be applicable. Provision shall be made for a fan installation, if so required during construction stage and approved by the Engineer.

3.18. SITE CONDITION AT HANDOVER

The site shall be left in a clean and neat condition.

4. GENERAL REQUIREMENTS FOR THE INSTALLATION OF CABLES

The following paragraphs covers the installation of cables for the distribution of power in buildings, other structures and in ground for system voltages up to 11 kV, 50 Hz.

4.1. CABLE TYPES

- a) All cables and jointing and termination accessories used for power distribution shall comply with CP_TSSPEC_002
- b) Cables with copper conductors shall be used throughout unless otherwise specified or approved.
- c) All unarmoured cables shall be installed in metal trunking, sleeves or conduit unless clearly specified to the contrary.

4.2. COMPETENCE OF PERSONNEL

It is a definite requirement that the Contractor shall only employ personnel fully conversant with cable manufacturer's recommendations for joining and terminating cables.

4.3. IDENTIFICATION OF CABLES

Cables shall be identified at all terminations by means of punched metallic bands or marked with labels or tags.

The use of PVC tape with punched characters is not acceptable.

The identification numbers of cables shall be shown on "as built" drawings of the Installation.

4.4. TRENCHING

The Contractor shall be responsible for all trenching excavations unless specified to the contrary. Any damage to existing services shall be the contractor's responsibility to fix.

The Contractor shall, before trenching commences, familiarise himself with the routes and site conditions and the procedure and order of doing the work shall be planned in conjunction with the general construction programme for other services and building requirements.

The Contractor shall acquaint himself with the position of all the existing services such as stormwater pipes, water mains, sewer mains, gas pipes, telephone cables, etc before any excavations are commenced. For this purpose he shall approach the Engineer's

representative, the City Power Clerk of Works and any other authority which may be involved, in writing.

The Contractor will be held responsible for damage to any existing services brought to his attention by the Engineer and shall be responsible for the cost of repairs.

The Contractor shall take all the necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and/or employees on site are not endangered.

The Contractor shall ensure that the excavations will not endanger existing structures, roads, railways, other site constructions or other property.

4.4.1. MECHANICAL EXCAVATORS

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

The use of power driven mechanical excavators shall be subject to the approval of the Engineer. Should the excavator produce trenches that exceed the required dimensions, payment based on volumetric excavation rates will be calculated on the required dimensions only.

4.4.2. BLASTING

No guarantee is given or implied that blasting will not be required.

Should blasting be necessary and approved by the Engineer, the Contractor shall obtain the necessary authority from the relevant Government Engineers and Local Authorities. The Contractor shall take full responsibility and observe all conditions and regulations set forth by the above authorities.

4.4.3. ROUTES

Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Engineer beforehand. All trench excavations shall be clearly marked / "chalked" for approval by the Engineer prior to starting excavation.

The Engineer reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.

The removal of obstructions along the cable routes shall be subject to the approval of the Engineer.

4.4.4. SHORING AND WATERLOGGING

The Contractor shall provide shoring for use in locations where there is a danger of the sides of the trench collapsing due to waterlogging or other ground conditions. Refer to the Machinery and Occupational Safety Act.

The strength of shoring must be adequate for site conditions prevailing and the shoring must be braced across the trench.

The Contractor shall provide all pumps and equipment required to remove accumulated water from trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

4.4.5. EXCAVATION

Trenching shall be programmed in advance and the approved programme shall not be departed from, except with the consent of the Engineer.

Trenches shall be as straight as possible and shall be excavated to the dimensions indicated in this specification.

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

The excavated material shall be placed adjacent to each trench in such a manner as to prevent nuisance, interference or damage to adjacent drains, gateways, trenches, water furrows, other works, properties or traffic. Where this is not possible the excavated materials shall be removed from site and returned for backfilling on completion of cable laying.

Surplus material shall be removed from site and disposed of at the cost of the Contractor.

Trenches across roads, access ways or footpaths shall not be left open. If cables cannot be laid immediately the Contractor shall install temporary "bridges" or cover plates of sufficient strength to accommodate the traffic concerned.

In the event of damage to other services or structures during trenching operations the Contractor shall immediately notify the Engineer and institute repairs.

Prior to cable laying the trench shall be inspected thoroughly and all objects likely to cause damage to the cables either during or after laying shall be removed.

Where ground conditions are likely to reduce maximum current carrying capacities of cables or where the cables are likely to be subjected to chemical or other damage or electrolytic action, the Engineer shall be notified before installing the cables.

For any excavations outside a construction yard the contractor shall appoint a qualified land surveyor to peg cadastral boundaries. Extreme care shall be taken not to disturb surveyor's pegs. These pegs shall not be covered with excavated material. If the surveyor's pegs are disturbed, they shall be replaced by a person qualified to do so.

4.4.6. DIMENSIONS OF TRENCHES

Cable trenches for one or two cables shall not be less than 300 mm wide and need not be more than 450 mm wide. The dimension shall be valid for the total trench depth.

The width shall be increased where more cables are installed to allow for the minimum cable spacing stipulated.

Where trenches change direction or where cable slack is to be accommodated, the Contractor shall ensure that the requirements of the relevant SABS / SANS Specification regarding the bending radii of cables are met when determining trench widths.

Trench depths shall be determined in accordance with cable laying depths and bedding thickness.

Payment will be made on a linear meter excavation rate which the contractor shall base on the applicable trench dimensions.

4.5. BEDDING

The bottom of the trench shall be filled across the full width with a 100 mm layer of suitable soil sifted through a 6 mm mesh and levelled off.

Only sandy clay or loam soil with a satisfactory thermal resistivity (not exceeding 1,2 K.m/W) may be used for this purpose. Sea or river sand, ash, chalk, peat, clinker or clayey soil shall not be used. The use of crusher sand is acceptable.

Where no suitable soil is available on site, the Contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of importing soil for bedding purposes shall be included in the unit rates for excavations.

After cable laying a further layer of bedding shall be provided to extend to 100 mm above the cables.

The bedding under joints shall be fully consolidated to prevent subsequent settling.

4.6. CABLE SLEEVES

Where cables cross under roads, railway tracks, access ways, other service areas, etc and where cables enter buildings, the cables shall be installed in PVC pipes.

Pipes shall be joined in accordance with the manufacturer's instructions. Sleeves shall be in accordance with CP_TSSPEC_045.

Sleeves shall cross roads and railway tracks at right angles.

Sleeves shall have a minimum diameter of 110 mm. They shall extend at least 2 m beyond the tracks of a railway line or of the outermost tracks where there is more than one line. In the case of roads, the sleeves shall extend at least 1 m beyond the road edge or kerb on both sides of the road.

All sleeves shall be graded 1:400 for water drainage.

Cable sleeves shall be installed to the spacing and depths stated in paragraphs above.

The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.

4.7. BACKFILLING

The Contractor shall not commence with the backfilling of trenches without prior notification to the Engineer so that the cable installation may be inspected. Should the Contractor fail to give a timeous notification, the trenches shall be re-opened at the Contractor's cost. Such an inspection will not be unreasonably delayed.

For all electric cables a coloured plastic marking tape shall be installed 400 mm above the cable. The tape shall be yellow, with a red skull and crossbones with the words "ELECTRIC CABLE". These markings shall not be more than 1 m apart from centre to centre.

Backfilling shall be undertaken with soil suitable to ensure settling without voids. The maximum allowable diameter of stones present in the backfill material, is 25 mm.

The Contractor shall have allowed in his tender for the importation of suitable backfill material if required.

The backfill shall be compacted in layers of 150 mm and sufficient allowance shall be made for final settlement. The Contractor shall maintain the refilled trench at his expense for the duration of the contract. Surplus material shall be removed from site and suitably disposed of.

On completion, the surface shall be made good to match the surrounding area.

In case of roadways or paved areas the excavations shall be consolidated to the original density of the surrounding material and the surface finish reinstated.

4.8. INSTALLATION DEPTHS

Cables shall be installed at the following minimum depths below final ground level:

Up to 1 kV	:	600 mm
Up to 11 kV	:	1 000 mm

All cable depth measurements shall be made to the top of the cable when laid directly in ground or to the top of the duct or sleeve where these are provided.

The above depths shall apply to the top layer where cables are installed in layers.

The Contractor may only deviate from the above depths provided prior authority in writing has been obtained from the Engineer. In this event the cables shall be protected with a suitable concrete covering.

The depth of cable pipes or ducts beneath railway lines or roads shall be not less than 1,1 m below the formation level.

4.9. CABLE SPACINGS

Cables installed in the same trench shall be laid parallel to each other with the following spacing between cables (LV: up to 1 kV; HV: 1 kV to 11 kV):

LV/LV: 2 cables diameters

LV/HV: 300 mm minimum

HV/HV: 300 mm minimum

Where HV and LV cables have to be installed in the same trench, the HV cable shall be laid on the one side of the trench at a depth of 800 mm and then covered with 300 mm of soil. The LV cable shall then be laid on the other side of the trench, i.e. not above the HV cable, and then completely backfilled.

Cables for telephones, communication systems and other low voltage systems (less than 50 Volt) shall be separated from power cables by at least 1 m. All control or pilot cables shall be laid at least 300 mm from power cables.

Cables shall not be buried on top of each other unless layers are specified. The minimum spacing between layers shall be 200 mm.

4.10. CABLE LAYING

Except where ducts, tunnels or pipes are provided, cables shall be laid directly in the ground.

The cable shall be removed from the drum in such a manner that the cable is not subjected to twisting for tension exceeding that stipulated by the cable manufacturer.

Cable rollers shall be used as far as possible to run out cables. Rollers shall be spaced so that the length of cable in the trench will be totally suspended during the laying operation and sufficiently close to prevent undue sagging and the cable from touching the ground. Rollers shall also be placed in the trench in such a manner that they will not readily capsize.

Cable rollers shall have no sharp projecting parts liable to damage the cables.

Where cables have to be drawn around corners, well-lubricated skid plates shall be used. The skid plates shall be securely fixed between rollers and shall constantly be examined during cable laying operations.

Where cables have to be drawn through pipes or ducts, a suitable cable sock shall be used and particular care shall be exercised to avoid abrasion, elongation or distortion of any kind. In the case of oil filled cables, a cable sock may never be used. Special eyes giving access to the interior of the cable, must be utilised.

The maximum allowable tension when pulling a cable, is 70 N/mm^2 of conductor area.

It will be assumed that the price or rates contained in the tender includes for the installation of cables in pipes and ducts or below existing or newly installed services. The Engineer shall be informed timeously of the intention to carry out all cable laying operations to allow an inspection of the works by the Engineer if so required.

4.11. INSTALLATION OF CABLES IN CONCRETE TRENCHES

This paragraph covers the installation of cables in building trenches, service ducts, etc. The trenches, ducts, etc inside buildings will be constructed and installed by others.

4.11.1. INSTALLATION

Cables shall be installed in one of the following ways:

- a) On horizontal cable trays.
- b) On horizontal metal supports with suitable clamps.
- c) On vertical cable trays or metal supports fixed to the side of the trench. The cables shall be clamped in position.

Cables shall not be bunched and laid on the floor of the building trenches.

4.11.2. COVERS

The covering of concrete trenches shall as a rule fall outside the scope of the electrical installation. The Contractor shall, however, be responsible for the cutting or drilling and smoothing of holes for cables through chequer plates, concrete or other coverings as required.

Cables shall enter and exit the trench through sleeves protruding 300 mm beyond the covering. The sleeves shall be permanently secured in position and the open space between the cable and sleeves shall be sealed with a non-hardening, watertight compound.

4.11.3. FILLED TRENCHES

Where specified floor trenches shall be filled with sand.

If a sand filling is specified, the cables shall be fixed to non-corroding supports.

Sand-filled trenches other than in substations shall be covered in one of the following ways:

- a) Reinforced concrete covers.
- b) Sand and cement screed.
- c) Removable chequer plates in steel edge frames.

Method a) above shall be used where vehicular traffic may be encountered over trenches. Unless otherwise specified allowance for a mass of 2 tons shall be made.

4.12. FIXING OF CABLES TO TRAYS OR STRUCTURES

4.12.1. INSTALLATION

Cables may be installed in one of the following ways:

- a) On horizontal cable trays.
- b) Against vertical cable trays with suitable clamps.
- c) Against horizontal or vertical metal supports or brackets with suitable clamps.
- d) On clamps which are fixed to the structure.

4.12.2. CLAMPS

Suitable clamps (cleats) which will secure cables without damage shall be used. Metal clamps or drilled hard wood blocks shall be used. Clamps shall consist of adjustable metal wings which clamp to a metal support, or consist of two halves that are bolted together. The correct clamp size to fit the cable shall be used. Cables of different sizes may only be fixed by a common clamp when the clamp is specially made to accommodate the various cables.

4.12.3. SPACING OF SUPPORTS

Two methods of supporting cables are found in practice. The most generally known method is the restrained installation where the distance between supports is small enough to prevent any noticeable sag in the cable. The alternative method is the unrestrained installation where the distance between supports should be great enough to ensure that there will be obvious sag in each span between supports.

4.12.4. SPACING OF SUPPORTS OF UNRESTRAINED CABLES

Large single core cables shall always be installed according to this method. Generally, single core cables with conductors exceeding a cross sectional area of 185 mm² should be supported at spacings in excess of 2 m since the sag between supports will safely accommodate any thermal expansion.

Reducing the spacing between the supports to 1,5 m or less shall be avoided at all costs, as expansion cannot be taken up by a change of sag and chances of sheath failure become considerable.

4.12.5. SPACING OF SUPPORTS OF RESTRAINED CABLES

The maximum spacing between cleats (clamps) to which cables are fixed in horizontal and vertical cable routes shall be in accordance with the requirements. Additional cleats shall be installed at each bend or offset in the cable run. The maximum distance between supports or cleats for multicore control cables shall be 20 times the outside diameter of the cable with a maximum spacing of 550 mm for unarmoured cables and 30 times the outside diameter of the cable with a maximum spacing of 900 mm for armoured cables. A minimum of 20 mm ventilation clearance shall be maintained between cables and the wall to which they are cleated.

4.13. GROUPING AND SPACING OF CABLES IN BUILDINGS AND STRUCTURES

4.13.1. SPACING CORRECTION FACTORS

Cables shall be as a rule spaced two cable diameters apart, for which no grouping correction factor need be applied.

4.13.2. CABLES ON DIFFERENT LEVELS

Where parallel cable runs are installed at different levels (e g on parallel cable trays) and where the spacing of the layers is not specified, a minimum spacing of 300 mm shall be maintained.

4.13.3. SINGLE CORE CABLES

Where single core cables are installed along a three-phase circuit, the cables shall be installed in trefoil formation and bound together at 300 mm intervals.

4.13.4. HIGH VOLTAGE CABLES

High voltage cables shall be separated from other cables and services throughout the installation and shall as far as possible be installed in separate floor trenches, pipes or metal channels. Where this is not feasible a minimum spacing of 500 mm shall be maintained.

4.13.5. CABLES FOR OTHER SERVICES

Cables for telephones, communication systems and other low voltage systems (less than 50 V) shall be separated from power cables. In building ducts a physical barrier shall be provided between power cables and cables for other services. Where armoured cables are used for such other services, they shall be installed on separate cable trays or shall otherwise be at least 1 m away from power cables. Where unarmoured cables are used for these other services, they shall be installed in separate conduits or metal channels.

4.14. TERMINATION AND JOINTING OF CABLES

Cable ends shall be terminated with glands or in cable boxes with the associated accessories such as clamps, shrouds, etc complying in all respects to the Engineer's quality specification.

Connection of cables to switchgear shall always be effected in such a way that the various phases, seen from the front of the switchgear will be in the following positions:

No 1 conductor: left (red) (A)

No 2 conductor: centre (white) (B)

No 3 conductor: right (blue) (C)

Exposed armouring shall be covered with bitumen-base paint.

All cable ends shall be supplied with the necessary earth connection.

A P4000 "SANKEYSTRUT" channel or other approved means of support shall be provided to remove mechanical stress from the glands.

Cable cores shall be marked with heat-shrunk sleeves where necessary to identify the phases.

The current-carrying capacity and breakdown voltage of the cable end shall be the same as for the complete cable.

Cables shall be determined in accordance with the recommendations laid down by the manufacturers of the cables and glands employed.

4.14.1. CONNECTION OF CABLE CONDUCTORS

Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the hole size of the lug.

Cables that are connected to clamp type terminals where the clamping screws are not in direct contact with the conductor, need not be lugged but the correct terminal size shall be used.

Ferrules shall be used as far as possible where cable conductors are connected directly to equipment with screws against the conductor strands.

When cutting away insulation from cable conductors to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances may any of the conductor strands be cut away to fit into lugs.

4.14.2. JOINTS

Joints in cable runs will not be allowed unless specified or authorised by the Engineer.

Jointing shall be carried out strictly in accordance with the manufacturer's instructions and by personnel competent in jointing the types of cables used.

During outdoor jointing operations, the joint bays shall be adequately covered by tents of waterproof material suitably supported. Where necessary a trench shall be excavated around

the bay to prevent the ingress of moisture. The sides of the hole shall be draped with small tarpaulin or plastic sheeting to prevent loose earth from falling in during jointing operations.

The joint shall not impair the anti-electrolysis characteristics of the cable.

The Contractor shall notify the Engineer timeously of the day on which jointing is to be carried out in order that an inspection may be arranged if so required. Any cable joint not inspected by the Engineer because of insufficient notice being given, shall be opened for inspection and redone at the discretion of the Engineer at the cost of the contractor.

LV cable joints shall be of the epoxy-resin type.

Joints shall be fully water- and air tight and shall be free of voids and airpockets.

The crossing of cores in joints will not be permitted under any circumstances.

4.15. TESTING

Each cable shall be tested after installation in accordance with SANS 150 - 1970 (up to 1 kV) for PVC cables and SANS 97 - 1970 (up to 11 kV) for XLPE cables and SANS 1339-1981 for paper cables as well as required by City Power.

LV cables shall be tested by means of a suitable megger at 1 kV and the insulation resistance shall be tabulated and certified.

The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The cost of testing shall have been included in the tender price.

On completion of the tests on any cable, the Contractor shall without delay, submit three copies of the certified Test Reports to the Engineer.

4.16. MEASUREMENTS

All measurements for payments shall be made jointly by the representatives of the Engineer and the Contractor shall obtain the signature of the Engineer's representative including approval of such measurements.

No allowance shall be made for the breaking away of the trench sides, other earth movements or for trenches excavated in excess of the stipulated dimensions.

The classification shall be as follows:

Very hard rock: shall mean rock that can only be excavated by means of explosives.

Hard rock: shall mean granite, quartzitic sandstone, slate and rock of similar or greater hardness, solid shale and boulders in general requiring the use of jack hammers and other mechanical means of excavations.

Soft rock and earth: shall mean rock and earth that can be loosened and removed by hand-pick and shovel.

Where very hard rock and hard rock are encountered, the prior approval of the Engineer shall be obtained before proceeding with the excavation. This requirement is stipulated in order to afford the Engineer the opportunity to determine whether an alternative cable route is justified.

All cable lengths indicated in the Detail Technical Specification and/or shown in the cable route drawings shall be regarded as estimates and are given for tendering purposes only. The successful tenderer shall measure actual cable lengths on site before ordering.

The final price for the supply and installation of all cables will be adjusted, on the basis of the actual lengths of installed cables, in accordance with the unit rates quoted at the time of tendering. Cable lengths shall be measured on site to the nearest 500 mm for this purpose and surplus cable will not be paid for.

4.17. COMPLETION

The Engineer reserves the right to inspect the installation at any stage during the course of construction. Such inspections will, however, not deem the portions inspected as being complete or accepted and the Contractor shall remain responsible for completing the installation fully in accordance with the Contract Documents.

The Contractor shall carry out a final "as built" survey of the cable routes and present to the Engineer "as built" route plans of the complete installation. The following information shall be reflected on the plans or submitted as separate schedules with the plans:

- i) Overall length of each cable.
- ii) Locations of all joints (if any) in relation to permanent reference points. Dimensions shall be shown and the method of triangulation i.e. two dimensions to each joint, shall be used.
- iii) Identification of each cable. The works will be deemed to be incomplete until all tests have been conducted successfully and all "as built" drawings and schedules have been handed to the Engineer.