DEPARTMENT OF HEALTH

NORTH WEST PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

CONTRACT NO: NWDoH/PS/06/18.

REPAIRS AND RENOVATION WORKS TO ICU UNIT
AT JOB SHIMANKANE TABANE HOSPITAL

PART A: BUILDING WORKS (separate document attached)
PART B: ELECTRICAL INSTALLATION (separate document attached)
PART C: MECHANICAL INSTALLATION (separate document attached)
PART D: ICT INSTALLATION (This Document)
PART E: FIRE INSTALLATION (separate document attached)

NAME OF TENDERER : .....

TENDER SUM : .....

ISSUED BY:

THE HEAD OF DEPARTMENT
DEPARTMENT OF HEALTH
PRIVATE BAG X2068
MMABATHO
2735

Tel: (018) 391 4239 **Fax: (018) 387 6755**

PART IV

RETURNABLE SCHEDULES

INTENSIVE CARE UNIT

ICT SERVICES INSTALLATIONS

	DEPARTMENT OF HEALTH:
	NORTHWEST PROVINCIAL GOVERNMENT
	JOB SHIMANKANA HOSPITAL
	SECTION 4 –INTENSIVE CARE UNIT ICT INSTALLATIONS
	TENDER No. NWDoH/PS/06/18.

PART D: Returnable Schedules and Additional Contract Data

The Returnable Schedules must be completed and submitted together with the Tender.
Should this requirement not be complied with in full the Tender may be considered invalid.

NOTE

1. This tender document should be read together with the Main Contractors Tender Document.

2. Only tenderers who have a CIDB contractor grading designation of minimum **5EBPE** or higher or potential emerging enterprises may submit tender offers for the ICT installations.

3. The ICT Installation forms an integral part of the Main Contract, and no other ICT sub-contractor may be appointed at any time in the place of the sub-contractor whose name has been given below without prior written approval by the Representative/Agent.

4. Tenderers are to note that the Total Amount (excl. VAT) must be carried over to the Final Summary in Part A and all fixed amounts shown in the price schedule for the Installations must be included therein. No adjustment will be made for any failure by Tenderers to include these amounts in the Sub-Total for the Installation.

5. All the Returnable Schedules and the Priced Schedule for the Installation must be completed and submitted to the Main Contractor Tendering for the job to include in his submission for the Building Work.

6. Should any ICT Materials offered not comply with the requirements contained in the specification, the Contractor will be required to arrange for the supply of the relevant material in accordance with the Contract at no additional cost.

7. The following questionnaire must be completed and signed by the ICT sub-contractor:

(a) Has the company registered as an Electrical Contractor with the Electrical Contracting Board of South Africa?

Registration No.: . . . . . .

Registration Authority: . . . . . .

Date of Issue: . . . . . .

(b) Has the company registered with the Compensation Commissioner (Department of Labour) in terms of Section 80 of the Compensation for Occupational Injuries and Diseases Act?

Registration No.: . . . . . .

Date of Issue: . . . . . .

(c) Has the company furnished the Director-General (Department of Labour) with the prescribed particulars of its business in terms of Section 28 of the Unemployment Insurance Act?

Registration No.: . . . . . .

Date of Issue: . . . . . .

I/We certify that the above information is correct and undertake to comply with the provisions of the Electrical Installation Regulations 4(2) and 6(1) published under notice R2920 in Government Gazette No. 14350 dated 23 October 1992.

Name of ICT Sub-Contractor: . . . . . .

Address: . . . . . .

. . . . . .

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. . . . . .

Tel No.: . . . . . .

Cell No.: . . . . . .

Fax No.: . . . . . .

Signature of ICT Sub-Contractor: . . . . . .

Date: . . . . . .

Part D List of Returnable Documents

1 Returnable Schedules required for tender evaluation purposes

The tenderer must complete the following returnable schedules as relevant:

- Compulsory Enterprise Questionnaire
- Record of Addenda to Tender Documents
- Proposed Amendments and Qualifications
- Certificate of Authority
- Schedule of Proposed Subcontractors
- Schedule of recently completed and current contracts
- Schedule of plant and equipment
- Occupational Health and Safety Questionnaire
- Occupational Health and Safety Statement
- Quality control procedures
- Evaluation Schedule: Tenderer's Experience
- Evaluation Schedule: Experience of Key Staff
- Evaluation schedule: Quality control procedures
- Tender evaluation schedule

2 Other documents required for tender evaluation purposes

The tenderer must complete the following returnable documents:

1. Certificate of attendance at clarification meeting
2. Tax Clearance Certificate for Tenders
3. Form of Intent to Provide a Performance Bond
4. Proof of Registration with the CIDB
5. Share Certificates of Tendering Entity

3 Returnable Schedules that will be used for tender evaluation purposes and be incorporated into the contract

1. Particulars of ICT contractors
2. Particulars of specialist contractors
3. Electrical / ICT / Security material and equipment schedule
4. Schedule of imported material & equipment

4 Other documents that will be incorporated into the contract

1. CIDB Certificate
2. Certified ID copies of all members and directors
3. Joint venture agreement if JV appointed
4. Letter of good standing from Compensation Commissioner (Workmen's Compensation)
5. Company registration documents

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Compulsory Enterprise Questionnaire

The following particulars must be furnished. In the case of a joint venture, **separate** enterprise questionnaires in respect of each partner must be completed and submitted.

Section 1: Name of enterprise: . . . . . .

Section 2: VAT registration number, if any: . . . . . .

Section 3: CIDB registration number, if any: . . . . . .

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	**Identity number***	**Personal income tax number***

***** Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 5: Particulars of companies and close corporations

Company registration number . . . . . .

Close corporation number . . . . . .

Tax reference number . . . . . .

Section 6: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

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If any of the above boxes are marked, disclose the following:

Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months been in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

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Name of Spouse, child or parent	**Name of institution, public office, board or organ of state and position**	**Status of service** **tick appropriate column**	
		Current	**Within last 12 months**

*Insert separate page if necessary

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
ii) confirms that neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;
iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;
iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and
iv) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise name ----------

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Record of Addenda to tender documents

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

	Date	**Title or Details**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Attach additional pages if more space is required.

Signed ..... Date .....

Name ..... Position .....

Enterprise name .....

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Proposed amendments and qualifications

The Tenderer should record any deviations or qualifications he may wish to make to the tender documents in this Returnable Schedule. Alternatively, a tenderer may state such deviations and qualifications in a covering letter to his tender and reference such letter in this schedule.

The Tenderer's attention is drawn to clause F.3.8.2 of the Standard Conditions of Tender referenced in the Tender Data regarding the employer's handling of material deviations and qualifications.

Page	Clause or item	Proposal

Attach additional pages if more space is required

Signed ..... Date .....

Name ..... Position .....

Enterprise name .....

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Certificate of Authority

This Returnable Schedule is to be completed by the Tendering Entity giving authority for the person to sign the tender documentation..

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms . . . . . , authorised signatory of the company . . . . . , acting in the capacity of lead partner, to sign all documents in connection with the tender offer and any contract resulting from it on our behalf.

NAME OF FIRM	ADDRESS	DULY AUTHORISED SIGNATORY
Lead partner CIDB registration number: ……		Signature. . . . . . Name …….. Designation
CIDB registration number: ……		Signature. . . . . . Name …….. Designation
CIDB registration number: ……		Signature. . . . . . Name …….. Designation
CIDB registration number: ……		Signature. . . . . . Name …….. Designation

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Schedule of Proposed Subcontractors

We notify you that it is our intention to employ the following Subcontractors for work in this contract.

If we are awarded a contract we agree that this notification does not change the requirement for us to submit the names of proposed Subcontractors in accordance with requirements in the contract for such appointments.

	Name and address of proposed Subcontractor	**Description of Work to be executed by Subcontractor**	**Previous experience with Subcontractor**

Attach additional pages if more space is required

Signed ..... Date .....

Name ..... Position .....

Enterprise name .....

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Schedule of recently completed and current contracts

List not more than seven contracts completed in the last five years

Contract title:		**Employer (name) Place (town)**	**Reference person**		**Contract Amount (R million)**	**Contract Period (months)**	**Date of Completion***
			Name	**Tel**			
1							
2							
3							
4							
5							
6							
7							

*Completed means that a certificate has been issued in terms of a contract by the employer, signifying that the whole of the construction works have reached a state of readiness for occupation or use for the purposes intended, although some minor work may be outstanding.

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List all current contracts not complete at the time of submitting this tender

Project:		**Employer (name) Place (town)**	**Reference person**		**Contract Amount (R million)**	**Contract Period (months)**	**Date of commencement**	**Date of expected Completion***
			Name	**Tel**				
1								
2								
3								
4								
5								
6								

*Date when defects liability period commenced

Signed ..... Date .....

Name ..... Position .....

Enterprise name .....

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Schedule of plant and Equipment

The following are lists of major items of relevant equipment that I / we presently own or lease and will have available for this contract or will acquire or hire for this contract if my / our tender is accepted.

(a) Details of major equipment that is owned by and immediately available for this contract.

Quantity	Description, size, capacity, etc.

Attach additional pages if more space is required.

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(b) Details of major equipment that will be hired, or acquired for this contract if my / our tender is acceptable.

Quantity (hired)	**Description, size, capacity, etc.**	

Attach additional pages if more space is required.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise Name: ----------

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OCCUPATIONAL HEALTH AND SAFETY QUESTIONNAIRE

1. HEALTH AND SAFETY POLICY

(a) Can a copy of current health and safety policy including procedures for risk assessment be supplied? Yes □ No □

(b) Please give full reasons, on a separate sheet, if the health and safety policy cannot be provided.

.....
.....

2. HEALTH AND SAFETY ADVICE

Do you

(a) Employ a full time health and safety advisor? Yes □ No □

(b) Use the services of a health and safety consultant? Yes □ No □

(c) Have access to the services of a health and safety group? Yes □ No □

4. ACCIDENT AND INCIDENT STATISTICS

(a) Have any dangerous occurrences been reported within the last three years? Yes □ No □

If Yes, please give brief details:

.....
.....
.....

(b) Has any employee or persons under your control been fatally injured at work within the last three years? Yes □ No □

If Yes, please give brief details:

.....
.....
.....

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise Name: ----------

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OCCUPATIONAL HEALTH AND SAFETY ACT: STATEMENT BY TENDERING ENTITY

I, ... duly authorised

to represent .....
(company name)

in my capacity as .....
hereby confirm that I accept full and exclusive responsibility for compliance by myself and all persons who perform work for me with the provisions of the Occupational Health and Safety Act, No. 85 of 1993 (as amended) and all regulations promulgated from time to time, whilst performing work on;

.....

I confirm that all employees who perform work on the site shall be properly trained to do this in a manner which is safe and without risk to health and safety to themselves and others in the vicinity and undertake to have our activities adequately supervised in the interest of health and safety.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise Name: ----------

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Experience of KEY STAFF

The following is a statement of similar work successfully executed by key staff members that will be utilised on this contract in the last three years:

Position	Name	Previous Projects and Position	Value of Work inclusive of VAT (Rand)	Client Name and Contact no.
Site Agent				
General Foreman				
Safety Officer				

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise Name: ----------

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Quality Control Procedures

QUALITY MANAGEMENT QUESTIONNAIRE

(a) Does the tenderer have a quality management system which is certified in terms of ISO 9001: 2000

Yes □ No □

(b) If "yes", tenderer to supply a brief summary of structure of system:

.....

.....

(c) If "no", do the tendered intend to apply for certification and by when; Yes □ No □

Date ----------

If the tenderer does not intend to apply for certification, he/she shall submit details of the quality management system they intend to put in place on this contract.

.....

.....

.....

.....

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Enterprise Name: ----------

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Evaluation Schedule: Tenderer's Experience

The experience of the tenderer or joint venture partners in the case of an unincorporated joint venture or consortium as apposed to the key staff members / experts in similar projects or similar areas and conditions in relation to the scope of work over the last five years will be evaluated.

Tenderers should very briefly describe his or her experience in this regard and attach this to this schedule.

The description should be put in tabular form with the following headings:

Employer, contact person and telephone number, where available	**Description of work (service)**	**Value of work (i.e. the service provided) inclusive of VAT (Rand)**	**Date completed**

The scoring of the tenderer's experience will be as follows:

Poor (score 40)	Tenderer has limited experience
Satisfactory (score 70)	Tenderer has relevant experience but has not dealt with the critical issues specific to the assignment.
Good (score 90)	Tenderer has extensive experience in relation to the project and has worked previously under similar conditions and circumstances.
Very good (score 100)	Tenderer has outstanding experience in projects of a similar nature.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ---------- Date ----------

Name ---------- Position ----------

Tenderer ----------

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Evaluation Schedule: Experience of Key Staff

The experience of assigned staff member in relation to the scope of work will be evaluated from three different points of view:

1) General experience (total duration of professional activity), level of education and training and positions held of each discipline specific team leader.
2) The education, training, skills and experience of the Assigned Staff in the specific sector, field, subject, etc which is directly linked to the scope of work.
3) The key staff members' / experts' knowledge of issues which the tenderer considers pertinent to the project e.g. local conditions, affected communities, legislation, techniques etc.

A CV of the project director, site agent and general foreman of not more than 2 pages should be attached to this schedule:

Each CV should be structured under the following headings:

1 Personal particulars
- name
- date and place of birth
- place (s) of tertiary education and dates associated therewith
- professional awards

2 Qualifications (degrees, diplomas, grades of membership of professional societies and professional registrations)
3 Skills
4 Name of current employer and position in enterprise
5 Overview of post graduate / diploma experience (year, organization and position)
6 Outline of recent assignments / experience that has a bearing on the scope of work

The scoring of the experience of key staff will be as follows:

	General experience and qualifications	**Adequacy for the assignment**	**Knowledge of issues pertinent to the project**
Poor (score 40)	Key staff have limited levels of general experience	Key staff have limited levels of project specific education, skills, training and experience	Key staff have limited experience of issues pertinent to the project
Satisfactory (score 70)	Key staff have reasonable levels of general experience	Key staff have reasonable levels of project specific education, skills, training and experience	Key staff have reasonable experience of issues pertinent to the project
Good (score 90)	Key staff have extensive levels of general experience	Key staff have extensive levels of project specific education, skills, training and experience	Key staff have extensive experience of issues pertinent to the project
Very good (score 100)	Key staff have outstanding levels of general experience	Key staff have outstanding levels of project specific education, skills, training and experience	Key staff have outstanding experience of issues pertinent to the project

Note: An individual may be nominated to serve as the team leader in more than one discipline and as the team leader and a discipline specific leader.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed ..... Date .....

Name ..... Position .....

Tenderer .....

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Certificate of attendance at clarification meeting

This is to certify that

…… (Enterprise name)

of

……...……

……

……(address)

was represented by the person(s) named below at the compulsory meeting held for all tenderers at

……(location)

……

On …… (date), starting at …… ..... hrs

I have made myself familiar with all site conditions likely to influence the work and all aspects that could influence either the cost or the construction of the service.

I further certify that I am satisfied with the description of the work and explanations given at the meeting and that I understand perfectly the work to be done, as specified and implied, in the execution of this contract.

Particulars of person(s) attending the meeting

Name …….. Signature …… …….

Capacity ……..

Name …….. Signature …… …….

Capacity ……..

Attendance of the above person(s) at the meeting is confirmed by the Employers Agent, namely

Name…….. Signature …… …….

Capacity …….. Date & Time …… ……...

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Tax Clearance Certificate for Tenders

The tenderer is to affix to this page:

An **Original Valid Tax** Clearance Certificate for Tenders issued by the South African Revenue Services (S.A.R.S.) in the **Name of the Tendering Entity** indicating the Trading Name.

Note:

Failure to affix such certificate **will** result in this tender not being considered for the award of the contract

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Form of Intent to Provide a Performance Bond

1 With reference to the tender of …… .... (hereinafter referred to as the " **TENDERER**" for the project …….. (hereinafter referred to as the "**CONTRACT**" for the DEPARTMENT OF HEALTH, (hereinafter referred to as the "**EMPLOYER**" for the tender dated ……..…. for the offered total of price s of (R ….....……) ..... (in words)

2 I/We ..... in my/our Capacity as ..... and hereby representing ..... ……. (hereinafter referred to as the " **INSURER**" advise that the " **INSURER**" undertakes to provide a **Performance Bond** to the **EMPLOYER** to the Employer's format included in Part C1.3 of this document within five (5) working days of the written acceptance of the contractor's tender offer.

Thus done and signed at …… on ……. ……..

.....	.....
Name of signatory	*Capacity of authorised signatory*
.....	.....
As witness	*for and on behalf of the **insurer** who by signature hereof warrants authorisation hereto*

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Proof of Registration with the CIDB

The tenderer is to affix to this page either:

- Written proof of his registration with the CIDB as a Category **5EBPE** or higher

OR

- Written proof of his application to the CIDB for registration as a contractor in the category listed above.

Notes:

- Failure to affix such documentation as prescribed to this page **shall** result in this tender not being further considered for the award of the contract.
- Should this tender be considered for award of the contract, based on proof of submission of application for registration in the appropriate category with the CIDB, and should proof of such subsequent registration not be forthcoming to the Department by the time of award of the contract, then this tender will no longer be considered for the award of the contract.
- The Department will verify the certificate on the CIDB's website.

Share Certificate of Company

The tenderer is to affix to this page:

- Copies of the Share Certificates of all the Shareholders of the Company.

Notes:

Failure to affix such documentation as prescribed to this page **shall** result in this tender not being further considered for the award of the contract.

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Particulars of ICT Contractors

Name of Specialist Contractor

Address ……

	DEPARTMENT OF HEALTH:
	NORTHWEST PROVINCIAL GOVERNMENT
	JOB SHIMANKANA HOSPITAL
	SECTION 4 –INTENSIVE CARE UNIT ICT INSTALLATIONS
	TENDER No. NWDoH/PS/06/18.

ICT Material and Equipment Schedule

ITEM	MATERIAL	MAKE OR TRADE NAME	COUNTRY OF ORIGIN
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
NB:	Only one manufacturer's name to be inserted for each item		

	DEPARTMENT OF HEALTH:
	NORTHWEST PROVINCIAL GOVERNMENT
	JOB SHIMANKANA HOSPITAL
	SECTION 4 –INTENSIVE CARE UNIT ICT INSTALLATIONS
	TENDER No. NWDoH/PS/06/18.

Schedule for Imported Materials and Equipment

Item	Material / Equipment	Rand (R) excluding Vat	Currency	Exchange Rate
1				
2				
3				
4				
5				
6				

Attach additional pages if more space is required

The Tenderer shall list imported items, materials and/or equipment which shall be excluded from the Contract Price Adjustment Provisions (if applicable) and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (provided that such costs shall not be higher than the relevant contract rate as listed above) should be lodged with the Project Manager within three (3) weeks of the starting date. No adjustment of the local VAT amount, nor the contractor's profit, discount, mark-up, handling costs, etc shall be allowed.

These net amounts will be adjusted as follows:

FORMULA FOR ADJUSTING IMPORTED MATERIAL/EQUIPMENT TO CURRENCY

The net amount to be added to or deducted from the contract sum:

$$A = V\left(\frac{Z}{Y} - 1\right)$$

A = the amount (R) of adjustment

V = the net amount (supplier's quotation) (R) of the imported item (material or equipment)

Y = official exchange rate at the closing date of tender submission

Z = official exchange rate on the date of payment

BILLS OF QUANTITIES

JST HOSPITAL INTENSIVE CARE UNIT BLOCK
ICT SERVICES INSTALLATIONS

6. BILLS OF QUANTITIES

6.1 General

The following is the provisional bills of quantities for the works and is to be the basis of the tender**.**

6.1.1. These bills of quantities contain pages numbered consecutively in each bill as indicated in the Master Index. Before the tenderer submits his tender, he should check the number of pages, and if any are found missing or duplicated or the figures or writing indistinct, or the bill of quantities contain any obvious errors, he should apply to the Engineer at once and have same rectified, as no liability whatsoever will be admitted by the Engineer in respect of errors in the Tender due to the foregoing.

6.1.2 These Bills of Quantities form part of and must be read in conjunction with the specifications and drawings which contain the full description of the work to be done and material and equipment to be used

6.1.3. Tenders shall be submitted for initial consideration on the declaration of the total value of the bills. Subject to declaration of intent to enter into a contract, the bills priced in detail shall be made available upon request within 7 days after the closing date of tenders.

6.1.4. The total tender sum in the tender form shall constitute the contract price of the successful tenderer. Tenderers are advised to check their item extensions and total additions, as no claim for arithmetical errors will be considered.

6.1.5. No alteration, erasure or addition is to be made in the text of the bill of quantities. Should any alterations, erasure or addition be made, it will not be recognized, but the original wording of the bill of quantities will be adhered to.

6.1.6. The priced bills of quantities of the successful tenderer will be checked. The Engineer reserves the right to call for adjustments to any individual price and to rectify any discrepancy whilst the total tender price, as submitted remains unaltered.

6.1.7. The responsibility for the accuracy of the quantities written into the bills remains with the party who prepared the bills. The tenderer shall be relieved of the responsibility of measuring quantities at the tender stage, and the tender sum submitted shall be in respect of the quantities set out in the bills, although he will be required to make his assessment of items as brackets, fixings, etc. from details stated in the bills and shall include in the item prices small installation materials as are required for the complete installation in accordance with the Specification.

6.1.8. The Contractor and the Employer or his Agent may agree that the total of any bill or bills, including any variations by way of additions thereto or deductions therefrom, represents a fair and accurate quantification of the items set out in the bills and the parties may agree final payment on that basis. In the event of any dispute as to the quantities, then the disputed item or items shall be adjusted where necessary.

6.1.9. The quantities in these bills of quantities are not to be used for ordering purposes.

6.1.10. Variations in the scope and extent of the work included in the bills shall be allowed to meet the Employer's requirements.

The rules governing the extent and valuation of variations shall be those provided for in the conditions of contract.

6.1.11. Unless separate rates for the supply and for the installation of any item is specifically called for, the supply and installation costs of any item shall be fully included in the unit price.

The description of each item shall, unless otherwise stated herein, be held to include making, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting and waste, patterns, models and templates, plant, temporary works, return of packings, establishment charges, profit and all other obligations arising out of the conditions of contract.

6.1.12. The quantities and rates included for day works shall form part of the tender price, but tenderers shall

note that this item must be regarded as indicative and will only be payable to the Contractor if and when covered by a Variation Order.

6.1.13. Tenderers shall price the Preliminaries under any or all of three groups, viz:

(a) a fixed amount
(b) an amount varied in proportion to the final contract value as compared to the tender price
(c) an amount varied in proportion to the final contract period as compared to the originally specified contract period

The allocation of prices to the three categories listed above must be realistic and the Contractor may be required to justify the allocation of the prices. Attention is particularly drawn to the right reserved in terms of Clause 6 above.

6.1.14. All provisional sums shall be expended as directed by the Engineer and any balance remaining shall be deducted from the amount of the contract sum.

6.1.15. The quantities in these bills of quantities are measured provisionally. All work executed in accordance with the drawings approved by the Engineer shall be re-measured and priced at rates contained in, or based on, the priced bills of quantities.

6.1.16. Provision is made on the final summary of the main contractors bills of quantities for the applicable Tax to be added.

NORTH WEST DEPARTMENT OF HEALTH
JST HOSPITAL NEW ICU UNIT
SECTION 1M - ICU (ICT INSTALLATIONS)

BILL NO 1 LAN INFRASTRUCTURE AND EQUIPMENT

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the following				
1.0	**Installation of Network & supporting Infrastructure**				
1,1	Core Switch -Multilayer (L2, L3, L4) - Managed - 12 x 1G SFP+; 4 X 10GBASE-T; GigE port aggregation, IEEE 802.1q; VLANs - Port-based; Voice VLAN; Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP and Rapid PVST+); DHCP & DHCP Relay; Layer 3 Routing; IGMP v1/v2/v3; Protocol Independent Multicast (PIM); SNMP v1/v2/v3; Syslog; SMTP alert; ACLs; MAC filtering; DoS Control; Quality of service (QoS); IP ARP / RARP; Super-netting (CIDR), Port security; SSL/HTTP; SSH/Secure Shell ; RADIUS/ TACACS+ Client; IPv4 & IPv6; PoE - IEEE 802.3af;	No.	2		
1,2	Access Switch, Layer 2, Managed, GigE - 24 x 10/100/1000 + 2 x 1 Gigabit SFP+, Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP & Rapid PVST+); IGMP Snooping: v1/v2/v3; PIM; VLANs - Port-based; Port Security; SSL/HTTP; SSH/Secure Shell ; RADIUS/ TACACS+ Client; - rack-mountable, PoE - IEEE 802.3af;	No.	7		
1,3	Distribution Switches: (L2, L3, L4) - Managed - 12 x 1G SFP+; GigE port aggregation, IEEE 802.1q; VLANs - Port-based; Voice VLAN; Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP and Rapid PVST+); DHCP & DHCP Relay; Layer 3 Routing; IGMP v1/v2/v3; Protocol Independent Multicast (PIM); SNMP v1/v2/v3; Syslog; SMTP alert; ACLs; MAC filtering; DoS Control; Quality of service (QoS); IP ARP / RARP; Super-netting (CIDR), Port security; SSL/HTTP; SSH/Secure Shell ; RADIUS/ TACACS+ Client; IPv4 & IPv6; PoE - IEEE 802.3af;	No.	2		
1,4	1 G SFP LC transceivers, multi-mode	No.	14		
1,5	Bend Insensitive Multimode Fiber fibre (BIMMF), 4 core, OM4 , 50/125 µm. 850nm. Minimum Bend radius: 7.5 mm with less than 0.2 dB bending loss. Attenuation: 3.0dB/km	m	2000		
1,6	Fibre Patch Panel with 4 x 6 LC Duplex modules	No.	6		
1,7	2m Single-mode LC duplex patchcodes	No.	12		
1,8	24-port patch panel-fully populated	No	7		
1,9	19" rack mount, 1U Brush Panels	No	7		
1.10	19" rack mount, 1U Brush Panels cable managers	No.	7		
1,11	Fiber splicing	No.	18		
1,12	Splice Boxes	No.	7		
1,13	Fiber pigtails	No.	7		
1,14	Cat6a Factory manufactured patchleads, 1m	No	168		
1,15	10kVA 3Phase smart UPS, 220V output ,sealed batteries • Modular with N+1 redundancy • Scalable to 15kVA to accommodate future expansion • Online delta conversion • 30 minutes runtime • Installed complete with a manual bypass switch for ease of maintenance.	No.	1		
1,16	42U 19inch cabinet, integrated rack, incl cooling fans, rack shelves, rack rails. Rack must also come with a 230V, 16A, 3pin round (X 10 socket) outlets adapter, white in colour, suitable for mounting on the 19" rack	No	2		
1,17	12U fixed swing out cabinet, wall mount, lockable, incl cooling fans, rack shelves, rack rails. Rack must also come with a 230V, 16A, 3pin round (X 10 socket) outlets adapter, suitable for mounting on the 19" rack	No	4		
1,18	**Firewall and Unified Threat Management:** intrusion prevention system (IPS), web filtering, secure sockets layer (SSL) inspection, and automated threat protection. 4 Gbps SSL Inspection Throughput.	No	1		
	Testing and Commissioning				
1,18	Commissioning of Installation	No	1		
1,19	OTDR Testing and Results	No	1		
1.20	Manuals, Documentation, AS Builts	No	3		
1.21	Provisional Amount Relocation of Services on walkway	Psum	1	450 000,00	R450 000,00
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH
JST HOSPITAL NEW ICU UNIT
SECTION 1M – ICU (ICT INSTALLATIONS)
BILL NO 2 CCTV SURVEILLANCE AND DIGITAL RECORDING SYSTEM

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the following				
2.0	**Installation of an IP H.264 CCTV surveillance and Recording System, with 30 days recording (on motion detection) with 365-days archiving for specified events and alarms . All Cameras and switches are PoE+ compliant. • H.264 • Smart Codec • 20fps • MBR • Motion detection •**				
2.1	Fixed IP Camera 4MP 2.8mm (100°) fixed lens, 1/3" progressive scan CMOS, 2560 × 1440@20fps, 2.8mm fixed lens, H.265+, H.265, H.264+, H.264, Dual stream, 120 dB WDR (Wide Dynamic Range), 3D DNR (Digital Noise Reduction), 30 m IR range, PoE (Power over Ethernet), IP67	No	7		
2.2	Operators Workstation, 1 x Xeon E5-1620V4 / 3.5 GHz - RAM 16 GB, HDD 1T, AMD Firepro 2GB Graphics with 4 (Display ports) Outputs, Serial port adaptor; Win 10 Pro 64-bit - 24" monitors. Include all licences and anti - virus software	No	1		
2.3	Operators Work Station Biometric Fingerprint Log ON reader. - Stainless Steel Vandal Resistant, USB 3.0 compatible standalone Reader, Optical sensor, Min Resolution: Min 500 dpi (280 x 320 pixels). Min Imaging Area: 16 x 18mm	No	1		
2,4	32" LED TFT (Active Matrix), Display Monitor, 1080p, mounting brackets. Input: Analogue (Composite) + Digital (SVGA) + HDMI - Contrast Ratio: 800:1. Minimum Resolution: 1366 x 768, - Pixel pitch: 0.650mm, - Minimum Viewing Angle: 170°/170°, - Scanning Frequency: 30-70kHz Horizontal, 50-85 Vertical, - Brightness: 500 cd/m2, Response Time: 8ms	No	2		
2,5	2.0KVA inline, rack mount, 30min autonomy UPS system	No.	4		
2,6	Video wall Server.Tower. Intel® Core™ i7-10750H Processor or better. 6 Core 16 GB RAM. Intel® 82599EB 10 Gigabit Ethernet Controller. Dual Port Configuration - 2 x 10GigE. Intel® Iris™ Pro Graphics P580 with 2 (Display ports) Outputs. Microsoft® Windows® Server 2019 (64 bit): Essentials, Standard and Datacenter. Microsoft SQL Server® 2017 SATA - hot-swap 3.5" - HDD 2 x 1 TB.	No.	1		
2,7	55" LED TFT (Active Matrix), Display Monitor, 1080p, mounting brackets. Input: Analogue (Composite) + Digital (SVGA) + HDMI - Contrast Ratio: 800:1. Minimum Resolution: 1366 x 768, - Pixel pitch: 0.650mm, - Minimum Viewing Angle: 170°/170°, - Scanning Frequency: 30-70kHz Horizontal, 50-85 Vertical, - Brightness: 500 cd/m2, Response Time: 8ms	No	1		
2,8	16 Channels Embedded Network Video Recorder.. 64TB onboard. ONVIF /PSIA, eSATA, HDMI/VGA/BNC, • H.264+, H.264, H.265, video formaty.• Video outputs at up to 4K (4096*2160) resolution. •Support various VCA detection alarm and VCA search. • Support HDD hot swap with RAID0 5 storage. Rack mount. Direct Attached - RAID 5, 10GbE - iSCSI.	No	1		
2,9	GPS Network Time Protocol (NTP) Server. Rack module. Complete with GPS antenna, receiver and cabling. Minimum hardware recommendation: CPU: Quad core 2,6GHz+ CPU, RAM: 6GB, Minimum database space: 10GB. 1Gbit/s and 10Gbit/s interfaces. Hardware timestampin. All network devices - Al Servers, computers, cameras, NVRs, Various controllers (access control, alarm, intercom, Nurse Call etc), must be synchronized to the NTP Server.	No	1		
2.10	Storage Archieving. RAID 10. SATA, Hot Swap, HDD Capacity - 96TB . iSCSI, hot-swappable hard drives, miniSAS for external storage. Intel® 82599EB 10 Gigabit Ethernet Controller, Dual Port Configuration - 2 x 10GigE. Internal DVD Writer. 19" 2U or 4U Rack mount. Simultaneous Recording Streams: 64 Video Streams at 6Mbs per stream, minimum. SCSI Host Bus Adapter: Single Channel U320 adapter for external storage connectivity. 64 bit operating system. PCI Gigabit Adapter. HDMI/VGA Output. Redundant Power Supplies	No	1		
2,11	Cat6a Cable	m	500		
2,12	25sq mm PVC conduit (inclusive of all boxes and accessories)	m	1000		
2,13	Wire Cable Tray and accessories, Electrogalvanised steel: 3m x 150mm x 30mm	m	300		
	Testing and Commissioning				
2,14	Testing and Commissioning of Installation	No	1		
2,15	Manuals, Documentation, AS Builts	No	3		
2,16	Training of Personnel	No	2		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

SECTION 1M – ICU (ICT INSTALLATIONS)

BILL NO 3 VO-IP: TELEPHONE SYSTEM

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the following				
3.0	**Voice over IP Telephony**				
3,1	Modular Voice over IP Gateway - VoIP phone adapter. Authentication Method - RADIUS, TACACS+ , GiE, DHCP, DNS, HSRP, CLI, HTTP, SNMP 3, TFTP, Telnet. Voip Protocols - H.323 v4, MGCP, RTP, SCCP, SIP, SRTP. Voice Codecs - G.711, G.729a, T.38. IP Telephony features - automatic fax/modem detection and pass-through, call hold, call transfer, call waiting, caller ID. Rack Mount, 1U. 2 x 10GE TCP/IP. The system must be able to support at least 10 Telkom lines, IP Trunk Ports and up to 100 extensions.	No	1		
3,2	SIP Compartible Telephone handsets .	No	15		
3,3	Telephone Console	No	1		
3,4	Call Management System / Software	No	1		
3,5	Line Lightning Arresters and Earthing	No	4		
	Testing and Commissioning				
3,6	Testing and Commissioning of Installation	No	1		
3,7	Manuals, Documentation, AS Builts	No	3		
3,8	Training of Personnel	No	2		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

SECTION 1M - ICU (ICT INSTALLATIONS)

BILL NO 4 ACCESS CONTROL

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the following				
4.0	**Access Control System**				
4.1	Access Control Server .2U Industrial Mount Chassis, Win Server 2019, 5 CALs, 3GB/s, RAID - 5, 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1, 24T per Module. 7200rpm 3.5", Intel® 82599EB, Dual Port Configuration - 2 x 10GigE. Intel® Core™ i7-10750H Processor, 6 Core, 12 MB Intel® Smart Cache RAM, 64 bit,Network Dual Intel® 82574L Gigabit LAN controller	No.	1		
4.2	Enrollment Workstation, 1 x Xeon E5-1620V4 / 3.5 GHz - RAM 16 GB, HDD 1T, AMD Firepro 2GB Graphics with 4 (Display ports) Outputs, Serial port adaptor; Win 10 Pro 64-bit - 32" monitors. Include all licences and anti - virus software	No.	1		
4.3	TCP/IP Ethernet Access Controller Door Controller. Support of Wiegand Card Readers. Authentication Password with Keypad Card Reader, Relay outputs. Power supply with a battery backup of 7Ah, Mounted in a secure lockable box. Offline operation; intelligence door controller, 8 digital inputs. Dedicated Fire and Tamper Inputs. On-board time/date battery backup. Mains monitoring.	No.	4		
4.4	Biometric Reader (Dual: Card & Finger reader). Patented active capacitance sensing technology, Protective coating allowing more than 10 million rubs, Interface USB 3.0 Full speed, Windows 10, AES2550 AuthenTec slide sensor, Trueprint® Subsurface RF Technology, 500 Pixels per inch, Image Area: 9.75mm X 0.41mm / 192 X 8 pixels, Scratch Resistant, Advanced 6-H hardness durability coating, Up to 8Mhz smart cards, and a 412 kbit/s communication speed	No.	4		
4.5	Electric Strike, fail secure, inclusive of door position switches & electric buzzer. Surface mounted, Must be able to fit on Aluminium, Hollow Metal or Wood frames, Stainless steel construction, Tamper-resistant, Static strength 1,500 lbs, Dynamic strength 70 ft-lbs, Endurance 1 million cycles, Field selectable fail secure/fail safe, Internally mounted solenoid	No.	4		
4.6	Heavy Duty Aluminum Commercial Door Closer +60kgs. Hands free closing, variable or adjustable latch speeds, must be suitable for suitable for different types of doors (wood/metal).	No.	4		
4.7	Printer and Card issuer	No.	1		
4.8	Access Cards (Smart / Magnetic /RFID)	No.	200		
4.9	Biometric Fingerprint Capturing Device. Stainless Steel Vandal Resistant housing, USB 3.0 Compatible standalone Reader, Optical, Min 500 dpi (280 x 320 pixels), Min Imaging Area: 16 x 18mm	No.	1		
4.10	12V 8.0AH Rechargeable sealed lead acid battery	No.	4		
4.11	Mylar cable	m	1000		
4.12	Push to exit Buttons - Proximity / No touch buttons	No.	0		
4.13	Emergency door release, resettable. Audible alarm & notification connectivity to the control room.	No.	4		
4,18	Two-way conveyor x-ray machine / Parcel Scanner. Dual Energy Detector system (Multi Energy Imaging), PC, Colour monitor, Conveyor belt, Screening for full profile of inspection tunnel, Discharge roller table,UPS, 30min backup.	No.	1		
4,19	Walk Through Metal Detector. Multi Zone Detection System, 45 min Battery Backup, Max Walk through Height: 2000mm, Walk through Width: 720mm. Sensitivity-adjustable fixed arch units. 2 x Handheld portable metal detectors for secondary scanning per walk through detector. High traffic throughput.	No.	1		
	Testing and Commissioning				
4,18	Testing and Commissioning of Installation	No	1		
4,19	Manuals, Documentation, AS Builts	No	3		
4.20	Training of Personnel	No	2		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

SECTION 1M - ICU (ICT INSTALLATIONS)

BILL NO 5 PUBLIC ADDRESS SYSTEM

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the followinq				
5.0	**Public Address System**				
5.1	Server with Audio Encorder. Evacuation Compliant. Chassis: 2U, 19" rack mount. Intel® Core™ i7-1065G7 Processor, 4 Core, Max turbo frequency- 3.9 GHz and 1.3 GHz Processor Base frequency, 8 MB Intel® Smart Cache, - Hard Drive: 500GB, 7200 Rpm, Serial ATA II, HD Controller: Integrated Intel chipset SATA 3.0Gb/s, - HD Configuration: All SATA drives, No RAID, - Network Adapter: Intel, PCI Express with SNTP and DMI2 support, Microsoft Windows 10, - Ports: 1 x USB 3.0 and 3 x USB 2.0, - Optical Drive: 16X DVD+/-RW Drive. Graphics Adapter: 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1DVI, Monitor: 32"LED HAS Wide Monitor, keyboard, mouse, speakers,	No	1		
5.2	IP Remote Call Station / Console	No	1		
5.3	CD, MP3 player, FM/AM/SW radio Tuner	No	1		
5.4	Mixer Pre - Amp	No	1		
5.4	IP network master audio amplifier, built-in audio streaming decorder, built-in 100V public address 240W Class-D Power Amplifier, 5 input sources, 3 mic inputs, 2 aux inputs, one line output and 100V speaker outputs. Must have high temp overload and short circuit protection. Class-D switching technology.,	No	1		
5.5	IP network section audio amplifier / adapter	No	2		
5.6	High quality, ceiling & wall mount, indoor speakers. Suitable for indoor background music or paging system use. Built in 100V/70V matching transformer, **3 - 10W power taps**, UV-protection features, 91db sensitivity, frequency response 150-15kH. Each speaker power output must be adjusted for the area it will be serving	No	5		
5.7	4 pair, twisted, screened, 22swg speaker cable. Intercom stations shall be connected in a modular bus configurationto to reduce cabling requirements	m	1000		
	Testing and Commissioning				
5,8	Testing and Commissioning of Installation	No	1		
5.9	Manuals, Documentation, AS Builts	No	3		
5.10	Training of Personnel	No	2		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

SECTION 1M - ICU (ICT INSTALLATIONS)

BILL NO 6 DATA NETWORK: WIRED

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the following				
6.0	**Wired and Wireless Data Network**				
6,1	Intercom / Purging Master Control Unit	No	1		
6,2	Intercom / Purging IP Amplifiers	No	2		
6,3	Offices	No	16		
6,4	Cameras	No	7		
6,5	Wireless Access points	No	4		
6,6	Access Control Master Controller Unit	No	1		
6,7	Door Controllers	No	4		
6,8	Nurse Stations	No	32		
6,9	Bed Consoles	No	44		
6.10	Intercom / Purging Master Control Unit	No	1		
6,11	Intercom / Purging IP Amplifiers	No	2		
6,12	RJ45 End-point box c/w inserts	No	114		
6,13	Cat6a Factory manufactured flyleads, 3m	No	114		
6,14	Cat6a Cable	m	3000		
6,15	AP: Indoor Wireless Access Point Device and point. Features: 802.11ac MU-MIMO technology, 802.11i, WPA2, WPA, 802.1X , AES, PoE	No	4		
6,16	WLC: Wireless LAN Controller with 10 AP License. Wireless intrusion prevention system (IPS) capabilities, RF management, QoS, and Layer 3 fast secure roaming. 2 x GigE support	No	1		
	Testing and Commissioning				
6,17	Testing and Commissioning of Installation	No	1		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

SECTION 1M - ICU (ICT INSTALLATIONS)

BILL NO 7 ANCILLARY EQUIPMENT

ITEM	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	Supply & Install Complete with all ancillaries and appurtinancies for a complte installation of the followina				
7.0	**Installation of Ancillary Equipment**				
	Installation of Satellite Televisions reception / waiting area & boardroom				
7,1	Antenna, mounting accessories and LNB	No	2		
7.2	Field Distribution boxes, IP66 - 36 x 24 x 15cm	No	2		
7.3	Sat Receiver / decorder	No	2		
7.4	TV - 55-inch Full LED Display (1920 x 1080) incl mounting accessories	No	2		
7.5	F - Connectors	No	4		
7.6	Line Lightning Arresters and Earthing	No	2		
7.7	RG6U Cable	m	40		
	Installation of overhead Projectors				
7,8	Full HD, 1080p, Business Projector	No	1		
7.9	Projector mounting base & all mounting accesories.	No	1		
7.10	Projector Connection Box consisting of: • 1 x USB port • 2 x HDMI ports • 1 x VGA port • 2 x RJ45 ports • 1 x audio port • 2 x single phase socket outlet points	No	1		
7.11	Active Extender Kit. HDMI Display Port to HDMI over CAT 6	No	1		
7.12	Active Extender Kit. VGA Display Port to VGA over CAT 6	No	1		
7.13	2m cable HDMI to HDMI	No	1		
7.14	2m cable - VGA to VGA	No	1		
7.15	2m cable - USB A Male to RJ45 serial Data Cable	No	1		
7.16	2m cable - RJ45 to RJ45	No	1		
7.17	Screened 4 core audio cable	m	500		
7,18	Motorised Projector screen, wall mount	m	1		
	Two way radio system for security guards.				
7,19	Radio Control Station, 2 - Way, VHF 136-174 MHZ, 50 Watt, 128 ch. Complete with antenna installation, charging station (UPS and backup batteries). Licence	No.	1		
7.20	Hand held portable two way radio, VHF 136-174 MHZ, 5 Watt, 16ch	No.	6		
	Control Room Furniture				
7,21	Control Room Console (desk), Construction Material: Rugged all steel, Powder coat paint finish with ventilation louvers for heat dissipation. Capable of integrating various types of equipment such as computers, cables & multiple monitors without affecting the workspace . Dual-surface height adjustment, side cabinets for storage, modular design - for easy expansion or modification, integrated cable management & electrical noise reduction.	No.	2		
7,22	Control Room Chair. 24/7 use, Heavy duty tubular steel frame, Adjustable air lumbar support, Height /tilt adjustable headrest, Adjustable arms, Extra strong gas pressure spring, Up to 180 kg capacity, Heavy duty knee tilt.	No.	2		
	Total Carried To Summary (Excluding VAT)				

NORTH WEST DEPARTMENT OF HEALTH

JST HOSPITAL NEW ICU UNIT

ICU (ICT INSTALLATIONS)

COST SUMMARY

ITEM	DESCRIPTION	TOTAL
1	Bill No 1 - Local Area Network (LAN) Infrastructure	
2	Bill No 2 - CCTV Surveillance System	
3	Bill No 3 - VO-IP Telephone System	
4	Bill No 4 - Access Control System	
5	Bill No 5 - Intercom System	
6	Bill No 6 - Data Network	
7	Bill No - 7 - Ancilliary Equipment	
8	Allow for Ps & Gs	
	Total (Excluding VAT)	

TECHNICAL SPECIFICATION FOR

ACCESS CONTROL

1.0 ANCILLARY EQUIPMENT

1.1 X-Ray Machine Specification

The contractor shall supply, install and commission compliant Dual Energy Imaging X-Ray machines in accordance with the following Specification:

A licence for the X-ray machine, issued in terms of the Hazardous Substances Act (Act 15 of 1973), must be submitted. Plus the ID No's and SABS BIN No. of the service technicians registered to carry out the installation and servicing of the X-ray machine in accordance with the requirements of the SABS.

In addition to complying with the specification the X-ray inspection unit shall meet the requirements of the SA Police Security Advisory Board, Pretoria.

The X-ray inspection unit shall be complete with:

- Dual Energy Detector system (Multi Energy Imaging)
- Colour monitor
- Conveyor belt
- Screening for full profile of inspection tunnel
- Discharge roller table
- UPS, 30minutes backup
- Computer PC

1.1.1 General Specification

- The unit must incorporate a facility to be controlled either from the right or the left-hand side.
- In addition a facility must be incorporated so that, the operating keyboard and monitor can be operated remotely, at least 5m from the unit.
- Maximum height including the tunnel shall not exceed 1400mm from the floor level.
- The unit must be quiet when in operation.

1.1.2 Technical Specification

X-Ray Generator and Image Performance

- Anode Voltage: Rated at 160kV and operate at 140kV.
- Tube Current: 0.7 mA typical
- Orientation: Vertically Upward
- Material Separation: Low Z, Medium Z, High Z to 0.5 Z accuracy
- Cooling: Sealed oil bath with forced air

Operating Environment

- Storage Temperature: -20°C to 50°C
- Operating Temperature: 0°C to 40°C
- Relative Humidity: 5 to 95% non-condensing

System Power:

- 230V ±5%, 50 Hz, single phase power supply
- The maximum running current shall be less than 5A.
- A suitable power point will be provided on the site by others.

Tunnel Size:

- Height: at least 400mm
- Width: at least 600mm
- Length: unlimited

Health & Safety

- Maximum leakage radiation less than 0.1mR/hr (1μ Sv/hr) in contact with outer panels. [Less than 0.1 mR/h at any point on the surface, 5cm from the surface
- Film Safety: For ISO 1600/33 DIN
- FCC & IEC Compliance:
- iso 9001:2000

Computer Specification

- Processor Speed: Intel Pentium® Processor
- Monitor: 24" XVGA colour, high refresh, non-flicker
- Memory: 64 MB RAM minimum
- Video Memory: 16 MB minimum
- Hard Disk Drive: 40 GB minimum
- CD-ROM Drive: 54X
- Floppy Disk: 1.44 MB
- Access to keyboard port and parallel port to be provided by means
- of a lockable access panel on the outside of the machine.

1.1.3 Construction Detail

- The unit must be of steel base construction on roller castors and not exceeding 700kg in total weight.
- The unit shall incorporate a facility to be controlled either from the right or the left-hand side.
- The operating keyboard and monitor shall be operable remotely, at a minimum of 5m from the unit.
- Control elements (pushbuttons, switches, etc.) are to be of sturdy design, selected for severe operating conditions.
- Discharge rollers shall be included with the unit. The discharge roller platform shall be long enough to prevent articles being X-rayed from

falling off before it is retrieved by the owner
- The conveyor belt shall be designed for 24 hour, heavy-duty operation.
- The unit shall not be longer than 900mm wide and 2600mm in overall length, including the conveyor belt platform.

1.1.4 Image Processing

- Monitor display shall cover not less than 500mm of the object length.
- Full scan volume shall be visible on the screen, without any corner cut-off. This is a firm requirement
- Imaging scale of all objects should be constant with the minimum distortion.
- Nine (9), independent zoom sectors. The selected sector shall be identified by light frame before zoom is activated.
- A colour monitor (non-interlaced), screen size of at least 34cm shall be provided. Parallel operation of additional monitors, without modification to the unit, must be available.
- The image on the monitor screen must be flicker free.
- Control of brightness and of contrast shall be provided on the front panel of the monitor.
- Ability to switch between "POSITIVE" and "NEGATIVE" images.
- Dual (Multi) energy colour system with a four (4) colour (Industry Standard) is a firm requirement.
- Organic/Inorganic colour stripping.
- High and low penetration.
- Variable colour stripping and variable gamma edge enhancement.
- Automatic density (variable) threat alert.
- Automatic organic material threat alert.
- Operator log-in identification facility.
- Video output capabilities for recording of images shall be included
- Voltage stabilizer must be included.

1.1.5 Resolution & Penetration

- The image quality on the monitor shall be uniform, without distortion in the centre or the edges.
- Penetration of 25mm steel minimum must be guaranteed.
- A pre-selectable density threat level shall be a feature of the equipment, with a visual and/or audible alarm if any item being screened exceeds that pre-selected density.
- A sample wire with diameter of 0.16mm (AWG 34) must be distinguished on a monitor, and 30AWG wire must be visible behind 29mm of aluminium.
- A digital memory is essential.
- The capacity of the digital memory must exceed 1Mbyte.
- The number of solid state detectors shall be not less than 1152.

1.1.6 Control Operation – Minimum Requirements Controls

- A mains key switch for 230V main power supply is required.
- Push button – power "ON".

- 3 Push buttons for conveyor control, “GO”, “STOP” & “REVERSE”.
- As a minimum, 9 push button keyboard for zoom sector selection and a separate push button for zoom activation is required.
- A robust, RED, emergency stop push button, fitted in a prominent position on the keyboard, as well as on the X-ray unit.
- Light symbols indicating “X-ray on”.
- X-ray warning signs, in accordance with the requirements of the SA Radiation Board, must be attached to each end of the tunnel in a visible position.
- Easy operation of the unit is essential.
- Passage of luggage through X-ray unit
- Objects must be able to be conveyed through the unit in any orientation.
- All objects, also those which are only partially lying flat on the conveyor belt (e.g. guitars, etc.) must be fully screened.
- The conveyor belt speed should be such that each point of an object, when passing through the unit, will be visible for at least 5 seconds

1.1.7 Conveyor Belt

Loading

- At least 75kg overall weight
- The conveyor belt must be driven by an almost noiseless drum-motor.

Dimensions

- Belt length: < 2100mm
- The height of the top of the conveyor belt above floor level shall be not less than 600mm, but shall not exceed 800mm

Speed and duty cycle

- Conveyor belt speed: approximately 0.2 m/sec.
- Up to 2400 objects must be screened per hour.

Operation

- Normal: Continuous operation in forward direction.
- Stop: To stop the belt
- Reverse: Intermitted operation by pressing the reverse button.
- Duty cycle: no warm-up period will be accepted.
- The unit must comply with all ruling international safety regulations such as the German TUV, Swiss SEV, UK NRPB or USA FDA.
- The feed and discharge ends of the conveyor belt are to be of such design that fingers, etc. cannot be caught during normal operation.

Operation under fault conditions

- The X-ray tube shall be automatically de –energised when conveyor belt is stopped.
- X-ray radiation shall only be switched on with the moving conveyor belt, before the object passes through the unit.
- X-ray radiation shall be automatically switched off if the radiation shielding covers are removed.

Film safety

- Tenderers must guarantee the unconditional safety of photographic material of professional quality.

- Typical standards must allow for highly sensitive films of 1000 ASA to be irradiated at least 30 times without damage.

1.1.8 Maintenance, Service and Repair

- The unit design must be of the low maintenance type and with minimum future service. A statement confirming this is required from the tenderer, together with a copy of the service/maintenance schedule.
- An overall design of modular type is preferred.
- Electronic modules must be easily exchanged.
- All sub-assemblies in the unit must be of such a design that, maintenance and repair can be carried out by a single person, including removal and exchange of the X-ray generator tanks.
- Spare parts must be locally stocked and availability guaranteed for a ten-year period, starting from the date of delivery.

Guarantee and Service

The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from the date of delivery to site, and successful commissioning of the unit.

During the period of guarantee, the successful tenderer shall, at his own expense, carry out all necessary repair work, including material and labour, (excluding work required due to damage by others) in order to maintain the unit in a working condition.

The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department, within 24 hours after he has been notified that the unit is not operating.

Training

The successful tenderer shall thoroughly train and instruct all the operators and supervisors, designated by Carletonville SAPS in the operation of the unit.

A two part training programme must be incorporated in the system.

Part 1 – Initial training

Pre-loaded images must be recalled by the computer, some without and some with threats. The operator must detect the threats and his progress is logged.

Part 2 – Ongoing training

The system must merge fake threat images into real time images and the performance of the operator must be logged.

1.1.9 Manuals

Three complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

a. Operating instructions
b. Technical description with diagrams and instructions for maintenance and repairs.

1.2 Walk Through Metal Detector Specification

1.2.1 Technical Specification

- Detection System: Multi Zone
- Power Supply: 240V AC 50Hz, 2A Maximum
- Battery Backup: 45 min
- Operating Temperature: 0-40°C
- Relative Humidity: 80% Non-condensating
- Min Walk through Height: 2000mm
- Min Walk through Width: 720mm
- Throughput: 50 persons per minute

1.2.2 General and Minimum Features

In addition to complying with the specification, the metal detector shall meet the requirements of the S.A. Police Security Advisory Board, Pretoria.

The metal detector shall consist of a free standing walk-through frame with an integral control unit, and shall be suitable to detect metallic objects on a person by means of the magnetic field principle.

The metal detector shall be suitable to detect ferrous and non-ferrous metals.

The metal detector shall be equipped to eliminate false alarms.

The metal detector shall scan the entire area of the walk through area and detect metal objects on a person passing through to the levels as specified.

The metal detector shall incorporate self-test button to confirm that the system is operating correctly.

The metal detector shall be completely tamper proof.

The programme and sensitivity push buttons shall be so arranged that tampering by unauthorised persons is entirely eliminated.

The metal detector shall not be adversely affected by stationary metal bars or structures in the vicinity of the unit or moving metal near the archway.

The metal detector shall be capable of operating adjacent to an X-Ray inspection unit.

The detector is intended for indoor use at an altitude of up to 1800m above sea level.

The detector shall be capable of operating in the following conditions:

Min. temperature: 0ºC

Max. Temperature: 40ºC

Max. Relative humidity: 80%

The operation of the metal detector shall not be adversely affected by repositioning of the frame within certain limits of its original adjusted position.

The metal detector shall have multi-zone vertical detection zones for the full height of a person. Each zone shall have a display bar with proportional indication on the vertical sides of the metal detector.

1.2.3 Construction

The metal detector shall comprise a free standing walk-through frame containing the detector coils and the control unit, complete with a 5m length of flexible cable and 16A 3-pin plug top. The cord and plug top shall comply with the relevant SABS specifications.

The frame and the control unit shall be of robust construction and the base of the frame shall be designed to ensure rigidity.

The unit shall be able to execute a full body scan and detect metal objects down to the lower feet level within the settings specified.

The finish shall be durable and maintenance free.

The type of material used for the construction of the frame and control unit must be stated by tenderers.

The colour range in which the metal detectors are available must be stated by tenderers. The Department will select a colour finish to suit the environment.

All material consisting of metal shall be treated against corrosion.

The approximate internal dimensions of the frame shall be as follows:

Walk-through height: 2m

The walk through width: 720mm.

The system shall operate by means of automatic level control adjustable to environmental changes, without the need to reset.

The control unit shall be equipped with the following:

"ON-OFF" main switch and "MAINS ON" indicator light.

Selector switch with at least ten sensitivity settings, with a maximum sensitivity to consistently detect metal at least the size of a R5 coin.

The sensitivity settings shall be consistent at average walking speed.

Visual indication in the form of vertical display bars shall give an indication of the volume of metal on a person in accordance with the sensitivity settings. When the "ALARM" zone is activated it shall simultaneously activate an audible alarm having a continuous tone and adjustable volume. The alarm system will automatically reset after the metal has passed through the frame.

The system shall be modular to facilitate maintenance and repairs.

All electronic and electrical components shall be protected by lockable panels.

The detectors shall not have any effect on heart pacemakers.

The detector shall not affect magnetic storage media or camera film.

The detectors shall be designed for connection to a 230V +/-5%, 50Hz, single phase, three wire (phase, neutral and earth) power supply.

The existing connection points on site comprises standard 16A, 3-pin, socket outlets.

A suitable and efficient battery back-up system to facilitate power failures of up to 45 minutes must be incorporated in the detectors.

The system shall accept a passage of at least 50 persons per minute without functional overload.

The detector shall be placed in position, tested, commissioned and adjusted to the user Department's requirements by the successful tenderer.

NOTE: The final positioning will be determined on site.

The system must be arranged so that the traffic-flow is channelled through the metal detector.

1.2.4 Maintenance

The unit must be relatively maintenance-free and with minimum future service. A statement confirming this is required from the tenderer.

Electronic modules must be easily exchangeable.

Spare parts must be locally stocked and availability guaranteed for a ten year period starting from date of delivery.

The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from date of delivery of every unit to site.

During the period of guarantee the successful tenderer shall at his own expense, carry out all necessary repair work including material and labour (excluding work required due to damage by others) in order to maintain the unit in a working condition.

The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department within 24 hours after he has been notified that the unit is not operating.

After the lapse of the initial twelve-month period of servicing under the guarantee, the successful tenderer may be required to enter into a service agreement with the Department.

1.2.5 Training

The successful tenderer shall thoroughly train and instruct operators designated by the user Department in the operation of the unit.

1.2.6 Brochures

Brochures furnishing descriptions and technical specifications, etc., of the unit offered shall be submitted with the tender.

1.2.7 Manuals

Two complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

a. Operating instructions
b. Technical description with diagrams and Instructions for maintenance and repairs.

1.3 Electronic Door Access Control System

1.3.1 Access Control Server

A redundant server configuration shall be provided, and shall comply with the following minimum specification:

- Chassis: 2U Industrial Mount Chassis with 2 Cabled HDs and Quad-Pack LED Diagnostics
- OS: Win Server 2016
- Licenses: Windows Server 2016, 5 CALs
- Optical Drives: 16X DVD-ROM Drive SATA
- RAID Controller: PERC S300 Internal Software Controller, 3Gb/s
- RAID-5 Standard configuration
- Raid Connectivity: C3 MST R1 with PERC S100 (Embedded SATA Software RAID
- Graphics Card: 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1
- Hard Drive Capacity: 24T per Module. 7200rpm 3.5”
- No. of Gigabit Ethernet ports: 2 x TCP/IP
- Archiving: Internal DVD Writer
- Simultaneous Recording Streams: Continuous 64 Video Streams at 6Mbs per stream
- Processor: Intel Pentium G6950 Dual Core
- Memory, minimum: 4 GB, DDR3-1333 ECC UNB (2 x 2 GB)
- Cache: 4 MB L2 Cache
- DVD: 1x 8/24X Slim line
- SCSI Host Bus Adapter: Single Channel U320 adapter for external storage connectivity

- The server installation shall support 64 bit operating system
- Ethernet Adapter: Network Dual Intel® 82574L Gigabit LAN
- Power Supply: Output rated steady state supply 1000W

1.3.2 Access Control Workstation (Enrolment and Management)

Chassis: Mini-Tower

- Processor: Intel® Xeon® Seven Core Processor
- Memory: 8G
- Hard Drive: 500GB, 7200 Rpm, Serial ATA II (Excl recording)
- HD Controller: Integrated Intel chipset SATA 3.0Gb/s
- HD Configuration: All SATA drives, No RAID
- Network Adapter: Intel, 1Gbps, PCI Express with SNTP and DMI2 support
- Operating System: Microsoft Windows 10
- Ports: 1 x USB 3.0 and 3 x USB 2.0
- Optical Drive: 16X DVD+/-RW Drive
- Graphics Adapter: 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1DVI
- Max Monitors/Server: Two (3)
- Monitor: 32"LCD HAS Wide Monitor, VGA/ DVI Inputs, Res 1680 x 1050 pixels
- Max Images/Server: Twenty Five (25)
- Max CPU Usage: 50% with 25 simultaneous Images
- Workstations shall support multi-monitor operation, allowing an operator to have up to three monitors for each workstation.

1.3.3 Access Control Software

Specification

- Capability to connect an unlimited number of 1, 2 or 4 door controllers.
- System must support or use NON-PROPRIETARY readers
- Inputs must be based on the industry standard Wiegand format.
- Individual door sensor/monitoring inputs for each door
- Individual request to exit RTE inputs for each door
- Support of unlimited number of control panels and doors on same system
- Audit trail customizable by date, department, user, and/or by door.
- Industry standard 26 bit Wiegand interface to work with any combination of Card readers, keypads, fingerprint reader, bar-code reader, etc. with Wiegand output.
- Real time monitoring through software for alarms, duress, invalid card reads, door propped, and door forced events.
- Anti-pass back
- Storage capacity: 20,000 users and 100,000 events
- Real time monitoring and management interface.
- Remote locking and unlocking of any one or all doors

1.3.4 Door Controllers

Specification

- Must be capable of controlling 2 doors, expandable , 1 bidirectional turnstile
- 32-bit High Speed Processor
- Must support up to 10 Wiegand Card Readers
- Anti-Passing Back, Authentication Password with Keypad Card Reader
- Log Search with Video Playback
- Must have min 4 relay outputs (potential free contact/powered output) & 8 programmable digital inputs. (say for fire alarm and tamper inputs)
- 15Vdc 5A power supply with a battery backup of 7Ah
- Must be mounted in a secure enclosure with a lockable
- Offline operation; intelligence at door controller.
- Offline transactions that is kept up to 180 days.
- Offline system logs that is kept for up to 90 days.
- 8 digital inputs.
- Dedicated Fire and Tamper Inputs.
- On-board time/date battery backup.
- Mains monitoring.
- Secure enclosure designed for easy installation.
- 3 expansion headers for expansion modules.
- RS-232 and TCP/IP communications onboard.
- Card capture/drop-box function available on reader.
- 2 pushbuttons or egress overrides per door provides
- Offline event / action combinations.
- Network-capable programming for easy product updates.
- Auxiliary 12Vdc output.
- SD Card used for data storage.

1.3.5 Single Sided Reverse Transfer printer and Card Issuer

The printer is for printing on smart cards and proximity cards with embedded electronics

Specification

HDP Dye-Sublimation / Resin Thermal Transfer
300 dpi (11.8 dots/mm) resolution
100 card input hopper
200 card output hopper
Single sided printing

1.3.6 Biometric Fingerprint Reader (Dual: Card & Finger reader)

Specification

- Combination Device: Must include both smartcard & fingerprint technologies.
- Patented active capacitance sensing technology
- Protective coating allowing more than 10 million rubs
- EMV Level 1 certified
- Compliant with major smart cards and relevant industry standards
- Interface USB 3.0 Full speed
- Operating System: Windows 10
- Fingerprint Sensor: AES2550 AuthenTec slide sensor
- Sensor Technology: Trueprint® Subsurface RF Technology
- Image Resoultion: 500 Pixels per inch
- Image Area: 9.75mm X 0.41mm / 192 X 8 pixels
- Surface Coating: Scratch Resistant, Withstands more than 10 million rubs Advanced 6-H hardness durability coating
- ISO Standards: ISO / IEC 7816 T=0 and T=1
- Communications: Up to 8Mhz smart cards, and a 412 kbit/s communication speed

1.3.7 Magnetic Lock

Specification

- Must have instant release circuit with no residual magnetism
- Surface mount
- Sealed electronics - tamper proof and weatherproof
- Architectural brushed stainless steel finish
- All ferrous metal surfaces plated to MIL specification
- Mounting brackets, housings and dress covers
- Integrated door position switch
- Holding Force: 800kgs
- Current Draw and Voltage: 350mA at 12VDC; 200mA at 24VDC
- Current Operating Temperature: -40 to +140F [-40 to +60C]

1.3.8 Electric Strike

Specification

- Surface mounted
- Must be able to fit on Aluminium, Hollow Metal or Wood frames
- Voltage 12/24 VDC

- 450 mA at 12 VDC/250 mA at 24 VDC
- Stainless steel construction
- Tamper-resistant
- Static strength 1,500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1 million cycles
- Field selectable fail secure/fail safe
- Horizontal adjustment
- Non-handed
- Internally mounted solenoid

1.3.9 IP Video Door Station

- Full Stainless-Steel, Surface Mount
- TCP/IP Ethernet.
- Must be able to work with maglock or electric strikes

TECHNICAL SPECIFICATION FOR CCTV SURVEILLANCE AND RECORDING SYSTEM

OVERVIEW

- The intent of this document is to outline the minimum requirements for the design, supply, delivery, installation, testing, commissioning and maintenance of the proposed CCTV Video Surveillance & Recording System
- The System shall be of open-architecture, PC and Windows based Operating Systems
- The System shall comply to the strict regulation and adapting state-of-the-art security technologies, the highest level of reliability, and integrate to the 1G networking infrastructure
- The main function of the System shall be to monitor all designated doors, passages, areas and gates
- The System shall provide and require a single security license key for system operation.
- The System shall provide the functions and specifications described in this document.
- The proposed overall system design and operation shall be user friendly and only require minimum training to allow an operator to perform his daily routine with minimum supervision required.
- All proposed security field devices installation shall not only operate functionally, they have also to blend with the interior design of the building.
- Installer shall liaise directly with the architect to ensure such requirements are harmonized.
- The system has been designed to allow foreseeable organizational changes and procedural changes beyond current plans
- Additional hardware units shall easily be added without any modification to the existing hardware, software and network configuration,
- All systems shall provide at least 10% spare for future expansion and connection.
- Footage shall always be readily available upon request based on date, time and
- The footage must be digitally signed

SCOPE OF WORKS

- The scope of work for this sub-contract shall include procurement, installation and associated services for a fully operational CCTV Video Surveillance & Recording System as per the drawings and manufacturer's equipment guidelines
- All equipment supplied by the sub-contractor shall be installed, configured, programmed, tested and commissioned, as specified herein and shown on the sub-contract drawings and the equipment schedules.
- The sub-contractor shall supply all materials and services necessary for or incidental to the installation and commissioning of the systems.
- The entire CCTV Video Surveillance & Recording System including all its hardware, peripherals, software and software licenses as specified within this document shall be supplied and provided as part of this sub-contract.
- The extend of the sub-contract works shall include all cabling necessary to interconnect the various network components, central equipment and cameras as specified in this sub-contract document.
- All cable enclosures including conduits, cable trays, ducts, wall boxes, termination panels and the like that are required to facilitate and complete the installation shall be supplied and installed as part of this sub-contract.
- The sub-contractor shall liaise directly with the main contractor; architect; civil engineer, and other sub-contractors at site in coordination of the installation work.
- All installations carried out by the sub-contractor shall conform to the national standards and code of practices.
- The sub-contractor shall cooperate and work closely with the appointed site safety officer to ensure safe working environment at all times.
- The sub-contractor shall upon completion of the installation provide complete training with documentations on the configuration, operation and maintenance of the systems to the required operators
- The sub-contractor shall supply all training materials, operational manuals, as-built drawings, diagram, negatives, printed materials, magnetic and optical storage disk as specific in the sub contract document.
- All equipments, systems and materials furnished and installed in this sub contract shall be in accordance with the applicable standards.
- All components, parts, and assemblies supplied and installed by the sub-contractor shall be warranted against defects in material and workmanship for a period of at least 24 months which include parts and labour.

1 Closed Circuit Television System (CCTV)

1.1 Introduction

The Contractor shall provide a fully IP based CCTV Solution as part of the project scope of works, consisting of Direct IP enabled cameras, Network Video Recording Servers and Video Wall Servers, all of which shall be seamlessly integrated to the Video Management System Servers and operator workstations.

Leading brand IP Video Management hardware shall be provided, and the CCTV components selected shall require the prior approval of the Engineer prior to purchase. The contractor shall provide a complete closed circuit television system to comply with the requirements as detailed in the specification and accompanying drawings.

The IP based video solution shall be networked via a 1GB High Speed Security Ethernet network as detailed in the specification.

1.2 General Camera Specifications

- The camera shall be based upon standard components and proven technology using open and published protocols. Support Gigabit Ethernet (802.3ab) and PoE (802.3af) network interfaces for streaming video and control data over standards compliant networks.
- The camera shall be designed for commercial/industrial 24/7/365 use
- All cameras must be able to adequately cope with variable lighting conditions and in scenes where simultaneous low and high light exist concurrently
- Shall have I/O terminals for connecting alarm inputs and alarm outputs
- The camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.
- The camera shall provide support for both IPv4 and IPv6
- The camera shall support Quality of Service (QoS) to be able to prioritize traffic.
- Support user configuration of network parameters including: Static IP address; Subnet Mask; Gateway; and Control Port for control communications.
- Quality Assurance
- All camera installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
- All equipment provided shall be backed by a minimum of three years manufacturer warranty.

- The manufacturer shall provide the option of extended warranty for the camera.

- The optional extended warranty shall be available in two-year extension blocks for a total warranty period of maximum five years.

- The minimum mean-time between failures (MTBF) for all the cameras should be 100 000hrs.

Environmental Sustainability

- The specified unit shall be manufactured in accordance with ISO 14001.

- The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

- The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).

Certifications and Standards:

- The camera shall meet the following certifications and standards:

EMC Approvals:

- EN55022 Class B
- EN55024
- FCC Part 15 - Subpart B Class A + B
- VCCI Class B
- C-tick AS/NZS CISPR22 Class B
- ICES-003 Class B

Product Safety

- IEC/EN/UL 60950-1
- IEC/EN/UL 60950-22

Video

- SMPTE 296M (HDTV 720p)
- SMPTE 274M (HDTV 1080p)
- ISO/IEC 14496-10 MPEG-4 Part 10, Advanced Video Coding (H.264)
- ISO/IEC 14496-2 (Profiles ASP and SP) (MPEG-4 Part 2)

Networking:

- IEEE 802.3af/802.3at (Power over Ethernet)
- IEEE 802.1X (Authentication)
- IPv4 (RFC 791)
- IPv6 (RFC 2460)
- QoS – DiffServ (RFC 2475)
- Network: 100BASE-TX
- Cabling CAT-6a
- Connector RJ-45
- Security SSL
- Protocols UDP, TCP, SOAP, DHCP, Zeroconf

Mechanical Environment

- IEC 60529 IP66
- NEMA 250 Type X
- IEC/EN 62262 IK10
- IEC 60068-2-1
- IEC 60068-2-2
- IEC 60068-2-14
- IEC 60068-2-27
- IEC 60068-2-64
- IEC 60068-2-78

Network Video

- ONVIF Profile S or ONVIF Version 1.01 or higher

Power requirements

- Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3

Functional Requirements

Transmission: The camera shall allow for video to be transported over

- HTTP (Unicast)
- HTTPS (Unicast)
- RTP (Unicast & Multicast)
- RTP over RTSP (Unicast)
- RTP over RTSP over HTTP (Unicast)

PTZ Functionality:

The camera shall:

- Provide at least 100 pre-set positions.
- Incorporate guard tour functionality.
- The camera shall support function for control of PT devices from third-
- party manufacturers.

Event Functionality

The camera shall be equipped with an integrated event functionality, which can be trigged by:

- Live Stream Accessed
- Tampering
- Video Motion Detection
- Audio Detection
- External Input
- Temperature
- Fan malfunctioning
- Schedule
- Manual Trigger/Virtual Inputs
- PTZ functionality
- Embedded third party applications
- Edge storage disruption detection

Response to Triggers

Shall include:

- Send notification, using HTTP, HTTPS, TCP or email
- Send images, using FTP, HTTP, HTTPS, network share or email
- Send video clip, using FTP, HTTP, HTTPS, network share or email
- Day/Night Vision Mode
- Play Audio Clip
- Activate External Output
- Send SNMP trap message
- PTZ control functionality

Protocol Support:

The camera shall incorporate support for at least

- IP, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP, CIFS/SMB and Bonjour.
- The SMTP implementation shall include support for SMTP authentication.

Security:

The camera shall:

- Support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.
- The camera shall provide centralized certificate management, with both pre-installed CA certificates and the ability to upload additional CA certificates. The certificates shall be signed by an organization providing digital trust services.
- Support IEEE 802.1X authentication.
- Provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.
- Restrict access to the built-in web server by usernames and passwords at three different levels.

1.3 Detailed Camera Specifications

Camera; Fixed Bullet - Indoor Network Camera

1.3.1.1 Technical Specification

4MP day/night fixed bullet camera with Image sensor: 1/3” progressive scan, RGB CMOS; Automatically removable infrared-cut filter Lens; Varifocal, remote focus and zoom, IR corrected, P-Iris, 3-10 mm/F1.4; Horizontal angle of view: 92°–42°; Vertical field of view: 50°–23°;Minimum illuminance: 0.05 (colour),0.01 (B/W), low light sensing; Shutter time: 1/100000 to 2 s; Video compression: H.264 (MPEG-4 Part 10/AVC) & Motion JPEG; Maximum video resolution: HDTV 1080p, 1920x1080 (2 MP); Frame rate: Up to 50/60 fps (100/120Hz, no WDR) in all resolutions; Audio: Two-way, External microphone or line input, line output; Alarm in/out: 1/1; Detection: Motion, Audio, Tamper; Security: Multi-level passwords, IP filtering HTTPS encryption IEEE 802.1X; Network: IPv4/v6, QoS; Power: IEEE 802.3af/802.3at (class 1 & 3); Vandal resistant; IP66 and NEMA 4X ratings; Wide Dynamic

Range (WDR), Forensic Capture: Up to 120 dB; Digital PTZ, preset positions; Pixel counter; Memory card slot, including 64GB Class 10 memory card; AVHS(1); ONVIF; Corridor Format; Multi-view streaming; IR illumination, Range up to 50 m; complete with mounting brackets, power supply, in accordance with specifications

1.4 Network Video Recorders (NVR's)

The Contractor shall provide a fully IP based Video Recording System whereby all images are stored on Digital Video Recording Servers. NVR's shall be connected directly to the appropriate 24 Port managed switches within the equipment cabinets.

The managed Ethernet switches shall be configured to limit the Video traffic onto the incoming 10Gb uplink ports on the switches, by restricting outgoing streams to those required for live video feeds based on Operator selection, and recorded video footage being reviewed by Central Operator Workstations or the Operations room.

In order to minimize traffic on the 10 GB uplink ports, the allocated recording stream on each of the Direct IP cameras or IP Video Servers shall be assigned to the IP address of the Network Video Recorders within the local subnet.

Licensing shall be provided on a once off basis. Systems requiring periodic re-licensing fees shall not be accepted.

Technical Specification

System Hardware Servers

- Must be 2U modules
- RAID-5 Standard configuration
- Capacity: 64TB
- No. of Gigabit Ethernet ports: 2 x TCP/IP
- Archiving: Internal DVD Writer
- Mounting: 19" 2U Rack – Horizontal mount
- Simultaneous Recording Streams: Continuous 64 Video Streams at 6Mbs per stream
- Processor: Intel Pentium G6950 Dual Core
- Memory, minimum: 4 GB, DDR3-1333 ECC UNB (2 x 2 GB)
- Network Dual Intel® 82574L Gigabit LAN
- Cache: 4 MB L2 Cache
- DVD: 1x 8/24X Slim line
- SCSI Host Bus Adapter: Single Channel U320 adapter for external storage connectivity
- NVR OS: A suitable OS and NVR software shall be installed that will allow multi-channel remote live viewing, playback, export and archiving.
- The server installation shall support 64 bit operating system
- Ethernet Adapter: PCI Gigabit Adapter
- Power Supply: Output rated steady state supply 1000W

1.5 CCTV Monitors

The Contractor shall provide two monitor types within the scope of the Security Contract as follows:

All operator workstations shall be of robust construction, ergonomically designed to minimize operator fatigue and conform to the following minimum requirements:

- Screen: An effective viewing screen size of 32".
- Character set: ASCII with near letter quality fonts with crisp, fully formed characters.
- Contrast: Sufficient brightness and contrast to be easily readable by an operator with average vision, but not to cause burn-in of fixed display on screen. Screen saver functionality shall be provided to prevent burn-in.
- Mounting: Semi-sunken mounting at 45º in an industrial frame complete with cooling fan and intercom console.
- Power: 230 VAC 50 Hz.

1. High Resolution 32" LCD Monitor

Each Operator shall be equipped with 3x 22"LCD. The monitors shall be driven by the Operators Work Station.

2. High Resolution 55" LCD Monitor

The Operators Control Room shall be equipped with 2x 55" LCD Monitors. The two monitors shall be driven by the Large Video Wall Server detailed in Clause 2.9.2 below.

1.5.1 32" LCD Monitor Technical Specification

- Viewing Image Size: 32" LED TFT (Active Matrix)
- Input: Analogue (Composite) + Digital (SVGA) + HDMI
- Contrast Ratio: 800:1
- Minimum Resolution: 1680 x 1050
- Pixel pitch: 0.255mm
- Minimum Viewing Angle: 160º/160º
- Scanning Frequency: 30-81kHz
- Brightness: 300 cd/m2
- Response Time: 5ms

1.5.2 55" LCD Monitor Technical Specification

- Viewing Image Size: 55" LED TFT (Active Matrix
- Input: Analogue (Composite) + Digital (SVGA) + HDMI
- Contrast Ratio: 800:1
- Minimum Resolution: 1366 x 768
- Pixel pitch: 0.650mm
- Minimum Viewing Angle: 170º/170º

- Scanning Frequency: 30-70kHz Horizontal, 50-85 Vertical
- Brightness: 500 cd/m2
- Response Time: 8ms

1.5.3 Keyboards

- Keyboards shall be supplied for all workstations, however shall only be used for commissioning and maintenance purposes.
- All operator functions shall be performed by means of an optical mouse, with system screens being designed so as to require the minimum operator action.

1.5.4 Mouse

- All mouse devices shall be optical of robust construction and suitably secured by an interconnecting cable.

1.6 Video Wall and Servers

The Contractor shall provide two video wall types within the scope of the Security Contract as follows:

1.6.1 Small Video Wall server: To drive the 2 x 24" Monitors

The Operators Room shall be equipped with an Operator Workstation configured in the default 2x 24" LCD Monitor layout. The operators work station shall be capable of displaying its Graphical User Interface, Live, Sequenced and Recorded Video images over the two (2) high resolution 32" LCD Monitors.

All two monitors shall be driven by the Operator Workstation.

Left Monitor: Up to twenty (20) Individual Live, Sequenced and recorded video images displayed as required by the operator. The image layout shall be configurable with the ability to select various tiled modes including 1,4,6,8,9,10 and 16 tiles. Operators shall be able to drag any camera icon from the Graphical User Interface onto the Left monitor as required.

Right Monitor: Up to four (4) Individual Live or recorded images displayed as required by the Operator. The image layout shall be configurable to display either a single image in full screen mode or four images in quad mode. Operators shall be able to drag any camera icon from the graphical User Interface onto the right hand monitor or into any one of the quad positions. In the default Mode the monitor shall be configured as a spot monitor whereby the operator is able to left mouse key on any camera icon on the GUI, and the images shall appear in full screen mode on the monitor.

1.6.2 Large Video Wall: To drive the 1 x 55" Monitor

In addition, a 55" Monitor video wall monitors shall be provided and mounted on the rear wall in front of the operator consoles at a distance of 3 meters.

The monitors shall be driven by an Large Video Wall servers, the images upon which shall be freely configurable with the ability for a System Supervisor to drag video images onto any of the two monitors at will.

The Video Wall shall enable the simultaneous display of up to 50 Live and recorded Video Images.

1.6.3 Operator Workstation: Technical Specification

Operators and Management Workstations

Chassis: Mini-Tower

- Processor: Intel® Xeon® Seven Core Processor
- Memory: 16G
- Hard Drive: 1 TB, 7200 Rpm, Serial ATA II (Excl recording)
- HD Controller: Integrated Intel chipset SATA 3.0Gb/s
- HD Configuration: All SATA drives, No RAID
- Network Adapter: Intel, 1Gbps, PCI Express with SNTP and DMI2 support
- Operating System: Microsoft Windows 10
- Ports: 1 x USB 3.0 and 3 x USB 2.0
- Optical Drive: 16X DVD+/-RW Drive
- Graphics Adapter: 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1DVI
- Max Monitors/Server: Two (3)
- Monitor: 24"LCD HAS Wide Monitor, VGA/ DVI Inputs, Res 1680 x 1050 pixels
- Max Images/Server: Twenty Five (25)
- Max CPU Usage: 50% with 25 simultaneous Images
- Workstations shall support multi-monitor operation, allowing an operator to have up to three monitors for each workstation.

1.6.4 Large Video Wall Server: Technical Specification

A redundant server configuration shall be provided, and shall comply with the following minimum specification:

- Chassis: 2U Industrial Mount Chassis with 2 Cabled HDs and Quad-Pack LED Diagnostics
- Processor: Intel® Core™ i7-10750H Processor or better. 6 Core
- Memory: 16G
- Ethernet Adapter: Intel® 82599EB 10 Gigabit Ethernet Controller. Gigabit LAN
- Hard Drive: 1 TB, 7200 Rpm, Serial ATA II (Excl recording)
- OS: Win Server 2019
- Licenses: Windows Server 2019, 5 CALs
- Optical Drives: 16X DVD-ROM Drive SATA

- RAID Controller: PERC S300 Internal Software Controller, 3Gb/s
- RAID-5 Standard configuration
- Raid Connectivity: C3 MST R1 with PERC S100 (Embedded SATA Software RAID
- Graphics Card: 1.5GB NVIDIA® Quadro® FX 4800, DUAL MON, 2DP & 1
- Hard Drive Capacity: 24T per Module. 7200rpm 3.5”
- No. of Gigabit Ethernet ports: 2 x TCP/IP
- Archiving: Internal DVD Writer
- Simultaneous Recording Streams: Continuous 64 Video Streams at 6Mbs per stream
- Processor: Intel Pentium G6950 Dual Core
- Memory, minimum: 16 GB RAM
- Cache: 4 MB L2 Cache
- DVD: 1x 8/24X Slim line
- SCSI Host Bus Adapter: Single Channel U320 adapter for external storage connectivity
- The server installation shall support 64 bit operating system
- Power Supply: Output rated steady state supply 1000W

1.7 Control Room Chair

Features

- Engineered for 24/7 use
- Heavy duty tubular steel frame
- Adjustable air lumbar support
- Height /tilt adjustable headrest
- Adjustable arms
- Extra strong gas pressure spring
- Up to 180 kg capacity
- Heavy duty knee tilt

Specification

- Height: 101 – 113 cm
- Width: 71cm
- Depth: 71cm
- Seat height: 42 – 53 cm
- Seat width: 47cm
- Seat depth: 46 cm
- Back height: 60 cm
- Back width: 48cm
- User Stature: Height: 1,54m to 1,85m and up to 180kg weight

1.8 Control Room Console (Desk)

Specification

- Primary Application: Heavy continuous use. 24 x 7 x365
- Construction Material: Rugged all steel
- Weight: 245lbs (111.13kg)
- Surface quality: Powder coat paint finish; tough protection from chips

- Ventilation: Must have ventilation louvers for heat dissipation. The metal (construction material) dissipates internal heat. Prolongs electronic equipment life span
- Enclosures: Must have side cabinets for equipment
- Design: Must be modular for easy expansion or modification
- Cable management: Must have built in cable management and electrical noise reduction.

TECHNICAL SPECIFICATION FOR

NETWORK CABLING

1 Cabling

1.0.1 General

Supply, install, connect, and terminate all cabling necessary to complete the installation, including all power & UPS distribution, data, control, fibre-optic, communications cabling and device cabling.

All cabling shall be supplied and installed as a part of this Sub-contract.

All terminated cabling shall be neatly tied/loomed to prevent damage to terminations and interference or obstruction of other services.

Strain relief shall be provided for cables connected to rack mounted equipment.

All cables shall have stranded copper conductors and shall be PVC insulated with overall PVC sheath, unless otherwise specified.

All cabling shall be concealed and installed on metal cable trays, cable ducts and galvanized conduits.

Cabling shall be installed with due regard to future removal and replacement of cables.

All cables shall be new and delivered on site in unbroken reels, and with the "manufacturer's" label attached.

Due consideration has been given to voltage drop on cable sizing.

Installation and cable route shall be to the satisfaction of the Engineer.

Cables shall be installed in a manner eliminating any possibility of strain on the cable itself or on cable terminations.

No joints or connections will be permitted. Adequate loose cable shall be left behind all equipment to facilitate removal for inspection, adjustment or replacement.

1.0.2 Cable Damage

During the installation of cable should any kinks or abrasions to insulation, braiding, sheathing or armoring occur, the affected cable shall be withdrawn and replaced with new.

1.0.3 Cables in Ceiling Space

Cables shall be supported at intervals not exceeding 1000 mm utilizing catenary wires, approved trimmers, roof or ceiling support members.

Cabling in major cable routes shall be installed on cable trays.

A minimum clearance of 400 mm shall be maintained from false ceilings, luminaries, hot water pipes or other heat or electrical noise generating equipment.

Cables shall be neatly grouped together and supported using approved clips or ties.

1.0.4 Cables in Conduits

In addition to the general requirements, cables shall be installed in conduits in such a way to prevent twisting or kinking of cables or damage to cable sheaths.

Communications, data or security cables installed in underground conduits shall be complete with external nylon jacket.

1.0.5 Cables in Ducts

Where cables are installed in ducting, cables shall be grouped and taped for easy identification.

Holes in duct through which cables pass shall be grommetted.

Changes in direction of duct shall be set such that the maximum bending radius of cables enclosed in the duct will not be exceeded.

1.0.6 Cables on Trays

Cables shall be neatly loomed, securely fixed to the tray and installed parallel with the edge of the tray.

Cables shall be arranged on the tray to:

a. Avoid unnecessary crossover of cables,
b. Spaced to allow adequate ventilation and prevent heating of cables, and separated to provide segregation between independent services.

1.0.7 Cable Numbering

Generally all cables shall be allocated and identified with unique cable number.

All cables including patch leads shall be clearly labeled. Labels shall be affixed within 250 mm of each termination.

Cables shall be fitted with tags at the following points:

a. On the cable sheath next to the gland at each end.
b. In cable pits.
c. At any additional point on the cable sheath (or around the core bunch) where the preceding requirements are not readily traceable from the core terminations.

Cable identification tags shall be orientated uniformly to read left to right from the logical viewing point horizontally; and from bottom to top viewed from the right where installed vertically.

Duplication of cabling and equipment identities shall be avoided.

1.0.8 Co-ordination and Separation of Services

Install services for each respective section and system and physically separate from other systems to a discipline and coordinated layout plan. Adjacent services shall run approximately parallel. Crossing services shall cross at approximate right angles.

Individual services between common points of the work shall follow similar parallel routes. Cables shall be parallel to the building major axes.

Separation distances shall not be less than the following:

a. Power cables - 100mm
b. ELV and Communication cables to parallel power cables - 300mm
c. ELV and Communication cables to power cables crossed at 900 - 100mm
d. Any trade to finish floor level - 80mm
e. Any trade to structure - 20mm

1.0.9 Co-ordination and Feasibility

The drawings, schematics and specification indicate the main routes and positions for the various services installations and equipment in relation to the building and other services.

Check the details shown on the drawings and co-ordinate the detail layout with the building structure and other services. Submit full details of proposed major cable routes for approval before proceeding.

1.0.10 Special Cabling

Where equipment to be supplied and installed under this specification requires special cabling (i.e. screened cables, unshielded twisted pair, coaxial, optical fibre or other special types of cable), these cables shall be provided as part of this Sub-contract.

2 Wiring Diagrams

Deliver to the Engineer in accordance with the scheduled works programme:

a. Details of all types of cabling to be installed as part of the Sub-contract works.
b. Block schematic cable diagrams indicating all system interconnecting cables including cable routes and cable types complete with core make up and numbers.
c. Detailed floor plans indicating cable routes and designated circuit identification.
d. Wiring diagram detailing system interconnections and cable/core identification.

3 Fibre Optic Cabling

The backbone, OM4, multi-mode fibre optic cabling and conduit system between floors shall be installed in a star topology switches housed in various floor equipment racks to the core switch in the server room.

3.0.1 Other Security Services Fibre Optic Requirements

Fibre optic cable shall be supplied and installed in the quantities and locations indicated on the drawings as part of these works.

3.0.2 General

A fibre-optic cabling network shall be provided for the connection and integration of all the Electronic services. The dedicated security services fibre optic cables will be terminated as part of this contract at 19" equipment racks or equipment cabinet installed on the ground and first floor. Patch fibers to extend the fibre cable from the equipment racks or cabinets at which the cable terminates to the security equipment racks shall be provided in a ST terminal array. Optical fibre fly-leads to connect security services equipment to this point shall be supplied and installed by the security services sub-contractor. The nominated security services element of the fibre optic cable network shall be utilized solely for the distribution of security services. An excess of three meters of fibre must be left, neatly coiled up at each termination to provide spare fibre for any re-termination work in the future. Cables shall be broken out into an approved Fibre Optic Termination Panel (FOTP) as per the cable manufacturer's specifications. Optical pigtails shall be terminated on the trunk side of the patch panel, using ST Bulkheads.

3.0.3 Fibre Optic Termination Panel (FOTP)

All FOTP shall be 19" rack mountable, or mounted in a suitable enclosure in the equipment racks and equipment enclosures. Security services FOTP in buildings will be supplied and installed as part of this contract. All FOTP shall provide for fibre optic termination and any through splicing and/or patching facility.
The FOTP©s shall be an industry standard type and shall consist of:

a. Fibre optic patch panel capable of terminating "ST" style bulkheads.
b. Number of terminations as required for cable and core numbers.
c. Splice organizer cassettes shall be provided to accommodate all the splices.
d. PVC gland entries shall be provided for up to six incoming optical fibre cables.
e. An approved strain relief fixing shall be provided for each central strength member.
f. Cable strain relief/management provision shall be provided for internal and outgoing optic patch cables.

3.0.4 Optic Fibre Transmitter Receiver

High quality optical fibre transmitters and receivers, International Fibre Systems or Fibre Options manufacture, or Engineer approved equivalent, shall be supplied and installed as part of these works. Fibre optic transmitters/receivers shall be located within Equipment Racks and equipment cubicles.
Transmit/Receive (Tx/Rx) equipment shall:

a. Be 19" rack mountable.
b. Have fully enclosed printed circuit boards.

c. Use duplex "ST" type fibre optic connectors.
d. Use BNC coaxial connectors.
e. Use RJ45 connectors for LAN connections.
f. Have screw clamped power connections.
g. Have “Plug & Play” operations, using modules for rack mounting.
h. Data modules shall be user programmable for RS232, RS422 and RS485, as a minimum.
i. Have automatically re-settable fuses to module power supplies.
j. Battery back-up for power supply modules.
k. Have no electronic or optical adjustments.
l. Operate over a temperature range of –10°C to +50°C.
m. Be fully compatible with the connected equipment (i.e. without any performance degradation).
n. Include self-adjusting AGC circuitry.
o. Utilize frequency modulation (FM) or 8-bit digital encoding.

Optical fibre transmitters and receivers shall be located within equipment racks, equipment cubicles, camera poles and other nominated locations. Provide optical fibre transmitters and receivers with an optical fibre budget of 18dB, including a 2.5 dB minimum margin. Provide non-rack mount modules, as required or directed by the Engineer, for alternative locations (e.g. inside the bases of camera poles).

3.0.5 Technical

The TX/RX equipment shall comply with the following minimum technical requirements:

a. Minimum video technical specifications:
b. Meet the requirements of the EIA/TIA RS-250C standard for medium-haul transmission.
c. 8MHz (-3dB) bandwidth.
d. Level unity gain (+/-2%) from 0Hz to 5MHz.
e. 65dB Crosstalk (minimum) at 4.43MHz.
f. Optical loss budget of 15dB.
g. Include AGC circuit, self-adjusting. The AGC circuit shall not cause short term video signal synchronization pulse, luminance or chroma crushing when the luminance levels of the video signal changes from 0% to 100% luminance and back to 0% luminance at intervals exceeding 60 seconds.
h. The RX/TX unit’s technical specifications (e.g. SNR, bandwidth, transmission characteristics, and the like) shall not change with the change in ambient temperature.
i. The RX/TX unit’s technical specifications (e.g. SNR, bandwidth, transmission characteristics, and the like) shall apply for the previously specified optical loss budget.
j. No intermodulation ‘noise’ shall be measurable on video signals.
k. No sub carrier ‘noise’ shall be measurable on video signals.
l. The sub carrier used to transmit audio and/or data shall be a different frequency for each direction of transmission.
m. The sub carrier frequencies for each RX/TX unit, at each end of the optical fibre core shall not drift to within 100kHz of each other when the differential ambient

temperature variation is at the maximum specified level (i.e. one TX/RX unit is operating at an ambient temperature of – 100C and the other TX/RX unit is operating in an ambient temperature of +700C).

4 Data Cabling

The Purpose of this portion of the specification is to ensure that standard and proper cabling practices are complied with at all times.

4.0.1 General

a. The purpose of this specification is to define the process to implement new cabling or alter existing cabling infrastructures
b. All cabling must be installed in accordance to international standards as defined in ISO/IEC 11801. This standard provides the specifications that have to be complied with.
c. Should issues arise during site inspections which are not defined within this standard, these should be discussed with the Engineer or the representative of DPW and to obtain a resolution.

4.0.2 Certification

a. The Cabling specifications must adhere to that of KRONE, MOLEX and AVAYA brands.
b. Cable certification will be enforced. The person performing/conducting the installation must produce a signed certificate in this regard.

4.0.3 Quality Control

It will be the responsibility of the contractor to conduct inspections of sites (or order inspections of sites) to ensure that all installations strictly comply with the latest set of specifications.

5 Cable Enclosure

5.0.1 General

All cable enclosures including conduits, cable trays, cable ducts and the like required to facilitate the installation of cabling within the building shall be supplied and installed as part of this Sub-contract.

All cabling shall be installed in cable enclosures, unless protected from mechanical damage by existing building structures.

Cable enclosures shall be installed as follows:

a. Within internal ceiling or roof spaces, wall cavities and the like galvanized conduit will be installed.
b. On external building walls, walkways and other areas rigid or flexible steel conduit or steel cable duct must be installed. All steel conduit or cable duct must be painted to match the existing adjacent structures.

c. All underground conduits shall be heavy duty steel.

All conduit shall be concealed unless it is unavoidable that the conduits be exposed. No surface mounted conduits are to be installed without consulting the Engineer.

Supply and install all conduits necessary for the installation of cabling for the various systems specified in this document.

5.0.2 Conduits

All conduits shall comply with the minimum requirements of this specification and referenced standards. Unless otherwise specified conduit used throughout the installation shall be steel.

All conduit and installation shall comply with the following:

a. AS2052 "Metallic Conduits and Fittings".
b. Oval conduits shall not be installed.
c. Minimum size of conduit shall be 20 mm.
d. All conduits shall be of an adequate size and have reserve capacity for at least one additional circuit unless the conduit size is specified.
e. Power, lighting and extra low voltage systems shall be installed in separate conduits.
f. Conduit saddles shall be spaced a maximum of 1200 mm apart.
g. Where saddles cannot be fixed to the building structure a suitable bracket shall be supplied and installed.
h. Conduits shall be a minimum of 1500 mm clear of gas and hot water pipes.
i. Conduits shall not be installed parallel to gas or hot water pipes.
j. Conduits installed in cavity walls shall be fixed to the face of the inner leaf and shall not touch the outer leaf.
k. Metallic conduit exposed to the weather shall be galvanized.
l. A 2.5 sq. mm. TPI draw wire shall be installed in all conduits whether containing cables or not.
m. Underground conduit shall be heavy-duty (HD) underground steel conduit, unless otherwise specified.
n. Flexible conduit shall be steel PVC sheathed conduit.
o. Where exposed conduits are unavoidably required, the approval of the Head Contractor shall be required prior to installation commencing.
p. Conduits shall be installed far enough above ceilings and below floors to avoid accidental piercing by nails and the like or restricting removal of ceiling tiles or floor panels.
q. To the maximum extent possible, conduits shall be installed 150 mm clear of underside of roof decking.
r. Half saddles shall not be installed.

5.0.3 Conduit Fittings

Use junction boxes of adequate size to allow installation of cables without damage to the cabling installation.

Conduit elbows and tees are not permitted in this installation unless specified or shown on drawings.

All conduit fittings with the exception of wall boxes shall be of a material and finish

Compatible with the type of conduit system to be installed.

5.0.4 Provision for Drawing in Of Cables

Conduit installations shall be so arranged that:

a. Wiring can be readily drawn in or out without damage.
b. Removal, damage or alteration to any part of the building structure is avoided.
c. No disruption to the conduit installation continuity occurs.
d. Draw wires are provided in all conduits.

5.0.5 Conduit to be concealed

Conduit shall be installed within walls, wall cavity, and secure ceiling space, contained in floor slab, chased into walls to be rendered and otherwise hidden by finished building structures.

Where exposed conduits are unavoidably required, the approval of the Engineer shall be required prior to installation commencing.

6 Cabinets

6.0.1 Cabinet Specifications:

The standard 19" rack mount cabinets (12u, 42u and 45u) will be used, to accommodate all the required equipment, i.e. patch panels, brush panels, network hardware etc. Sizing of the cabinet is based on the principle of being able fit the required equipment in with at least a minimum expansion factor of 20% within the space provided in the cabinet.

Cabinets will be POWDER COATED metal based, have lockable glass front doors, removable side and back panels, dual electric fans, and have a power socket distribution array housed inside the cabinet.

Smaller cabinets (12u) fitted against the wall, should be fitted above a height of 1.9 metres unless stipulated by the customer, and the cabinet should be of the swing frame type and fitted to allow for the cabinet to open a full 180 degrees in the open position.

Cabinets should be supplied with a dedicated electrical supply fed from the distribution board and not from the nearest wall mounted socket.

The Cabling installer must confirm that the cabinet size specified will be able to house the LAN equipment that is to be installed in it.
The Cabling installer should make provision for a sleeve within the cabinet in order to keep a copy of the cabling CAD for reference purposes.

6.0.2 Cabinet Positioning:

The position of the cabinet should be installed centrally on the floor in order to reduce unnecessary LAN infrastructure requirements for that floor.
The position of the cabinet should not be installed next to any floor personnel's desk and where possible in a server room. Each floor has a dedicated cabinet.
The position of the cabinet shall be as per the issued drawing by the Engineer.
Sufficient space must be provided behind the cabinet to enable a technician to work with ease.

6.0.3 Cabling into the Cabinet

a. Cabling reticulating into the cabinet should have at least an additional 2 meters of cable slack to enable limited cabinet movement should this be required in future.
b. Cables leading into the cabinet should be encapsulated within an EGA- Duct trunk.
c. The UTP specification is CAT 6

All cabling installations must be fully compliant to the TIA/EIA-568-A standard, which provides additional specifications for connecting hardware and cable at transmission speeds of up to 100 MBPS.

6.0.4 Patch Panels

a. Patch panels should be neatly mounted in the cabinet in order to minimize the obstruction of equipment faceplates by fly leads.

b. Fly leads within the cabinet should only be long enough to easily interconnect between the two given points.

c. Two or more long spare patch leads should be supplied per cabinet and are to be housed within the cabinet.

d. Patch panels should be of the KRONE or MOLEX type with interchangeable modules.

e. Proper labelling techniques and tools should be utilized when labelling within the patch panel. A clear adhesive or a window holder must cover the labels in order to prevent the accidental loss of labels.

f. The placement of switches and patch panels should be alternated inside the cabinet.

g. The patch panels for data distribution must be in multiples of 24 way RJ45 19" rack mount.

6.0.5 Electrical Supply to Cabinets

a. Electricity supply to all installed cabinets should have a clean earth and a direct connection to an independent MCB (Miniature Circuit Breaker), suitable to the load to be carried in the cabinet.

b. Provision should be made for as many electrical points with-in the cabinet, as the maximum possible number of electronic units/devices that can be mounted in the cabinet at a time.

7 Switches

7.0.1 Specification

Switches must be mounted in the 19" rack. Mounting bracket costs must be included in the quotation.

7.0.2 Topology

a. Sufficient port capacity has been catered for the number of devices on each floor.

b. Only fibre optic cables has been allowed to interconnect devices on separated floors or between buildings.

c. Server(s) or Router devices will be connected to the main switch stack in Admin ground floor server room

8 AS Built Drawings

Two different CAD drawings must be supplied for each site.

8.0.1 Detailed floor plan.

Detailed floor plans that clearly indicate the location of the cables, switches and points that were installed. The CAD plan will be fully readable (in other words, all points should be clearly marked on the plan by means of legends or otherwise.)

8.0.2 Backbone CAD.

The backbone CAD must consist of the following information:

a. Indication of all network hardware components on the network.

b. Indication of the types of cabling installed. I.e. UTP, fiber, matrix etc

c. Identification of the names for each component. I.e. IP address and MAC address.

d. Indication of the location of all networks devices, switches, door controllers, cameras, access readers, etc.

8.0.3 Acceptance

a. UTP - Entire installation will be tested with a Cat 6 cable scanner before acceptance and payment of the installation will be authorized.

b. Fibre Optic – All splices and connectors must be tested from both ends by means of an Optical Time Domain Reflectometer (OTDR) and the printed results must be submitted.

c. These CAD's are to be compiled in Visio in soft copy after initial installation and after any change to the network irrespective of the extent thereof.

9 Cable Specifications

d. UTP CAT6a. All jacks, patch cables, patch panels, cross-connects, and cabling must all meet CAT6a standards.

e. Cat6a cables, provide lower crosstalk, have a higher signal-to-noise ratio, and do support 10-Gigabit Ethernet.

f. Fibre: OM4. 850nm, 50/125. This fibre gives very high bandwidth, supports 10-Gigabit Ethernet (40 and 100G Ethernet)

10 Maintenance Tools and Spares

10.0.1 Parts Cabinet

a. The contractor shall supply and install a double door floor-standing steel lockable spare parts cabinet in the maintenance office to store parts and a copy of the O&M manuals.

b. The cabinet shall consist of horizontal and vertical compartments. Each part type shall be stored in its own compartment, labelled with the shelf-number, part and quantity.

c. A complete part schedule indicating the number, quantity and type of part shall be attached permanently to the inside of the door behind protective material.

d. A spares schedule shall be kept with the following columns:

- Part description
- Quantity
- date taken
- by whom it was taken
- date returned and signature of the responsible person.

10.0.2 Spare Parts

a. Spare parts shall be supplied as part of this contract.
b. The equipment as listed in the schedules of quantities shall be supplied and maintained to the completion of the maintenance phase.

11 1G HIGH SPEED LOCAL AREA NETWORK

11.0.1 General Description and System Overview:

A high speed 1GB high speed Ethernet network shall be supplied, installed and commissioned by the contractor, which shall provide system networking for Access Control, CCTV, Nurse Call, IP Telephony, Public address / Intercom, Data and Access Control

It is a specific requirement that all sub-system hardware shall interface either directly or by means of IP converters within the local equipment rack in each building. All communications between buildings shall be IP based.

The LAN shall be installed in a star topology. Each equipment rack shall be equipped with a sufficient number of 24 port 10/100/1000 Layer 2 Managed PoE Ethernet switches with a minimum of two 10GB uplink ports. Sufficient Switches shall be provided to enable the termination of all 10/100/1000 devices provided.

The 1 GB Uplink ports shall be networked via fiber optic converters to the Server room and terminated in the Layer 3 Core Switch.

The contractor shall supply and install all cables, enclosures, switches and any other components to make the system complete.

11.0.2 LAN Specification

Media

a.	Distance <100m:	Ethernet Category 6 – UTP
b.	Distance >100m:	Fibre Optics–1000Base-SX, 850nm Multimode 50/125 μm, OM4
c.	Conversion Mod:	TX/FX Multi Mode/Plus-SC

11.0.3 General Switch Specifications

- Physical Port:
  - 8 10/100/1000Base-T RJ45 copper

- 2 100/1000Base-X mini-GBIC/SFP slots
- 1 RJ-45 serial console interface for switch management and set-up

- IP Routing Features
  - Ripv1/v2, OSPFv2/v3, BGP/4+
  - Per-port routing and VLAN routing
  - Support for route redistribution

- Multicast Routing Features
  - IGMP v1/v2/v3
  - MLD v1/v2
  - Protocol Independent Multicast – Dense Mode (PIM-DM)
  - Protocol Independent Multicast – Sparse Mode (PIM-SM)
  -
- Layer 2 Features
  - Gigabit Ethernet Standards: IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z,
  - Auto-negotiation
  - Auto MDI/MDI-X detection for each RJ-45 port
  - 16k MAC address table, automatic address learning and ageing
  - Store-and Forward architecture
  - Broadcast storm control
  - Bandwidth optimisation by Runt/CRC filtering thereby eliminating erroneous packets
  - VLAN Support
    - IEEE 802.1QTagged VLAN
    - MAC based VLAN
    - Protocol based VLAN
    - Voice VLAN
    - Spanning Tree Protocol

  - STP IEEE 802.1d
    - RSTP IEEE 802.1w
    - MSTP IEEE 802.1s
  - Link Aggregation
    - 802.3ad (LACP)
    - Cisco ether-channel
    - Port Mirror (many-to-1)

- Quality of Service
  - Up to 8 priority queues per port
  - Adjustable Weighted-Round-Robin (WRR) CoS policies
  - Traffic-policing policies based on application

- Multicast
  - IGMP Snooping v1, v2 and v3
  - MLD snooping v1 and v2
  - Querier mode support
  - Multicast VLAN Registration (MVR)

- Security
  - IEEE 802.1 x Port-Based network access /edge authentication
  - Port-based MAC address alert and lock-down
  - MAC- Based network access authentication
  - IP based and MAC based Access Control List
  - ARP inspection to mitigate against ARP-DOS attack and address clone
  - Switch access password protection
  - IP address filtering for management access via Telnet, HTTP, HTTPS/SSL, SH and SNMP
  - RADIUS and TACACS+ remote authentication for switch management access
  - SSLv3 and SSHv2 encryption

- Management
  - SNMP v1/ v2 1nd v3
  - SSH /SSL access
  - Console /Telnet CLI
  - Built in TFTP client
  - IPv4, v6 address / NTP/ DNS management
  - DHCP IP address management support
  - Link Layer Discovery protocol (LLDP)
  - BOOTP and DHCP

11.0.4 Detailed Switch Specifications

11.0.5 Multilayer (L2, L3, L4); **Managed Switch**

Managed - 12 x 1G SFP; 4 x 10GbE; GigE port aggregation, IEEE 802.1q; VLANs - Port-based; Voice VLAN; Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP and Rapid PVST+); DHCP & DHCP Relay; Layer 3 Routing; IGMP v1/v2/v3; Protocol Independent Multicast (PIM); SNMP v1/v2/v3; Syslog; SMTP alert; ACLs; MAC filtering; DoS Control; Quality of service (QoS); IP ARP / RARP; Super-netting (CIDR), Port security; SSL/HTTP; SSH/Secure Shell ; RADIUS/ TACACS+ Client; IPv4 & IPv6; PoE - IEEE 802.3af;

11.0.1 Multilayer (L2, L3, L4); **Managed Switch**

Managed - 12 x 1G SFP; 2 x 10GbE; GigE port aggregation, IEEE 802.1q; VLANs - Port-based; Voice VLAN; Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP and Rapid PVST+); DHCP & DHCP Relay; Layer 3 Routing; IGMP v1/v2/v3; Protocol Independent Multicast (PIM); SNMP v1/v2/v3; Syslog; SMTP alert; ACLs; MAC filtering; DoS Control; Quality of service (QoS); IP ARP / RARP; Super-netting (CIDR), Port security; SSL/HTTP; SSH/Secure Shell ; RADIUS/ TACACS+ Client; IPv4 & IPv6; PoE - IEEE 802.3af;

11.0.2 Layer 2 Managed Switch

Layer 2, Managed, GigE - 24 x 10/100/1000: 2 x 1 Gigabit SFP; Spanning Tree Protocols: 802.1d/w/s (RSTP, MSTP and Rapid PVST+); IGMP Snooping: v1/v2/v3; PIM; VLANs: 4K IEEE 802.11Q VLANs: Port-based; Port Security; SSL/HTTP; SSH/Secure Shell; RADIUS/ TACACS+ Client; - rack-mountable, PoE - IEEE 802.3af;

11.0.3 Fibre Transceivers

- SFP optical module, multimode, 850nm
  - Connection speed 1Gbps
  - Operating Distance: 300m
  - Fibre Type: OM4, 50/125nm, MMF
  - Wavelength: 850nm (laser – optimised)
  - Optical connector: dual LC

- SFP+ optical module, multimode, 850nm
  - Connection speed 10Gbps
  - Operating Distance: 300m
  - Fibre Type: OM4, 50/125nm, MMF
  - Wavelength: 850nm (laser – optimised)
  - Optical connector: dual LC

11.0.4 Equipment Rack- Enclosures

- 12U Wall-Mount Rack Enclosure
  - 12U wall-mount enclosure
  - Ventilated front door and side panels for increased airflow
  - Easy equipment access, and cable management.
  - Locking, reversible front door
  - Locking, removable side panels
  - Installed whole system maximum rack depth (cm) 41.9
  - Installed whole system minimum rack depth (inches) 3
  - Rack Height (U Spaces 12)
  - Unit Dimensions (cm) 63.7 x 60 x 44.93
  - Unit weight (kg) 22
  - Weight Capacity (kg) 90.7
  - Grounding lug: front and backdoor frames
  - 2 x Wall Mount high performance Roof fans (15A plug)
  - 2 x keys and owner’s manual

- 43U Rack Enclosure
  - Main frames

- Removable vented front glass door with lock (swing type)
- Removable vented rear metal door with lock (swing type)
- Removable solid side doors with lock (push-down type)
- 4 EIA standard vertical mounting rails (Square type)
- 2 sets of depth supporter
- Castor wheels
- Levelling feet
- Solid top panel with front & rear cable entries and 9 fan spots
- Solid bottom panel with front & rear cable entries grounding wires
- 43U free standing equipment cabinet
  Front and rear support for 19”W (482.6 mm), EIA rack-mount equipment and shelves
- Equipment mounting hardware, (25) M6 cage nuts and screws
  Factory installed grounding/bonding system. A mounting location for a ground lug must be provided on the cabinet frame
- Levelling feet and casters
- Floor attachment brackets, PDU Brackets
- Standard or Vertical Exhaust Duct top panel with cable access ports/knock-outs
- Double perforated metal rear door with standard top panel
- Bottom Panel with Vertical Exhaust Duct top panel
- Equipment Space:
  - Dimensions: Inside H x D x W: 2120mm x 800mm x 600mm
  - Minimum capacity 1020kg
- Doors/Latches:
  - Swing handle latch with keyed lock
  - Easy to remove
  - reversible to open from the right or left
- Solid side Panels:
  - Each panel must have a single recessed spring-loaded locking latch located near the top,
- Equipment Support:
- Equipment mounting rails in the cabinet
  - Square punched holes that accept cage nuts
  - M6 cage nuts and screws
  - Includes attachment points for accessory snap on Cable Ring Kits
- Load Capacity:
  - 1360 kg, static load on levelling feet
  - 1020 kg, rolling on casters
- Grounding/Bonding:
  - Mounting rails, top panel, side panels and doors must be electrically bonded to the cabinet frame
- Colour /Finish: Epoxy-polyester hybrid powder coat in black or grey

12 Commissioning Of Installation

a. All commissioning shall be performed by the Contractor, to the satisfaction of the Engineer.

b. The Contractor shall confirm in writing that all systems have been installed according to specification and are fully operational.

public works

Department:
Public Works
REPUBLIC OF SOUTH AFRICA

GENERAL SPECIFICATION FOR ELECTRONIC AND PABX INSTALLATIONS

AND

PROJECT SPECIFICATION

October 2004

INDEX

PART 1

GENERAL SPECIFICATION

FOR ELECTRONIC AND PABX INSTALLATIONS

1. GENERAL

This part of the specification describes general requirements of material, equipment and functions related to Electronic Equipment. The detail of the specification is included in the project specification that forms part of this document and shall however be read in conjunction with the General Specification for Electronic Installations.

The complete installation shall comply with the requirements of this specification. Should any differences or contradictions exist between this specification and the project specification, then the latter shall take preference.

It is in the interest of the Contractor to notify the Engineer when the installation of equipment reaches various stages of completion so that the Engineer may inspect the installation and point out deficiencies, thus setting a typical standard of craftsmanship of installing equipment. These inspections will be informal and under no circumstances will partly or wholly invalidate the requirements of the documents. Any costs incurred in correcting deficiencies shall be for the Contractor's account.

2. STANDARDS

2.1. Regulations

The installation of equipment and commissioning thereof shall be done in compliance with the latest amendments of the following acts and regulations:

(1) The Occupational Health and Safety Act, Act No 85 of 1993.
(2) The Minerals Act, Act No 50 of 1991, which includes the Mines and Works Regulations.
(3) The local Municipal bye-laws and regulations as well as the regulations of the local Supply Authority.
(4) The local Fire Regulations.
(5) The National Building Regulations and Building Standards Act including the Code of Practice for the Application of the Regulations, SANS 10400.
(6) The regulations of Telkom SA Ltd.

3. QUALITY CONTROL

(1) The Contractor shall apply the codes of practice for quality systems as outline in SABS ISO 9000 to SABS ISO 9004.

(2) The particular codes of practice for quality systems shall be applied and carried out by the Contractor during all stages of design, development, production, installation and servicing.

4. COMPLIANCE OF ELECTRICAL AND ELECTRONIC COMPONENTS AND CIRCUITS WITH STANDARD EQUIPMENT AND MATERIAL SPECIFICATIONS

4.1 General Requirements

	SABS specification	Alternative specification
Standard voltages, currents and insulation levels for electricity supply.	SANS 1019	
The protection of structures against lighting.	SANS 0313	

4.2 Cables and conductors

	SABS specification	Alternative specification
Electrical cables 0 Flexible cords.	SANS 1574	
Flexible cords for power and lighting appliances (Schedule no. 4).		VC 8006

4.3 Alternative Standards

(1) Material and equipment shall comply in respect of quality, manufacture, tests and performance with the aforementioned standards or alternatively to the current specification of at least one (1) of the following standards institutes:

(a) International Standards Organisation (ISO).
(b) International Electrotechnical Commission (IEC).
(c) European Standards (EN).
(d) British Standard Organisation (BS).
(e) Deuthsche Industrie Normen (DIN).

(2) When referring to the aforementioned specifications, the abbreviations, ISO, IEC, BS, etc will be stated. When a specific specification number is specified, the latest applicable issue and amendment shall be consulted.

(3) Should material and apparatus used comply or be in accordance with the standard of any other recognized standards institution, this shall be clearly stated at the time of tender.

(4) Upon being requested to do so by the Engineer the Contractor shall supply a certificate of a recognized Research Laboratory or Bureau of Standards for materials used.

(5) Imported materials shall comply with the requirements of the appropriate SABS or other specification although these materials need not necessarily bear these marks.

5. STANDARD OF CRAFTMANSHIP

(1) All work for this installation shall be executed according to the latest professional standards.

(2) The Contractor shall nominate a senior and competent member of his staff to supervise all his staff on site throughout the period of installation in order that standards of craftsmanship are maintained and safety regulations are adhered to.

This nominated person shall also liaise with other contractors, where necessary, and with the Architect and Engineer on a day-to-day basis where applicable.

(3) Site staff shall be experienced and competent personnel, adequately trained to execute the various duties assigned to them.

(4) Before equipment is installed, all installed wiring shall be checked to ensure that routes are correctly followed, category segregation is maintained, in respect of electrical power circuits, electrical control circuits and communications systems, and that no accidental damage has occurred to the cables during installation. All metal conduits shall be connected by a low impedance path to earth.

(5) Material or workmanship which is not to the satisfaction of the Engineer shall be rectified at the cost of the Contractor. All rejected material shall be removed from the site at the cost of the Contractor.

6. INSPECTIONS AND TESTS

6.1. Routine inspections and tests

(1) The equipment and components of the installation will be inspected by the Engineer on a routine basis during the manufacture of the equipment and during installation on site. For this purpose the Engineer must be allowed access at all reasonable times to the workshops of all manufactures of equipment and components for the installation.

(2) Such inspections shall not exempt the Contractor from his responsibility in respect of the control of quality of equipment and workmanship.

(3) The Contractor must execute all tests in the workshops of manufacturers or at any other venue or on site during or before erection of the installation in compliance with the requirements of this specification.

(4) Any additional tests which according to the judgement of the Engineer may be necessary to determine whether the installation or equipment complies with the requirements of the specification, must be done upon instruction of the Engineer. All tests must be done in the presence of and to the satisfaction of the Engineer at the place, date and time mutually agreed to.

(5) The Contractor shall provide all test equipment, test apparatus and other auxiliary equipment and must prepare test certificates as specified or as requested by the Engineer.

(6) The Contractor must report to the Engineer on a routine basis regarding the progress of manufacturing the equipment and the progress of installing the equipment on site, so that the Engineer may decide when progress inspections should be undertaken as necessary to inspect workmanship and quality of material.

6.2. Testing on Site

(1) After the equipment has been installed on site, the Contractor shall undertake performance tests of the equipment to ensure that the equipment is fully operational in compliance with the requirements of this specification. These tests shall be undertaken during the commissioning of the equipment on site.

(2) Should the Contractor be satisfied that such test meet all the requirements of the specification, the Engineer shall be informed thereof so that inspection and test may be witnessed and undertaken by the Engineer and representatives of the Employer to determine whether the specified requirements have been met.

(3) All equipment, instruments and test equipment, including all interconnections for executing such tests, must be supplied by the Contractor.

(4) Should the results of such tests prove that the equipment does not comply with the requirements of this specification, the Contractor shall, without delay, at his own cost undertake modifications and adjustments as required, to ensure that the installation and equipment is modified to comply with the requirements of this specification. These modifications and adjustments shall be carried out with the full knowledge and approval of the Engineer.

7. CONTROL CONSOLES

7.1. Construction

7.1.1. General layout

(1) The construction of the operating face shall be such that equipment to be controlled such as individual controllers, toggle switches, push buttons and other equipment protrude from the face of the console and are clearly visible to an operator. They shall be within easy reach of an operator sitting on a normal swivel desk type chair.

(2) The equipment to be controlled must be grouped and installed as compactly as is practical. The grouping of equipment must in general be according to the following main groups:

(a) Equipment for controlling emergency situations;
(b) Main control equipment used during a particular operational function;
(c) Subsidiary control equipment for individual control of components normally used in conjunction with the main control equipment.

(3) The operating face of desk type consoles shall be inclined between 5˚ and 7˚ to the horizontal.

(4) The inclined control panel of the console must be provided as a hinged panel which is installed flush in the console framework. The hinges of the panel must be provided at the far side of the console operating side whereas panels housing measuring instruments shall be hinged at the side. The panels shall be hinged to allow easy access to the wiring and connections to potentiometers, switches, push buttons, instruments, etc.

(5) The hinged panels shall be secured at the non-hinged side by means of flush type “Philips” screws or “Dzus” type latch screws.

(6) Desk type consoles shall be manufactured as a unit or alternatively the top section of the console must be manufactured as a separate unit from the plinth or base section of the console. The base or plinth section must be manufactured so that the console will be provided with sufficient knee space for an operator sitting on a chair in front of the console.

(7) The height of the console panel nearest to the operator shall be approximately 750mm. The base or plinth section of the console and the side and rear section of the base shall be wide enough to allow for the entry of cables on the side and bottom of the console base.

(8) The vertical section of the plinth or base must be provided with removable cover plates similar to the panels of control boards to allow access to the console plinth and terminals installed in the console plinth. The latter cover plate panels must be installed flush in the sides and rear of the console plinth or base and must be fixed to the base section as specified for panels.

7.1.2. External connections

(1) External connections to the console must be done via the plinth or base frame of the console and must be connected to the terminals to be supplied and installed as part of the console.

7.1.3. Finish

(1) Unless otherwise specified, the finish of consoles must comply with the requirements specified in the project specification.

(2) Should hinged steel panels be provided for inclined desk type consoles, the panels must be finished in a light grey colour. The surrounding framework of the console must be finished in a darker grey colour unless a different type of finish is specified in the project specification.

(3) Should stainless steel type panels be specified, these panels must be brushed to a 150 grain finish parallel to the sides of the console. Samples of such a finish must be submitted to the Engineer for approval.

(4) Should aluminium panel finished be provided these aluminium panels must be of the anodized type similar to the aluminium panel finishes provided for standard 19” (483mm) racks.

7.2. **General construction of consoles**

7.2.1. Conductors and Wiring

(1) Conductors of the internal wiring shall be large enough to carry the current in each respective circuit. Conductors shall be derated to comply with the regulations when bunched in trunking or bound together as installed.

(2) Wiring shall be done by means of PVC insulated conductors neatly arrange in horizontal and vertical rows, and bound by means of suitable plastic band or installed in PVC type wiring ducts provided complete with snap-in type PVC cover plates.

(3) The colour of the insulated conductors of the internal wiring of the boards shall be done according to a colour code used throughout the installation and the following colours must be utilized in agreement with regulations:

(a) Alternating voltage phase conductors – red, white and blue.
(b) Neutral conductor – black.
(c) Earth continuity conductor – green or green/yellow.

(d) Control wiring – grey.
(e) DC voltage conductors – orange.

(4) All wiring shall be kept free and away from any exposed terminals, or other insulated current carrying components.

(5) The boards shall be completely wired before installation. All external connections to the boards and consoles shall terminate in terminal strips.

7.2.2. Terminals

(1) All external connections for control, alarm interlocking and measuring circuits must be connected to terminal strips.

(2) The terminals shall be of the “Klippon” type SAK series or similar, the type number depending upon the current rating as required or as recommended by the supplier for the particular conductor size connected to those particular terminals.

7.2.3. Grouping of equipment and circuits

(1) Control circuits and individual control components for one particular control function or for a particular section of the installation, shall be grouped separately from, but may be installed in the same control board or console as other similar control equipment.

(2) The extent of each individual group shall be clearly marked and fitted with a separate label in the English language, e.g.

POWER SUPPLY 24V DC

7.2.4. Racks

(1) Racks, also called cabinets, for housing electronic equipment shall be standard 483mm (19”) racks fitted with guides to slide into the board or console framework on sliding rails.

(2) The racks shall be manufactured of an extruded aluminium framework.

(3) Each rack shall have a nominal width of 483mm but the depth and height may vary according to standard multiples for housing the specified electronic equipment in each particular case.

(4) Racks shall be installed in individual cubicles or sections of the control boars or control consoles. Such cubicles shall be provided with extruded aluminium sub-frames fitted with the required support brackets and sliding rails to house the racks in a vertically tiered fashion.

(5) A locking screw shall be provided for each rack to lock the rack in its normal operating position.

(6) Two individual U-type slider rails shall be provided for locating and housing each printed circuit board (PC board) in the rack.

(7) These slider rails shall be manufactured of extruded aluminium or suitable glass fibre bonded synthetic material or equivalent and pairs shall be installed in a vertical configuration so that frames of PC boards slide into the rails in a vertical fashion.

(8) Each PC board shall be provided with two guide pins or guide buffers engaging in two corresponding sockets or notches in the rack to ensure that male and female sockets mate correctly.

7.2.5. Subdivision in sections

(1) The Contractor shall verify the position of all consoles on site.

(2) Each section of the console shall be of suitable size to pass through doorways, passages, etc. each section shall be rigidly manufactured to ensure that damage to the equipment will not occur during transportation and handling.

(3) Where required, consoles shall be provided with temporary timber or steel bracing to protect the equipment and facilitate handling.

(4) When positioned the sections shall be bolted together. Rubber packing shall be installed between joints to provide a finished appearance.

7.2.6. Identification labels

(1) Identification labels shall be installed for identifying the main function of the equipment or group of components or equipment within the area assigned to that equipment.

(2) Control components such as switches, relays, etc, shall each have an identification label corresponding to the identification letter and/or number shown on the schematic diagram.

(3) All labels shall consist of engraved plastic strips of the “Traffolik” type black letters or numerals on a white background and shall be fixed to or on the panel framework or below components with a non-ageing adhesive such as an epoxy type adhesive.

(4) For individual components or equipment the size of the letters or numbers must be 6mm.

7.2.7. Finish

(1) All metal parts shall be degreased, rinsed, pickled, rinsed, phosphated, neutralized and then thoroughly dried.

(2) Within 48 hours the metal parts shall be painted with one layer of a zinc chromate or other suitable primer utilized for an epoxy based paint followed by two coats of good quality epoxy based paint.

(3) The consoles shall be finished with a cured epoxy based poly-urethane paint, ensuring that the surface finish of the console is very smooth and has good wear and tear properties.

(4) In general the paint finish of control boards and control consoles shall comply with the general requirements as specified for steelwork.

(5) After the boards and consoles have been installed on site, any damage done to the paint work shall be neatly repaired by means of the specified epoxy based paint to the satisfaction of the Engineer.

(6) The general external colour of the consoles shall be navy light grey code G35 unless otherwise specified. The inside surfaces shall be cloud white code G80. Samples of all colours must be provided to the Engineer for approval. The finish of the paint must comply with the general requirements as specified for paint work.

(7) Cable support brackets shall be repainted after holes have been made in these panels to ensure that the openings made in the plate for support brackets will not be the cause of future corrosion of these panels and consoles.

7.2.8. Drawings

(1) Drawings of the consoles shall be submitted to the Engineer for his approval prior to the manufacture of these consoles. The Engineer shall be informed so that he may inspect them in the factory and that he may be present when the control systems are tested before dispatch.

(2) Upon completion of the installation, final "as-built" schematic diagrams of all control boards and consoles, including detail of all control and power interconnections between boards and consoles shall be submitted to the Engineer in agreement with the requirements of the project specification. Should no requirements be specified, three copies of such drawings shall be submitted to the Engineer.

8. ELECTRONIC EQUIPMENT, COMPONENTS AND CIRCUITS

8.1. Selector switches

(1) Selector switches shall be of the cam-operated type provided with air-break type contacts. Each pole must be provided with two sliding action type contacts. The specified number of poles and the number of switching functions must be provided so that the switching functions can be done by means of one switch operating on a common shaft.

(2) Unless otherwise specified the selector switches shall be manufactured for installing flush on consoles.

(3) An identification label indicating the switching position and function of the selector switch for each switching position must be installed on the front face of the panel.

(4) The voltage and current rating of the selector switch must be suitable for the control functions and for the current in the particular circuits to which the selector switch will be connected.

(5) The current rating for closing contacts must be three times the normal full load current of the selector switch.

8.2. Relays

(1) All relays installed in the installation shall be fitted with transparent plastic or other moulded type housing. The housing shall enclose the contacts, relay mechanism and coil and shall ensure that these components are kept in a dust-free environment.

(2) Each relay shall be fitted with a plug-in type base of bakelite or other equivalent type of insulating material. The base shall be fixed to the control console in such a fashion that the relay and its housing may be unplugged easily.

(3) When the relay is plugged into the base, the relay and housing shall be secured by means of a wire spring type clip onto the base framework so that the relay contacts will not be dislodged from the socket during abnormal vibration of the relays.

(4) The choice of contact material of the relay must be done after having considered all factors influencing the operation of the relay such as:

- (a) Current, voltage, inductance and capacitance of the circuit, and the duty cycle of the relay;
- (b) Environmental conditions such as temperature and humidity, and
- (c) The switching and mechanical operating mechanism of the relay.

(5) The relays must be provided to allow for the switching functions as specified in the project specification. Contacts of the break-before-make and make-before-break type must be inherent in the design of the relay. These contacts shall not be provided by bending contacts leaves or stems.

(6) All external connections to the relay shall be soldered to the contacts on the base of the relay.

8.3. Push buttons

(1) Impulse type push buttons or self-locking type push buttons must be manufactured for the rating and the operational duty required and must be provided with the required number of contacts for the particular circuit to which the push buttons are connected.

(2) The push buttons must be suitable for flush mounting in control boards and control consoles or in draw boxes installed in walls. Push buttons must be provided with a screw type fixing ring for mounting these on a sub-framework in the equipment shroud.

(3) Red push buttons must generally be provided for the “TRIP”, “STOP” or “OFF” control functions, whereas green push buttons must be provided for “ON” control functions. For other control functions the colour of the push buttons shall be selected in a logical format associated with the particular function to meet the requirements of the Engineer.

(4) Push buttons installed in walls or other non-metallic surfaces and flush mounted in the surface must be provided with special draw boxes so that the cover plates are installed flush in the wall.

(5) Self-locking buttons must be manufactured similar to impulse type push buttons. When the self-locking push button is pressed a second time, the self-locking latch of the push button must be released.

(6) Where required push buttons must be provided with internal light emitting diodes (LED's) or key switches as specified in the project specification. If push buttons are provided with indicator lights, series resistors must be installed such that the voltage rating of the LED's are not exceeded.

(7) Generally switching functions of push buttons shall be indicated by means of symbols or figures engraved on the moulded shroud. This shall be the preferred method of identifying the push buttons. Details of the proposed symbols shall, however, be submitted to the Engineer for approval, prior to installation of the push button bezels.

8.4. Indicator lights

(1) All indicator lights on the control consoles shall be with light emitting diodes (LED's) only. The size of the indicator light shall be approximately 18 X 24mm suitable for the particular applications as specified in the project specification.

(2) The LED's shall consist of the multiple LED's installation in a common screw or bayonet cap lamp holder (depending upon the lamp holder type of the indicator light) and shall be provided complete with a series protective diode and series resistors suitable for the particular circuit. In general the number of LED's shall be suitable to fully illuminate the shroud of the indicator light (approximately 6 LED's).

(3) Indicator lights installed on control consoles must generally be manufactured similarly to the push buttons. The LED to internally illuminate the indicator light shroud must switch on when a certain switching function must be displayed.

(4) The colour of the shroud shall be green and red for indicating an "ON" and "OFF" switching states respectively or any other colour for a particular control function as required.

(5) Indicator lights on consoles shall generally be of the rectangular type installed in logical groups for each particular control function.

(6) Where indicator lights are installed on boards or consoles connected to a common control voltage supply a lamp push button shall be installed and connected via diodes so that all indicator lights can be tested simultaneously for operation of these indicator lights.

(7) Generally indicator light functions shall be indicated by means of symbols or figures engraved on the moulded shroud. This shall be preferred method of identifying the display function of indicator lights. Details of the proposed symbols shall however be submitted to the Engineer for approval prior to the installation of the indicator light bezels.

8.5. Multiple plug and sockets

8.5.1. General

(1) Generally, when selecting particular plug and sockets, care shall be taken that the selection shall be such that the connecting cables are not exposed to undue stress at the point where the cable enters the plug or socket receptacle.

(2) The selection shall thus be made so that straight connectors or angled connectors shall be utilized to ensure that when the plug and socket are housed in the normal operational state, the cable is not subjected to a short bend directly after leaving the clamping device of the plug or socket.

(3) Where possible, either the plug or socket (depending on which is at the supply side) be screwed and mounted on a solid box which in turn is mounted against the wall or framework in a permanently fixed and mounted position.

(4) The latter requirement generally applies to external panel connections. Interior panel connections need however not comply with the latter requirement.

8.5.2. Power plugs and sockets

(1) Power connections, i.e. sockets, where the individual pins must have a rating of 5 Amp and larger, shall be of robust design; the casing material of both the plug and sockets manufactured of polyester reinforced glass fibre to provide a high degree of resilience and long life in arduous conditions.

(2) Both the plug and socket shall be provided with a secure screw type clamping arrangement to clamp the connection cable to the plug or socket housing to ensure that any tension in the cable is not transferred to the terminations of the plug and socket.

(3) The coupling terminations shall be spring-assisted terminals to provide a positive connection. Grub screw type terminations shall ensure that any conductor strand settlement in the terminal will not have a deteriorating effect on the contact between the multi-strand conductor termination and the terminal.

(4) Each socket and plug shall be equipped with a protective dust cover lid or shutter held in the closed position by means of a bayonet or screw type configuration or alternatively be provided with a spring loaded mechanism and held in the closed position by a snap spring loaded catch.

(5) The sockets shall be deeply recessed to ensure protection against accidental contact and shall be provided with a shutter, which prevent access to the socket contacts when the plug is removed.

(6) The plug and socket shall be provided in a particular pin configuration to prevent incorrect mating and be provided with a special keying system so that sockets with the common shroud enclosure can be keyed in such a way that only a particular plug may fit into the mating socket.

(7) When the plug is inserted, the plug shall be retained in the connected state by means of the spring loaded catch or by means of locking levers to prevent dislocation of the plug during normal industrial use.

8.5.3. General purpose low power connections

(1) These connections shall in general be of the MS series standard circular connectors with the exposed pins provided in a shrouded protected configuration.

(2) Both the plug and socket connectors shall be provided with a secure screw type clamping arrangement to clamp the connection cable to the plug or socket housing to ensure that any tension in the cable is not transferred to the terminations of the plug and socket.

(3) Cable terminations shall be soldered to the pins of both the plug and socket connector respectively.

(4) The shroud of the plug and socket connector may be of metal such as brass or copper alloy or alternatively of polyester reinforced glass fibre.

(5) The engaging shroud of the plug and socket connectors and the coupling ring to lock the plug onto the socket shroud shall however be of brass or copper alloy.

(6) When the plug is inserted into the socket, the plug shall be retained in the socket by means of a screw type coupling or a bayonet type latching arrangement.

(7) Each plug and socket connector shall be provided with environmental dust caps, either screwed or latched by means of the bayonet cap arrangement to cover the pins and sockets until the plug has been removed from the socket connector.

(8) Each plug and socket shall be provided with guide pins which are longer than the pins of the plug or socket to ensure proper mating. Matching notches shall be provided in the enclose housing of the plug and socket and socket to ensure that matching sockets and plugs are inserted in a selected configuration only.

8.5.4. Plug and socket connectors for electronic circuits

(1) Sub-miniature connectors shall generally be provided with plastic metal shells (screw or clip type) and with male and female screw lock assemblies.

(2) Plug and socket connectors utilized for high frequencies shall be of the brass shrouded type and be provided with a screw cap and receptacle only.

(3) Generally the connecting pins shall be suitable for solder connection only to individual conductors.

(4) The socket and plug connectors shall be provided with shrouds to enclose and clamp any cables, either round or ribbon cables, securely to the plug or socket to prevent any strain on individual conductors soldered to the terminals.

8.6. Keyboards

(1) Keyboards of the alpha-numeric type and associated with computer control systems, shall be of the “QWERTY” type.

(2) If required, a separate numerical keypad shall be adjacent to or separately from the alpha-keyboard. Functional keys must be provided and arranged in a logical order above the alpha keyboard.

(3) If more than one computer is required for control purposes, the keyboards of all computers must be similar and where possible; the same keys and passwords must be used to enter program instructions to the computers.

(4) The individual keys must be manufactured in a pyramid form with a slightly concave finger touch surface. The individual keys for various functions e.g. alpha-numeric board, functional instruction keys, cancel-, break-, or escape keys must be in distinguishable colours. The keys shall not be transparent.

(5) The keys shall be of the self-cleaning carbon rod contact type and shall be provided complete on one printed circuit board with plug-in contacts.

(6) The total unit that houses all keys for the relevant functions must be installed separate from the computer and hard disk and diskette drives of the computer in a solid thermoplastic injection housing. The unit shall be of the conventional desk-top type as described in the project specification.

8.7. Digital display units

(1) Display units must be manufactured as single units; i.e. multi-digit display units may not be made up of single display units.
(2) The display unit must be legible at a distance of at least 1 000mm.

(3) The display units shall be mounted flush into the faceplate and shall be protected by means of a non-reflecting glass cover.

(4) The display unit must consist of a sufficient number of digits to display all the relevant information as required. The digital data pin connection shall be inter-connected by means of ribbon cable and DIN type sockets.

(5) All display units shall be protected against the following:

(a) Accidental physical damage.
(b) Over-voltage.
(c) Surge currents.
(d) Voltage spikes.
(e) Reverse voltage.

(6) All multi-digit displays shall be multiplexer driven and must be powered from the same power supply as the control equipment.

(7) A segment display for numerical characters shall consist of at least 8 digits.

(8) A segment display for alpha-numerical characters shall consist of at least 16 digits.

(9) A dot matrix display for alpha-numerical characters shall consist of a matrix of at least 16 X 16 dots with a dot size of 0.55mm wide and 0.55mm high.

8.8. Electronic components and circuits

(1) The general arrangement, composition and build-up of electronic circuits and components shall be in a clear logical fashion, with a view to ease of maintaining these components.

(2) Components shall be of the high quality industrial type to ensure maximum precision and close tolerance as required for the installation.

(3) As far as possible electronic circuits shall be built up in logical banks of printed circuit frames, which can easily be withdrawn for maintenance or replacement purposes.

(4) The logical build-up of printed circuit frames shall be such as to allow for sequential fault tracing by means of the instruments referred to in the acceptable test plan and procedure for tracing faults, after having plugged in the printed circuit and inserted the test probe into the plug-in base. Terminals of the plug-in base engaging on a printed board shall be gold electro-plated.

(5) Printed circuits shall be mounted with the long or short edges vertical to allow for free movement of air components for cooling purposes. Care shall be taken that the emission of heat by components on printed circuit boards does not cause the ambient temperature to rise above the acceptable level allowed for by the manufacturers of the components.

(6) All electronic equipment shall be adequately and suitable protected against damage, faulty operation or interference by any external factors such as static electricity induced voltages, magnetic fields and forces or radio emissions, lighting strikes etc.

(7) Equipment that is sensitive to interference and surges in electrical power, variations in voltages and frequencies which normally occur in the electrical reticulation network and municipal supplies and which cannot be prevented, shall be furnished and supplied with the necessary stabilizers, over and under voltage protection equipment, suppressors etc.

(8) All electronic equipment inputs from data or signal lines must be provided with in-line protection. The protection equipment and manufacture shall be of an approved standard generally utilized and offered to comply with the standards as specified in this specification.

(9) The design, manufacture and installation of equipment shall be such that it will not create any interference of any kind to other equipment (it must be supplied amongst other items with suitable suppressors) to prevent a negative affect on the operation of other equipment.

(10) The design and manufacture of components intended for mounting on boards with printed wiring and printed circuits shall be in accordance with Publication 321 of the International Electrotechnical Commission, as amended, which is affiliated to ISO.

8.8.1. Printed circuits

(1) The design and manufacture of printed circuits shall be done according to the most modern techniques and development.

(2) Circuitry shall be accurately positioned and accurate registration of circuitry common to both sides of the boards such as terminals and edge contacts shall be maintained. Definition of all circuitry, coding and solder masking shall be of a high standard, without rough edges and saw tooth. Component leads through the boards shall be short and neatly trimmed.

(3) Holes through the boards shall be through-plated and the diameter shall be such as to ensure effective capillary action between component leads and sides during soldering. No termination shall have more than one conductor per solder joint.

(4) The printed boards used shall be of epoxy glass fibre laminate or equivalent material and shall be of the general purpose type.

(5) Edge contacts and terminals shall be of electro-deposited gold on the printed circuits. The gold shall be clean and bright in appearance without porosity.

(6) All other circuitry and the holes shall be of bright electro-deposited tin on the surface.

(7) Printed wiring boards shall be properly washed and neutralized after the etching process so that no hygroscopic crystals remain on the board or printed wiring.

(8) Heavy components of 100gm or more shall not be mounted on printed wiring boards unless it can be guaranteed that the board will stand up to severe handling without fracturing with the components so mounted.

(9) Soldering direct to the chassis of any equipment shall not be permitted, unless it can be demonstrated that all components can be readily replaced without having to unsolder the chassis termination. All terminations should be made with soldering tags.

(10) No point to point or component wiring shall be permitted on the printed circuit board for modification purposes unless such wiring or jumpers were the intention of the original designer and suitable termination points thereby provided.

(11) Mounting screws, where used, shall not be self-tapping. Threaded inserts shall be used with soft materials such as aluminium or plastic.

(12) Terminations on printed circuit boards shall not be made direct to the wiring. Where edge connections are not used, termination to printed wiring shall be made via terminal posts. This requirement will however be waived in instances where space consideration prevail.

(13) Resistors and all resistive components may not rise in temperature so that mounting boards or markings thereon are burnt or discoloured.

(14) Fuses must be rated to give adequate protection to the circuits served while not rupturing prematurely.

(15) The overall appearance of the completed printed circuit shall be with accurate definition, clean and uniform plating. The outer edges of the board shall be neatly machined.

(16) Components in printed circuit boards shall be open and installed on one side only, the leads being soldered and fixed on the opposite side. All components shall be properly marked and identified in respect of size, rating, type etc.

(17) After the printed circuit boards has been completed, all components and all printed circuit tracks shall be covered by means of a suitable insulated varnish to protect the circuitry against faults due to the collection of dust or other foreign objects such as ants or termites.

(18) Each printed circuit boards shall be fitted with a frame of insulating material on the outer perimeter which shall ensure that the board will not work loose when inserted in the plug-in unit.

(19) The frame shall be fitted with an identification code number on a particular printed circuit board used at that particular plug-in base for identification purposes. The code number on the frame shall be visible when viewing the printed circuit boards. The code numbers shall correspond to the code number shown on the schematic diagrams.

(20) All components shall be clearly marked and shall be capable of easy identification and reference to circuit diagrams and handbooks as supplied with the equipment.

9. CONDUCTORS AND WIRING IN CONDUIT AND WIRING CHANNELS OR DUCTING

9.1. Type of conductors

(1) All wiring, excepting when cables are specified, must be done with PVC insulated single core copper conductors with minimum section of 3-strand 1,5mm². The earth conductor must consist of an uninsulated single-core standard copper conductor or a green PVC insulated stranded copper conductor.

(2) The wiring of low voltage circuits with a voltage of less than 50 Volt may be done with PVC insulated multi-stranded single conductors, or be means of PVC shrouded type cables.

(3) The colour code of the PVC insulating material for the conductors must be as follows:

(a)	Alternating voltage phase conductors	- Red, white and blue.
(b)	Neutral conductor	- Black.
(c)	Earth continuity conductor	- Green or green yellow.
(d)	Control wiring	- grey
(e)	DC voltage conductors	- orange

9.2. **Wiring in conduit and wiring channels or ducting**

(1) All PVC insulated conductors must be installed in galvanized sheet metal ducting supplied complete with galvanized cover plate or shall be installed in conduit.

(2) Should the conductors be bunched in cable ducting, the appropriate derating factor as specified in SANS 10142 - 1 must be utilized for determining the size of conductors so that these conductors will not overheat when carrying the normal calculated full load current for the particular circuit.

(3) Conductors must not be exposed and must be installed in conduit or in the sheet metal ducting along the total route of a particular circuit.

(4) PVC insulated conductors must be lubricated with quality French chalk before they are drawn into conduit.

(5) The total sectional area of all conductors (including insulation) in cable ducting or floor ducting must not exceed 40 per cent of the total sectional area of the ducting.

9.3. **Connections**

(1) The insulation at the ends of conductors must be removed only to allow for the connection of ferrules where such conductors are connected to terminals of equipment and components. Where more than one conductor must be connected together, the strands must be securely bound together before inserting the ferrule.

(2) All conductor ends must be provided with tinned ferrules soldered to the conductor ends or must be provided with ferrules of lugs fixed to the conductor by means of a crimping method.

(3) All connections at control boards must be done via the terminals supplied as part of the control boards and consoles.

(4) Earth conductors must be connected similarly to the conductors as specified and must be connected from terminal to terminal on control boards and consoles.

(5) All conductors must be installed without joints and may only be connected from terminal to terminal on control boards and consoles and equipment connecting terminals.

10. EARTHING OF THE INSTALLATION

10.1. General

The installation must be properly earthed to comply with requirements of SANS 10142 - 1: Wiring of Premises, and according to the by-laws of the local Supply Authority

10.2. Earth connections

(1) All individual components such as control boards, control consoles, etc, shall be connected to the earth connection of the domestic earth supply as supplied BY OTHERS, or according to the requirements of the project specification.

(2) Under no circumstances shall the above-mentioned domestic earth supply be interconnected to the earth supply utilized for electronic control equipment and installations.

(3) The ends of all earth conductors shall be tin plated and provided with lugs for the connection to earth terminals or clamps provided with bolts and nuts. Where bolts, nuts, clamps or terminals are utilized, these shall be of the brass type only.

(4) If required, separate earth connections shall be supplied and installed by the Contractor according to the requirements specified in the project specification for particular connections to electronic control components and circuits of the installation.

10.3. Earthing of sub circuits and components

(1) Earth conductors of all sub circuits shall be connected to the earth bar of the main earth connection as provided.

(2) The ends of all metal channels, cable trays, etc, containing cables and conductors, shall be earthed to the nearest control board or control console be means of earth straps or conductors.

(3) These earth connections shall be connected to the domestic earth supply system.

(4) All metal conduits shall, where installed by the Contractor, be terminated at control boards or junction boxes. Where this cannot be done, conduit ends shall be earthed separately by means of stranded earth conductors according to the requirements of the regulations.

(5) Earth conductors shall be installed in all flexible conduit to interconnect the two ends of the flexible conduit.

10.4. Earthing of electronic equipment

(1) Interconnections and proper earthing between electronic components must be done on a radial wiring system.

(2) To minimize interference with the operation of electronic components, the earthing system of the components must comply with the following:

(a) The individual earth connections must be interconnected by means of suitable green PVC insulated conductors.

(b) The total earthing network must be connected at one point at the substation directly to the low earth resistance main earth pin at the substation by means of green PVC insulated conductors.

(c) All connections to individual electronic components must be connected from the main insulated earth bar on the control board and must be radially connected to each individual component to prevent earth loop currents between individual control equipment and components.

(d) Should the Contractor consider it essential that the interconnecting earth connections between individual components be done according to the floating earth principle, such interconnections shall be done according to the radial method of gas discharge diodes connected directly to the domestic earth so that peak voltage transients in the electronic earthing system can be discharged via the gas diodes. This must be done to protect electronic components and circuits against such peak voltages and transients which could be induced in such electronic circuits.

(3) To avoid formation of earth loop currents in electronic circuits, printed circuit layout must be designed so that a common earthing track or point is established.

(4) Where digital integrated circuits are used, decoupling of the supply line (VCC) to earth must be done with suitable decoupling capacitors at regular intervals to avoid fluctuation of potentials during switching.

(5) Common earthing bars or points should be utilized where banks of electronic equipment are connected to function on common banks. These points could either be at “absolute” earth potential i.e. returning to the earth of the input power circuits, or may be at “floating” earth potential i.e. an earth potential isolated (by making use of an insulating transformer) from the supply earth potential.

(6) The resistance between the earth electrode and earth strata for earth connections utilized for electronic equipment shall be less than 5 ohms.

10.5. **Connections to electronic equipment**

(1) Earthing methods applied in electronic equipment shall be basically the same as that used in electrical circuits. The size of earthing bars and lugs, etc, could be of a lower rating.

(2) Any conducting material that has been anodized, e.g. aluminium may not be used as an earth busbar unless special precautions have been taken to ensure that the anodising material has been removed where the earthing connections are made.

(3) Connections to electronic equipment must be made using cadmium plated lugs, bolts and nuts fixed to properly cleaned and prepared surfaces on the electronic sub-racks or trays.

(4) From the sub-rack earthing point to all the individual earthing points of the electronic equipment, separate copper conductors must be installed for each electronic rack.

(5) The conductor size shall be determined according to SANS 10142 - 1 and must be sufficient for that particular rack and must be soldered to the terminal(s) of edge connector(s) on that rack.

(6) All connections between racks or sub-racks used to transmit digital data must be made using coaxial type cable having the correct matching impedance.

(7) Terminations of coaxial cables shall be in proper connectors (plugs and sockets) of the BNC, RG8U or equivalent approved type, depending on the particular application.

10.6. Installation procedure

When the equipment is installed, the Contractor must accurately determine that all earth connections are done as specified. It is recommended that the Contractor utilise suitable measuring equipment and auxiliary equipment such that the earth connections can be individually monitored during installation of the earth connections to obviate any earth loops which might occur.

11. SPARE PARTS

(1) At completion of the installation, the Contractor shall supply to the Engineer a recommendation containing a list of components, which should be acquired as spares for maintenance purposes.

(2) The list (in triplicate) shall include the number of components that should be kept in stock as well as the unit price of such components (the date and exchange rate of prices, if applicable, shall be stated).

(3) The following information shall be submitted with the list:

(a) The exact code or identification number of the component.
(b) The firm or agency in South Africa from whom or through whom an additional number of the components can (ff necessary) be acquired.
(c) Cross-reference numbers of such components referring to identification numbers given in the maintenance and instruction manuals.

(4) When tendering, the tenderer shall recommend which component values shall be acquired as spares for the installation.

(5) Such spare parts shall be available at all times after the installation has been commissioned and shall include the time of guarantee extending over a twelve months period after the installation has been completed and commissioned in agreement with the requirements of the contractual obligations.

12. MAKING GOOD

The successful tenderer will be responsible for making good in all trades, any damage or disturbance to the building, installation, tarred surfaces, concrete surfaces, paved surfaces, drains and other surfaces his employees may have caused in the course of the construction of the system.

13. DOCUMENTATION

13.1 Final drawings and cable schedules

(1) The Contractor shall within one (1) month after the total installation has been completed, supply the following drawings to the Engineer for his approval:

(a) One (1) set of high quality "as installed" drawings containing detail of the complete installation as specified in Part 4 of this specification.
(b) These drawings must indicate detail dimensions of all electronic equipment installed, as well as schematic diagrams of all electronic circuits, terminal numbers, resistor values, capacitor values, as well as the voltage, current and other properties of the components installed, where applicable.
(c) Where required, drawings must indicate details of terminal points, terminating equipment, interfaces, etc. Where possible full dimensions of such equipment must be supplied.
(d) All final "as-installed" drawings, after the installation has been completed and accepted, must be certified as being correct.

13.2 Cable schedules

Cable schedules must be supplied which must amongst other include the following.

(1) The number of cables mutually connected between all terminating points.

(2) Cable sizes.

(3) Number of conductors in each cable.

(4) Number of reserve cables and/or conductors in each cable.

(5) Cable types.

(6) Technical references of the cables.

13.3 Classification of drawings

All drawings must be classified under the following sections of sub-sections:

(1) A schematic diagram must be supplied for the total installation.

(2) A separate wiring diagram must be supplied for the total installation, so that the termination of cables and the relative equipment components and connections can be clearly identified.

PART 2

PROJECT SPECIFICATION

1. GENERAL INFORMATION

1.1 Contractual Information

This part of the specification covers the detail technical requirements for the PABX Installation for the ……..

The equipment offered by tenderers and the general installation requirements and standards shall be in accordance with the General Specification for Electronic and PABX Installations referred to in Part 4 of this document. Where there are discrepancies between the General Specification and the Project Specification, the latter shall take precedence.

1.2 Environmental Conditions

The following site conditions will be applicable and equipment shall be suitably rated to develop their assigned performance and duty at these conditions:

(a)	Height above sea level	:	m
(b)	Minimum ambient temperature	:	ºC
(c)	Maximum ambient temperature	:	ºC
(d)	Maximum ambient humidity at maximum temperature	:	%
(e)	Lightning strikes per square km per year	:	

It is a requirement of this specification that the tenderer shall forward with his tender at tender stage in writing the heat load of the equipment offered so that the mechanical engineer can verify the efficiency of the air-conditioning equipment specified for the PABX/Hub room.

1.3 Supply Voltage and Power Requirements

An electrical supply of suitable capacity will be provided for the PABX Installation in the PABX/Hub room. The electrical supply will be fed from the normal power supply in the building and will be a 2-wire single-phase supply with earth at 231 Volt plus 5 per cent and minus 10 per cent and at a frequency of 5OHz.

The Contractor shall provide a suitable Uninterruptible Power System (UPS) for un-interrupted service of the PABX Telephone System and all ancillary equipment for at least 60 minutes.

1.4 General Availability of Service

Only PABX manufacturers tendering their own equipment through ICASA registered agents will be considered for this PABX installation.

Only authorised agents or dealers with valid ICASA LMOI licences for the equipment offered will be considered. The manufacturers ICASA licence for the equipment must be provided together with SABS ISO 9000 certificates.

Manufacturers must have a service centre, where sufficient spares and qualified personnel are based, in …….. This service centre must be in operation for at least five years.

All personnel based at the Service Centre must be in the full and permanent employment of the manufacturer or his agent.

2. GENERAL TECHNICAL INFORMATION

2.1 Standards

The equipment shall comply with this specification and the following CCITT recommendations:

Q.23	:	Technical features of push-button telephone sets.
Q.711	:	Pulse Code Modulation for voice frequencies.
Q.712	:	Performance characteristics for pulse code modulation channels at audio frequencies.
Q.732	:	Characteristics of primary pulse code modulation multiplex equipment operating at 2 048 kbits/s.

2.2 Proven design requirements

The tenderer shall submit at tender stage a list of installed system sizes with commissioning dates. The list shall clearly indicate whether the tendered equipment is of identical or modified design to that previously installed.

The PABX configuration of the system shall be type approved by the Manager of Telkom SA Ltd. The type approved reference number and date shall be stated at tender closing.

The system will be digital, stored program controlled, pulse code modulation (A-law encoding).

The system must be configured as per the attached Telkom specification in the schedule of requirements in the Schedule of Information in Part 7.

2.3 General technical requirements

The following general technical requirements shall be applicable to the equipment offered as a minimum standard:

All equipment shall be Telkom approved at closing date of tenders.

All workmanship e.g. cabling etc. will be done in accordance with Telkom specifications and standards.

All peripheral cards will be compatible to fit any slot on the equipment shelf.

All outdoor extensions shall be lightning protected on the MDF or as specified else-where in this specification.

The system will be able to accommodate the following options:

- Pulse dialling.
- DTMF (tone dialling) direct into the digital Telkom exchange.
- Digital DDI via PCM 30 link directly connected to the Telkom main exchange.

- Digital DDO via PCM 30 link directly to the Telkom main exchange.

The tenderer shall state at tender closing the following:

- Whether a mix of the above is possible on the same link;
- Year of introduction of equipment in the RSA;
- The life expectancy of the offered equipment;
- Whether there is currently still ongoing development on the tendered equipment;
- Whether the systems can support ACD (automatic call distribution);
- The level of product support on hardware that is available;
- Whether the system will boot up automatically after a power failure, and stipulate the delay in seconds, after the power has been restored;
- Whether the system will provide software backup e.g. tape or disc;
- Whether software parameters will be changeable from the service terminal provided;
- What type of modem will be provided for the execution of remote maintenance and what maintenance functions will be possible.

3. SCOPE OF WORK

3.1 General Description of Scope of Work

This specification makes provision for the following:

- The PABX unit complete with extension and exchange line units suitable for EURO ISDN as specified;
- The Main Distribution Frame as a Data Distribution Panel suitable for patching UTP type cable with RJ 45 connectors;
- The Telephone Call Management System complete with hardware and suitable programmable software as specified;
- Two (2) operators consoles, Windows NT based;
- The VDU terminal and printer for maintenance and facility changes on the PABX unit;
- The Telephone instruments;
- The UPS system with suitable capacity to guarantee uninterrupted service of the complete PABX Telephone system and ancillary equipment for at least 60 minutes;
- The Telephone network cabling necessary to integrate the PABX system effectively with the structured wiring system by others;

3.2 Specific System Requirements

For the specific system requirements tenderers are referred to the Schedule of Requirements (SOR) as included in the schedules of Part 7 of this specification. Tenderers must also note that it is required to compile a Schedule of Compliance for acceptance and approval by Telkom on completion of the Installation.

4. DRAWINGS

For details of the location of the PABX room, tenderers are referred to the schedule of drawings included in the schedules in Part 7 of this specification.

5. EQUIPMENT, ACCOMMODATION AND EARTHING

5.1 General information

The tenderers shall take note of the allocated accommodation for the PABX system. The following requirements shall be incorporated in the design, manufacture and earthing of the tender equipment offered:

(1) The equipment shall be enclosed in steel cabinets and sized so as to permit transportation into the computer room without the removal of partitioning, doors, etc.

(2) It shall be possible to mount the equipment cabinets, if more than one cabinet is required, back to back or against a wall

(3) Special computer flooring will be supplied and installed by others in the Computer Room for the installation of the equipment offered by the PABX Contractor. The cost of this flooring shall not be included in this tender. Tenderers must however allow for liaising and coordinating with other contractors to enable a suitable and functional PABX installation in accordance with the specified requirement.

(4) Tenderers shall state the mass of apparatus, fully equipped in kilograms.

(5) Tenderers shall state the dimensions of cabinets in millimeters (width x height x depth)

(6) Tenderers shall indicate whether the main distribution frame is an integral part of the system or whether it is a separate unit, stating the dimensions

(7) Tenderers shall state whether PABX cabinets are floor mounted and whether rear access is required

(8) It should be noted where the operator's consoles are to be installed as indicated on the drawings and that sufficient interconnecting cable length is allowed

(9) The Contractor is also responsible for the installation and commissioning of the specified earthing system. Should the Contractor disagree with the requirements specified in this section of the specification written consent should be lodged at tender stage, an alternative earthing proposal submitted and the tender price amended accordingly. The specified earthing system will comprise of the following elements:

- An earth mat consisting of bare copper conductors and copper electrodes driven into the earth core by a specialist contractor 1,000mm under ground level under the UPS Room as indicated on the drawings.
- A Green PVC insulated 70mm square stranded copper cable connecting the earth mat with the PABX Room by the Electrical Contractor.
- An isolated earth bar mounted against the wall 300mm AFFL in close proximity to the PABX Cabinet in the PABX/Hub room. The earth bar shall be provided and installed by the PABX Contractor and all connections terminated on the earth bar with suitable lugged copper cables. The earth bar shall be 300mm long x 60mm wide x 12mm thick, tinned, predrilled with tinned holes and mounted on the wall with suitably sized insulators to space the earth bar approximately 40mm from the wall surface. There shall be only one electronic earthing system for the PABX system and all electronic

equipment forming part of the system shall be connected to the one earth bar.

5.2 Cable Network Requirements

5.2.1 Conduit, Sleeves, Manholes, etc.

Tenderers must refer to the schedule of drawings in Part 7 of the specification for a layout of the conduit, sleeves, manholes and ancillary services that form part of the contract for the purpose of accommodating the telephone system for the project.

5.2.2 Structured Wiring System

Tenderers must take note that the internal telephone system for the building forms part of a structured wiring system. The telephone cable wiring and all other communications systems, and specifically the data cabling system, will be installed as a structured wiring system which shall enhance the flexibility and interchange ability of the wiring and interconnecting system.

5.2.3 Cabling under this Scope of Work

Tenderers shall take note that the cabling for the internal telephone system will be specified in a separate specification. The minor portion of cabling and wiring that is however required to connect the PABX unit to the 'MDF' or Data Distribution Panel, shall form part of this contract and is included as a single item in the Bill of Quantities in Part 6 of the specification.

6. TECHNICAL REQUIREMENTS OF THE SYSTEM (CPU AND ENVIRONMENT)

6.1 System configuration

The system shall be fully electronic, using the latest technology available. The Exchange shall use Stored-Program Control in CMOS logic and affect switching by digital techniques. Preference is given to systems carrying a SABS certificate for Manufacturing and Maintenance.

The system shall in general be configured to fulfil the requirements of this Specification and all the features and facilities described shall be enabled when and where specified without resource to additional hardware and/or software, unless otherwise specified. All facilities shall be pre-programmed and stored in the Exchange on a permanent basis. Should modifications or additions (i.e. additional line cards) be deemed necessary at some future date, it shall be possible to update the database to accommodate these changes without incurring additional expenses. The programming must also be done on site.

If called for in the system description or Schedule of Requirements the system must be equipped with PCM 30 EUROISDN signalling as per Telkom requirements for both incoming, and outgoing traffic. No other signalling system shall be considered. The system must also be able to accommodate ISDN universal S0 basic access and S2 primary access interfaces that comply with the current CCITT specifications. The system shall employ QSig for networking to other PABX systems.

The design must be modular, permitting expansion of the exchange by simply adding printed circuit boards as the need arises. In this respect, the exchange shall be designed to permit printed circuit board addition, be it extension, (analogue or digital) exchange or

tie-line, based on the universal slot principle, i.e. cards need to be located in dedicated frame positions. All equipment cards, racks and shelves shall be fully accessible from the front of the cabinets. Systems requiring side or rear access for maintenance and upgrading purposes are not preferred.

The software language preferred is the CCITT high level language CHILL. Tenderers must state the language used. The system shall support both Dual Tone Multi Frequency (DTMF) and dial pulse telephone instruments in any mix without the need to add any hardware like DTMF receivers, etc. No programming must be required when switching telephone instruments

6.2 **Service terminal**

A VDU terminal and printer shall be supplied with the PABX for maintenance and facility changes on the PABX.

It must be possible to effect changes to the data base at any time in order to introduce or refine say a service class, change an extension number, add another abbreviated dialling code telephone number, etc. These changes must be easily accomplished via either the service terminal or via a remote terminal.

Although it should be possible to gain access to the data base at any time for amendment or examination purposes, the System must not allow unauthorized personnel such access and must be so designed as to prevent said parties from introducing changes or modifications thereto. The system must also be able to allow authorised users to access only certain parts of the database (i.e. different levels of entry).

Access to the service terminal must be controlled as follows:

- By means of a series of passwords.
- Passwords must be assigned on a function related basis.
- All access to the service terminal must be recorded in a log book file.

Remote access to the system by means of a modem must be provided. Access must be on a return call to service centre" basis.

It shall be possible to make a back-up of the data base on a disk or tape for reference purposes which, in the event of loss or corruption of the data base, may be used to reload the system. Tenderers must state what options are available for re- loading the system from the back-up device and typically what times to reload are envisaged.

The successful tenderer shall retain a back-up disk or tape for reference purposes which in the event of loss or corruption of the data base, may be used to reload the system. The tape or disk shall be brought up to date every two months as part of the maintenance contract procedure.

The exchange data base must be protected against mains power failure where RAM is used. Details of the power arrangements and the back-up time must be submitted with the tender. Tenderers shall also submit details of precautions that has been taken and in the event of a power failure what happens to transient data, e.g. features activated by extensions, individual speed call numbers, etc. Tenderers shall also indicate what medium is used for data storage as protection against power failure and in the event of a prolonged power failure, what mains failure circuits are provided on the incoming and outgoing lines

6.3 **Signalling considerations**

The system shall comply to the following signalling conditions:

(1) The system shall accept dial pulses of 5 - 12 pulses per second with a 30 - 70 % break/maximum and a minimum interdigital time of 215 ms.

(2) The tones of the PABX shall be in accordance with the Telkom specifications for PABX's

6.4 **Number scheme**

The system offered shall make provision for a full flexible numbering scheme. Any number level may be used for any facility within the PABX. A six digit extension numbering scheme is required, starting at level I to 7, access to operator level 9, access to public exchange level 0. No other numbering scheme is permitted, unless otherwise stated

6.5 **System performance**

(1) Frequency response

The frequency response shall be in accordance with the Telkom specification for PABX's.

(2) Crosstalk

The crosstalk attenuation from extension-to-trunk and extension-to-extension shall exceed 65 dB in the range of 300 - 3400 Hz.

(3) Call Logging

The PABX shall be capable of providing the necessary data so that incoming and outgoing calls could be monitored by a Telephone Management System.

(4) Quantitative reliability

The equipment shall operate efficiently in the normal office environment. The mean time between failures (MTBF) shall not be less than 1,000 hours. The MTBF time shall be demonstrated.

(5) Electromagnetic radiation

The electromagnetic radiation of the system shall meet the requirements of a good commercial specification, number of specification to be submitted when complying with the specification.

(6) Earthing safety

The PABX shall be provided with a single earth point on the cabinet for safety reasons. The dedicated earth point for the PABX system will be supplied and installed by the electrical Contractor. The dedicated earth will comprise of a 70 mm square PVC insulated stranded copper conductor connected to a dedicated earth point with suitable connectivity to enable an earth resistance of less than 5 ohm. Should this earthing system not be suitable tenderers shall allow upgrading

the earthing system to their specific requirements and allowing for such additional cost in their tender price

(7) System self-test

The system must automatically, on an ongoing basis, scan and test all ports. Faulty ports must automatically be taken out of service, periodically tested and automatically or remotely placed back into service when the fault is cleared.

(8) Integrated Voice and Data

The system shall support the 2B + D connection formats for voice and data or two data connections over a single telephone line (two wires).

Two 64 kbit 'B" channels and one 16 kbit 'D' channel over a single pair of wires, giving a simultaneous voice and data call, using the CCITT transmission correction of Echo Cancelling.

6.6 **Lightning protection**

The building structure housing the computer room where the PABX Exchange will be installed will be earthed and bonded for protection against lightning. The lightning protection will make use of the steel roof structure as the air terminal, the steel columns as down conductors and earth electrodes as earth terminals, all to Standards specified in SANS 10313 as amended. Should the Contractor for the PABX installation requires additional protection against lightning to enable a safe and functional system any additional material and installation cost to acquire such protection shall be included in the tender price.

6.7 **MDF and surge protection**

The manufacturer and supplier of the PABX system shall supply the Main Distribution Frame (MDF). The type of terminating block used on the MDF shall make provision for the fitting of gas filled surge arresters. The tenderers shall provide full details of the MDF frame, terminating blocks and recommended gas filled surge arresters that can be accommodated on the terminating blocks.

The exchange equipment shall be protected internally to withstand surges not absorbed by the gas filled surge arresters.

The contractor shall provide and install all cabling between the equipment cabinets and the MDF.

Surge protection is normally provided by means of gas filled surge arresters with a dc stoking voltage of 350 volts ±15 per cent and an impulse stoking voltage of maximum 700 volts at a rising speed of I kV per microsecond. The nominal impulse discharge current rating is either 10kA or 2OkA for an 8/20 microsecond wave, and the nominal AC discharge current rating is either 10A or 20A for a 5OHz surge of one second duration.

Equipment that is sensitive to interference and surges in electrical power, variations in voltages and frequencies that normally occur in the electricity reticulation network and municipal supplies and which cannot be prevented, shall be finished supplied with the necessary stabilizers, over and under voltage detection equipment, suppressors etc.

The design, manufacture and installation of equipment shall be such that it will not create an interference of any kind to other equipment (it must be supplied amongst others with

suitable suppressors) to prevent that it will negatively effect the operations of other equipment.

The design and manufacture of components intended for mounting on boards with printed wiring and printed circuits shall be in accordance with Publication 321 of the International Electrotechnical Commission, as amended, which is affiliated with ISO.

6.8 **Exchange offered**

The exchange offered shall:

- In all respects conform to the Standard Specification for Private Automatic Branch Exchanges of Telkom.
- Utilise the Pulse Code Modulation technique for speech processing and transmission.
- Shall have a thirty-two channel capacity with 'A' law encoding as per CCITT Recommendation G.711/712.
- Shall be suitable for use either with dial, digital or DTMF telephone sets. The DTMF and digital capabilities shall be in accordance with SAPT requirements.

6.9 **Operating loop limits**

The system shall provide the following loop features:

- The extension line maximum loop resistance, including the resistance of the telephone, shall not be less than 1000 ohm.
- The trunk and tie line shall be capable of detecting a signalling current from the distant end, with the supply at a minimum of 45 volt.
- A system with distributed control is preferred.
- Tenderers shall also indicate at tender stage:
  - (a) Whether the system can be equipped with duplicated controls and processor unit.
  - (b) What type of main processor/s will be supplied?
  - (c) Which components are duplicated, e.g. main memories, clock generator, switching network, multibus, signal unit, conference equipment, and voice mail?
  - (d) What the size of the main system memory is.
  - (e) What the dynamic traffic value is as specified in Busy Hour Call Attempts (BHCA) on the basis of CCITT Q514.
  - (f) Whether the main processor can be upgraded to allow for a greater number of BHCA.

The databases of the system and the computer (i.e. extension records) will be synchronized; changes on one database will automatically be reflected on the other.

The switching network must be non-blocking to both voice and data and the overall connection availability (connection factors etc.) must be stated for each major section of the system

Tenderers shall submit the necessary traffic handling calculations to show how the required traffic will be catered for and where and how much spare capacity exists in the configuration offered.

The tenderer shall also state the reliability of the equipment in terms of Mean Time To Repair (MTTR) and (MTBF) Mean Time Between Failure.

6.10 **Ventilation and protection**

No additional or peripheral ventilation equipment, over and above the air- conditioning already provided in the Computer Room should be necessary for the effective operation of the PABX system

However, should the equipment being offered by the tenderer, require any special environmental conditions or apparatus to ensure its reliable operation, such as:

- Additional air-conditioning, including the structural changes;
- Forced ventilation
- Or, anti-static floor mats, etc

then these costs for the supplying, installation and maintenance of such equipment, must be provided for in the tenderer's pricing

6.11 **System technology**

The modular concept that is required for the PABX system shall also include the distribution of power within the system, a separate supply being available for each subassembly.

The internal numbering scheme of the exchange must be completely flexible, allowing changes to and removal of extensions K so desired without rewiring i.e. by programming only.

6.12 **Data**

The system and equipment offered shall comply with the concept of ISDN (Integrated Services Digital Network) and CCITT recommendations in this regard.

The system must allow for voice and text messages (mail) to be left for senior personnel, to access on return to the office or remotely via external line using either a computer (for data) or digital pulse codes (for voice) and incorporating security measures to prevent unauthorised access.

Tenderers must submit technical details of data communication capabilities of the system in respect of data, text and voice. Transmission rates, protocols and details of data communication interfaces (where required) are also to be stated. Tenderers shall also state the following at tender closing:

- To what levels the system can support data/text communication.
- What effect voice and data traffic would have on each other in the system offered, and what impact a busy hour upsurge of one type of traffic could have on the other.
- How the system offered could be upgraded and/or expanded to cater for an in-crease in each type of traffic as referred to above.
- What type of data ring and/or LAN is supported and provide the specifications thereof.
- What the cost is of providing extra ports.

Tenderers must also state at tender stage whether any of the following Gate-ways/Facilities are available and submit full technical details:

- Packet switching interface to provide access to the X25 Packet Switched Data Network (SAPONET).
- Text interface (X21, X25).

- Local Area Network interface to connect broadband/base band LAN system.
- Wide Area Network interface.
- Modem interface for pool or modem.
- Whether the system is data transparent and states the bit rate.

The ISDN capability of the system offered must include the ability to carry data at the current recommendation of up to 19.2 Kb/s asynchronous speeds, on a simultaneous Voice and Data, or 2 x Data Channels basis over the standard twisted pair supplied for the voice network, as per CCITT recommendations for 2B + D working. The system shall also be capable of interfacing Modem Pools in such a way as to allow maximum use of the total voice network facilities and recourses, to expand and exchange these other communication Networks.

6.13 **Networking**

The PABX offered must be capable of supporting the following networks:

- Non-integrated networks (Auto-to-auto and exchange line tie lines).
- Partially integrated networks (E+M Tie Lines).
- A combination of both.
- QSig supported integrated networks.

The system offered should be inherently capable, even if not initially equipped, for networking with other Nodes of equipment (not necessarily from the same supplier) in any topology.

It should be noted that the sites of these Nodes and decentralized modules are distant from each other and require Telkom supplied links. DIGINET or E+M tie lines therefore are required.

The system shall support the following types of interfaces with regard to the net- working of ISDN connectivity:

- Two wire auto/auto (loop disconnect and DTMF signalling).
- Four wire "E + M" signalling (options to be listed).
- PCM 30, 2 Mb/s signalling (options to be listed).
- CCITT SO basic rate ISDN (2B + D): options to be listed.
- CCITT S2 primary rate ISDN (30B + D): options to be listed.

It should be noted that a network signalling system based on the CCITT recommendation (Q93x) for public ISDN network which meets OSI (Open System Interconnections) requirements for open communication is preferred.

With regard to Facility Transparency the system offered shall be capable of working in a network system utilising QSig. All facilities on the system shall be transparent throughout the network. Facilities shall also be transparent from one node to an- other, including those supplied by other suppliers.

7. FEATURES AND FACILITIES OF THE SYSTEM

7.1 General

The PABX system described in this specification shall have the following minimum features and facilities integrated into the system and ancillary equipment:

- DDI and DDO: The PABX system offered shall have Direct Dialling In (DDI) and Direct Dialling Out (DDO) facilities to be utilized to full advantage by the user to and from all extensions.
- The system will make provision for internal dialling.
- The baring of individual telephone extensions for at least 10 levels will be provided.
- Individual code baring will be possible (e.g. the baring of code 087) .
- The system will allow for Data Detection.
- The system will allow for three (3) way conference.
- The system will allow for eight (8) way conference.
- The system will make provision for call transfer.
- The system wiII have a shuttle enquiry service possible.
- The system will have ring back when free.
- The system will make provision for speed call numbers. A common pool of at least 600 will be possible.
- The system will make provision for Individual Speed Call. At least ten (10) speed call numbers per extension will be possible.
- The system will make provision for Call Park.
- The system will make provision for Code Looking of extensions
- The system will make provision for Automatic Booking of outgoing lines.
- The system will make provision for Last Number Redial.
- The system will make provision for Call Hold.
- The system will make provision for Cut in Priority.
- The system will support DTMF and dial impulses analogue telephones.
- The system will support two (2) wire digital telephones.
- The system will make provision for nuisance call tracing.
- The system will make provision for the Do Not Disturb function
- The system will allow for the leaving of a message on an unanswered telephone.
- The system will allow for Call Pick-up. Tenderers must specify the number of groups and the maximum number of members in a group.
- The system will allow for single Digit Dialling and it will be possible to various services on site e.g. manager, security officer on duty, etc.
- The system will make provision for Call Forwarding / Follow Me as follows:
  (a) To another phone when no reply.
  (b) To voice mail system.
  (c) To switchboard.

7.2 RCOM facilities

The Exchange shall allow for an intercom facility on the digital telephones. The pressing of a button must activate the intercom facility. The called terminal must be switched directly into the hands-free mode.

It must also be possible to make an all call to ALL the intercom telephones in the institution as listed in the schedule of Requirements, by the pressing of a single key. The result of this action will set up a one-way speech connection between the calling terminal and all free intercom terminals in the institution. The calling terminal must be informed whether all terminals in the group were reached or whether some terminals were busy.

If the above-suggested method of operation is not possible Tenderers must put for- ward an alternative proposal in order to achieve the above-mentioned objectives

7.3 Telephone Instruments

The contractor shall supply, install, test and commission telephone instruments in- tended for use with the PABX installation for all indoor extensions, as well as those outdoor extensions which are included in the telephone schedule included else- where in the specification

The contractor shall functionally check each telephone jack point, using a standard telephone instrument, for successful operation.

The PABX system must offer a choice of telephone instruments to meet the various requirements of the users. The telephone instruments should include:

(1) Basic analogue 2 wire DTMF connections.
(2) Digital 2 wire connections for both B + D, and 2B + D connections.
(3) The system shall have the capability of handling telephone instruments with 16 digit keypads.
(4) Integrated Data Connections.

The tenderer shall define clearly in his tender every type of telephone instrument which may be used in conjunction with the system offered, as well as the type of analogue and digital telephone instruments that will be supplied, the facilities which each type of telephone offers and the cost of these instruments.

All telephone instruments shall be provided with a standard three-(3) metre connecting cable with a plug.

The tenderer must take note that the quantities of telephone instruments may be increased or decreased during the construction phase of this contract. The final contract sum will be adjusted accordingly.

7.4 Digital terminals

Digital terminals, when required, must have the following features:

(1) Hands-free function - the hands-free function must be of good quality employing state of the art components.

(2) Feature buttons must be programmable and the pressing of one button must activate the feature.

(3) Users of digital telephones shall be able to program their own telephone instruments.

(4) The digital terminals must have a liquid crystal display showing the time and date whilst in the idle state.

(5) Where required digital telephones must have LC displays that provide comprehensive information on call status and the following are minimum requirements:

- Name and number display for all extensions.

- Telephone number of internal callers, from other nodes in the network.
- Feature activation, e.g. Call Forward, Do Not Disturb, Ring Back-, and Message Waiting.
- Call Waiting Display.
- Name and number of Calling and Called parties on Call Pick Up.
- Details of both Voice Mail and Fax messages.
- Prompting on the use of Voice Mail and Fax Mail systems.

(6) As secretaries will use digital telephones to answer many telephones, these telephones must be capable of showing the current status, busy or free, of a minimum of eight extensions. Each extension will be indicated on a different button.

(7) Digital telephones must be capable of accepting external devices such as tape recorders, second microphones, etc.

(8) The Tenderer should state any additional features.

8. **TELEPHONE CALL MANAGEMENT SYSTEM**

The Contractor shall provide a suitable Telephone Call Management System with the PABX Installation. The Telephone Call Management System (TCMS) shall be of the Hotel type and provide the following:

- The required software programming and associated interface equipment to monitor calls on the PABX System continuously;
- The required software to generate reports and accounts for calls in the typical Hotel Industry environment;
- Suitable functionality and software to register hotel guests and process wake-up calls over the system K required;
- A suitable report printer for printing of reports and accounts on a regular basis.

9. **DECT (DIGITAL ENHANCED CORDLESS TELECOMMUNICATIONS)**

The Contractor shall provide a fully functional Digital Enhanced Cordless Telecommunications (DECT) System with appropriate equipment with the following requirements as part of the PABX Installation:

- The DECT System shall comply with the latest international and local standards and codes related to digital cordless telecommunications;
- The DECT System shall include all required equipment and interface cards as part of the PABX switch unit to support the number of remote units, known as radio fixed ports (RFP's) in the terminology of some suppliers and associated handsets;
- The DECT System shall include all the RFP's and handsets in accordance with the Schedule of Quantities that form part of this document;
- The Contractor for the PABX System shall allow to do a proper survey with appropriate tests to establish the most suitable location for remote equipment and the optimal usage of handsets;
- The Contractor for the PABX System shall allow for all license applications on behalf of the Owner at the appropriate institutions required and include such fees in the tender bid at tender stage;

10. **OPERATOR'S CONSOLES**

Two operator consoles are required. It is a specific requirement that incoming calls must be identifiable to allow the operators of the two departments to work totally in- dependent of each other.

PART 3

BILL OF QUANTITIES

BILL NO. 1: PABX SYSTEM (EQUIPMENT)

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1.	**PABX SYSTEM (EQUIPMENT)** **Nett amount for the supply, delivery, installation and commissioning of the complete PABX system equipment installation in accordance with the specification, including the following equipment:**				
1.1	PABX switching unit complete in accordance with the specification and the Schedule of Requirements with all accessories and auxiliary equipment.	No.			
1.2	Windows NT based Operator's Console complete with interfacing cards and auxiliary equipment, including sufficient cabling to be interconnected with the PABX switching unit.	No.			
1.3	Main Distribution Frame complete with terminal blocks and jumper wiring to terminate the number of extensions and exchange lines in accordance with the specification and the Schedule of Requirements.	No.			
1.4	Complete UPS power supply in accordance with the specification to maintain an uninterruptible supply to all connected equipment for 60 minutes including wiring, cabling and associated connections.	No.			
1.5	Complete call management system in accordance with the specification including all Software, hardware and interface equipment with the PABX switching unit.	No.			
	PAGE TOTAL (CARRIED FORWARD)				
	AMOUNT BROUGHT FORWARD				

BILL NO. 1: PABX SYSTEM (EQUIPMENT)

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1.6	Complete report printer in accordance with the specification to print reports generated by the call management system including sufficient paper for testing and two reams for use by the client. Allow for a LaserJet printer with 19 pages per minute printing speed and toner cartridge of at least 4000 pages.	No			
1.7	VDU terminal with printer interface facility to use the telephone call management printer, for maintenance and facility changes on the PABX unit	No.			
1.8	Testing, commissioning and handover of the complete PABX installation in accordance with the specification and Telkom's requirements.	Sum			
1.9	Co-ordination and liaising with the Principle Contractor and the sub-contractor for the data- and telephone cable installation in order to establish a fully functional working system.	Sum			
1.10	Training of an operator to be fully conversant with the operators console including a refresher course monthly for three (3) months.	Sum			
1.11	Training of the users staff to be conversant and fully acquainted with the telephone call management system including the generating of monthly reports and in-house detailed telephone accounts for a period of six (6) months.	Sum			
1.12	Nett amount for any additional items required to complete the specified installation which is not included in the paragraphs of the bill above (please specify):	Sum			
(a)	……				
(b)	……				
(c)	……				
(d)	……				
(e)	……				
	TOTAL FOR BILL NO. 1 PABX SYSTEM (EQUIPMENT) (CARRIED FORWARD TO FINAL SUMMARY)				

BILL NO. 2: PABX SYSTEM (TELEPHONES)

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
2.	**PABX SYSTEM (TELEPHONES)** **Nett amount for the supply, delivery, installation and commissioning of the complete telephone instrument installation in accordance with the specification, including the following equipment:**				
2.1	Telephone instruments, suitable for two wire working, as standard extension telephones making use of a structured wiring system installed by others:				
2.1.1	Supply	No.			
2.1.2	Install, test and commission	No.			
2.2	Telephone instruments, suitable for two-wire working, for manager/secretary workstations making use of a structured wiring system installed by others for the main unit and local wiring for the connection to the secretary unit:				
2.2.1	Supply of manager units	No.			
2.2.2	Supply of secretary units	No.			
2.2.3	Install, test, commission of complete manager/secretary systems	No.			
2.2.4	Supply and installation of interconnecting wiring between main and secretary unit (allow for 30m wiring each).	No.			
2.1	Fully digital, two-wire telephone instruments to be used as extension telephones where required making use of the structured wiring system by others.				
2.1.1	Supply	No.			
2.1.2	Install, test, commission	No.			
	TOTAL FOR BILL NO. 2 PABX SYSTEM (TELEPHONE) (CARRIED FORWARD TO FINAL SUMMARY				

BILL NO. 3: DECT EQUIPMENT

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
3.	**PABX COMPATIBLE DECT EQUIPMENT** **Nett amount for the supply, delivery, installation and commissioning of the complete Digital Enhanced Cordless Telecommunication system in accordance with the specification, including the following equipment:**				
3.1	Line equipment for connecting remote stations to the PABX equipment on extention lines for 2 (four) stations. Specify the equipment included for the specific DECT systems offered:				
(a)	……..				
(b)	……..				
(c)	……..				
3.2	Remote station equipment (e.g. radio fixed port) with power supply equipment if required:				
3.2.1	Supply	No.			
3.2.3	Install	No.			
3.3	DECT telephone to be used with each remote station:				
3.3.1	Supply	No.			
3.3.2	Install	No.			
3.4	Nett amount for any additional items required to complete the specified installation which is not included in the paragraphs of the bill above (please specify):				
(a)	…….				
(b)	…….				
(c)	…….				
(d)	…….				
(e)	…….				
	TOTAL FOR BILL NO. 3: DECT EQUIPMENT (CARRIED FORWARD TO FINAL SUMMARY)				

BILL NO. 4: DAYWORK SCHEDULE

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
4.1	**DAYWORK FOR THE FOLLOWING LABOUR**				
4.1.1	Engineer				
(a)	Normal time.	Man-hours			
(b)	Overtime	Man-hours			
(c)	Sunday time	Man-hours			
4.1.2	Foreman				
(a)	Normal time.	Man-hours			
(b)	Overtime	Man-hours			
(c)	Sunday time	Man-hours			
4.1.3	Qualified artisan				
(a)	Normal time.	Man-hours			
(b)	Overtime	Man-hours			
(c)	Sunday time	Man-hours			
4.1.4	Labourers				
(a)	Normal time.	Man-hours			
(b)	Overtime	Man-hours			
(c)	Sunday time	Man-hours			
	PAGE TOTAL (CARRIED FORWARD)				

BILL NO. 4: DAYWORK SCHEDULE

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
4.2	**TRANSPORT COSTS FOR THE FOLLOWING:** TRUCKS, BASED ON A TRAVELLING DISTANCE OF 200 km PER DAY				
4.2.1	1 Ton Truck	days			
4.2.2	2 Ton Truck	days			
4.2.3	5 Ton Truck	days			
4.2.4	Light delivery vehicle	days			
	TOTAL FOR BILL NO. 4: DAYWORK SCHEDULE (CARRIED FORWARD TO FINAL SUMMARY)				

FINAL SUMMARY OF QUANTITIES

The price for the complete installation in working order is in accordance with Section 5 of the Project Specification brought forward from the Bills and is made up as follows:

Preliminary	R
Bill 1 - PABX System (Equipment) ……..	R
Bill 2 - PABX System (Telephones) …….	R
Bill 3 - DECT Equipment ……	R
Bill 4 - Day work Schedule …….	R
Subtotal (A) ……..	R
Contingency amount (IO%) ……..	R
Subtotal (B) ……..	R
Add 14 % VAT……..	R
TOTAL TENDER PRICE (Carried forward to the Tender Form)	**R**

NOTES TO BE READ IN CONJUNCTION WITH THE TENDER PRICE:

The amount given as the 'Total Tender Price'' and carried to the official tender form will be regarded as including the amounts shown in the Bill and no adjustments will be made for any failure by Tenderers to include these amounts in the total appearing on the official form.

The entire PABX installation in this contract shall be completed concurrently with the building works which is due for completion within 3 months from the date of the letter of acceptance.

All material covered by this Specification should, wherever possible, be of South African manufacture. In the adjudication of tenders, preference will be given to items manufactured in the Republic of South African from South African materials.

Should any Tenderer offer products of South Africa manufacture as an alternative to imported products that may be specified, such offers will receive full consideration, provided, the alternative article complies with the technical requirements of the Specification.

The successful Tenderer will be required to establish storage accommodation for materials and provide adequate security and stock control. Allowance for this requirement must be made in the Tender Price.

PART 4

SCHEDULE OF INFORMATION

PABX SYSTEM

Tenderers are requested to complete this questionnaire without resorting to a separate document and/or Statement of Compliance. If, however, space is insufficient, the tenderer may insert additional pages into this document, quoting relevant Section, Clause and Item numbers.

1.	GENERAL	
a)	Manufacturer	…….
b)	System offered	…….
c)	Place of manufacture	…….
d)	Local Content claimed, based on new Telkom Specification	…….
e)	Telkom Type Approved received	YES/NO
	If YES, year of approval	……
	If NO, when is approval expected	……
f)	Is your Statement of Compliance for Telkom included	YES/ NO
g)	Number of systems already commissioned	……..
2.	**SYSTEM RELATED FEATURES**	
2.1	**Type of Equipment:**	
	Digital, Stored program Controlled, Pulse Code Modulation (A-Low encoding)	YES/NO
	If NO, describe technique employed.	……..
		……..
2.2	**Capacity of System**	
a)	Total number of available ports Accommodated in Equipment Cabinets	……..
b)	Maximum No of Trunks (including Tie-Lines)	……
c)	Maximum No of Extensions	……..
d)	Maximum No of Operator Consoles	……..

2.3	**Traffic Handling:**	
	Is system total non-blocking:	
a)	Within each shelf	YES/NO
b)	Between shelves	YES/NO
c)	Within each cabinet	YES/NO
d)	Between cabinets	YES/NO
	If NO, specified restrictions	……
		……
		……
2.4	**Memory:**	
a)	System type (e.g. RAM, EPROM, etc)	……
	Capacity	……
	Memory per circuit card (e.g. 256 Kb)	……
	Is provision made for memory expansion	YES/NO
	If YES, up to what capacity	……
b)	Back-up medium	DISK / TAPE
2.5	**Hot Standby: (with duplicated processors)**	
	Is Hot Standby available	YES/NO
a)	As a standard feature	YES/NO
b)	As an Option	YES/NO
c)	If Hot Standby is available: i) Is there any loss of data during switchover?	YES/NO
	ii) Can automatic switchover be programmed to occur at predetermined intervals?	YES/NO
2.6	**Sampling Frequency:**	……Hz
2.7	**Maintenance:**	
a)	Is an integral Maintenance/Service panel provided?	YES/NO
b)	Is a Man/Machine interface provided (e.g. Service Terminal)	YES/NO

c)	Is dialogue conducted in plain language	YES/NO
d)	Are HELP functions inherent in the system?	YES/NO
e)	Are all customer updating procedures possible without entering the system code area (i.e. operating system software)	YES/NO
f)	Is remote access possible	YES/NO
g)	Are on-site maintenance/administration/customer updating procedures all possible remotely	YES/NO
h)	Is MODEM provided as standard	BUILT-IN/SEPARATE
i)	Is a specimen Maintenance Contract included with your documents?	YES/NO
j)	Where is the nearest Service centre?	……..
k)	Can a suitably-trained Company official carry out facility changes?	YES/NO
l)	Is system-administration training included in the total price?	YES/NO
m)	Is the system password-protected?	YES/NO
n)	Can customer updating procedures be selectively split amongst the various password levels?	YES/NO
	If YES, how many levels are available to the user?	……..
2.8	**Night Service (N/S)**	
a)	<u>Types:</u>	
	i) Predetermined Extensions	YES/NO
	ii) General N/S	YES/NO
	If YES. How many separate N/S Groups/Zones?	……
	iii) Mixed Predetermined/General	YES/NO
b)	Is provision made for automatic change-over to N/S?	YES/NO
2.9	**Main Distribution frame:**	
	<u>Incoming:</u>	
a)	Wall-mounted or cabinet?	……

b)	Type of protection:	
	For extensions	……
	For exchange lines	……
2.10	**Power Requirements:**	
a)	Mains power required	……..Volts, ……..Phase
b)	Maximum power	…… Watts
c)	Is a “clean” supply required	YES/NO
d)	Separate power cabinet required	YES/NO
e)	State number and type of power points required	……
f)	Battery capacity, if required	……
g)	Is a separate battery room required	YES/NO
h)	Are system power supplies distributed or centralised?	DISTRIBUTED / CENTRALISED
2.11	**Accommodation:**	
a)	State overall dimensions of PABX suite	…...mm (w) X …...mm (d) X ……mm (h)
b)	Is air-conditioning required?	YES/NO
c)	How is equipment cooled?	CONVECTION / FANS
d)	Cable entry to cabinets	TOP / BOTTOM / BOTH
2.12	**Trunks:**	
a)	Incoming:	
	i) Does the standard analog trunk module cater for both way and Direct In-Dialling operation	YES/NO
	If NO, specify	…….
	ii) Does the analog trunk module cater for Dedicated (or Direct) In-Line operation?	YES/NO
	iii) Does the system support PCM 30 Direct In-Dialling using R2MFC signalling as specified by Telkom?	YES/NO

	Outgoing:	
b)	i) Can the standard analog trunk module cater for both dial pulse and DTMF signalling to the public exchange without replacement or modification?	YES/NO
	If NO, specify	…….
	ii) Can the standard R2MFC trunk module provide digital Outgoing operation?	YES/NO
	iii) Is dial tone detection included in the standard module?	YES/NO
	Tie-Lines:	
c)	What types of tie-line terminations can be provided?	AUTO-AUTO / AC RING/E+M 4-WIRE/PCM 30/ALL
	State maximum number of voice trunk groups	……
d)	State maximum number of trunks per trunk group	……..
e)	State number of trunk terminations per module (circuits per module)	……..
f)	Analog	……..
	Digital	……..
2.13	**Extensions:**	
a)	Telephone connections	2-WIRE / 3-WIRE / BOTH
b)	DTMF and Dial-pulse on same line	YES/NO
c)	Digital Telephone	YES/NO
	If YES,	……..
	i) 2-wire of 4-wire	……..
	ii) System- or Mains Powered	……
d)	Data Devices	YES/NO
e)	Can the system support 2B+D operation	YES/NO
f)	State number of extension terminations per module	……
g)	Method of Transfer/Enquiry	HOOKFLASH/EARTHWIRE/ DIGIT”1”/TIMED BREAKALL

h)	Can system accommodate 16-button DTMF telephones (CCITT frequencies)	YES/NO
2.14	**Telephone Management:**	
a)	Does the system provide Station Message detail recording (SMDR)	YES/NO
b)	Can system record full details of outgoing calls:	
	i) Extension number	YES/NO
	ii) Called number	YES/NO
	iii) Time when call is originated	YES/NO
	iv) Call duration	YES/NO
	v) Call cost in Rands	YES/NO
	vi) Call cost in meter units	YES/NO
	vii) Can meter unit cost be easily changed without technician assistance?	YES/NO
c)	Can the PABX system provide detailed traffic measurements in Erlang?	YES/NO
d)	Can an external micro-processor-based Management system be connected via an RS232 port?	YES/NO
2.15	**Voice Paging:**	
	Does the system provide a neutral interface for connection of a paging system?	YES/NO
a)	For one-way paging	YES/NO
b)	For “meet-me” operation	YES/NO
2.16	Voice Mail System:	
	Is a Voice mail system available?	YES/NO
	If YES, integrated or separate system?	……
2.17	**Nodal Operation:**	
	<u>If the total system consists of two or more Nodes, the following Section should be completed:</u>	
a)	Maximum number of ports available	…….
b)	How many nodes can be linked together?	……..
c)	Type of inter-node connections	ANALOG / DIGITAL

d)	Inter-system protocol	DPNSS / OWN
e)	Transparent numbering scheme	YES/NO
f)	Call-back and transfer	YES/NO
g)	Conferencing	YES/NO
h)	Call forwarding	YES/NO
	i) All	YES/NO
	ii) Busy	YES/NO
	iii) No-Answer	YES/NO
	iv) Secretarial	YES/NO
	v) Network	YES/NO
i)	Ring-Back-When-Free	YES/NO
j)	Can the linked nodes be served by one centralised Telephone Management System?	YES/NO
k)	Centralised Attendant Service (CAS)	YES/NO
	If YES, how many linked systems can be served?	……
	Maximum number of Consoles	……..
l)	Can Data be switched between nodes?	YES/NO
m)	Will failure of one linked node have any effect on:	
	i) Internal operation on any other individual nodes?	YES/NO
	ii) Operation of total nodal system	YES/NO
	If answer to either i) or ii) is YES, clarify ……..	
2.17	**Networking:**	
	Tenderer is invited to supply, separately, a description of networking facilities:	
a)	<u>Hardware:</u>	
	i) 4-Wire E+M trunks	YES/NO
	ii) 2-Wire both way loop with supervision (DTMF and Dial-pulse)	YES/NO

	iii) 2-Wire AC Ringing	YES/NO
	iv) PCM 30 digital links	YES/NO
	If NO, when will these become available?	……
	If YES, state common date channel, protocol(s)	……
	v) Is system upgradable for new CCITT standards	YES/NO
	vi) Can inter-system fibre-optic cable be connected directly into the system without requiring external line equipment?	YES/NO
b)	<u>Facilities:</u>	
	i) Open or closed numbering scheme	OPEN / CLOSED / BOTH
	ii) Digit translation	YES/NO
	iii) Digit insertion and deletion	YES/NO
	If YES,	
	Maximum number of digits inserted	……..
	Maximum number of digits deleted	…….
	iv) Digit Echo	YES/NO
	v) Alternate routing	YES/NO
	If YES, how many alternate routes	…….
	vi) Number of trunk routes	…….
	vii) Route restriction for specified extensions and/or extension groups	YES/NO
	viii) Transparent extension/extension calls	YES/NO
	xi) Are the above networking facilities part of the standard software package?	YES/NO
	x) Is Least-Cost Routing incorporated in the standard software package?	YES/NO
	xi) Enquiry and Transfer	YES/NO
	xii) Call forwarding	YES/NO
	xiii) Conferencing	YES/NO
	xiv) Ring-Back-When-Free	YES/NO

	xv) Can operator transfer calls to other systems in the network?	YES/NO
	xvi) Centralised Attendant service	YES/NO
	xvii) Specify any other facilities:	……
3.	**OPERATOR-RELATED FEATURES:**	
3.1	**Facilities:**	
a)	Are consoles system-powered?	YES/NO
	If NO, describe power source	……
b)	Is Console digital?	YES/NO
c)	Automatic Call Distribution (if more than one console)	YES/NO
d)	Can operator perform temporary class of service changes	YES/NO
e)	Can operator invoke/cancel call forward on extensions	YES/NO
f)	Last number re-dial	YES/NO
g)	Save number re-dial	YES/NO
h)	Speed Call (Abbreviated dialling):	
	No of stored numbers	……
i)	Inter-console calling	YES/NO
j)	No of Holding Loops per Console	……..
k)	Call Hold	YES/NO
l)	Secrecy	YES/NO
m)	Attendant-controlled conference	YES/NO
n)	Timing / Pricing of calls	YES/NO
o)	Attendant Override (Extensions and Trunks)	YES/NO
p)	Series Calls	YES/NO
q)	Annoyance call tracing	YES/NO
r)	Consoles lockable?	YES/NO
	If YES, how	……
s)	Can operator “toggle” between outside caller and	

	extension?	YES/NO
t)	Control of dial restriction by single button depression	YES/NO
u)	Control of facilities by single button depression	YES/NO
v)	Volume control for faint calls	YES/NO
w)	Entering of account codes for outgoing calls	YES/NO
x)	Manually operated overflow	YES/NO
y)	Automatically controlled overflow	YES/NO
z)	Blink Operation	YES/NO
	If YES,	SYNTHESIZED VOICE / TONES / TACTILE
3.2	**Displays:**	
a)	Type(s) of displays	……
b)	No of characters	…….
c)	Plain English Displays (i.e. ringing, busy, etc.)	YES/NO
	If YES, specify	……
d)	Digital clock (time/date)	YES/NO
e)	Indication of number of calls waiting	YES/NO
f)	Trunk group(s) busy indication	YES/NO
g)	Alarm indications:	
	Major	YES/NO
	Minor	YES/NO
h)	Are Auxiliary/Overflow Consoles available	YES/NO
3.3	**Connection:**	
a)	Size and type of cable	……..
b)	Maximum distance from PABX	……..
c)	Maximum number of consoles	……
d)	Number of consoles per module	……..
4.	**<u>EXTENSION-RELATED FEATURES:</u>**	
a)	DTMF and/or dial-pulse analog telephones	YES/NO

b)	Digital 2-wire telephones	YES/NO
	If YES, system-related, or add-on	……
c)	Dial access to Operator	YES/NO
d)	Operator recall	YES/NO
e)	Executive override (cut-in)	YES/NO
f)	Data line security	YES/NO
g)	Last number re-dial	YES/NO
h)	Outgoing trunk camp-on	YES/NO
i)	Enquiry and transfer (internal)	YES/NO
j)	Enquiry (external)	YES/NO
k)	Call hold	YES/NO
l)	Call park	YES/NO
m)	Call forward – all calls	YES/NO
n)	Call forward – no reply	YES/NO
o)	Call forward - busy	YES/NO
p)	Call forward – external	YES/NO
q)	Call pick-up - group	YES/NO
r)	Call pick-up - directed	YES/NO
s)	<u>Ring-bank-when-free:</u>	
	Automatic:	YES/NO
	By dialled feature access code	YES/NO
t)	Speed-call - System	YES/NO
	If YES, how many stored numbers	……
u)	Speed-call - individual	YES/NO
	If YES, how many extensions how many codes per extension	……
v)	Does speed-call bypass trunk barring exist	YES/NO
w)	Secretarial intercept	YES/NO

x)	Do Not Disturb	YES/NO
y)	Message waiting	YES/NO
z)	Add-on conference	YES/NO
aa)	Extension-Controlled conference	YES/NO
bb)	Meet-me conference	YES/NO
cc)	Direct outward dialling	YES/NO
dd)	Immediate ringing	YES/NO
ee)	Discriminating ringing	YES/NO
ff)	Annoyance call tracing	YES/NO
gg)	Trunk Barring	YES/NO
hh)	State how many classes of services:	
	Voice	……
	Data	……
ii)	Data security	YES/NO
5.	**DATA CAPABILITY**	
a)	Can system switch data internally	YES/NO
	Method of INTERNAL data switching	CIRCUIT / PACKET
	i) Asynchronous	YES/NO
	Max. speed	……..
	ii) Synchronous	YES/NO
	Max. speed	……
b)	Can system switch data externally	YES/NO
	i) Direct via PCM	YES/NO
	ii) Via Modem	YES/NO
c)	If system uses CIRCUIT SWITCHING:	
	Does the standard system include the switching facility for data	YES/NO
	If NO, your price schedule should include prices for switching per 50 ports.	……

	Is the same switching network used for voice and data	YES/NO
	If YES, is there any blocking	YES/NO
	Data connection at system MDF2-wire / V24-RS232C	……..
d)	If system uses PACKET SWITCHING,	…….
	Does the standard system include the Packet Switching facility for data	YES/NO
	If NO, your price schedule should include prices for switching hardware per 50 ports	……
e)	<u>Data-Related Features:</u>	
	i) Number of port wires required per data device	……
	ii) No of data Classes of Service (in addition to voice COS)	……
	iii) Maximum internal date transmission speed	……..…Kb/sec
	iv) Are protocols flexible	YES/NO
	v) Automatic data speed selection	YES/NO
	vi) Manual data speed selection	YES/NO
	vii) Data traffic measurement	YES/NO
	viii) Data Message detail Recording (DMDR)	YES/NO
	ix) Group Data Speed Call (abbreviated dialling)	YES/NO
	x) Individual Data Speed Call	YES/NO
	xi) Last Number Redial	YES/NO
	xii) Data Least Cost Routing	YES/NO
	xiii) Internal Standby Call Queuing	YES/NO
	xiv) External Standby Call Queuing	YES/NO
	xv) Hot-Line	YES/NO
	xvi) Warm0Line	YES/NO
	xvii) System support modem-pooling for internal and external data switching	YES/NO
	xviii) Automatic Modem selection (from pool)	YES/NO
	xix) Manual Modem selection (from pool)	YES/NO

	xx) Associated dialling/call set-up (i.e. telephone associated with data device by software means)	YES/NO
	xxi) What interface is used for simultaneous connection of data and analog voice terminals to the system	……..
	xxii) <u>Can the system interface to the following services:</u>	
	Local Area network (LAN)	YES/NO
	Telex	YES/NO
	Teletex	YES/NO
	Videotex	YES/NO
	Diginet	YES/NO
	SAPONET	YES/NO
6.	**<u>DIGITAL TELEPHONE INTRUMENTS</u>**	
a)	Can PABX system support fully digital, two-wire instruments	YES/NO
b)	Maximum number of digital instruments per system	…….
c)	How are the instruments powered	SYSTEM / LOCAL
d)	Are the instruments fully hands-free (built-in loudspeaker and microphone)	YES/NO
e)	How many freely programmable buttons are available	……
	Are these equipped with LED's	YES/NO
f)	How many other lines can be paralleled (i.e. programmed to appear separately) excluding the main line	…….
g)	Can these additional lines be a mixture of analog and digital lines	YES/NO
h)	Can Executive/Secretary functions be programmed (e.g. intercom between instruments with distinctive ringing)	YES/NO
i)	Does the instrument have a display (e.g. LED)	YES/NO
j)	Is the calling number displayed on ringing (prior to answering)	YES/NO

7.	**SCHEDULE OF BASIC REQUIREMENTS** The following are specific requirements stipulated by the client for the PABX Installation and related services and shall be taken note of. Should Telkom wish to alter the Schedule of Requirements, the engineer must be advised.	
	Type of Service:	Quantity
7.1	Direct lines for ATM	……..
7.2	Direct lines for Speed points	…….
7.3	Direct dial up lines (through PABX)	……
7.4	ISDN Basic rate lines	……
7.5	256k Diginet lines	……

8. **SCHEDULE OF REQUIREMENTS FOR TENDER PURPOSES**

The following schedule of requirements has been compiled for the PABX system and must be read in conjunction with the requirements included in the Project specification.

	PERIOD	**INITIALLY 3 YEARS**	**ULTIMATELY 10 YEAS**
1.	**TRAFFIC INFORMATION**		
1.1	Incoming traffic from PSTN		
1.2	Outgoing traffic to PSTN		
1.3	Outgoing traffic via the operator's console		
1.4	Incoming traffic via the operator's console		
1.5	Extension to extension traffic		
1.6	Tie line traffic to:		
2.	**EQUIPMENT REQUIRED**		
2.1	Windows NT based Operator's consoles	*……	*……
2.2	Extensions	*……	*……
2.3	DDI Answer Unit	*……	*……
2.4	DTMF Receivers	*……	*……
2.5	Power equipment	UPS FOR 60 MINUTES	
3.	**PUBLIC EXCHANGE CONNECTIONS**		
3.1	Incoming from PSTN (Digital)		
3.2	ISDN Primary Rate	*……	*……
3.3	Both way Analogue	*……	*……
3.4	2 Mbit Interface Card	*……	*……
3.5	Outgoing to PSTN (Analogue)	*……	*……
3.6	Additional DTMF Receivers if Required		
3.7	R2MFC Receivers		
3.8	ISDN basic rate lines		

* Consultant to determine quantities.

3.9	256 Diginet lines	
4.	**ADDITIONAL FACILITIES**	
4.1.1	Trunk Barring	YES
4.1.2	Right of Way Service	YES
4.1.3	System to Support Call Centre Functionality	YES
4.2	**Abbreviated Dialling**	YES
4.2.1	Number of codes	*……
4.2.2	Number of extension groups	*……
4.3	Hot line service	YES
4.4	**Add-On Conference facility**	YES
4.4.1	3-way	YES
4.4.2	8-way	YES
4.5.1	Secretarial interception	YES
4.5.2	Cut-in priority	YES
4.6	**Call Forwarding**	YES
4.6.1	Called Party Engaged	YES
4.6.2	No answer	YES
4.6.3	Follow me	YES
4.7	**Call Pick-Up**	
4.7.1	Number of groups	*……
4.7.2	Number of extensions per group	*……
4.8	Ring back when free	YES
4.9	Exchange Lines with Meter Pulse Recovers	N/A

* Consultant to determine quantities.

4.10	**System facilities**	
4.10.1	ISDN	YES
4.10.2	General system	NO
4.11.1	Direct dialling inward (DDI)	YES
4.11.2	Direct dialling outward (DDO)	YES
4.12	Call information logging service	YES
4.13	Networking	NO
4.14	Full transparency	YES
4.15	Internal dialling	YES
4.16	Data detection	YES
4.17	CLIP (Calling Line Identification)	YES
4.18	PIN Number Dialling	YES
4.19	Last number redial	YES
4.20	Call hold	YES
4.21	Nuisance call tracing	YES
4.22	Do not disturb function	YES
4.23	Message on an unanswered phone	YES
4.24	Single digit dialling	YES
4.25	**Call forwarding / follow me**	YES
4.25.1	To another phone when no reply	YES
4.25.2	To voice mail system	YES
4.25.3	To switchboard	YES
4.26	System to support analogue and digital telephones on a two wire system	YES
4.27	System to support digital enhanced cordless telecommunication (DECT) systems in accordance with prescribed international standards.	YES

public works

Department:
Public Works
REPUBLIC OF SOUTH AFRICA

0

SPECIFICATION

FOR THE

SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

AT

BUILDING NAME

TOWN

QUANTITY SURVEYORS

NAME
ADDRESS
ADDRESS
ADDRESS
TEL NO
FAX NO
CONTACT PERSON: NAME
CELL NO

ARCHITECTS

NAME
ADDRESS
ADDRESS
ADDRESS
TEL NO
FAX NO
CONTACT PERSON: *NAME*
CELL NO

ELECTRICAL ENGINEER

NAME
ADDRESS
ADDRESS
ADDRESS
TEL NO
FAX NO
CONTACT PERSON: *NAME*
CELL NO

DEPARTMENT OF PUBLIC WORKS

Building
Street address
CITY
Postal Address
CITY , Code

DATE

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SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 1 – GENERAL

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SECTION 1 – GENERAL

1. Intent of Document

The specification is intended to cover the complete installation of the uninterrupted power supply. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

2. Standards and Codes

Refer to clause 1 of Section 2 of this document for the relevant standards and codes.

All equipment shall be Y2K compliant.

3. Scope of Work

Supply, delivery, installation and commissioning of the complete uninterrupted power supply specified in this document.

The plant room will be provided by other trades and the contractor shall ensure that the space allowed is sufficient for the installation of the UPS and that the ventilation of the plant room is adequate. If any changes to the design have to be made the contractor must inform the consulting engineer in writing.

Consultant to include Particulars of this contract

4. Ambient Operating Conditions

a) Ambient Temperature
b) Relative Humidity
c) Altitude
d) Dust
e) Corrosion

Consultant to include information a – e particular to this project

5. Site Information

Consultant to include Particulars of this contract

6. Co-ordination

Due to the nature of the installation, a fixed sequence of operation is required to properly install the complete uninterrupted power supply. The work shall be closely scheduled in order not to delay the entire project.

The contractor shall familiarise himself with the requirements of the other trades and shall examine the plant and specification covering each of these sections.

The space requirements shall be carefully checked with the other trades to ensure that he equipment can be installed in the proper sequence in the space allocated.

7. Test Certificates and Inspections

The following tests are to be carried out :

(a) After completion of the works and before first delivery is taken, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installation will be inspected and

the contractor shall make good, to the satisfaction of the Representative/Agent, any defects which may arise.

(b) The Contractor shall provide all instruments and equipment required for testing and any water, power and fuel required for the commissioning and testing of the installation at completion.

(c) Test reports of both tests as specified under (a) and (b) are to be submitted to the Department.

8. Guarantee and Maintenance

The Contractor shall guarantee the complete plant for a period of twelfth months after first delivery has taken place.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the Contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site at his own expense.

The Contractor shall maintain the plant in good working condition for the full twelfth month period to the final delivery of the installation. However, should the Contractor fail to hand over the plant in good working order on the expiry of the specified twelfth months, the Contractor shall be responsible for further monthly maintenance until final delivery is taken.

During this period the contractor will undertake to arrange that the plant be inspected at regular intervals (whatever number of visits the contractor deems necessary to fully maintain the equipment) by a qualified member of his staff who shall: -

(a) Check the mechanical soundness of all parts

(b) Check and adjust all the output and control values of the system (voltage, frequency, control voltages, etc.)

(c) Take control measurements on the major system components and record these measurements.

(d) Replace all defective components.

(e) Service batteries.

(f) Check ventilation UPS equipment.

(g) Clean all equipment and/or rooms as required.

(h) Provide 24 hour standby maintenance and repair service at all times, including statutory holidays.

Note: At each visit, which shall be arranged in advance with the client's representative, a record of maintenance carried out shall be kept. The time and date of visits shall be entered in a logbook, which shall be kept in the plant room.

9. Materials and Workmanship

(a) The work throughout shall be executed to the highest standards and to the entire satisfaction of the Representative/Agent who shall interpret the meaning of the Contract Document and shall have the authority to reject any work and materials, which, in his judgement, are not in full accordance therewith. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(b) All work shall be executed in a first-class manner by qualified tradesman.

(c) The Contractor shall warrant that the materials and workmanship shall be of the highest grade, that the equipment shall be installed in a practical and first-class manner in accordance with the best practices and ready and complete for full operation. It is specifically intended that all material or labour which is usually provided as part of such equipment as is called for and which is necessary for its proper completion and operation shall be provided without additional cost whether or not shown or described in the Contract Document.

(d) The Contractor shall thoroughly acquaint himself with the work involved and shall verify on site all measurements necessary for proper installation work. The Contractor shall also be prepared to promptly furnish any information relating to his own work as may be necessary for the proper installation work and shall co-operate with and co-ordinate the work of others as may be applicable.

(e) All components and their respective adjustment, which do not form part of the equipment installation work, but influence the optimum and safe operation of the equipment shall be considered to form part of, and shall be included in the Contractor's scope of works.

(f) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(g) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the installation and guarantee periods to ensure the safety of the public and the User Client.

(h) The Contractor is to include for all scaffolding required to complete the work required.

10. Brochures

Detailed brochures of all equipment offered shall be presented together with the tender documents.

11. Submittals

The following information must accompany the tender documents

(a) The information requested in the schedule of information.

(b) A paragraph by paragraph schedule of compliance with detailed description of any deviations from this specification.

(c) If alternative systems are offered, a clear description of the operating characteristics and special features of the equipment along with a motivation for offering the alternative.

(d) Descriptive and illustrated brochures and other information pertaining to the inverter and ventilation equipment and switchgear.

(e) The proposed layout as stated.

(f) Arrangement of batteries.

(g) A sample test report as stated.

(h) The circuit diagram requested.

(i) The information requested.

(j) Tenderers shall submit a list of successful installations completed in the Republic of South Africa.

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 2 – EQUIPMENT REQUIREMENTS

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1. QUALITY, STANDARDS AND REGULATIONS

All material and equipment supplied for this contract shall be new and the best of their respective kind. All new materials and equipment supplied, shall comply fully with the requirements laid down in the specification. The whole of the works shall be executed in accordance with best practice and to approval of the engineer. The equipment shall comply with the latest issues of the following standard specifications:

1.1 South African Bureau of Standards

SABS 150	Insulated wire.
SANS 1091	Colour standards for paint.
SANS 0142	Wiring code of practice.
SANS 1474	UPS units.

1.2 Regulations and Rights of Engineer

Apart from any other authority, which the engineer may have in terms of the contract, he shall have the right to set the standard and to accept or reject part of the specified equipment depending on the quality of material and workmanship offered.

The contractor shall be notified if the quality of such materials and/or workmanship is not acceptable. In such an event, the contractor shall replace the specific part or repair it to the satisfaction of the engineer, all at the cost of the contractor. Such an instruction shall not exempt the contractor from any of his obligations in terms of the contract.

The installation shall be erected and carried out in accordance with:

a) The Basic Conditions of Employment Act and the Machinery and Occupational Safety Act of 1983, as amended.

b) The local Municipality by-laws and Regulations as well as the regulations of the local Supply Authority.

c) The local Fire regulations.

d) The Regulations of the Department of Posts and Telecommunications.

e) The Standard Regulations of any Government Department or public service company where applicable.

In addition the contractor shall at his cost issue all notices in respect of the installation to the local authorities, and shall exempt the client from all losses, costs or expenditures which may arise as a result of the contractor's failure to comply with the requirements of the regulations enumerated above.

It shall be assumed that the contractor is conversant with the above-mentioned requirements. Should any requirements, by-law or regulation, which contradicts the requirements of this document, apply or become applicable during erection of the installation, the contractor shall immediately inform the engineer of such a contradiction. Under no circumstances shall the contractor carry out variations to the installation in terms of such contradictions without obtaining the written permission to do so from the engineer.

2. UNINTERRUPTED POWER SUPPLY (UPS)

2.1 Definitions

(a) **UPS** shall denote the complete UPS unit with associated controls, remote alarm panel and batteries and any accessories required by the system for its successful operation.

(b) **Power Converter Module** shall denote a rectifier, battery charger, inverter, electromechanical by-pass switch and manually operated by-pass switch.

(c) **Rectifier** shall denote that portion of the converter module containing the equipment and controls to convert the incoming AC power to regulated DC power required by the inverter.

(d) **Inverter** shall denote that part that converts the DC supplied by the rectifier to AC satisfying the load requirements.

(e) **Electro-mechanical** by-pass static switch shall denote a by-pass system provided break free switching from inverter to mains operation and vice versa.

(f) **Battery charger** shall denote that portion of the power converter module containing the equipment and controls to convert the incoming AC power to precisely regulated DC power required for battery charging.

(g) **Critical load** denotes the load as presented to the UPS by the computer or other load requiring constant supply and associated circuits and apparatus.

(h) **Mean-Time-Between-Failure (MTBF)** shall denote an overall MTBF of the UPS as a complete system.

(i) **A system failure** shall denote any interruption to, or degradation of the critical load bus voltage or frequency beyond the limits set forth herein.

(j) **Efficiency** shall denote the ratio of real output power (kW) to real input power (kW) with the UPS operating at a defined load power at the defined power factor, the battery fully charged and with nominal input voltage.

2.2 System Requirements (The Required Input and Output Voltages Are Detailed In Part 2 Of This Specification)

(A) Input to the UPS

(a)	Input voltage	:	400/231V ± 10% or 231V ± 5%
(b)	Frequency	:	50Hz ± 4%
(c)	System	:	1 phase 2 wire or 3 phase 4 wire with operative earth conductor, supplied from utility network or standby generator set. Refer to detail specification.
(d)	Power factor		Not less than 0,8 lagging.
(e)	Max starting current:		10 times full load current for not more than ½ a cycle with rectifier soft starting facility.

(B) **Output to Load**

(a)	Rating	:	Refer to detail specification.
(b)	Output voltage	:	Refer to detail specification.
(c)	Frequency	:	50 Hz ± 0,5 Hz.
(d)	System	:	1 phase 2 wire or 3 phase 4 wire with operative earth conductor. Refer to detail specification.
(e)	Voltage regulator	:	± 10% maximum deviation of steady state voltage recovering to within 5% in less than 50 ms and to within 1% less in that 100 ms.

(f) Frequency stability : Normally automatically synchronised to mains frequency if the latter is within 50 Hz ± 2% (adjustable window) Runs free at 50 Hz ± 0,5 Hz at any load when mains is out of limits.

(g) Harmonic content : Less than 4% total distortion.

(h) Amplitude modulation : Less than 2%

(C) Overall Performance

Efficiency (overall) : 80 - 85%

(D) Ambient Operating Conditions

Refer to Section 1, General – Clause 5

(E) System Description

The system shall consist of a static UPS complete with the following components :

(a) Rectifier/charger.

(b) Inverter.

(c) Battery.

(d) Automatic electronic no-break bypass circuit and switch.

(e) Separate manual bypass switch.

(f) Protective devices and measuring equipment.

(g) The required controls and necessary equipment.

(h) A self monitoring system with digital readout by means of which all critical functions can be checked.
Note: Requirement (h) Is Only For Ups Systems Above 200 kVA

The system shall be capable of providing an uninterrupted supply to the load with the output characteristics as specified for a minimum period of **30 minutes** during a total mains failure (i.e. normal mains and standby generator supply failure). The batteries shall be rated at an AC load power factor of 0,8 lagging.

The complete system, including all controls shall be designed in such a way that the failure of any one vital central component will **NOT** cause a complete system failure. If necessary such a failure must be avoided by connecting the load directly to the mains by means of the bypass switch.

The UPS shall operate satisfactorily synchronous with the mains supply even under severe conditions of up to 100% unbalanced load.

The UPS shall be amply rated to carry the stated full load current. The UPS shall furthermore be capable of withstanding the following overloads.

Static Overloads: 100% of full load continuously.
125% of full load for 5 minutes.
150% of full load for 2 minutes.
165% of full load for 1 second with inductive decay after initial equipment switch on surge current.

Dynamic Overload : 300% for less than 5 msec.
1000% for less than 1 msec.

All component parts, cables and other connections shall be amply rated to withstand the overloads stated and maintain the input voltage **at the load** within the tolerances stated.

The equipment shall be designed for the maximum operating efficiency. The efficiency shall be determined when the system is delivering full load at 0,8 power factor with the batteries fully charged. The load required by the auxiliary equipment (controls, alarms, etc). electronic switches and cabinet fan shall be included in he determination of overall efficiency. A typical test report clearly showing how the efficiencies are calculated, shall be submitted with the tender.

It shall be the responsibility of the successful tenderer to ensure satisfactory operation of the complete system for the load to be supplied. It is, therefore, essential that the tenderer acquaint himself fully with typical load conditions before the tender closing date.

All cabinets containing thyristors shall be adequately screened and earthed to prevent direct radio frequency radiation.

Tenderers shall submit with their tenders a schematic diagram showing :

Input circuit breakers.
System busbars.
Rectifiers.
Batteries.
Inverters.
Electronic switches.
Bypass circuit.
Detour circuit.
Fuse protection.
Output circuit breakers.
Oscillator.
Power supply circuits to oscillator, alarms, controls, etc.
Battery isolator.

The diagram shall also show the relative phase displacement of the rectifier transformers.
NOTE: This Is Not Applicable To Systems Below 200kVA.

(F) Inverter Oscillator

The inverter shall contain an oscillator capable of operating and maintaining the inverter output frequency as specified. The inverter oscillator shall be capable of frequency synchronisation and phase locking to the mains (or standby generator) power source frequency. When operating as a slave to the mains or standby power and a failure occurs in the slaving signal, the invertor oscillator shall automatically revert to a free running state and maintain the specified limits. All changes in output frequency to free run or synchronise shall be gradual to suit the load requirements.

(G) Rectifier

The UPS shall have its own rectifier and rectifier transformer which shall operate satisfactorily from the mains or standby supply.

The rectifier shall be of the solid state type providing full wave rectification of the input voltage suitably regulated to suit the input requirements of the inverter. Where necessary, a high grade DC filter shall be utilised to limit the output ripple to within acceptable levels for the inverter input. Current limiting features shall be provided to protect the rectifier. The current limiting settings shall be variable for final adjustment on site.

Voltage free contacts shall be provided for the malfunction alarms of the rectifier.

An input monitoring circuit shall be provided for the rectifier. This circuit shall switch off the rectifier when the r.m.s. value or frequency of the input voltage falls below present values.

The necessary protection circuitry shall be provided to switch off the rectifier if any one of the rectifier phases should fail, thus presenting an unbalanced load to the incoming supply.

The output of the rectifier shall be connected in parallel to the battery and inverter.

The rectifier shall have over temperature protection. Temperature sensing probes shall be placed on the thyristor housing, thyristor mounting, or on the heat sink close to the thyristor. The sensing of the off coming air temperature alone is not acceptable.

Tenderers shall take into account the possible effects of harmonics that may be present on the input supply due to non-sinusoidal waveforms at the rectifier input, phase commutation, the effect of reactance during phase commutation etc. The input voltage monitoring circuits of the rectifiers shall be adequately filtered and buffered to ensure reliable load control and to prevent continuous on-off switching of the rectifiers.

For three phase units each of the three rectifier transformers shall have a different primary to secondary phase displacement in order to minimise the harmonics generated by the rectifiers.
NOTE: This Is Not Applicable For Systems Below 200 kVA

(H) Inverter

The inverter shall be adequately protected against any excessive overload or short circuits that occur in the load. Reactive current limiting or other methods shall be employed to render the thyristors short circuit proof. The successful tenderer shall replace any thyristors or any inverter components at his own expense if these should be damaged.

The necessary feedback and control circuits shall be incorporated to ensure satisfactory operation separately or in synchronisation with the mains supply under all conditions of dynamic load variations, stated overloads, severe unbalanced conditions and high operating temperatures. The thyristor bridge shall contain the necessary auxiliary circuitry to ensure satisfactory operation.

The output of the inverter shall be connected in parallel with the thyristor switch output.

Each inverter shall have over temperature protection similar to the over temperature protection for the rectifier.

A discharge device shall be provided across the D.C. input to the inverter, which will discharge any capacitors in the inverter module when it is switched off.

(I) Battery charger

The battery charger shall be a solid state, constant voltage type providing full wave rectification of the input voltage with the output regulated to an accuracy as specified. A high grade D.C. filter shall be utilised to limit the output ripple to the stated tolerance. Current limiting features shall be provided. The value of the current limit setting, shall be in accordance with the maximum allowable charging current that the batteries can withstand.

The maintained voltage on float charge shall be such as to give maximum life to the batteries whilst maintaining the maximum charge conservation and minimising gas formation and water loss. The optimum float charge voltage shall be specified by the battery manufacturer but is expected to be approximately 2,23 volts per cell. The voltage shall be kept within ± 0,5% of the nominal value for all loads from no load to the full rated battery charger current when supplying the full output with batteries discharged.

(J) Computer rooms/office UPS installation

The rectifier shall be equipped with **2 independent** over voltage shutdown contacts for maximum charger security.

The battery charger shall be designed to charge the batteries to 90% of its fully charged capacity within 14 hours and to 100% capacity within 20 hours.

The battery charger shall be capable of boost charging the batteries to 2,6 volt per cell. The boost facility shall be manually operated.

The battery charger shall be provided with a current limiting circuit.

The current limit setting shall be variable for easy adjustment on site.

The necessary voltage free contacts for the alarms and battery charger failures shall be allowed for in the tender price.

The battery charger shall have over temperature protection similar to the protection specified for the rectifier.

The battery charger shall have circuitry to inhibit the charging of batteries from the standby generator. This circuitry shall be activated by normally open contacts on the generator control panel. The interconnecting cables will be supplied and installed as part of this contract.
NOTE: This requirement is only applicable for UPS systems above 200kvA

(K) Battery

The battery capacity shall be sufficient to provide full load for the specified time. The capacity shall be rated at a maximum specific gravity of 1,245 at 25 C and correctly filled.

Tenderers shall state the discharge capacity of the battery after 10 hours of charge and the battery voltage at its terminals under various conditions. The inverter shall switch off on low battery voltage.

The battery cells shall be of the maintenance free type.

The batteries shall give satisfactory service for a minimum period of **3 years**. Tenderers shall state the maximum expected lifetime of the batteries and motivate their statement, and provide a statement by the battery manufacturer supporting this and stating that the charger offered is suitable for the battery.

The cells must be mounted in a matching steel cabinet or in the same cabinet as the control equipment. The vented type cells should be mounted on a wooden stand, consecutively, numbered with positive and negative terminals clearly marked in a ventilated battery room.

The batteries shall be complete with cell inter-connectors and row inter-connectors. The output terminals shall be robust and adequately dimensioned for the output cable terminations.

The inter-connectors between cells and shall be made in a manner giving the lowest volt drop and maximum resistance to corrosion.

All connections to cells must consist of flexible cable to avoid mechanical stress at the cell terminals.

The tenderer shall describe the method of removal and replacement of a faulty cell.

The battery shall be complete with a battery fuse isolator capable of breaking the full load current drawn by the inverter. These battery fuse isolators shall be installed in the inverter unit room or cabinet.

Terminal posts should be effective for the expected lifetime of the battery and should be effective even if the cell is overfilled.

The battery may be resistance grounded through 5000 ohm to 10000 ohm for the purpose of ground fault.

Tenderers shall submit full details with dimensioned drawings of the batteries offered.

Tenderers shall submit the calculations and motivations complete with curves supporting the selection of a specific battery cell.

All cabling for the battery shall be installed on PVC cable trays and fitted to the satisfaction of the engineer.

(L) Automatic by-pass switch

An integral automatic bypass switch shall be provided to transfer the critical load without break to the mains should the UPS unit fail. The latter unit shall simultaneously be disconnected from the critical load bus. This transfer shall, however, be inhibited if the mains is out of synchronism with the UPS output. Retransfer to the UPS output shall be on a manual or automatic command. This switch must have a cover fitted screwed to the panel so as to make the operating of this switch impossible without having first removed the cover. This switch cover must also have the following words etched in white with a red background mounted on or adjacent the cover: **CAUTION : BYPASS SWITCH ONLY : ONLY TO BE OPERATED BY QUALIFIED PERSONNEL**

The static switch should prevent "hunting" and after trying unsuccessfully to switch a maximum of **three** times the static switch should be inhibited from further switching.

3. CONSTRUCTION OF CUBICLES AND SWITCHBOARDS

All the converter equipment shall be housed in totally enclosed, free standing, floor mounted cubicles, designed top provide adequate ventilation for the equipment.

All cubicles shall be rigid with suitably braced doors providing front access.

All cubicles shall be vermin proof.

All equipment shall be mounted on the metal framework suitably arranged to provide safe operation and ease of access. Fuses and switchgear in particular should be safely accessible even under load conditions.

All power bridges, filters and other major components both in the inverter and rectifier, shall be completely withdrawable to facilitate rapid repair and/or replacement. The method of withdrawal shall be such that a complete module can be extracted in the operating condition so that checks and measurements may be made while in operation and access to all components facilitated.

All electronic printed circuit cards shall be of a good quality and shall be easy and simple to interchange.

All auxiliary power supplies shall be duplicated and shall be connected so as to operate in parallel redundancy. At least two primary sources of power shall be provided for each of the power supplies in the system.

Flexible wires shall not be soldered directly onto terminals but shall have a crimped tab, which is soldered onto a terminal or post. The wire wrapping technique shall be employed for electronic circuits where possible.

The front panel alarms shall be clearly and adequately marked in both official languages. A single line mimic layout of the switchgear shall be provided on the front of the cubicles providing a graphic display of the circuitry of the equipment involved.

All input and output power cables shall be terminated using approved cable glands, onto a cable gland support bracket. The cable conductors shall terminate at the connecting busbars or shall be connected directly to the appropriate switchgear. All power cables

shall be properly numbered with wrap around cable markers with punched figures to identify cables at each termination point.

4. INSTRUMENTATION AND CONTROLS

All the required instrumentation as indicated on the drawings shall be provided.

Supply and install all the necessary controls for the operation of the system. Facilities shall be provided for controlling the rectifier, switching the inverter on, switching the inverter output to the synchronous motor/alternator and controlling the bypass thyristor switch circuit.

All control switching of the rectifier and inverter as well as the bypass operation shall be pushbutton initiated.

Standard electronic equipment from overseas manufactures shall **not be accepted** if not duly protected with transsorbs and metal oxide varistors in power supplies and external communication lines. Standard electronic equipment not internally protected with transsorbs or MOV's may be protected externally by means of transsorbs and MOV's mounted on klippon type terminals. All external communication and remote power supply lines shall be protected by means of transsorbs and MOV's of sufficient rating mounted on klippon type terminals.

5. ALARMS

All alarms shall be of the tell tale type with memory features e.g. a flashing light indicates a fault coupled with an audible alarm. The pressing of the appropriate button shall cancel the audible alarm and allow the alarm lamp to burn continuously until the fault is removed.

The following minimum alarm conditions shall be monitored on the equipment:

(1) Normal
(2) Mains failure
(3) Inverter failure
(4) Shutdown imminent
(5) Load on mains
(6) Overload
(7) Charger fails

Where required a remote panel must be supplied and installed. The alarms indicated must duplicate all the alarms indicated on the UPS control panel. In addition a buzzer must be provided. Any alarm occurring must sound the buzzer to draw attention. An alarm accept pushbutton to silence the buzzer must be provided.

Provision shall be made on all the alarms mentioned above to be remotely monitored. Normally open contacts shall be supplied at the converter for each alarm for this purpose. The contacts shall close under an alarm condition.

6. VENTILATION

All equipment racks shall be positioned in logical fashion on the floor in a configuration, which will ensure proper ventilation

Each cubicle containing heat-generating equipment (thyristors, transformers electronic circuitry, filters, etc) shall, where necessary, have extraction ventilation fans mounted on the top of the cubicle to assist air circulation. These fans shall be fed from the output distribution panel of the uninterrupted power supply.

7. QUALITY ASSURANCE

The manufacturer shall be responsible for the performance as specified herein and to prove such performances to the satisfaction of the engineer. Except as otherwise specified, the supplier must utilise facilities acceptable to the engineer.

8. DRAWINGS

As soon as possible after the awarding of the contract, the successful tenderer shall at his expense submit to the engineer for approval, three prints of:

(1) All general arrangement drawings.

(2) Detailed dimensioned drawings of all plant and equipment.

(3) Complete wiring diagrams and block schematic diagrams.

At the same time a list of all equipment designations, labels, etc. in both official languages shall be submitted for approval.

The approval of drawings shall not relieve the successful tenderer of his liability to carry out work in accordance with the terms of the contract.

On completion of the contract, a complete set of transparencies of all drawings of a quality acceptable to the engineer shall be handed to the engineer at the expense of the successful tenderer. These final drawings shall include:

(1) A proper and accurate as-made wiring diagram of the complete installation showing circuit numbers, terminal strip numbers and conductor colours.

(2) A schematic diagram clearly showing functions and component values. A material list showing make, model and characteristics of all components of the control equipment and switchgear is to be included.

(3) Fully dimensioned as-made physical layout drawing of the equipment, batteries and ventilation equipment.

(4) A detailed **schedule** of all wiring.

The contract shall be deemed incomplete until all drawings have been received by the client.

9. INSTRUCTION OF OPERATOR AND MANUALS

After completion of the installation, and when the plant is in running order, the successful tenderer will be required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and handling thereof.

Three (3) copies of maintenance, fault-localising and operating manuals together with the drawings required shall be handed over to the engineer.

10. TESTS

The complete testing including the provision of test facilities, instruments, dummy loads and switchgear at the manufacturer's premises in the Republic of South Africa shall form part of this contract. If the factory tests cannot be performed in the RSA, the client may, at his discretion and own cost, decide to attend tests at the supplier's overseas factory. Tenderers shall not allow for this.

For the test in the manufacture's premises the client shall be notified four weeks in advance in order that a representative can be sent to witness these tests.

10.1 Battery tests

(1) The output voltage of the battery unit (i.e. all the cells making up one battery) shall be tested with the incoming supply removed.

(2) The full rated load for the battery shall then be connected to it. The voltage shall be measured at 5 minute intervals for the duration discharge period.

(3) The batteries shall be left to recharge. The voltage shall be checked after 14 hours with the load and incoming supply removed as well as with the load connected but incoming supply removed.

(4) When fully recharged, the voltage and specific gravity of every cell shall be measured with the incoming supply removed.

(5) The circulating A.C. current through and the A.C. voltage across the batteries shall be measured when the rectifiers are on with the battery discharged and fully charged.

10.2 Oscillator tests

(1) Frequency within tolerances at all loads.

(2) Parallel redundancy.

(3) Auto automatic synchronisation for connection of the synchronous motor/alternator to mains via the thyristor switch.

An electronic frequency counter shall be used to measure the frequency.

10.3 Rectifier tests

(1) Output voltage of rectifiers at no load and full load with batteries charged and not charged.

(2) Current limit, both for mains failure and return to mains.

(3) Switch off value mains input monitor.

(4) Sequential switch on for return to mains.

(5) Soft start circuits.

10.4 General

Ammeters will not be acceptable to prove the above items. A wave analyser and a recording oscilloscope will be required. Photographs shall be taken of the oscillograms by the contractor in the presence of the engineer.

The overall efficiency of the complete uninterrupted power supply shall be proved to be within the specified limit at full load and at no load.

The overcurrent protection mechanisms of the A.C.B. shall be proved by current injection (either primary or secondary)

The bypass and detour circuits shall be proved.

All alarms, indications and control functions shall be proved.

The test instruments provided shall in all cases be of high quality and suitable to be able to adequately assess the quantities being measured and the equipment being tested. All instruments shall be calibrated by a testing laboratory approved by the National Calibration Service of the CSIR. The test equipment remains the property of the successful tenderer.

At the completion of the tests, a full test report shall be submitted by the contractor to the engineer in triplicate.

Continuously adjustable dummy loads of a rating suitable to comprehensively test the UPS shall be provided by the contractor as well as any temporary cables required for the connection of the dummy load to the UPS on site.

11. CABINET

The contractor shall supply and install a metal cabinet with lockable doors of sufficient size to house all operating and maintenance instructions, drawings, spares, tools, etc.

12. SCHEMATIC DIAGRAM

A schematic diagram of the complete system shall be mounted in a suitable place and shall be resin encapsulated.

13. AUXILIARY EQUIPMENT

Tenderers shall make all allowances for plant required (i.e. hoists, cranes, trolleys, etc.) ensuring positioning of the equipment in the UPS room.

14. UPS POWER PLUG OUTLET

All UPS power plug outlets must be of the red non-standard 3-pin type with the earth pin not earthed to the plug baseplate to facilitate the installation of a single earth connection earthing system. Each socket outlet must be provided with a red plug top.

Each socket outlet must be labelled with an engraved label indicating the power circuit number to which it is connected.

15. DISTRIBUTION WIRING

All sub-distribution wiring circuits must be wired as follows:

15.1 Mains power plug circuits

4 mm^2 PVC/copper in red and black conductors and a 2,5mm^2 bare copper earth.

15.2 UPS power plug circuit

4 mm^2 PVC/copper in blue and black and a green PVC insulated 2,5mm^2 earth wire.

The black neutral conductors must be clearly labelled at each end as follows: "UPS" or "OKT"

15.3 UPS Earthing

The main earth bar must be connected to the insulated earth bar of the UPS via a removable copper link bar.

All UPS boards must have insulated earth bars, separately earthed to a clean 1,2m earth spike be means of 70mm^2 insulated earth to obtain at least one ohm at the UPS board.

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY

SECTION 3 – SCHEDULES OF TECHNICAL INFORMATION

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SECTION 3 – SCHEDULES OF TECHNICAL INFORMATION

1. SYSTEM PARAMETERS

1.	Net output power of inverter system	kVA
2.	Power factor for which the system is rated	Lagging
3.	Nominal input voltage	Volts
4.	Maximum input voltage tolerated	Volts
5.	Minimum input voltage tolerated	Volts
6.	Maximum input frequency deviation tolerated	Hz
7.	Maximum and minimum input power factor at rated KVA	kVA
8	Maximum harmonic input tolerated for successful operation	%
9	Nominal output voltage	Volts
10	Steady state output voltage regulation	Volts
11	Dynamic output voltage regulation:	
(a)	Step load of 25% between 10% and 100% of full load	%
(b)	150% overload for 1 sec	%
(c)	Input voltage step variation of ± 15%	%
12	Time for voltage recovery to steady state:	
(a)	25% step load	ms
(b)	100% step load	ms
(c)	150% step load for 1 sec and then returned to 100%	ms

13.	Relative output phase angles at 100% unbalanced load (in degrees)	Degrees
14.	Maximum harmonic content of output voltage	%
15.	Overload capacity	
(a)	One hour	%
(b)	One minute	%
(c)	Ten seconds	%
(d)	One second	%
(e)	Five msec	%
(f)	One msec	%
16.	Total input required with batteries charged for rated full load	KVA
17.	Total input required at full load and and battery discharged	KVA
18.	Allowable temperature rise across equipment at input air temperature of:	
(a)	25 °C	°C
(b)	30 °C	°C
(c)	32 °C	°C
(d)	35 °C	°C
(e)	40 °C	°C
19.	Heat dissipation under normal full load Running conditions:	
(a)	Converter	KW

(b)	Battery		KW
20.	Efficiency of the complete UPS system	**1,0p.f.**	**0.8p.f**
(a)	Full load	%	%
(b)	80% load	%	%
(c)	75% load	%	%
(d)	65% load	%	%
(e)	50% load	%	%
(f)	40% load	%	%
21.	R.M.S. value of the A.C. **current** component through the batteries for:		
(a)	Discharged battery		Amp
(b)	Charged battery		Amp
22.	R.M.S. value of the A.C. **voltage** component through the batteries for:		
(a)	Discharged battery		Volts
(b)	Charged battery		Volts
23.	Total number of cubicles		
24.	Total floor space required		m^2
25.	Dimensions of cubicle in mm		W
			H
			L

2. BATTERY CHARGER

1.	Type	
2.	Output voltage for trickle charge	Volts
3.	Steady state regulation of output voltage trickle to full load	± %
4.	Output voltage for input voltage fluctuation	
(a)	± 10%	%
(b)	± 15%	%
5.	Ripple content (%)	%
6.	Current limit value	Amp
7.	Input voltage at which battery charger switches off	
(a)	Maximum	Volts
(b)	Minimum	Volts
8.	Maximum switch on inrush current	Ampere
9.	Battery charger overload protection (type)	
10.	Efficiency	%
11.	How is the effect of harmonics on input voltage minimised ?	

3. OSCILLATOR

1.	Type of oscillator (RC, crystal, etc.)	
2.	Stability:	
(a)	With oscillator supply fluctuation	± %
(b)	Temperature variation	± °C
(c)	Number of power supplies in parallel redundancy	
3.	Number of batteries from which oscillator is fed	
4.	Minimum time synchronise to mains frequency	sec

4. INVERTER

1.	Maximum continuous power output (kVA)	KVA
2.	Nominal output voltage	Volts
3.	Maximum harmonic content	%
4.	Nominal input voltage:	
(a)	Maximum	Volts
(b)	Nominal	Volts
(c)	Minimum	Volts
5.	Input current at full load	Ampere
6.	Input power factor at full load	Lagging
7.	Efficiency at full load	%
8.	Overload protection	

5. STATIC SWITCH

	Does switch comply to clause 3.2.2.12	
1.	Describe electronic switch	
2.	Minimum power factor at which switches will operate satisfactorily	
3.	How does switch derive operating signal ?	
4.	Maximum break time for switchover	ms

6. BATTERIES

1.	Manufacturer	
2.	Country of origin	
3.	Type	
4.	Type No	
5.	Total number of cells	
6.	Number of cells per inverter	
7.	Battery voltage (float conditions)	Volts
8.	Battery voltage (Boost charge)	Volts
9.	Capacity (rated for time required)	Ah at
		Hrs
10.	Battery time offered under load conditions specified in Clause 2.17 Part 2) and (Clause 3.2.2.5 (Part 3)	Minutes
11.	Maximum output current	Ampere

12.	Cell voltage under float conditions	Volts
13.	Cell conditions under boost conditions	Volts
14.	Cell voltage at start of discharge and full inverter load	Volts
15.	Cell voltage at end of discharge period	Volts
16.	Expected lifetime of batteries	Years
17.	Time to charge to 90% capacity	Hrs
18.	Total time to charge to 100% capacity	Hrs
19.	Material of supporting framework	
20.	Finish of framework	
21.	Dimensions of each cell	W
		H
		L
22.	Design of positive plate of cell	
23.	Rating of fused isolator	Ampere
24.	Cell configuration	

7. SYSTEMS ABOVE 200kVA

1.	No of shelves	
2.	No of rows/shelves	
3.	No of tiers/shelves	
4.	Shelf length	
5.	Shelf height (incl. Batteries)	

NOTE : ALL BATTERY CALCULATIONS INCLUDING CURVES SHALL BE INCLUDED IN THE TENDER

8. DETAILS OF MANUFACTURE OF UPS

1.	Manufacturer	
2.	Address	
3.	Country of origin	
4.	Make or trade name of equipment	
5.	Manufacture's type no.	
6.	Is tenderer an accredited agent ?	YES/NO
7.	Furnish details of maintenance and repair service facilities which can be rendered.	

SPECIFICATION FOR THE SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF UNINTERRUPTED POWER SUPPLY
SECTION 4 – PRICE SCHEDULES

TABLE OF CONTENTS

SECTION 4 – PRICE SCHEDULES

1. General

1.1 The conditions of contract and the application of the Contract Price Adjustment Provisions shall be as set out in Part A: Section 1: Preliminaries.

1.2 The descriptions in this Price Schedule shall be read in conjunction with the specification.

1.3 The unit rate for each item in the Price Schedules shall include for all materials, labour, profit, transport, etc., everything necessary for the execution and complete installation of the work in accordance with the description.

1.4 The Price Schedules shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors on site before ordering any of the cables. Any allowance for off-cuts shall be made in the unit rates.

1.5 The rates shall exclude Value Added Tax and the total carried over to the final summary in PART A.

1.6 All material covered by this **Specification** shall, wherever possible, be of South African manufacture.

2. Schedule

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT	
					R	c
1.1	Delivery, installation and commissioning of the UPS, complete with all equipment as specified:					
	a) … kVA					
	Supply	No	1			
	Installation	No	1			
	b) …kVA					
	Supply	No	1			
	Installation	No	1			
1.2	Battery as specified:					
	a) … kVA					
	Supply	No	1			
	Installation	No	1			
	b) …kVA					
	Supply	No	1			
	Installation	No	1			
1.3	Three Copies of Operation and Maintenance Manuals:					
	a) … kVA	No	1			
	b) …kVA	No	1			
	Total Carried to Summary			R		

3. Summary of Schedules of Quantities

Schedule		Page No	Amount R	c
1.	……	4.1		
Total Tender Price (Excluding VAT) for the Supply, Delivery, Installation And Commissioning Of Uninterrupted Power Supply to be Carried Forward to Part A			R	

ANNEXURE A WCS_____

SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT TO BE COMPLETED BY TENDERER

Items	Material / Equipment	Rand (R) (Excluding VAT)
1		
2		
3		
4		
5		
6		

The Contractor shall list imported items, materials and/or equipment which shall be excluded from the Contact Price Adjustment Provisions (if applicable) and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (not higher than the Contract rate as listed below) should be lodged with the Representative/Agent of the Department of Public works within 60 (sixty) days from the date of acceptance of the tenders. No adjustment of the contractor's profit, local VAT amount, discount, mark-up, handling costs, etc. shall be allowed.

The net amounts will be adjusted as follows

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V\left(\frac{Z}{Y} - 1\right)$$

A = the amount (R) of adjustment

V = the net amount (R) (Supplier's Quotation) of the imported item (Material or Equipment)

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment

CONTRACTOR

_____

SIGNED _____

DATE _____

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF PUBLIC WORKS

SPECIFICATION
FOR THE
SUPPLY AND DELIVERY

OF

ONE CONVEYOR TYPE X-RAY INSPECTION UNIT

AND

ONE WALK THROUGH TYPE METAL DETECTOR

AT

.....

PART F

QUANTITY SURVEYORS
Name
Address
Address
Address
Tel:
Fax:
Contact Person:
Cell:

ARCHITECTS
Name
Address
Address
Address
Tel:
Fax:
Contact Person:
Cell:

ELECTRICAL ENGINEERS
Name
Address
Address
Address
Tel:
Fax:
Contact Person:
Cell:

DEPARTMENT OF PUBLIC WORKS

CENTRAL GOVERNMENT OFFICES
MADIBA ROAD
PRETORIA 0002
PRIVATE BAG X 65
PRETORIA 0001

APRIL 2018

TABEL OF CONTENTS

TECHNICAL SPECIFICATION FOR X-RAY INSPECTION UNIT

CLAUSE	DESCRIPTION	STATE DETAILS OF OFFER
1.1	**GENERAL**	
1.1.1	A licence for the X-ray machine, issued in terms of the Hazardous Substances Act (Act 15 of 1973), must be submitted with the tender, failing which the tender will not be considered. Plus the ID No's and SANS BIN No. of the service technicians registered to carry out the servicing of the X-ray machines in accordance with the requirements of the SANS.	_____
		_____
	Name and tel. No. of the tenderer's contact person to make arrangements with: Name: _____ Tel. No. _____	
1.1.2	The X-ray inspection unit shall complete with:	
	- Dual Energy Detector system (Multi Energy Imaging)	_____
	- Colour monitor (remotely operated)	_____
	- Conveyor belt	_____
	- Screening for full profile of inspection tunnel	_____
1.2	**GENERAL SPECIFICATION**	
1.2.1	**Construction Details**	
1.2.1.1	The unit must incorporate a facility to be controlled either from the right or the left-hand side.	_____
1.2.1.2	In addition a facility must be incorporated so that, the operating keyboard and monitor can be operated remotely, at least 5m from the unit.	_____
1.2.1.3	Maximum height including the tunnel shall not exceed 1400mm from the floor level.	_____
1.2.1.4	The unit must be quiet when in operation.	_____
1.2.1.5	X-ray high voltage generator, shall be rated at 160kV and operate at 140kV	_____
1.2.1.6	Ambient conditions, under which the unit must operate: -0°C to 40°C	_____
	-relative humidity 95%, non-condensing	_____
1.2.1.7	Control elements (pushbuttons, switches, etc.) are to be of sturdy design, selected for severe operating conditions.	_____
1.2.1.8	The unit must be of steel base construction on roller castors and not exceeding 700kg in total weight.	_____

1.2.1.9 Discharge rollers to be included with the unit. The discharge roller platform shall be long enough to prevent articles being X-rayed from falling off before it is recovered by the owner. _____

1.2.1.10 The conveyor belt must be designed for 24 hour, heavy-duty operation. _____

1.2.1.11 The unit shall not be longer than 900mm wide and 2600mm in overall length, including the conveyor belt platform. _____

1.2.2 **Power ratings**

1.2.2.1 The unit has to operate from 230V ±5%, 50 Hz, single phase power supply. _____

1.2.2.2 The maximum running current shall be less than 5A. _____

1.2.2.3 A suitable power point will be provided on the site by others. _____

1.2.3 **Image presentation**

1.2.3.1 Objects of the following dimensions must be able to be passed through the tunnel without any obstruction:

- Height: at least 400mm _____
- Width: at least 600mm _____
- Length: unlimited _____

Monitor display shall cover not less than 500mm of the object length. _____

Full scan volume must be seen on the screen, without any corner cut-off. This is a firm requirement. _____

1.2.3.2 Imaging scale of all objects should be constant with the minimum distortion. _____

1.2.3.3 A zoom facility is essential. The optimum requirement is for the push-button selection of at least 9, independent zoom sectors. The selected sector must be identified by light frame before zoom is activated. _____

1.2.3.4 A colour monitor (non-interlaced), screen size of at least 34cm, is required. Parallel operation of additional monitors, without modification to the unit, must be available. _____

1.2.3.5 The image on the monitor screen must be flicker free. _____

1.2.3.6 Control of brightness and of contrast must be provided on the front panel of the monitor. _____

1.2.3.7 Possibility of switching over from “POSITIVE” to “NEGATIVE” image should be available as an option. _____

1.2.3.8 A digital memory is essential. _____

1.2.3.9 The capacity of the digital memory must exceed 1Mbyte. _____

1.2.3.10 The number of solid state detectors shall be not less than 1152. _____

1.2.3.11 Dual (Multi) energy colour system with a four (4) colour (Industry Standard) is a firm requirement. _____

1.2.3.12	Organic/Inorganic colour stripping.	_____
1.2.3.13	High and low penetration.	_____
1.2.3.14	Variable colour stripping and variable gamma edge enhancement.	_____
1.2.3.15	Automatic density (variable) threat alert.	_____
1.2.3.16	Automatic organic material threat alert.	_____
1.2.3.17	Operator log-in identification facility.	_____
1.2.3.18	Video output capabilities for recording of images shall be included.	_____
1.2.3.19	Voltage stabiliser must be included.	_____
1.2.3.20	UPS shall be included to provide 10 – 15 minutes back-up.	_____
1.2.4	**Resolution and penetration**	
1.2.4.1	A sample wire with diameter of 0.16mm (AWG 34) must be distinguished on a monitor, and 30AWG wire must be visible behind 21mm of aluminium.	_____
1.2.4.2	The image quality on the monitor must be uniform, without distortion in the centre or the edges.	_____
1.2.4.3	Penetration of 25mm steel minimum must be guaranteed.	_____
1.2.4.4	A pre-selectable density threat level must be a feature of the equipment, with a visual and/or audible alarm if any item being screened exceeds that pre-selected density.	
1.3	**CONTROL OPERATION – MINIMUM REQUIREMENTS**	
1.3.1	**Controls**	
1.3.1.1	A mains key switch for 230V main power supply is required.	_____
1.3.1.2	Push button – power “ON”.	_____
1.3.1.3	3 Push buttons for conveyor control, “GO”, “STOP” & “REVERSE”.	_____
1.3.1.4	As a minimum, 9 push button keyboard for zoom sector selection and a separate push button for zoom activation is required.	_____
1.3.1.5	A robust, RED, emergency stop push button, fitted in a prominent position on the keyboard, as well as on the X-ray unit.	_____
1.3.1.6	Light symbols indicating “X-ray on”.	_____
1.3.1.7	X-ray warning signs, in accordance with the requirements of the SA Radiation Board, must be attached to each end of the tunnel in a visible position.	_____
1.3.1.8	Easy operation of the unit is essential.	_____

1.3.2	**Passage of luggage through X-ray unit**	
1.3.2.1	Objects must be able to be conveyed through the unit in any orientation.	
1.3.2.2	All objects, also those which is only partially lying flat on the conveyor belt (e.g. guitars, etc.) must be fully screened.	
1.3.3	**Object representation**	
1.3.3.1	The conveyor belt speed should be such that each point of an object, when passing through the unit, will be visible for at least 5 seconds	
1.4	**CONVEYOR BELT**	
1.4.1	**Loading**	
1.4.1.1	At least 75kg overall weight	
1.4.1.2	The conveyor belt must be driven by an almost noiseless drum-motor.	
1.4.2	**Dimensions**	
1.4.2.1	Belt length: < 2100mm	
1.4.2.2	The height of the top of the conveyor belt above floor level shall be not less than 600mm, but shall not exceed 800mm	
1.4.3	**Speed and duty cycle**	
1.4.3.1	Conveyor belt speed: approximately 0.2 m/sec.	
1.4.3.2	Up to 2400 objects must be screened per hour.	
1.4.4	**Operation**	
1.4.4.1	Normal: Continuous operation in forward direction.	
1.4.4.2	Stop:	
1.4.4.3	Reverse: Intermitted operation by pressing the reverse button.	
1.4.4.4	Duty cycle: no warm-up period will be accepted.	
1.5	**SAFETY**	
1.5.1	**X-ray dose: Screened object**	
1.5.1.1	Standard –0.1 mrem per inspection. Lower dose units may be offered as an alternative.	
1.5.2	**Radiation leakage to surrounding**	
1.5.2.1	Less than 0.5 mrems/h at any point on the surface, 5cm from the surface	
1.5.2.2	The unit must comply with all ruling international safety regulations such as the German TUV, Swiss SEV, UK NRPB or USA FDA.	

1.5.3 **Conveyor belt**

1.5.3.1 The feed and discharge ends of the conveyor belt are to be of such design that fingers, etc. cannot be caught during normal operation. _____

1.5.4 **Operation under fault conditions**

1.5.4.1 The X-ray tube shall be automatically de –energised when conveyor belt is stopped. _____

1.5.4.2 X-ray radiation shall only be switched on with the moving conveyor belt, before the object passes through the unit. _____

1.5.4.3 X-ray radiation shall be automatically switched off if the radiation shielding covers are removed. _____

1.5.5 **Film safety**

1.5.5.1 Tenderers must guarantee the unconditional safety of photographic material of professional quality. _____

1.5.5.2 Typical standards must allow for highly sensitive films of 1000 ASA to be irradiated at least 30 times without damage. _____

1.6 **PLACING IN POSITION AND ASSEMBLING**

1.6.1 The unit shall be placed in position and assembled on site by the successful tenderer.
NOTE: The final placing will be determined on site. _____

1.7 **BROCHURES**

1.7.1 Brochures, furnishing description and technical specification, etc. of the unit offered, shall be submitted with the tender. If the brochures have information, which does not comply with the specification, the tenderer must submit a covering letter listing all brochure items, which do not comply and confirm that the equipment offered will comply with the specification, referring to these items. _____

1.7.2 The following information is also required:

Manufacturer: _____

ISO Rating: _____

Country of origin: _____

Model number of the unit offered _____

Date of manufacture _____

1.8 **MAINTENANCE, SERVICE AND REPAIR**

1.8.1 The unit design must be of the low maintenance type and with minimum future service. **A statement confirming this is required from the tenderer, together with a copy of the service/maintenance schedule.** _____

1.8.2 An overall design of modular type is preferred. _____

1.8.3 Electronic modules must be easily exchanged. _____

1.8.4 All sub-assemblies in the unit must be of such a design that, maintenance and repair can be carried out by a single person, including removal and exchange of the X-ray generator tanks. _____

1.8.5 Spare parts must be locally stocked and availability guaranteed for a ten-year period, starting from the date of delivery. _____

1.9 **GUARANTEE AND SERVICE**

1.9.1 The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from the date of delivery to site, and successful commissioning of the unit. _____

1.9.2 During the period of guarantee, the successful tenderer shall, at his own expense, carry out all necessary repair work, including material and labour, (excluding work required due to damage by others) in order to maintain the unit in a working condition. _____

1.9.3 The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department, within 24 hours after he has been notified that the unit is not operating. _____

1.10 **TRAINING**

1.10.1 The successful tenderer shall thoroughly train and instruct all the operators and supervisors, designated by the User Department in the operation of the unit. _____

1.11 **ONBOARD COMPUTER**

1.11.1 Video Memory: at least 64MB

1.11.2 Processor Speed: at least 3.2GHz

1.11.3 Storage Capacity: At least 160GB

1.11.4 A two part training programme must be incorporated in the system.

1.11.4.1 Part 1 – Initial training
Pre-loaded images must be recalled by the computer, some without and some with threats. The operator must detect the threats and his progress is logged.

1.11.4.2 Part 2 – Ongoing training
The system must merge fake threat images into real time images and the performance of the operator must be logged.

1.12 **MANUALS**

Three complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

(a) Operating instructions _____

(b) Technical description with diagrams and instructions for maintenance and repairs. _____

1.13 **DEVIATIONS FROM SPECIFICATION AS ALTERNATIVE (STATE BRIEFLY)**

_____

_____

_____

_____

1.14 **DELIVERY ARRANGEMENTS/ADDRESS**

Delivery arrangements shall be co-ordinated with

Contact Person:
Tel:

And the unit to be delivered to: -

Address

2. **TECHNICAL INFORMATION**

State the following information of the unit offered:

2.1 Total height above floor level _____

2.2 Maximum X-ray voltage _____

2.3 Dimensions of the unit
- Height _____
- Width _____
- Length (including conveyor belt) _____

2.4 Total running current _____

2.5 Maximum dimensions of objects:
- Height _____
- Width _____
- Length _____

2.6 Number of detectors _____

2.7 Capacity of digital memory _____

2.8 Number of shades of grey _____

2.9 Maximum over-all loading on conveyor belt _____

2.10 Conveyor belt speed _____

2.11 X-ray dose per inspection _____

2.12 Radiation leakage at any point, 5cm away from surface _____

2.13 Multi-Energy mode – State colours for material discrimination _____

TECHNICAL SPECIFICATION
FOR
ITEM - 2: ONE METAL DETECTOR

CLAUSE	DESCRIPTION	STATE DETAILS OF OFFER
3.1	**GENERAL**	
3.1.1	In addition to complying with the specification, the metal detector shall meet the requirements of this Specification. Name and tel. no. of the tenderer's contact person to make arrangements with: Name: _____ Tel. No.: _____	_____
3.1.2	The metal detector shall consist of a free standing walk-through frame with an integral control unit, and shall be suitable to detect metallic objects on a person by means of the magnetic field principle.	_____
3.1.3	The metal detector shall be suitable to detect ferrous and non-ferrous metals.	_____
3.1.4	The metal detector shall be equipped to eliminate false alarms.	_____
3.1.5	The metal detector shall scan the entire area of the walk through area and detect metal objects on a person passing through to the levels as specified.	_____
3.1.6	The metal detector will incorporate self-test button to confirm that the system is operating correctly.	_____
3.1.7	The metal detector shall be completely tamper proof.	_____
3.1.8	The programme and sensitivity push buttons shall be so arranged that tampering by unauthorised persons is entirely eliminated.	_____
3.1.9	The metal detector shall not be adversely affected by stationary metal bars or structures in the vicinity of the unit or moving metal near the archway.	_____
3.1.10	The metal detector shall be capable of operating adjacent to an X-Ray inspection unit.	_____
3.1.11	The detector is intended for indoor use at an altitude of up to 1800m above sea level.	_____
3.1.12	The detector shall be capable of operating in the following conditions:	
3.1.12.1	Min. temperature: 0ºC	_____
3.1.12.2	Max. temperature: 40ºC	_____
3.1.12.3	Max. relative humidity:80%	_____

3.1.13	The operation of the metal detector shall not be adversely affected by repositioning of the frame within certain limits of its original adjusted position.	_____
3.2	**CONSTRUCTION**	
3.2.1	The metal detector shall comprise a free standing walk-through frame containing the detector coils and the control unit, complete with a 5m length of flexible cable and 16A 3-pin plug top. The cord and plug top shall comply with the relevant SABS specifications.	_____
3.2.2	The frame and the control unit shall be of robust construction and the base of the frame shall be designed to ensure rigidity.	_____
3.2.3	The unit shall be able to execute a full body scan and detect metal objects down to the lower feet level within the settings specified.	_____
3.2.4	The finish shall be durable and maintenance free.	_____
3.2.5	The type of material used for the construction of the frame and control unit must be stated by tenderers.	_____
3.2.6	The colour range in which the metal detectors are available must be stated by tenderers. The Department will select a colour finish to suit the environment.	_____
3.2.7	All material consisting of metal shall be treated against corrosion.	_____
3.2.8	The approximate internal dimensions of the frame shall be as follows:	
3.2.8.1	Walk-through height : 2m	_____
3.2.8.2	State Walk-through width	_____
3.3	**CONTROL SYSTEM**	
3.3.1	The system shall operate by means of automatic level control adjustable to environmental changes, Without the need to reset.	_____
3.3.2	The control unit shall be equipped with the following:	
3.3.2.1	"ON-OFF" main switch and "MAINS ON" indicator light.	_____
3.3.2.2	Selector switch with at least ten sensitivity settings, with a maximum sensitivity to consistently detect metal at least the size of a R5, 00 coin.	_____
	The sensitivity settings shall be consistent at average walking speed.	_____

3.3.2.3	Visual indication in the form of an LED Bar graph indicator having at least five green lights and five red lights representing the "PROCEED" and "ALARM" zones respectively. The indicator shall give an indication of the volume of metal on a person in accordance with the sensitivity settings of the selector switch. When the "ALARM" zone is activated it shall simultaneously activate an audible alarm having a continuous tone and adjustable volume. The alarm system will automatically reset after the metal has passed through the frame.	_____
3.3.2.4	The system shall be modular to facilitate maintenance and repairs.	_____
3.4	**SAFETY FEATURES**	
3.4.1	All electronic and electrical components shall be protected by lockable panels.	_____
3.4.2	The detectors shall not have any effect on heart pacemakers.	_____
3.4.3	The detector shall not effect magnetic storage media or camera film.	_____
3.5	**ELECTRICAL SUPPLY SYSTEM**	
3.5.1	The detectors shall be designed for connection to a 230V +/-5%, 50Hz, single phase, three wire (phase, neutral and earth) power supply.	_____
3.5.2	The existing connection points on site comprises standard 16A, 3-pin, socket outlets.	_____
3.5.3	A suitable and efficient battery back-up system to facilitate power failures of up to 1 hour must be incorporated in the detectors.	_____
3.6	**THROUGHPUT**	
	The system shall accept a passage of at least 50 persons per minute without functional overload.	_____
3.7	**PLACING IN POSITION AND TESTING**	
3.7.1	The detector shall be placed in position, tested, commissioned and adjusted to the user Department's requirements by the successful tenderer. NOTE: The final positioning will be determined on site.	_____
3.7.2	The system must be arranged so that the traffic-flow is channelled through the metal detector.	_____
3.8	**BROCHURES**	
3.8.1	Brochures furnishing descriptions and technical specifications, etc., of the unit offered shall be submitted with the tender.	_____

3.8.2 The following information is also required:

Manufacturer _____

Year of manufacture _____

Country of origin _____

Model number _____

3.9 **MAINTENANCE**

3.9.1 The unit must be relatively maintenance-free and with minimum future service. A statement confirming this is required from the tenderer. _____

3.9.2 Electronic modules must be easily exchangeable. _____

3.9.3 Spare parts must be locally stocked and availability guaranteed for a ten year period starting from date Of delivery. _____

3.10 **GUARANTEE AND SERVICE**

3.10.1 The successful tenderer shall guarantee and service the complete unit for a period of twelve (12) months from date of delivery of every unit to site. _____

3.10.2 During the period of guarantee the successful tenderer shall at his own expense, carry out all necessary repair work including material and labour (excluding work required due to damage by others) in order to maintain the unit in a working condition. _____

3.10.3 The successful tenderer shall, during the period of guarantee, repair the unit to the satisfaction of the Department within 24 hours after he has been notified that the unit is not operating. _____

3.10.4 After the lapse of the initial twelve-month period of servicing under the guarantee, the successful tenderer may be required to enter into a service agreement with the Department. _____

3.11 **TRAINING**

The successful tenderer shall thoroughly train and instruct operators designated by the user Department in the operation of the unit. _____

3.12 **MANUALS**

Two complete sets of manuals, each with the following information shall be handed over to the Department when the unit is delivered to site:

(a) Operating instructions _____

(b) Technical description with diagrams and Instructions for maintenance and repairs. _____

3.13 **DEVIATIONS FROM SPECIFICATION AS ALTERNATIVE (STATE BRIEFLY)**

_____

_____

_____

_____

_____

3.14 **DELIVERY ARRANGEMENTS**

Delivery arrangements shall be co-ordinated with

Contact Person:
Tel:

And the unit to be delivered to: -

Address

PRICE SCHEDULE FOR ITEM 1 & 2

ITEM 1 – ONE X-RAY INSPECTION UNIT

LOCAL CONTENT	R
IMPORTED CONTENT	R
LABOUR	R
TRAINING	R
TRANSPORT AND DELIVERY	R
TENDER PRICE (EXCLUDING VAT)	R

ITEM 2 – ONE WALK-THROUGH TYPE METAL DETECTOR

LOCAL CONTENT	R
IMPORTED CONTENT	R
LABOUR	R
TRAINING	R
TRANSPORT AND DELIVERY	R
TENDER PRICE (EXCLUDING VAT)	R

Summary

Item 1 + Item 2 (Excluding VAT) R……

Total Tender Price carried to Final Summary in Part A R……

TENDERER'S SIGNATURE_____ DATE _____