public works & infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

TENDER No: KIM03/2023

CLOSING DATE: 3 November 2023

PROCUREMENT DOCUMENTS

VOLUME 3: CONTRACT

KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF A NEW BUILDING INCLUDING PARKING BAYS

IN

NORTHERN CAPE PROVINCE

DEPARTMENT OF PUBLIC WORKS
KIMBERLEY REGIONAL OFFICES
PRIVATE BAG X5002
KIMBERLEY
8300

PROJECT MANAGER:
SANDISO COSA

OCTOBER 2023

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VOLUME 3 : THE CONTRACT

PART C1: AGREEMENT AND CONTRACT DATA

FORM OF OFFER AND ACCEPTANCE
(DPW-07 EC)

SEE VOLUME 2 OF THESE DOCUMENTS
FOR
FORM OF OFFER AND ACCEPTANCE (DPW-07 EC)

C1.2 CONTRACT DATA (DPW-04 EC)

public works & infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

DPW-04 (EC): CONTRACT DATA: JBCC PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018)

Project title:	KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF A NEW BUILDING INCLUDING PARKING BAYS

Tender / Quotation no:	KIM03/2023	**WCS no:**	046641	**Reference no**:	19/2/4/2/2/2324/7

	The Conditions of Contract are clauses 1 to 30 of the **JBCC®** Principal Building Agreement (Edition 6.2 of May 2018) prepared by the Joint Building Contracts Committee. **Contractors are cautioned to read the JBCC PBA and Contract Data (DPW-04 (EC)) together as some clauses in the JBCC PBA have been amended in the Contract Data (DPW-04 (EC)).** Copies of these conditions of contract may be obtained through most regional offices of the Association of South African Quantity Surveyors, Master Builders Association, South African Association of Consulting Engineers, South African Institute of Architects, Association of Construction Project Managers, Building Industries Federation South Africa, South African Property Owners Association or Specialist Engineering Contractors Committee. Bidders to note that materials procured for the works should be from South African manufactures and suppliers. Imported materials shall only be considered under exceptional circumstances, based on compelling technical justifications, and subject to the approval by the NDPWI.
	CONTRACT VARIABLES **THE SCHEDULE** The **schedule** is the listed variables in this agreement and contains all variables referred to in this document including specific changes made to JBCC® documentation. It is divided into part 1: contract data completed by the **employer** and part 2: contract data completed by the **tenderer**. Part 1 must be completed in full and included in the tender documents. Both the part 1 and part 2 form part of this **agreement.** **Spaces requiring information must be filled in, shown as 'not applicable' or deleted but not left blank.** Where choices are offered, the non-applicable items are to be deleted. Where insufficient space is provided the information should be annexed hereto and cross referenced to the applicable clause of the **schedule**. Reference to clause numbers in the JBCC Principal Building Agreement are shown in [square brackets] in this contract data e.g. [3.1].

PART 1: CONTRACT DATA COMPLETED BY THE EMPLOYER:

A PROJECT INFORMATION

A 1.0 Works [1.1]

Works description	Refer to document ***PG01.2 (EC) – Scope of Works*** for detailed description

CONSTRUCTION OF A NEW MAGISTRATE'S OFFICE AT KEIMOES.

The new building comprises mainly the construction of a multi-storey building consisting of a double storey with the magistrate's courts and offices and with a lower ground floor level for parking

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A 2.0 Site [1.1]

Erf / stand number	2867
Site address	Long Street
Township / Suburb	
City / Town	KEIMOES
Province	Northern Cape
Local authority	Kai!Garib
GPS Coordinates	28°42'19.8"S 20°58'05.9"E

A 3.0 EMPLOYER AND ITS REPRESENTATIVE

A 3.1 Employer:

Official Name of Organ of State / Public Sector Body	Government of the Republic of South Africa in its Department of Public Works & Infrastructure		
Business registration number	Not applicable	VAT number	Not applicable
E-mail		Telephone	
Postal address	Private Bag X5002 KIMBERLEY 8300		
Physical address	Old Magistrate's Office 21-23 Market Street KIMBERLEY 8301[		

A 3.2 Employer's representative:

Name	Mr Sandiso Cosa	Telephone number	053 838 5356
E-mail	Sandiso.Cosa@dpw.gov.za	Mobile number	079 516 9085
Postal address	Private Bag X5002 KIMBERLEY 8300		
Physical address	Old Magistrate's Office 21-23 Market Street KIMBERLEY 8301		

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A 4.0	**Principal Agent** [1.1; 6.2]	**Discipli**ne	Architect

Name	Asquith McGregor Design Studio CC		
Legal entity of above	Close Corporation	Contact person	Asquith McGregor
Practice number	1999/036356/23	Telephone number	054 338 0702
Country	RSA	Mobile number	082 772 6368
E-mail	amds@mweb.co.za		
Postal address	P.O.Box 1113 UPINGTON 8800		
Physical address	80 Wildebees Street Middelpos UPINGTON 8801		

A 5.0	**Agent** [1.1; 6.2]	**Discipline**	Quantity Surveyors

Name	McLachlan Du Plooy Upington (Pty) Ltd		
Legal entity of above	(Pty) Ltd	Contact person	Berta Nel
Practice number	2000/007986/07	Telephone number	054 332 3728
Country	RSA	Mobile number	083 701 7295
E-mail	bnel@mdpupt.co.za		
Postal address	P.O.Box 76 UPINGTON 8800		
Physical address	5 Albatros street Middelpos UPINGTON 8801		

A 6.0	**Agent** [1.1; 6.2]	**Discipline**	Electrical & electronic engineers

Name	BVi Consulting Engineers Northern Cape (Pty) Ltd		
Legal entity of above	(Pty) Ltd	Contact person	Malcolm Du Plessis
Practice number		Telephone number	054 337 6600
Country	RSA	Mobile number	083 718 0888
E-mail	malcolmdp@bvinc.co.za		
Postal address	P.O.Box 1155 UPINGTON 8800		
Physical address	55 Bult Street Die Rand UPINGTON 8801		

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A 7.0	**Agent** [1.1; 6.2]	**Discipli**ne	Structual and civil engineers

Name	iX Engineers		
Legal entity of above		Contact person	J.Rousseau
Practice number	20130018	Telephone number	012 745 2518
Country	RSA	Mobile number	072 433 7350
E-mail	jeanpierre.r@ixengineers.co.za		
Postal address	PostNet suite #222, OR Private Bag X5879 UPINGTON 8800		
Physical address	Hillside Offices, 277 The Hillside Street Menlo Park PRETORIA 0081		

A 8.0	**Agent** [1.1; 6.2]	**Discipli**ne	Mechanical engineers

Name	iX Engineers		
Legal entity of above		Contact person	M.Smit
Practice number	20150251	Telephone number	054 332 4943
Country	RSA	Mobile number	07 505 8422
E-mail	Magnus.m@ixengineers.co.za		
Postal address	PostNet suite #222, Private Bag X5879 UPINGTON 8801		
Physical address	Hillside Offices, 277 The Hillside Street Menlo Park PRETORIA 0081		

A 9.0	**Agent** [1.1; 6.2]	**Discipli**ne	Civil engineers

Name	iX Engineers		
Legal entity of above		Contact person	Herman Schmidt
Practice number	201070036	Telephone number	054 332 4943
Country	RSA	Mobile number	083 456 6022
E-mail	herman.s@iXengineers.co.za		
Postal address	PostNet suite #222, Private Bag X5879 UPINGTON 8800		
Physical address	2 Kerk Avenue CBD UPINGTON 8801		

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A 10.0	**Agent** [1.1; 6.2]	**Discipli**ne	N/A

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
Country		Mobile number	
E-mail			
Postal address			
Physical address	i		

A 11.0	**Agent** [1.1; 6.2]	**Discipli**ne	N/A

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
Country		Mobile number	
E-mail			
Postal address			
Physical address			

A 12.0	**Agent** [1.1; 6.2]	**Discipli**ne	N/A

Name			
Legal entity of above		Contact person	
Practice number		Telephone number	
Country		Mobile number	
E-mail			
Postal address			
Physical address			

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B CONTRACT INFORMATION

B 1.0 Definitions [1.1]

Bills of quantities: System/Method of measurement	Standard system of measurement of building works 7th edition

B 2.0 Law, regulations and notices [2.0]

Law applicable to the works, state country [2.1]	Law of the Republic of South Africa

B 3.0 Offer and acceptance [3.0]

Currency applicable to this agreement [3.2]	South African Rand

B 4.0 Documents [5.0]

The original signed agreement is to be held by the principal agent [5.2], if not, indicate by whom	Employer
Number of copies of construction information issued to the contractor at no cost [5.6] (3 Copies of all relevant construction documentation – this to includes 1 priced Bills of Quantities and 2 unpriced Bills of Quantities)	3

Documents comprising the agreement	Page numbers
The JBCC® Principal Building Agreement, Edition 6.2 May 2018	1 to 30
DPW-04 (EC): CONTRACT DATA: JBCC PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018)	1 to 31
The JBCC® General Preliminaries for use with the JBCC® Principal Building Agreement, Edition 6.2 May 2018	1 to 10
Drawings as per drawing register issued with the tender	
Specifications issued with the tender	
Schedules issued with the tender	
Bills of Quantities issued with the tender	
Addenda as issued during tender stage, if applicable	As issued

B 5.0 Employer's agents [6.0]

Authority is delegated to the following agents to issue contract instructions and perform duties for specific aspects of the works [6.2] [6.7 [CD]]	**Principal Agent**
Principal agent's and agents' interest or involvement in the works other than a professional interest [6.3]	
N/A	

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B 6.0 Insurances [10.0]

Insurances by contractor
NB: Insurances submitted must be issued by either an insurance company duly registered in terms of the Insurance Act [Long-Term Insurance Act, 1998 (Act 52 of 1998) or Short-Term Insurance Act, 1998 (Act 53 of 1998)] or by a bank duly registered in terms of the Banks Act, 1990 (Act 94 of 1990). **Insured amounts to include VAT.**

	New works [10.1.1] With a deductible not exceeding 5% of each and every claim	Contract sum plus 10%	Applicable
Or	Works with practical completion in sections [10.2] With a deductible not exceeding 5% of each and every claim	Contract sum plus 10%	Not Applicable
Or	Works with alterations and additions [10.3] (reinstatement value of existing structures with or including new works) With a deductible not exceeding 5% of each and every claim	Contract sum plus 10%	Not Applicable
	Direct contractors [10.1.1; 10.2] where applicable, to be included in the contract works insurance	R	Not Applicable
	Free issue [10.1.1; 10.2] where applicable, to be included in the contract works insurance	R	Not Applicable
	Escalation, professional fees and reinstatement costs must be included in the above respective insurances		Applicable
Supplementary insurance [10.1.2; 10.2]		Contract sum plus 10%	Applicable
Public liability insurance [10.1.3; 10.2]		R 5 000 000	Applicable
Removal of lateral support insurance [10.1.4; 10.2]		R 20 000 000.	Applicable
Other insurances [10.1.5]			
Hi Risk Insurance Refer B18.0 [10.1.5.1]		R	Not Applicable
Other insurances: If applicable, description 1:		R	Not Applicable
Other insurances; If applicable, description 2:		R	Not Applicable

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B 7.0 Obligations of the employer [12.1]

Existing premises will be in use and occupied [12.1.2]	Not Applicable
If applicable, description:	
Restriction of working hours [12.1.2]	Applicable
If applicable, description: Normal working hours	
Natural features and known services to be preserved by the contractor [12.1.3]	Not Applicable
If applicable, description:	
Restrictions to the site or areas that the contractor may not occupy [12.1.4]	Applicable
If applicable, description: The contractor must at all time limit his personnel, plant, equipment and materials to the Contractor's site or the working areas as approved by the Principal Agent. No personnel shall be accommodated on the grounds. Only guards approved by the Employer and on duty may be on site at all times	
Supply of free issue of material and goods [12.1.10]	Not Applicable
If applicable, description:	

B 8.0 Appointment of Nominated Subcontractors [14.0]

Applicable	If applicable, description of specialisation

Specialisation 1	Court Recording Technologies - to be procure and appointed directly by DOJ
Specialisation 2	Telephone, Data & VOIP Systems - to be procure and appointed directly by DOJ
Specialisation 3	
Specialisation 4	
Specialisation 5	

B 9.0 Appointment of Selected Subcontractors [15.0]

Not Applicable	If applicable, description of specialisation

Specialisation 1	
Specialisation 2	
Specialisation 3	
Specialisation 4	
Specialisation 5	

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B 10.0 Appointment of Direct Contractors [16.0]

Not Applicable	If applicable, description of extent of work [12.1.11]
Extent of work	
Extent of work	
Extent of work	
Extent of work	
Extent of work	

B 11.0 Works to be completed in sections [20.1]

Not Applicable	If applicable, description of sections
Section 1	
Section 2	
Section 3	
Section 4	
Section 5	
Section 6	
Remainder of the works.	

B 12.0 Contract period [B18: 1.2], Construction period [B18: 1.1], Possession of site [12.1.5], Practical Completion [19.0; 20.0], Works Completion Refer B18.0 [19.8], Final Completion [21] and Penalties [24.0]

B12.1 Contract Period

Contract period [B18: 1.2]**:** Period in **months** as indicated**,** include the time from the date of award (commencement date) for submitting contractual obligatory documents, submission of Health & Safety Plan and approval, period for obtaining the Construction Permit (if applicable), the Construction Period and the Defect Liability Period up to and including Final Completion	
The contract period is determined as follows (Period/s indicated in months):	
Period to submit contractual obligatory documents including submission and approval of health and safety plan by the appointed Health & Safety Agent	1

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Period to obtain Construction Permit from Department of Labour upon approval of the Health & Safety Plan by the appointed Health & Safety Agent	2
Total construction period for the Works as a whole up to and including Practical Completion, as indicated below [24.1]	26
Period to achieve Works Completion Refer B18.0 [19.8]	1
Defect liability period up to and including Final Completion	12
Total Contract Period [B18: 1.2]	42
Penalty amount per calendar day for late submission of contractual obligatory documents: Ten percent (10%) of the penalty amount per calendar day for late Practical Completion, excluding VAT. [24.1]	R 0.125 per R100 of contract sum

B12.2 Construction Period for completion of the Works as a whole

Construction period [B18: 1.2] and **Practical Completion for the Works as a whole** [19.0] The time for achieving Practical Completion of the whole of the Works is **measured from the** date of possession of the **site** by the **contractor** inclusive of all **public holidays, special non-working days and builders' holiday shut down periods.**	Applicable
The date for practical completion for the works as a whole shall be the period in **months** as indicated, starting from the date of possession of the site by the contractor inclusive of all special non-working days and builders' holiday shut down periods [12.2.7; 24.1]	26 MONTHS
Period for inspection in **working days** by the principal agent [19.3]	7
Penalty amount per calendar day for **late Practical Completion**, excluding VAT. [24.1]	1.25 Cents per R100 of contract sum
Penalty amount per calendar day for **late Works Completion** Refer B18.0 [19.8]: Thirty percent (30%) of penalty amount per calendar day for late Practical Completion, excluding VAT.	R 0.375 Cents per R100 of contract sum
Penalty amount per calendar day for **late Final Completion** [21]: Fifteen percent (15%) of penalty amount per calendar day for late Practical Completion, excluding VAT.	R 0.1875 Cents per R100 of contract sum

B12.3 Construction Period for completion of the Works in portions

Construction period [B18: 1.1] and **Practical completion for portions of the Works** [20.0]					Not Applicable	
Portions of the Works in sections:	1	2	3	4	5	6
Period for inspection by the principal agent in **working days** [19.3]						
The date for practical completion shall be the period in **months** as indicated from the date of possession of the site by the contractor [12.2.7; 24.1]						

The date for practical completion for **the whole** of the Works, if applicable shall be the period in **months** as indicated from the date of possession of the site by the contractor inclusive of all **public holidays, special non-working days and builders' holiday shut down periods** [12.2.7; 24.1]	N/A
Penalty for late Practical Completion, ***if completion in sections is required***, excluding VAT	
The penalty amount per day for failing to complete **section 1** of the Works is:	R
The penalty amount per day for failing to complete **section 2** of the Works is:	R
The penalty amount per day for failing to complete **section 3** of the Works is:	R
The penalty amount per day for failing to complete **section 4** of the Works is:	R
The penalty amount per day for failing to complete **section 5** of the Works is:	R
The penalty amount per day for failing to complete **section 6** of the Works is:	R
The penalty amount per day for failing to complete **the whole** of the Works, if applicable, is:	R
Penalty amount per calendar day for late Works Completion Refer B18.0 [19.8]: To be calculated at Thirty percent (30%) of penalty / calendar day to complete **the whole of the Works**, excluding VAT	
Penalty amount per calendar day for late Final Completion [21]: To be calculated at Fifteen percent (15%) of penalty / calendar day to complete **the whole of the Works**, excluding VAT	

B 13.0 Criteria to achieve Practical Completion [19.0; 20.0]

Criteria to achieve Practical Completion not covered in the definition of practical completion	
13.1	Obtain Occupation Certificate from the relevant authority prior to issuing the Practical Completion certificate
13.2	All relevant CoCs
13.3	All guarantees
13.4	Training on electrical, security and mechanical installations if contractually required
13.5	Maintenance / operating manuals
13.6	CPG and cidb BUILD programme achievement certificates submitted with substatiating documentation
13.7	
13.8	
13.9	
13.10	

B 14.0 Defects liability period [21.0]

Extended defects liability period: Refer B18.0 [21.13]

Applicable	If applicable, description of applicable elements

14.1	Emergency generator/s - 12 months
14.2	Air conditioning system and plant - 12 months
14.3	Security system/s (e.g. Access control, Intruder alarm, etc) - 12 months
14.4	Electrical equipment (e.g. Electric operated doors, Electric motors, etc.) - 12 months
14.5	Lifts - 12 months
14.6	Mechanical equipment (e.g. Fire detection, Fire suppression system, Kitchen equipment, etc). - 12 months
14.7	Civil works - 12 months
14.8	Landscaping including automated systems (irrigation) - 12 months
14.9	
14.10	

B 15.0 Payment [25.0]

Date of month for issue of regular payment certificates Refer B18.0 [25.2]	25
Contract price adjustment / Cost fluctuations Refer [25.3.4; 26.9.5]	Applicable
If applicable, method to calculate	CPAP
Employer shall pay the contractor within: Refer B18.0 [25.10]	Thirty (30) calendar days

B 16.0 Dispute resolution [30.0]

Mediation	Applicable
Name of nominating body	Association of Arbitrators (Southern Africa)
Appointment of Mediator	State Attorney
Litigation	Court with Jurisdiction

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B 17.0 JBCC® General Preliminaries - selections

Provisional bills of quantities [P2.2]		Not Applicable
Availability of construction information [P2.3]		Not Applicable
Previous work - dimensional accuracy - details of previous contract(s) [P3.1]		Applicable
Previous work - defects - details of previous contract(s) [P3.2]		Applicable
Inspection of adjoining properties - details [P3.3]		Applicable
Handover of site in stages - specific requirements [P4.1]		Not Applicable
Enclosure of the works - specific requirements [P4.2]		Applicable
Geotechnical and other investigations - specific requirements [P4.3]		Applicable
Existing premises occupied - details [P4.5]		Not Applicable
Services - known - specific requirements [P4.6]		Applicable
Water [P8.1]	By contractor	Applicable
	By employer	Not Applicable
	By employer – metered	Not Applicable
Electricity [P8.2]	By contractor	Applicable
	By employer	Not Applicable
	By employer – metered	Not Applicable
Ablution and welfare facilities [P8.3]	By contractor	Applicable
	By employer	Not Applicable
Communication facilities - specific requirements [P8.4] Cell phone and internet facilities		Applicable
Protection of the works - specific requirements [P11.1]		Not Applicable
Protection / isolation of existing works and works occupied in sections - specific requirements [P11.2] Entrance to SAPS cell block		Applicable
Disturbance - specific requirements [P11.5] The contractor shall keep the site, structures, etc, well watered during operations to prevent dust.		Applicable
Environmental disturbance - specific requirements [P11.6]		Not Applicable

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B 18.0 SPECIFIC CHANGES MADE TO JBCC® DOCUMENTATION

[Details of changes made to the provisions of **JBCC** standard documentation]

1.2	**Definitions** **The following definitions replace corresponding definitions or are added to the definitions in the JBCC PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018), whatever the case may be.** **ADVERSE WEATHER CONDITIONS:** Adverse weather and inclement weather has the same meaning and used interchangeably and means any weather conditions i.e.: Rain, wind, snow, frost, temperature (cold or heat) that are not in the norm for the area where the construction takes place and during which no work is possible on site. **AGREEMENT:** The completed Form of Offer and Acceptance, the completed JBCC® Principal Building Agreement and contract data for organs of state and other public sector bodies, the contract drawings, the priced document and any other documents reduced to writing and signed by the authorised representative or representatives of the parties. **CONSTRUCTION PERIOD:** The period commencing on the date of possession of the **site** by the **contractor** and ending on the date of **practical completion.** **CONTRACT PERIOD:** The period commencing on the date of the letter of acceptance and ending on the date of final completion. **COST FLUCTUATION** shall mean contract price adjustment provision (CPAP) for the adjustment of fluctuation in the cost of labour, plant, material and goods as stated in the schedule. **DEFAULT INTEREST**: No clause. **GUARANTEE FOR CONSTRUCTION**: A security in terms of the DPWI's Guarantee for Construction form/s, obtained by the contractor from an institution approved by the employer [CD]. **INTEREST:** The interest rates applicable on this contract, whether specifically indicated in the relevant clauses or not, will be the rate as determined by the Minister of Finance from time to time, in terms of section 80(1)(b) of the Public Finance Management Act, 1999 (Act No 1 of 1999) as amended, calculated as simple interest, in respect of debts owing to the State, and will be the rate as published by the Minister of Justice and Correctional Services from time to time, in terms of section 1(2) of the Prescribed Rate of Interest Act, 1975 (Act No 55 of 1975) as amended, calculated as simple interest, in respect of debts owing by the State. **LETTER OF ACCEPTANCE**: The letter of formal acceptance of the Contractor's or Service Provider's Tender / Bid, issued and signed by the Employer. **PAYMENT CERTIFICATE**: A certificate issued at regular agreed intervals [CD] by the principal agent to the parties certifying the amount due and payable in terms of clause 25.3. **PRINCIPAL AGENT:** The person or entity appointed by the **employer** and named in the **contract data for organs of state and other public sector bodies.** In the event of a **principal agent** not being appointed, then all the duties and obligations of a **principal agent** as detailed in the **agreement** shall be fulfilled by the employer's representative as named in the **contract data for organs of state and other public sector bodies.**

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CONTRACT SPECIFIC DATA

The following contract specific data, referring to the General Conditions of Contract for Construction Works, JBCC PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018), are applicable to this Contract:	
3.3	Replace clause with the following: This agreement shall come into force on the date of letter of acceptance and continue to be of force and effect until the end of the latent defects liability period [22.0] notwithstanding termination [29.0] or the certification of final completion [21.0] and final payment [25.0].
4.2	Refer to clause 6.7 [CD].
4.3	Replace clause with the following: Where a contractor cedes any right or any monies due to or to become due under this agreement as security in favour of a financial institution, the prior written consent of the employer, which consent shall not be unreasonably withheld, must be obtained.
5.2	Replace last sentence with the following: The original signed agreement shall be held by the Employer.
5.4	Replace clause with the following: The Bills of Quantities shall not be used as a specification of material and goods or methods unless so instructed by the Principal Agent. The contractor may not use the Bills of Quantities for purpose of ordering material. All dimensions and quantities must be determined on site before ordering. In the event of discrepancy between the drawings and Bills of Quantity, the drawings shall take preference.
5.5	Replace clause with the following: The parties may publish or disclose on any platform only the contract scope and contract amount.
6.5	Replace clause with the following: Where the principal agent and/or an agent fails to act or is unable to act or ceases to be the principal agent or an agent in terms of this agreement, the employer may appoint another principal agent and/or an agent, be it temporary or permanently.
6.7	Add the following as clause 6.7: In terms of the clauses listed hereunder, the employer has retained its authority and has not given a mandate to the principal agent, notwithstanding other provisions in the contract. The employer shall sign all documents in relation to clauses 4.2, 14.1.4, 14.4.1, 14.6, 15.1.4, 15.4.1, 23.1, 23.2, 23.3, 23.7, 23.8, 26.1, 26.7, 26.12.
7.2	Replace first sentence with the following: Any design responsibility undertaken by a subcontractor shall not devolve on the contractor except for items that require specific component design and or compatibility design and or shop drawings and or the assembly thereof.
8.4	Replace clause with the following: The contractor shall bear the full risk of damage to and/or destruction of the works by whatever cause during construction of the works and hereby indemnifies and holds harmless the employer against any such damage. The contractor shall take such precautions and security measures and other steps for the protection and security of the works as the contractor may deem necessary.
9.2.7	Add the following to the end of the first sentence: "…. due to no fault of the contractor".

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9.2.9	No clause.
9.2.10	No clause.
9.3	Add the following as clause 9.3: The employer's rights to claim damages for the contractor's omissions and actions will not be affected.
10.1	Replace clause with the following: The party responsible shall effect and keep the respective insurances [CD] in force, in favour of the employer as beneficiary, from the date of possession of the site until the issue of the certificate of practical completion and with an extension to cover the contractor's obligations after the date of practical completion [8.2.2].
10.1.5.1	Add the following as clause 10.1.5.1: Hi Risk Insurance In the event of the project being executed in a geological area classified as a "High Risk Area", that is an area which is subject to highly unstable sub-surface conditions that might result in catastrophic ground movement evident by sinkhole or doline formation the following will apply:
10.1.5.1.1	Add the following as clause 10.1.5.1.1: Damage to the works The contractor shall, from the date of possession of the site until the date of the certificate of practical completion, bear the full risk of and hereby indemnifies and holds harmless the employer against any damage to and/or destruction of the works consequent upon a catastrophic ground movement as mentioned above. The contractor shall take such precautions and security measures and other steps for the protection of the works as he may deem necessary. When so instructed to do so by the principal agent, the contractor shall proceed immediately to remove and/or dispose of any debris arising from damage to or destruction of the works and to rebuild, restore, replace and/or repair the works, at the contractor's own costs.
10.1.5.1.2	Add the following as clause 10.1.5.1.2: Injury to persons or loss of or damage to property The contractor shall be liable for and hereby indemnifies and holds harmless the employer against any liability, loss, claim or proceeding arising at any time during the period of the contract whether arising in common law or by statute, consequent upon personal injuries to or the death of any person whomsoever resulting from, arising out of or caused by a catastrophic ground movement as mentioned above. The contractor shall be liable for and hereby indemnifies the employer against any and all liability, loss, claim or proceeding consequent upon loss of or damage to any moveable, or immovable property, or personal property, or property contiguous to the site, whether belonging to or under the control of the employer or any other body or person whomsoever arising out of or caused by a catastrophic ground movement, as mentioned above, which occurred during the period of the contract.
10.1.5.1.3	Add the following as clause 10.1.5.1.3: It is the responsibility of the contractor to ensure that he has adequate insurance to cover his risk and liability as mentioned in 10.1.5.1.1 and 10.1.5.1.2. Without limiting the contractor's obligations in terms of the contract, the contractor shall, within twenty-one (21) calendar days of the date of letter of acceptance, but before commencement of the works, submit to the employer proof of such insurance policy.

10.1.5.1.4	Add the following as clause 10.1.5.1.4: The employer shall be entitled to recover any and all losses and/or damages of whatever nature suffered or incurred consequent upon the contractor's default of his obligations as set out in 10.1.5.1.1; 10.1.5.1.2 and 10.1.5.1.3. Such losses or damages may be recovered from the contractor or by deducting the same from any amounts still due under this contract or under any other contract presently or hereafter existing between the employer and the contractor and for this purpose all these contracts shall be considered one indivisible whole.
10.2	Replace clause with the following: Where practical completion in sections is required [20.0), or where the works is for alterations and additions, the contractor shall effect and keep in force contract works insurance [10.1.1], supplementary insurance [10.1.2], public liability insurance [10.1.3] and where applicable, removal of lateral support insurance [10.1.4] and other insurances [10.1.5) in favour of the employer as beneficiary.
10.6	No clause.
10.11	Add the following as clause 10.11 In the event that an insurer dispute the amount of the claim to be paid to the employer, the contractor shall be liable to the employer for the difference between the claim (as determined by the employers QS appointed on the project) made by the employer and the amount that the insurer is willing to pay.
11.1	Add the following to clause 11.1. In respect of contracts with a contract sum up to R1 million, the security to be provided by the contractor to the employer will be a payment reduction of five per cent (5%) of the value certified in the payment certificate (excluding VAT). In respect of contracts with a contract sum above R1 million, the contractor shall have the right to select the security to be provided in terms of C 1.0 Securities, as stated in the schedule. Such security shall be provided to the employer within fifteen (15) working days from contract commencement date. Should the contractor fail to select the security to be provided or should the contractor fail to provide the employer with the selected security within fifteen (15) working days from the contract commencement date, the security in terms of C 1.0 Option C shall be deemed to have been selected. The payment reduction of the value certified in a payment certificate shall be *mutatis mutandis* in terms of 25.12.1 - 25.12.5.
11.1.1	No clause.
11.1.2	No clause.
11.2.2	No clause.
11.3	No clause.
11.4.1	Replace clause 11.4.1 with the following: Hand over the site to the contractor and withhold an amount equal to ten per cent (10%) of each interim payment certificate until practical completion is achieved. The value certified shall be subject to the adjustments in terms of 25.12.6 to 25.12.10.
11.5	No clause.
11.6	No clause.

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11.7	No clause.
11.8	No clause.
11.9	No clause.
11.10	No clause.
11.11	Add the following as clause 11.11 Where the security as a cash deposit of ten per cent (10%) of the contract sum (excluding VAT) has been selected:
11.11.1	Add the following as clause 11.11.1 The contractor shall furnish the employer with a cash deposit equal in value to ten percent (10%) of the contract sum (excluding VAT) within fifteen (15) working days from the contract commencement date. Failure to furnish the employer with a cash deposit within fifteen (15) working days clause 11.4 will apply *mutatis mutandis*.
11.11.2	Add the following as clause 11.11.2 The employer shall be entitled to recover expense and loss from the cash deposit in terms of 27.0 provided that the employer notifies the Contractor in which event the employer's entitlement shall take precedence over his obligations to refund the cash deposit security or portions thereof to the contractor.
11.11.3.	Add the following as clause 11.11.3 Within fifteen (15) working days of the date of practical completion of the works the employer shall reduce the cash deposit to an amount equal to three per cent (3%) of the contract value (excluding VAT).
11.11.4	Add the following as clause 11.11.4 Within fifteen (15) working days of the date of final completion of the works the employer shall reduce the cash deposit to an amount equal to one per cent (1%) of the contract value (excluding VAT).
11.11.5	Add the following as clause 11.11.5 On the date of payment of the amount in the final payment certificate, the employer shall refund the remainder of the cash deposit to the contractor.
11.11.6	Add the following as clause 11.11.6 The parties expressly agree that neither the employer nor the contractor shall be entitled to cede the rights to the deposit to any third party.
11.12	Add the following as clause 11.12 Where security as a variable construction guarantee of ten percent (10%) of the contract sum (excluding VAT) has been selected:
11.12.1	Add the following as clause 11.12.1 The contractor shall furnish the employer with an acceptable variable construction guarantee equal in value to ten per cent (10%) of the contract sum (excluding VAT) within fifteen (15) working days after issuance of the letter of acceptance. Failure to submit an acceptable variable construction guarantee within fifteen (15) working days clause 11.4 will apply *mutatis mutandis*.
11.12.2	Add the following as clause 11.12.2 The variable construction guarantee shall reduce and expire in terms of the Variable Construction Guarantee form included in the invitation to tender.

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11.12.3	Add the following as clause 11.12.3 The employer shall return the variable construction guarantee to the contractor within fourteen (14) calendar days of it expiring.
11.12.4	Add the following as clause 11.12.4 Where the employer has a right of recovery against the contractor in terms of 27.0, the employer shall issue a written demand in terms of the variable construction guarantee.
11.13	Add the following as clause 11.13 Where security is a fixed construction guarantee of five per cent (5%) of the contract sum (excluding VAT) and a five per cent (5%) payment reduction of the value certified in the payment certificate (excluding VAT) has been selected:
11.13.1	Add the following as clause 11.13.1 The contractor shall furnish a fixed construction guarantee to the employer equal in value to five per cent (5%) of the contract sum (excluding VAT).
11.13.2	Add the following as clause 11.13.2 The fixed construction guarantee shall come into force on the date of issue and shall expire on the date of the last certificate of practical completion.
11.13.3	Add the following as clause 11.13.3 The employer shall return the fixed construction guarantee to the contractor within fourteen (14) calendar days of it expiring.
11.13.4	Add the following as clause 11.13.4 The payment reduction of the value certified in a payment certificate shall be *mutatis mutandis* in terms of 25.12.1 - 25.12.5.
11.13.5	Add the following as clause 11.13.5 Where the employer has a right of recovery against the contractor in terms of 27.0, the employer shall be entitled to issue a written demand in terms of the fixed construction guarantee or may recover from the payment reduction or from both.
11.14.1	Add the following as clause 11.14.1 Where security as a cash deposit of five per cent (5%) of the contract sum (excluding VAT) and a payment reduction of five per cent (5%) of the value certified in the payment certificate (excluding VAT) has been selected:
11.14.2	Add the following as clause 11.14.2 The contractor shall furnish the employer with a cash deposit equal in value to five per cent (5%) of the contract sum (excluding VAT) within fifteen (15) working days from the contract commencement date. Failure to submit a cash deposit within fifteen (15) working days clause 11.4 will apply *mutatis mutandis*.
11.14.3	Add the following as clause 11.14.3 Within fifteen (15) working days of the date of practical completion of the works the employer shall refund the cash deposit in total to the contractor.
11.14.4	Add the following as clause 11.14.4 The payment reduction of the value certified in a payment certificate shall be *mutatis mutandis* in terms of 25.12.1 - 25.12.5.
11.14.5	Add the following as clause 11.14.5 Where the employer has a right of recovery against the contractor in terms of 27, the employer may recover from the payment reduction or cash deposit or from both.

11.15	Add the following as clause 11.15 Where security as a payment reduction of ten per cent (10%) of the value certified in the payment certificate (excluding VAT) has been selected:
11.15.1	Add the following as clause 11.15.1 The payment reduction of the value certified in a payment certificate shall be *mutatis mutandis* in terms of 25.12.6 to 25.12.10.
11.15.2	Add the following as clause 11.15.2 The employer shall be entitled to recover expense and loss from the cash deposit in terms of 27.0 provided that the employer notifies the Contractor in which event the employer's entitlement shall take precedence over his obligations to refund the cash deposit security or portions thereof to the contractor.
11.16	Add the following as clause 11.16 Payments made by the guarantor to the employer in terms of the fixed or variable construction guarantee shall not prejudice the rights of the employer or contractor in terms of this agreement.
11.17	Add the following as clause 11.17 Should the contractor fail to furnish the security in terms of 11.2 the employer, in his sole discretion, and without notification to the contractor, is entitled to change the contractor's selected form of security to that of a ten per cent (10%) payment reduction of the value certified in the payment certificate (excluding VAT).
12.1.1	No Clause.
12.1.5	Replace clause with the following: Give possession of the site to the contractor within ten (10) working days after approval of the Health and Safety Plan or the issue of a construction permit by the Department of Labour, if applicable, after the contractor complied with the terms of 12.2.22.
12.1.6	No clause.
12.1.8	No clause.
12.2.2	Replace clause with the following: The priced Bills must be submitted to the Employer within fourteen (14) calendar days from date of request. Where the **priced document** contains errors or discrepancies and/or prices considered by the employer or **principal agent** to be imbalanced or unreasonable the employer or **principal agent** and the **contractor** shall adjust such prices without any change to the **contract sum.**
12.2.5	Replace clause with the following: Effect and keep in force insurances in favour of the employer as beneficiary where the contractor is responsible for providing insurances [10.0) [CD].
12.2.13	Replace clause with the following: Designate a competent person full time on site to continuously administer and control the works on site and to receive and implement notices and contract instructions on behalf of the contractor.
12.2.22	Insert the following clause as 12.2.22: Within fourteen (14) working days of the date of the letter of acceptance submit to the principal agent an acceptable health and safety plan, required in terms of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993).

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12.2.23	Insert the following clause as 12.2.23: The contractor shall within reasonable time inform the agents regarding inspection of the works before covering / closing [B 12.0].
14.1.4	Refer to clause 6.7 [CD].
14.1.5	No clause.
14.4.1	Replace “principal agent” with “employer” [6.7 [CD]].
14.6	Refer to clause 6.7 [CD].
15.0	See clause 6.7 above for clauses, 15.5.
15.1.2	Replace clause with the following: The principal agent shall call for tenders from a list of tenderers agreed between the contractor and the employer.
15.1.4	Refer to clause 6.7 [CD].
15.1.5	No clause.
15.4.1	Replace “principal agent” with “employer” [6.7 [CD]].
17.4	Replace clause with the following: The contractor shall comply with and duly execute all contract instructions except any contract instruction for additional work issued after the date of practical completion other than making good physical loss and repairing damage to the works in terms of 8.0 and 21.
17.6	Add the following as clause 17.6: Minutes of meetings shall not constitute a site instruction unless reduced to a written contract instruction issued by the principal agent in terms of this contract / agreement.
19.5	Replace clause with the following: On issue of the only or last certificate of practical completion the employer shall be entitled to possession of the works and the site. On issue of the certificate of practical completion for a section, the employer shall be entitled to possession of such section.
19.8	Add the following as: 19.8 **WORKS COMPLETION** (1) Within seven (7) calendar days of the date of practical completion the principal agent shall issue to the contractor a works completion list defining the outstanding work and defects apparent at the date of practical completion to be completed or rectified to achieve works completion. (2) Where, in the opinion of the contractor, the works completion list has been completed the contractor shall notify the principal agent who shall inspect within seven (7) calendar days of receipt of such a notice. Where, in the opinion of the principal agent, the Works Completion list: (2)(a) Has been satisfactorily completed, the principal agent shall forthwith issue a certificate of Works Completion to the contractor with a copy to the employer

19.8 Continued	(2)(b) Has not been satisfactorily completed, the principal agent shall forthwith identify the works completion list items that are not yet complete and inform the contractor thereof. The contractor shall repeat the procedure in terms of 19.8(2) (3) Should the principal agent not issue a works completion list, in terms of 19.8 (1) or 19.8 (2) (b), within seven (7) calendar days from the end of the inspection period, the contractor shall notify the employer and principal agent. Should the principal agent not issue such Works Completion list within seven (7) calendar days of receipt of such notice, the employer may within seven (7) calendar days issue to the contractor a Works Completion list. Should the employer: (3)(a) Not issue such works completion list within seven (7) calendar days, then the certificate of Works Completion shall be deemed to have been issued on the date of expiry of the initial notice period and works completion shall be deemed to have been achieved on such date (3b) Issue a works completion list and the work on Works Completion list not have been completed or where further defects have become apparent, the employer shall forthwith identify such items on the updated works completion list and notify the contractor. The contractor shall repeat the procedure in terms of 19.8 (2) (b) until such items have been completed to the satisfaction of the employer (4) Should the works completion list not be completed to the satisfaction of the employer within a period of twenty (20) working days of the issue final works completion list the contractor shall be liable to a daily penalty as described in B13. (5) The defects liability period in terms of 21.1 shall commence with the issue or deemed issue of the certificate of Works Completion in terms of 19.8(2)(a) or 19.8(3).
20.2.1.A	Add the following as: 20.2.1.A A certificate of Works Completion [19.8]
21.1	Replace clause 21.1 with the following: The defects liability period for the works shall commence on the calendar day following the date of works completion and end at midnight (00:00) ninety (90) calendar days from the date of works completion [CD] or when work on the list for completion has been satisfactorily attended to [21.6), whichever is the later (if we use works completion).
21.6	Replace clause 21.6 with the following: On the expiry of the ninety (90) calendar days defects liability period [21.1] for items not indicated as items with an extended liability as indicated in B14 and on receipt of the contractor's notice to the principal agent. And/or On the expiry of the defects liability period as indicated in B14, for items indicated in B14 and on receipt of the contractor's notice to the principal agent, the principal agent shall: (1) inspect the works And within ten (10) working days either issue a list for final completion detailing all outstanding work or defects that must be attended to, or rectified to achieve final completion or (2) issue the certificate of final completion to the contractor with a copy to the employer for that part of the works where defects liability period has expired.
21.6.1.	Omit clause.

21.6.2	Omit clause.
21.13	Add the following as clause 21.13 The ninety (90) calendar day defects liability period for the works [21.1] is replaced with an extended defects liability period of three hundred and sixty-five (365) calendar days in respect of the listed applicable elements in B14.
21.14	Add the following as clause 21.14 Penalties will be applied if the items on the completion list have not been attended to within a period of ninety (90) calendar days [21.1]. If additional defect items have being added to the list during this period, then the Principal Agent and Contractor will agree on a revised completion date. Failing in achieving the revised date will result in penalties being applied [B12.0].
22.3.2	No clause.
23.1	Refer to clause 6.7 [CD].
23.2	Refer to clause 6.7 [CD].
23.2.13	No clause.
23.3	Replace 23.3 with the following: Further circumstances that delays practical completion due to any other cause beyond the contractor's reasonable control that could not have reasonably been anticipated and provided for which the contractor may be entitled to a revision of the date for practical completion, with or without an adjustment of the contract value as determined by the Employer [6.7 CD].
23.7	Refer to clause 6.7 [CD].
23.8	Refer to clause 6.7 [CD].
24.1	Replace clause 24.1 with the following: Where the **contractor** fails to bring the **works,** or a **section** thereof, to **practical-, works-, or final- completion** by the applicable completion date [B10 CD], or the revised applicable completion date**,** the **contractor** shall be liable to the **employer** for the **penalty** [B10 CD].
24.2	Replace clause 24.2 with the following: Where the **employer** elects to levy such **penalty** the **employer,** or the **principal agent** on instruction from the **employer,** shall give **notice** thereof to the **contractor.** The **principal agent** shall determine the **penalty** due from the later of the date for **practical- works-, or final- completion** [B10 CD], or the revised date for **practical- works-, or final- completion,** up to and including the earlier of:
24.2.1	Replace clause 24.2.1 with the following: The actual or deemed date of **practical-, works- or final- completion** of the **works,** or a **section** thereof [23.7.1].
25.2	Replace clause 25.2 with the following: The principal agent shall issue at regular agreed intervals [CD] payment certificates, to the contractor with a copy to the employer, up to and including practical completion. Interim Payment certificates may be issued to the contractor between practical completion and the final payment certificate. A payment certificate may be for a nil or negative amount.

25.3	Add the following to clause 25.3: 25.3.12 Monthly Local content report. 25.3.13 EPWP / NYS payment register, labour reports and certified ID document of EPWP/ NYS beneficiaries, Contract between Contractor and EPWP/ NYS beneficiaries, attendance register (if applicable). 25.3.14 Tax Invoice. 25.3.15 Labour intensive report. 25.3.16 Contract participation goal and cidb BUILD programme reports.
25.5	No Clause.
25.6	Replace clause 25.6 with the following: Materials and goods will only be certified and paid for upon providing proof of full payment to the supplier and proof of transfer of ownership from the supplier to the contractor by the contractor. Once paid, material and goods shall become the property of the employer and shall not be removed from site without the written authority of the Employer.
25.7.5	No Clause.
25.10	Replace clause 25.10 with the following: The employer shall pay the contractor the amount stipulated in an issued payment certificate, correct in all material respects, within thirty (30) calendar days from the date of receiving the payment certificate and invoice including all other substantiating documentation for items certified in the payment certificate.
25.12	Replace clauses 25.12 to 25.12.3 with the following: The value certified shall be subject to the following percentage adjustments: (Clauses 25.12.1 to 25.12.5 shall be applicable to a contract sum up to R1 million. In the event of a contract sum more than R1 million for Options D & E (C 1.0 Securities [11.0]) Clauses 25.12.1 to 25.12.5 shall be applicable) 25.12.1 Where a **security** is selected in terms of C 1.0 Securities [11.0] the value of the **works** in terms of 25.1 and of the **materials and goods** in terms of 25.4 shall be certified in full. The value certified shall be subject to the following percentage adjustments: 25.12.2 Ninety-five per cent (95%) of such value in interim **payment certificates** issued up to the date of **practical completion.** 25.12.3 Ninety-seven per cent (97%) of such value in interim **payment certificates** issued on the date of **works completion** and up to but excluding the date of **final completion.** 25.12.4 Ninety-nine per cent (99%) of such value in interim **payment certificates** issued on the date of **final completion** and up to but excluding the final **payment certificate** in terms of 26. 25.12.5 One hundred per cent (100%) of such value in the final **payment certificate** in terms of 26 except where the amount certified is in favour of the **employer**. In such an event the payment reduction shall remain at the adjustment level applicable to the final **payment certificate**.

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25.12 Continued	(Clauses 25.12.6 to 25.12.10 shall be applicable to a contract sum more than R1 million for Option C (C 1.0 Securities [11.0]) 25.12.6 Where security is a payment reduction in term of Option C, the value of the **works** in terms of 25.1 and **materials and goods** in terms of 25.4 shall be certified in full. The value certified shall be subject to the following percentage adjustments: 25.12.7 Ninety per cent (90%) of such value in interim **payment certificates** issued up to the date of **practical completion.** 25.12.8 Ninety-seven per cent (97%) of such value in interim **payment certificates** issued on the date of **practical completion** and up to but excluding the date of **final completion.** 25.12.9 Ninety-nine per cent (99%) of such value in interim **payment certificates** issued on the date of **final completion** and up to but excluding the final **payment certificate** in terms of 26. 25.12.10 One hundred per cent (100%) of such value in the final **payment certificate** in terms of 26 except were the amount certified is in favour of the **employer**. In such an event the payment reduction shall remain at the adjustment level applicable to the final **payment certificate.**
26.1	Refer to clause 6.7 [CD].
26.4.3	Omit clause.
26.7	Refer to clause 6.7 [CD].
26.10	Replace 26.10 with the following: The **principal agent** shall prepare the final account in consultation with the employer and issue the **final account,** to the **contractor** within sixty (60) **working days** of the date of **practical completion.**
26.12	Refer to clause 6.7 [CD].
27.1. 2	Replace 27.1.2 with the following: Interest due to late payment only.
27.1.4	Replace 27.1.4 with the following: Interest due to late payment only.
27.1.5	No clause.
27.5	Add the following as clause 27.5: Where the employer decides to recover an amount due in terms of 27.2 from a construction guarantee, cash deposit or retention money held as security, the employer shall issue a written demand to the contractor before recovering the amount. Should such amount not be paid to the employer within fourteen (14) calendar days of the date-of notice by the employer, the employer may recover such an amount from the security.

27.6	Add the following as clause 27.6: Where a provisional sequestration or provisional liquidation order has been granted or where an order has been granted which commences sequestration, liquidation, bankruptcy, receivership, winding-up or any similar effect, against the contractor or this agreement is cancelled in terms of 29, the employer may issue a demand to the guarantor in terms of the construction guarantee or advance payment guarantee held as security.
28.0	No clause.
28.1	No clause.
28.1.1	No clause.
28.1.2	No clause.
28.1.3	No clause.
28.1.4	No clause.
28.1.5	No clause.
28.2	No clause.
28.3	No clause.
28.4	No clause.
29.1.4	Add the following as clause 29.1.4: The **contractor**'s estate has been sequestrated, liquidated or surrendered in terms of the insolvency laws in force within the Republic of South Africa.
29.1.5	Add the following as clause 29.1.5: The **contractor** has engaged in corrupt or fraudulent practices in competing for or in executing the contract.
29.1.6	Add the following as clause 29.1.6: Honour his obligations in terms of clauses 10.1.5.1.3, 11.4.1 and 12.2. sub-clauses 5, 6, 8, 9, 10, 11, 12, 13, 15, 16, 19, 20, 22.
29.7	Replace clause 29.7 with the following: The employer, on notice to the contractor, may recover damages from the contractor from the date of termination including, but not limited to, additional costs incurred in the completion, consultant cost, rental of alternative accommodation, invitation of completion tenders, salaries of officials and safeguarding the site, of the remaining work [25.3.7; 27.1.3].
29.9	Replace clause 29.9 with the following: The **employer** has the right of recovery against the **contractor,** where applicable, [CD] from: The guarantee for construction (variable) until the final payment has been made; **or** The guarantee for construction (fixed) until the date of practical completion**;** **or** The payment reduction until the final payment is made; **or** The cash deposit made as security until the final payment is made.
29.14.1	No clause.
29.14.3	No clause.

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29.14.4	No clause.
29.14.5	No clause.
29.14.6	No clause.
29.14.7	No clause.
29.15	No clause.
29.16	No clause.
29.17.3	No clause.
29.17.6	No clause.
29.21.5	No clause.
29.22	No clause.
29.23	No clause.
29.25.3	No clause.
29.25.4	No clause.
29.27	No clause.
30.2	Replace clause 30.2 with the following: Where such disagreement is not resolved within ten (10) working days of receipt of such notice it shall be deemed to be a dispute and shall be submitted to Mediation as a first method of dispute resolution failing which the parties will resort to Litigation.
30.3 to 30.7.7	No clauses.
30.8	Replace clause 30.8 with the following: The parties may, by agreement and at any time before Litigation, refer a dispute to mediation, in which event:
30.8.1	No clause.
30.8.2	Replace clause 30.8.2 with the following: The appointment of a mediator, the procedure, and the status of the outcome shall be agreed between the parties.
30.8.3	Replace clause 30.8.3 with the following: Regardless of the outcome of a mediation the parties shall bear their own costs concerning the Mediation and equally share the costs of the mediator and related expenses.
30.9	Replace clause 30.9 with the following: Institution of Litigation shall be commenced and process served within three (3) year from the date of existence of the dispute, failing which the dispute shall lapse.
30.10	No clause.
30.12	No clause.

B 19.0 CONTRACT PARTICIPATION GOAL TARGETS AND CIDB B.U.I.L.D. PROGRAMME

The contractor shall achieve in the performance of the contract the following Contract Participation Goals (CPGs) as described in PG-01.2 (EC): Scope of Work and PG-02.2 (EC): Pricing Assumptions and in accordance with the feasibility study, which forms part of the specifications in the CPG Section of the Specification of this contract.

(a)	Minimum Targeted Local Manufacturers of Material Contract Participation Goal, in accordance with the cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.	***Not applicable***
(b)	Minimum Targeted Local Building Material Suppliers Contract Participation Goal in accordance with the cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.	***Applicable***
(c)	Minimum Targeted Local Labour Skills Development Contract Participation Goal in accordance with the cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.	***Applicable***
(d)	**cidb BUILD Programme:** Minimum Targeted Enterprise Development Contract Participation Goal in accordance with the cidb Standard for Indirect Targeting for Enterprise Development through Construction Works Contracts, No 36190 Government Gazette, 25 February 2013, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.	***Applicable***
(e)	**cidb BUILD Programme:** Minimum Targeted Contract Skills Development Goal in accordance with the cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 48491 of 28 April 2023. and the cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.	***Applicable***
(f)	DPWI National Youth Service training and development programme (NYS) – Condition of Contract.	***Applicable***
(g)	Labour Intensive Works – Condition of Contract.	***Applicable***
(h)		***Select***
(i)		***Select***

PART 2: CONTRACT DATA COMPLETED BY THE TENDERER:

C TENDERER'S SELECTIONS

C 1.0 Securities [11.0]

In respect of contracts with a contract sum up to R1 million, the security to be provided by the contractor to the employer will be a payment reduction of five per cent (5%) of the value certified in the payment certificate (excluding VAT).

In respect of contracts with a contract sum more than R1 million, the security to be provided by the contractor to the employer will be selected by the Contractor as indicated below:

Guarantee for construction: Select Option A, B, C, D or E

Option A	cash deposit of 10 % of the contract sum (excluding VAT)
Option B	variable construction guarantee of 10 % of the contract sum (excluding VAT) (DPW-10.3 EC)
Option C	payment reduction of 10% of the value certified in the payment certificate (excluding VAT)
Option D	cash deposit of 5% of the contract sum (excluding. VAT) and a payment reduction of 5% of the value certified in the payment certificate (excluding. VAT)
Option E	fixed construction guarantee of 5% of the contract sum (excluding VAT) and a payment reduction of 5% of the value certified in the payment certificate (excluding VAT) (DPW-10.1 EC)]

NB: Insurances submitted must be issued by either an insurance company duly registered in terms of the Insurance Act [Long-Term Insurance Act, 1998 (Act 52 of 1998) or Short-Term Insurance Act, 1998 (Act 53 of 1998)] or by a bank duly registered in terms of the Banks Act, 1990 (Act 94 of 1990) on the pro-forma referred to above. No alterations or amendments of the wording of the pro-forma will be accepted.

Guarantee for payment by **employer** [11.5.1; 11.10]	Not applicable
Advance payment, subject to a **guarantee for advance payment** [11.2.2; 11.3]	Not applicable

Tender / Quotation no: KIM03/2023

C 2.0 Payment of preliminaries [25.0]

Contractor's selection

Select Option A or B

Where the **contractor** does not select an option, Option A shall apply

Payment methods

Option A	The **preliminaries** shall be paid in accordance with an amount prorated to the value of the **works** executed in the same ratio as the amount of the **preliminaries** to the **contract sum**, which **contract sum** shall exclude the amount of **preliminaries**. Contingency sum(s) and any provision for cost fluctuations shall be excluded for the calculation of the aforesaid ratio

Option B	The **preliminaries** shall be paid in accordance with an amount agreed by the **principal agent** and the **contractor** in terms of the **priced document** to identify an initial establishment charge, a time-related charge and a final dis-establishment charge. Payment of the time-related charge shall be assessed by the **principal agent** and adjusted from time to time as may be necessary to take into account the rate of progress of the **works**

Lump sum contract

Where the amount of **preliminaries** is not provided it shall be taken as 7.5% (seven and a half per cent) of the **contract sum**, excluding contingency sum(s) and any provision for cost fluctuations.

C 3.0 Adjustment of preliminaries [26.9.4]

Contractor's selection

Select Option A or B

Where the **contractor** does not select an option, Option A shall apply.

Provision of particulars

The **contractor** shall provide the particulars for the purpose of the adjustment of **preliminaries** in terms of his selection. Where completion in **sections** is required, the **contractor** shall provide an apportionment of **preliminaries** per **section.**

Option A	An allocation of the **preliminaries** amounts into Fixed, Value-related and Time-related amounts as defined for adjustment method Option A below, within fifteen (15) **working days** of the date of acceptance of the tender
Option B	A detailed breakdown of the **preliminaries** amounts within fifteen (15) **working days** of possession of the **site**. Such breakdown shall include, inter alia, the administrative and supervisory staff, the use of **construction equipment**, establishment and dis-establishment charges, insurances and guarantees, all in terms of the **programme**

Adjustment methods

The amount of **preliminaries** shall be adjusted to take account of the effect which changes in time and/or value have on **preliminaries**. Such adjustment shall be based on the particulars provided by the **contractor** for this purpose in terms of Options A or B, shall preclude any further adjustment of the amount of **preliminaries** and shall apply notwithstanding the actual employment of resources by the **contractor** in the execution of the **works.**

Option A	The **preliminaries** shall be adjusted in accordance with the allocation of **preliminaries** amounts provided by the **contractor,** apportioned to **sections** where completion in **sections** is required Fixed - An amount which shall not be varied. Value-related - An amount varied in proportion to the **contract value** as compared to the **contract sum**. Both the **contract sum** and the **contract value** shall exclude the amount of **preliminaries**, contingency sum(s) and any provision for cost fluctuations. Time-related - An amount varied in proportion to the number of **calendar days** extension to the date of **practical completion** to which the **contractor** is entitled with an adjustment of the **contract value** [23.2; 23.3] as compared to the number of **calendar days** in the initial **construction period** [26.9.4].
Option B	The adjustment of **preliminaries** shall be based on the number of **calendar days** extension to the date of **practical completion** to which the **contractor** is entitled with an adjustment of the **contract value** [23.2; 23.3] as compared to the number of **calendar days** in the initial **construction period** [26.9.4]. The adjustment shall take into account the resources as set out in the detailed breakdown of the **preliminaries** for the period of construction during which the delay occurred.

Failure to provide particulars within the period stated

Option A	Where the allocation of **preliminaries** amounts for Option A is not provided, the following allocation of **preliminaries** amounts shall apply: Fixed - Ten per cent (10%) Value-related - Fifteen per cent (15%) Time-related - Seventy-five per cent (75%) Where the apportionment of the **preliminaries** per **section** is not provided, the categorised amounts shall be prorated to the cost of each **section** within the **contract sum** as determined by the **principal agent**
Option B	Where the detailed breakdown of **preliminaries** amounts for Option B is not provided, Option A shall apply

Lump sum contract

Where the amount of **preliminaries** is not provided it shall be taken as 7.5% (seven and a half per cent) of the **contract sum**, excluding contingency sum(s) and any provision for cost fluctuations.

C1.3 FORM OF GUARANTEE

Fixed Construction Guarantee
DPW-10-1 (EC)

Variable Construction Guarantee
DPW-10-3 (EC)

DPW-10.1 (EC): FIXED CONSTRUCTION GUARANTEE - JBCC 2000 PRINCIPAL BUILDING AGREEMENT (EDITION 6.2 OF MAY 2018)

Director-General
Department of Public Works and Infrastructure
Government of the Republic of South Africa

FOR ATTENTION

Mr Sandiso Cosa
Private Bag x5002
KIMBERLEY
8300

Sir,

FIXED CONSTRUCTION GUARANTEE FOR THE EXECUTION OF A CONTRACT IN TERMS OF JBCC 2000 (EDITION 6.2 OF MAY 2018)

1. With reference to the contract between _____

   _____ _____(hereinafter referred to as the "**contractor**") and the Government of the Republic of South Africa in its Department of Public Works and Infrastructure (hereinafter referred to as the "**employer**"), Contract/Tender No: KIM03/2023, for the KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF NEW BUILDING (hereinafter referred to as the "contract") in the amount of R ***insert amount*, (*insert amount in words),*** (hereinafter referred to as the **contract sum**),

   I / We, _____

   in my/our capacity as _____and hereby

   representing _____ (hereinafter referred to as the "**guarantor**") advise that the **guarantor** holds at the **employer's** disposal the sum of R ***insert amount*, (*insert amount in words*)** being 5**%** of the **contract sum** (excluding VAT), for the due fulfillment of the contract.

2. The **guarantor** hereby renounces the benefits of the exceptions *non numeratae pecunia; non causa debiti; excussionis et divisionis;* and *de duobus vel pluribus reis debendi* which could be pleaded against the enforcement of this guarantee, with the meaning and effect whereof I/we declare myself/ourselves to be conversant, and undertake to pay the **employer** the amount guaranteed, on receipt of a written demand from the **employer** to do so, stating that the **employer** has a right of recovery against the **contractor** in terms of 33.0 of the contract.

3. Subject to the above, but without in any way detracting from the **employer's** rights to adopt any of the procedures provided for in the contract, the said demand can be made by the **employer**, at any stage prior to the expiry of this guarantee.

4. The amount paid by the **guarantor** in terms of this guarantee may be retained by the **employer** on condition that upon the issue of the last final **payment certificate**, the **employer** shall account to the **guarantor** showing how this amount has been expended and refund any balance due to the **guarantor**.

Tender no: ***(Insert Tender Number)***

5. The **employer** shall have the absolute right to arrange his affairs with the **contractor** in any manner which the **employer** deems fit and the **guarantor** shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the **guarantor**. Without derogating from the aforegoing, any compromise, extension of the **construction period**, indulgence, release or variation of the **contractor's** obligation shall not affect the validity of this guarantee.

6. The **guarantor** reserves the right to withdraw from this guarantee at any time by depositing the guaranteed amount with the **employer**, whereupon the guarantor's liability ceases.

7. This guarantee is neither negotiable nor transferable, and

   (a) must be surrendered to the **guarantor** at the time when the **employer** accounts to the **guarantor** in terms of clause 4 above, or
   (b) shall lapse on the date of the last **certificate of practical completion**.

8. This guarantee shall not be interpreted as extending the **guarantor's** liability to anything more than payment of the amount guaranteed.

SIGNED AT _____ **ON THIS** _____ **DAY OF**

_____ **20__**

AS WITNESS

1. _____

2. _____

_____

By and on behalf of

_____

_____

_____

(insert the name and physical address of the guarantor)

NAME: _____

CAPACITY: _____
(duly authorised thereto by resolution attached marked Annexure A)

DATE: _____

A. No alterations and/or additions of the wording of this form will be accepted.

B. The physical address of the guarantor must be clearly indicated and will be regarded as the guarantor's *domicilium citandi et executandi,* for all purposes arising from this guarantee.

C. This GUARANTEE must be returned to: _____

_____

DPW-10.3 (EC): VARIABLE CONSTRUCTION GUARANTEE - JBCC 2000 PRINCIPAL BUILDING AGREEMENT (EDITION 6.2 OF MAY 2018)

Director-General
Department of Public Works and Infrastructure
Government of the Republic of South Africa

FOR ATTENTION

Mr Sandiso Cosa
Private Bag ***X5002***
KIMBERLEY
8300

Sir,

VARIABLE CONSTRUCTION GUARANTEE FOR THE EXECUTION OF A CONTRACT IN TERMS OF JBCC 2000 (EDITION 6.2 OF MAY 2018)

1. With reference to the contract between _____

   _____ _____(hereinafter referred to as the "**contractor"**) and the Government of the Republic of South Africa, in its Department of Public Works and Infrastructure, (hereinafter referred to as the "**employer**"), Contract/Tender No: ***KIM03/2023***, for the ***KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF NEW BUILDING*** (hereinafter referred to as the **"contract"** in the amount of R ***insert amount*, (*insert amount in words*)** (hereinafter referred as the **contract sum),**

   I / We, _____

   in my/our capacity as _____and hereby

   representing _____ (hereinafter referred to as the "**guarantor**") advise that the **guarantor** holds at the **employer's** disposal the sum of R ***insert amount*, (*insert amount in words*)** being 10**%** of the **contract sum** (excluding VAT), for the due fulfillment of the contract.

2. I / We advise that the **guarantor's** liability in terms of this guarantee shall be as follows:

   (a) From and including the date on which this guarantee is issued and up to and including the date of payment of the amount in the last final **payment certificate**, the **guarantor** will be liable in terms of this guarantee to the maximum amount of 10% of the **contract sum** (excluding VAT);

   (b) The **guarantor's** liability shall reduce to 3 % of the **contract value** (excluding VAT) as determined at the date of the last **certificate of practical completion**, subject to such amount not exceeding 10% of the **contract sum** (excluding VAT).

   (c) The **guarantor's** liability shall reduce to 1 % of the **contract value** (excluding VAT) as determined at the date of the last **certificate of final completion**, subject to such amount not exceeding 10 % of the **contract sum** (excluding VAT).

   (d) This guarantee shall expire on the date of the last **final payment certificate**.

   (e) The **practical completion certificate** and the **final completion certificate** referred to in this guarantee shall mean the certificates issued in terms of the contract.

Tender no: ***insert tender number***

3. The **guarantor** hereby renounces the benefits of the exceptions *non numeratae pecunia; non causa debiti; excussionis et divisionis;* and *de duobus vel pluribus reis debendi* which could be pleaded against the enforcement of this guarantee, with the meaning and effect whereof I/we declare myself/ourselves to be conversant, and undertake to pay the **employer** the amount guaranteed on receipt of a written demand from the **employer** to do so, stating that the **employer** has a right of recovery against the **contractor** in terms of 33.0 of the contract.

4. Subject to the above, but without in any way detracting from the **employer's** rights to adopt any of the procedures provided for in the contract, the said demand can be made by the **employer** at any stage prior to the expiry of this guarantee.

5. The amount paid by the **guarantor** in terms of this guarantee may be retained by the **employer** on condition that upon the issue of the last **final payment certificate**, the **employer** shall account to the **guarantor** showing how this amount has been expended and refund any balance due to the **guarantor**.

6. The **employer** shall have the absolute right to arrange his affairs with the **contractor** in any manner which the **employer** deems fit and the **guarantor** shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the **guarantor**. Without derogating from the aforegoing, any compromise, extension of the construction period, indulgence, release or variation of the **contractor's** obligation shall not affect the validity of this guarantee.

7. The **guarantor** reserves the right to withdraw from this guarantee at any time by depositing the amount guaranteed with the **employer**, whereupon the **guarantor's** liability ceases.

8. This guarantee is neither negotiable nor transferable, and

   (a) must be surrendered to the **guarantor** at the time when the **employer** accounts to the **guarantor** in terms of clause 5 above, or

   (b) shall lapse in accordance with clause 2(d) above.

9. This guarantee shall not be interpreted as extending the **guarantor's** liability to anything more than the payment of the amount guaranteed.

SIGNED AT _____ON THIS _____ DAY OF _____ 20__

AS WITNESS

1. _____

2. _____

Tender no: ***insert tender number***

By and on behalf of
_____

_____

_____
(insert the name and physical address of the guarantor)

NAME: _____

CAPACITY: _____
(duly authorised thereto by resolution attached marked Annexure A)

DATE: _____

A. **No alterations and/or additions of the wording of this form will be accepted.**

B. **The physical address of the guarantor must be clearly indicated and will be regarded as the guarantor's *domicilium citandi et executandi,* for all purposes arising from this guarantee.**

C. **This guarantee must be returned to:** _____

_____

_____

PART C2 :
PRICING DATA

PG-02.2 (EC) PRICING ASSUMPTIONS - JBCC 2000 PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018)

Project title:	KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF A NEW BUILDING INCLUDING PARKING BAYS				
Tender / Quotation no:	*KIM03/2023*	**WCS no:**	*046641*	**Reference no:**	*19/2/4/2/2/2324/7*

C2.1 Pricing Assumptions

The Bills of Quantities consists of:

Section 1 – Preliminaries
Section 2 – Building work
Section 3 – External Work
Section 4 – Roadworks (Provisional)
Section 5 – Electrical Installation
Section 6 – Electronic Installation
Section 7 – Mechanical Installation
Section 8 – Provisional Sums
Section 9 – Contract Participation Goals (CPG)
Final Summary

C2.1.1 BILLS OF QUANTITIES

The **bills of quantities** forms part of and must be read and priced in conjunction with all the other documents forming part of the **contract documents**, the Standard Conditions of Tender, Conditions of Contract, Specifications, Drawings and all other relevant documentation.

The prices and rates to be inserted by the Tenderer in the Bill of Quantities shall be the full inclusive prices to be paid by the Employer for the work described under the several items, and shall include full compensation for all cost and expenses that may be required in and for the completion and maintenance during the defects liability period of all the work described and as shown on the drawings as well as all overheads, profits, incidentals and the cost of all general risks, liabilities and obligations set forth or implied in the documents on which the Tender is based.

Each item shall be priced and extended to the "Total' column by the Tenderer, with the exception of the items for which only rates are required, or items which already have Prime Cost or Provisional Sums affixed thereto. If the Contractor omits to price any items in the Bill of Quantities, then these items will be considered to have a nil rate or price.

No alterations, erasures, omissions or additions is to be made in the text and/or conditions of these Bills of Quantities. Should any such alterations, amendments, note/s or addition be made, the same will not be recognized, but reading of these Bills of Quantities as originally prepared by the Quantity Surveyor will be adhered to.

The contractor is cautioned that the use of any quantities appearing in these Bills of Quantities for the purpose of ordering material, it is done at own risk and no liability whatsoever will be admitted by the Employer or Quantity Surveyor for the correctness of such Quantities. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.

The prices and rates to be inserted by the Tenderer in the Bills of Quantities shall be the full inclusive prices to be paid by the Employer for the work described. Such prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. Market related prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out. The Employer reserves the right to balance the Bill rates where deemed necessary within the Tendered Amount.

A price or rate is to be entered against each item in the Bills of Quantities, whether the quantities are stated or not. An item against which no rate is/are entered, or if anything other than a rate or a nil rate (for example, a zero, a dash or the word “included” or abbreviations thereof) is entered against an item, it will also be regarded as a nil rate having been entered against that item, i.e. that there is no charge for that item. The Tenderer may be requested to clarify nil rates, or items regarded as having nil rates; and the Employer may also perform a risk analysis with regard to the reasonableness of such rates.

Should the full intent and meaning of any description not be clear, the bidder shall, before submission of his tender, call for a written directive from the principal agent, failing which it shall be assumed that the contractor has allowed in his pricing for materials and workmanship in terms of National Best Practice.

All items for which terminology such as “inclusive” or “not applicable” have been added by the Tenderer will be regarded as having a nil rate which shall be valid irrespective of any change in quantities during the execution of the Contract.

The Tenderer is required to check the Bills of Quantities and the numbers of the pages and should any be found to be missing or in duplicate, or should any of the typing be indistinct, or any doubt of obscurity arise as to the meaning of any description or particulars of any item, or if this Tender Enquiry contains any obvious errors, then the Tenderer must immediately inform the Principal Agent and have them rectified or explained in writing as the case may be. No liability whatsoever will be admitted by reason of the Contractor having failed to comply with the foregoing instruction.

The contractor is cautioned that the use of any quantities appearing in these Bills of Quantities for the purpose of ordering material, it is done at own risk and no liability whatsoever will be admitted by the Employer or Quantity Surveyor for the correctness of such Quantities. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.

No alterations, erasures, omissions, or additions are allowed to be made to the text and/or conditions contained in these Bills of Quantities. If any such alteration, amendment, note or addition is made, it will not be recognised and the Bills of Quantities will be deemed to be as originally drawn up by the Quantity Surveyor.

A price or rate is to be entered against each item in the Bills of Quantities, whether the quantities are stated or not. An item against which no rate is/are entered, or if anything other than a rate or a nil rate (for example, a zero, a dash or the word “included” or abbreviations thereof) is entered against an item, it will also be regarded as a nil rate having been entered against that item, i.e. that there is no charge for that item. The Tenderer may be requested to clarify nil rates, or items regarded as having nil rates; and the Employer may also perform a risk analysis with regard to the reasonableness of such rates.

All items for which terminology such as “inclusive” or “not applicable” have been added by the Tenderer will be regarded as having a nil rate which shall be valid irrespective of any change in quantities during the execution of the Contract.

The Tenderer shall fill in rates for all items where the words “rate only’ appear in the “Total” column. “Rate Only” items have been included where:

(a) variations of specified components in the make-up of a pay item may be expected; and

(b) no work under the item is foreseen at tender stage but the possibility that such work may be required is not excluded.

For 'Rate Only" items no quantities are given in the "Quantity" column but the quoted rate shall apply in the event of work under this item being required. The Tenderer shall however note that in terms of the Tender Data the Tenderer may be asked to reconsider any such rates which the Employer may regard as unbalanced.

Descriptions in the Bills of Quantities are abbreviated and comply generally with those in the "PW 371" and the principles contained in the latest version of the Standard System for Measuring Builders' Work in South Africa. It is the intention that the abbreviated descriptions be fully described when read with the applicable measuring system and the relevant preambles and/or specifications. However, should the full intent and meaning of any description not be clear, the bidder shall, before submission of his tender, call for a written directive from the principal agent, failing which it shall be assumed that the contractor has allowed in his pricing for materials and workmanship in terms of National Best Practice.

The price quoted against each item of this Bills of Quantities shall cover the full inclusive cost of the complete work to which it refers, as described in the Conditions of Contract and Specifications and as shown on the Drawings and shall allow for labour, material, transporting, loading, storage, supervision, commissioning, wastage, as well as the builders profit and attendance.

The Tenderer must ensure that he fully completes all columns of the Bill of Quantities including the Final Summary. The fully priced bill of quantities must be submitted with the tender or The Final Summary and the Section Summary pages MUST be returned with the tender document as indicated the PA-03 Notice and Invitation to Tender / PA-04 Notice and Invitation for quotation.

The tenderers are to ensure that they have read and understood the project specifications included in C3: Scope of Work. All the information provided in the Scope of Works form part of the work and must be included in the rates.

"The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself before submitting his tender (as far as is practicable) as to:

(a) the form and nature of the Site and its surroundings, including subsurface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works,

(d) the means of access to the Site and the accommodation he may require

and, in general, shall be deemed to have obtained all information (as far as is practicable) as to risks, contingencies and all other circumstances which may influence or affect his Tender"

C2.1.2 VALUE ADDED TAX

The contract sum must include for Value Added Tax (VAT). All rates, provisional sums, etc. in the bills of quantities / lump sum document shall be in Rands and cents and shall include all levies and taxes (other than VAT). VAT will be added in the summary of the Bill of Quantities. The rates must however be net (exclusive of VAT) with VAT calculated and added to the total value thereof in the Final Summary.

C2.1.3 CORRECTION OF ENTRIES

Incorrect entries shall not be erased or obliterated with correction fluid but must be crossed out neatly. The correct figures must be entered above or adjacent to the deleted entry, and the alteration must be initialled by the Tenderer.

C2.1.4 ARITHMETICAL ERRORS

Arithmetical errors found in the Bill of Quantities as a result of faulty multiplication of addition, will be corrected by the Engineer at the tender evaluation stage, as set out in the Tender Data.

C2.1.5 TRADE NAMES

Tenderers attention is drawn to the fact that wherever trade names or references to any catalogue have been made in these Bills of Quantities, it is purely to establish a standard for the required material. If use is made of any other equally approved material in lieu of the prescribed trade name or catalogue, the necessary price adjustments will be made.

C2.1.6 CONTRACT DOCUMENTS

The Tenderers are advised to examine the bills of quantities, drawings and specifications including all other contract documents and make themselves thoroughly acquainted with the nature and requirements of the work, as no claim for extra payment in this regard will be entertained. Should any parts of the drawings not be clearly intelligible to the Tender, he must, before submitting his tender, obtain clarification from the Principal Agent.

C2.1.7 FIXED PRICE CONTRACT

The Bills of Quantities document is not a fixed price contract and the Tenderers are to take note that contract price adjustments (CPAP) are applicable to this contract.

C2.1.8 PAYMENTS

Interim valuations and payments will be prepared on a monthly basis, all in terms of the conditions of contract.

The contractor is to note that no payment will be made for materials stored off site and in the case of materials being stored on site, payment will only be made for such materials on condition that they have not been delivered to the site prematurely, a tax invoice and proof of payment (ownership) is submitted by the Contractor.

C2.1.9 ACCOMMODATION ON SITE

It is imperative to note that no living quarters for construction workers on site will not be permitted for the full duration of the contract unless otherwise stated in the contract data or permission be granted by the Employer.

C2.1.10 SUBMISSION OF LOCAL MATERIAL UTILISATION REPORT (LOCAL CONTENT)

Submission of Local Material Utilisation Reports is *"not applicable"* to this project.

Bidders to note that materials procured for the works should be from South African manufactures and suppliers. Imported materials shall only be considered under exceptional circumstances, based on compelling technical justifications, and subject to the approval by the NDPWI.

The contractor shall be responsible for record keeping, documenting and submission of monthly local material utilization report with supporting documentation to the Employer's representative within 7 working days of the beginning of the successive month, indicating the percentage targets achieved in terms of DTI&C designated industry/sector/sub-sector schedule as per the PA36 and Annexures C attached to the tender document. The final percentage achievement to be reconciled upon completion of the project and form part of the final account. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.1.11 CONTRACT PARTICIPATION GOALS

The contractor shall achieve in the performance of this contract the following Contract Participation Goals (CPGs) as indicated below:

Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

Monthly progressive reports to be submitted to the Employer's representative indicating the percentage targets achieved which must be reconciled upon completion of the project and to form part of the final account.

C2.1.11.1 MINIMUM TARGETED LOCAL BUILDING MATERIAL MANUFACTURERS CONTRACT PARTICIPATION GOAL

The Minimum Targeted Local Building Material Manufacturers CPG is "*not applicable*" to this project.

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Building Material Manufacturers CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.1. Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.1.11.2 MINIMUM TARGETED LOCAL BUILDING MATERIAL SUPPLIERS CONTRACT PARTICIPATION GOAL

The Minimum Targeted Local Building Material Suppliers CPG is *"applicable"* to this project.

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Building Material Suppliers CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.2. Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.1.11.3 MINIMUM TARGETED LOCAL LABOUR CONTRACT PARTICIPATION GOAL

The Minimum Targeted Local Labour Skills Development CPG is *"applicable"* to this project.

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Labour CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.3. Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports

to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.1.11.4 MINIMUM TARGETED ENTERPRISE DEVELOPMENT CONTRACT PARTICIPATION GOAL

The Minimum Targeted Enterprise Development Contract Participation Goal is *"applicable"* to this project.

A provisional amount has been allowed for within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Enterprise Development CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.4. The provisional amount allowed is for the appointment of training coordinator, mentor, training service providers and training of the beneficiary enterprises. The provisional amount will be adjusted in accordance with the actual Contract Amount (Awarded tender amount excluding allowance, provisional amounts and VAT) of the awarded bid.

Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

The contractor shall complete a separate bill of quantities upon the award of the project and identification of the respective beneficiaries and the appointment of the training coordinator, mentor, training service providers of which the cost will be offset against the provisional amount allowed in the Bills of Quantities.

C2.1.11.5 MINIMUM TARGETED TARGETED CONTRACT SKILLS DEVELOPMENT GOALS (CSDG)

The Minimum Targeted Contract Skills Development CPG is *"applicable"* to this project.

A provisional amount has been allowed for within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Skills Development CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.5. The provisional amount allowed is for:

- stipends payable to the beneficiaries
- appointment of training coordinator
- appointment of mentor (where applicable)
- appointment of training service providers
- other additional costs as per Table 3 of the Standard

The provisional amount will be adjusted in accordance with the actual Contract Amount (Awarded tender amount excluding allowance, provisional amounts and VAT) of the awarded bid.

Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

The contractor shall complete a separate bill of quantities upon the award of the project and identification of the respective beneficiaries. The CPG value to be achieved will be based on the actual contract amount which will be offset against the provisional amount allowed for within the Contract Participation Goal section in the Bill of Quantities.

Payment

The contractor shall upon the appointment of beneficiaries, provide a breakdown of all the associated costs. The contractor shall provide a payment schedule as to how the CPG costs will be claimed against for inclusion in the monthly payment certificates.

(a) Payment to the contractor to accommodate Part/Full Occupational qualification and Trade qualifications;

Should the contractor select Part/Full Occupational qualification and Trade qualifications learners, then the employer shall make provision for payment to the contractor as indicated in Table 3 of the Standard.

The contract skills participation goal, expressed in Rand, shall not be less than the contract amount multiplied by a percentage (%) factor given in Table 2 in the Standard for the applicable class of construction works. Should the contractor select Part/Full Occupational qualification and Trade qualifications learners, then the employer shall make provision for payment to the contractor as indicated in Table 2 of the Standard.

Table 2: Contracting skills development goals for different classes of engineering and construction works contracts
Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No 48491 Government Gazette, 23 April 2023 (Table 2, Page 7)

Class of construction works as identified in terms of Regulation 25 (3) of the Construction Industry Regulations 2004		**Construction skills development goal (CSDG) (%)**
Designation	**Description**	
CE	Civil Engineering	0.25
CE and GB	Civil engineering and General Building	0.375
EE	Electrical Engineering works (buildings)	0.25
EP	Electrical Engineering works (infrastructure)	0.25
GB	General Building	0.5
ME	Mechanical Engineering works	0.25
SB	Specialist	0.25

No provision for an additional payment item for the payment of the supervisor and/or mentors for the provision of training as provided for in the Contract Participation Goal section in the Bill of Quantities for the training of part/full time occupational learners and/or trade qualification learners. The associated cost is deemed to be included in general supervision on site.

The contractor shall complete a separate bill of quantities upon award, indicating the type and number of beneficiaries as well as the associated Notional Cost of Training to be provided, on which payment will be based.

(b) Payment to the contractor to accommodate Work Integrated Learners and Candidates for professional registration;

Should the contractor select Work Integrated Learners and/or Candidates for professional registration, then the employer shall make provision for payment to the contractor as indicated in Table 3 of the Standard.

Provisional amounts have been included in the Contract Participation Goal section in the Bill of Quantities for the training of Work Integrated Learners and Candidates for professional registration. The contractor shall price his Profit and Attendance (all inclusive of associated costs to the contractor for implementation and reporting), based on the provisional amount in the Contract Participation Goal section in the Bill of Quantities.

The contractor shall complete a separate bill of quantities upon award, indicating the type and number of beneficiaries as well as the associated Notional Cost of Training to be provided, on which payment will be based.

The CPG value to be achieved will be based on the contract amount as defined by the Standard, which will be offset against the provisional amount allowed for within the Contract Participation Goal section in the Bill of Quantities.

The contractor shall apportion the cost of accommodating work integrated learners (P1 and P2 learners) and candidates for professional registration by using Table 3 in the Standard and this cost will be used to determine the Rand value and will be used in determining the contract participation goal in the Bills of Quantities.

Table 3: The notional cost pf providing training opportunities per quarter
Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No 48491 Government Gazette, 23 April 2023 (table 3, Page 9)

Type of Training Opportunity	Provision for stipends (Unemployed learners only)	Provisions for mentorship	Provisions for additional costs*	Total costs	
				Unemployed learners	Employed learners
Method 1					
Occupational qualification	**R7 000**	**R0**	**R9 000**	**R16 000**	**R9 000**
Method 2					
TVET College graduates	**R14 000**	**R0**	**R9 000**	**R23 000**	**N/A**
Apprenticeship	**R14 000**	**R0**	**R12 000**	**R26 000**	**R12 000**
Method 3					
P1 and P2 learners	**R24 000**	**R20 000**	**R4 500**	**R48 500**	**N/A**
Method 4					
Candidates with a 3 year diploma	**R37 000**	**R20 000**	**R4 500**	**R61 500**	**R20 000**
Candidates with 4 year qualification	**R47 000**	**R20 000**	**R4 500**	**R71 500**	**R20 000**

Note: The notional cost of providing training opportunities will increase by CPI on an annual basis based on April CPI. Should the rates increase after bid award or during construction the rates will be adjusted as a provisional item.

Example: Training Target Calculation for a R65,7m GB contract

Contract amount	R65 700 000
Contract duration	12 Months
CSDG	0,50%
Minimum CSDG target	0,50% x R65 700 000 = R328 500 (Minimum requirement)

Skills Types	Number of learners	Notional Cost / Learner / Quarter	Notional cost/learner/year	Total Notional Cost over 12 months Contract
Method 2: Workplace learning opportunities, with unemployed TVET graduates	1	R23 000	R92 000	R92 000
Method 3: Candidacy for an unemployed learner with a 3-year qualification	1	R61 500	R246 000	R246 000
Total	2			R338 000

C2.1.11.6 NATIONAL YOUTH SERVICE TRAINING AND DEVELOPMENT PROGRAMME

The National Youth Service Training and Development Programme is *"applicable"* to this project.

The programme shall be implemented in terms of the Implementation of the National Youth Service Programme under the Expanded Public Works (EPWP) and shall be priced in the CPG section of the Bills of Quantities.

Provision has been made within the Contract Participation Goal section in the Bill of Quantities for the National Youth Service Training and Development Programme CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.6.

Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.1.11.7 LABOUR-INTENSIVE WORKS

Labour Intensive Works is *"appliacble"* to this project.

Where labour intensive work is specified in the Bill of Qualities and indicated by "LI" the contractor must price for and include in rates. Contractors are expected to use their initiative to identify additional activities that can be done labour-intensively to comply with the set minimum labour intensity target. Provision has been made within the Contract Participation Goal section in the Bill of Quantities for the monthly reporting illustrating the value of the works executed under Labour Intensive Works CPG in the execution of this project as described in PG-01.2 (EC) SCOPE OF WORKS C3.6.7 and any other supplementary specifications.

Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.2 Submission of Accrual Reports

The Contractor shall submit accrual reports to the client representative at the end of March and September each year for the duration of the Service Contract period from the date of appointment up to and including project closeout. This is to ensure that PMTE complies with the accounting framework GRAP, which requires that PMTE disclose all its accruals as at the end of each reporting date. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

C2.3 SECURITY CLEARANCE

Provision for pricing of the Security clearance is made under Preliminaries Clause C 8.0 and it is explicitly pointed out that all requirements of the aforementioned are deemed to be priced hereunder and no additional claims in this regard shall be entertained.

The **contractor will be required** to have his personnel and workmen, or a certain number of them, security classified before commencement of the contract.

C2.4 BILLS OF QUANTITIES IN ELECTRONIC FORMAT

An edible electronic version of the Bills of Quantities document shall be made available to the tenderers, subject to the following:

- The edible electronic version shall not be regarded as a substitute for the issued tender documents. The edible electronic version is only supplied for convenience when pricing.

- The excel-sheet is only supplied for your convenience when pricing and to be used for calculation purposes. No formatting was done or formulas added to the excel-sheet. No liability whatsoever with regard to any calculations, formulas used, etc., will be recognised as a result of the aforementioned.

- The Bills of Quantities that form part of the document remains the official document. Only the hard copy Bills of Quantities obtained from the DPW offices or the pdf's printed out from the e-tender website and filled in with pen are acceptable as part of the tender documents.

- The Employer accepts no responsibility or liability arising from any reliance on or use of the edible electronic version. Tenderers are alerted to the fact that the edible electronic version of the Bills of Quantities documents may not reflect any notices or addenda that amend the Bills of quantities.

- Any non-compliance with these provisions, including effecting any unauthorised alterations to the Bills of Quantities shall render the tender non-responsive.

- In using the electronic version of the Bills of Quantities or parts thereof, the tenderer is deemed to have read, understood and accepted all of the above conditions

PART C3 :

SCOPE OF WORK

PG-01.2 (EC) SCOPE OF WORKS – JBCC 2000 PRINCIPAL BUILDING AGREEMENT (Edition 6.2 of May 2018)

Project title:	***KEIMOES MAGISTRATE OFFICE: CONSTRUCTION OF A NEW BUILDING INCLUDING PARKING BAYS***		
Tender / Quotation no:	*KIM03/2023*	**Reference no:**	*19/2/4/2/2/2324/7*

C3. Scope of Works

GENERAL

The description of the work contained in the Scope of Work serves as a guideline only and merely an outline of the work to be executed in terms of the Contract and shall not limit the work to be carried out by the Contractor as detailed in the drawings and Bills of Quantities

C3.1 EXTENT OF THE WORKS

The new building comprises mainly the construction of a multi-storey building consisting of a double storey with the magistrate's courts and offices and with a lower ground floor level for parking. The ground floor level houses the Criminal (District) court with all the auxiliary services, the SAPS & DCS areas including holding cells and court cells, administration areas and offices, cash hall areas, public and security areas. The first-floor level houses the Regional Court with all the auxiliary services, the court cells, administration areas and offices, conference and library areas, public and security areas. The basement level provides parking for 15 parking bays for staff vehicles, double garages for the magistrates and the area for the fire water tank and services.

The building will be constructed of concrete and brickwork structure with pre-fabricated timber roof trusses with metal roof covering. The basement is formed with bulk earthworks to lower parts of the sloping site and construct the concrete retaining walls, vehicle ramp to the parking, and concrete columns and beams. Part of the foundations comprise reinforced concrete column bases and strip footings and concrete surface bed. The works include the brickwork, external and internal face brick work, plaster and paint finishes, aluminium windows, suspended ceilings and tile floor finishes, fittings, sanitary fittings, etc

The work comprises also all the associated services e.g. plumbing, electrical, electronic and mechanical work. as well as the installation of a lift for the disabled persons and alarm system.

External works including the provision of paving area at the entrance to the offenders off-loading area and other smaller areas with new paving, a security fence at front area and security border walls. The civil work comprises also of surface and sub-surface drainage to accommodate stormwater and a sewer connection to the existing sewer reticulation network. A water connection will be made to the existing reticulation network to supply water to a bulk water holding tank for domestic water on the roof slab and the supply network to the building from the tank.

Electrical installation shall consist of the complete electrical installation and LV supply, the supply and installation of a UPS, Standby Generator, lift for disabled persons and a wheel chair stair lift.

The electronic installation comprises the Fire alarm system, Public access system, Telephone and Data system, PABX system, Court Recording Technology system, Building Management System, Access Control system, CCTV, X-ray Machine and Metal Detector installations.

Mechanical installation consisting of the HVAC installation including VRF system air-conditioning and ventilation systems, condensate drainage and control's systems and associated electrical work.

The Fire Protection installation includes the fire water storage tank and booster pumps in the lower ground level, hose reels and portable fire extinguisher installation in building and the Gas suppression services in server and record rooms, etc.

One of the objectives of the project is to train P1 and P2 learners & professional candidates.

C3.2 ORDER OF THE WORKS

The Contractors programme shall:

i) be in a bar chart form programmed into MS Project or similar
ii) show the various activities related to the time-chart indicating the sequence of performing the works comprising the contract.
iii) indicate critical path activities

No payment certificate will be issued before the detail programmed has been received.

C3.3 DAMAGE TO EXISTING FACILITIES AND SERVICE

Damage to existing services by the contractor must be repaired without delay and with no expenses to the employer.

C3.4 ACCESS

The site is accessible via existing tarred roads from National Route N14 (main road) via Jooste Street and right into Lang Street

Security clearance and access permits need to be arranged for all personnel that will be working on the premises.

C3.5 STANDARD MINIMUM REQUIREMENTS

In terms of section 5(2) of the Construction Industry Development Board Act, 2000 (Act no. 38 of 2000) (the Act), the Construction Industry Development Board is empowered to establish and promote best practice standards, Standard Requirements and Guidelines which includes the following but not limited to:

C3.5.1 cidb Best Practice: Green Building Certification, No. 34158 Government Gazette, 1 April 2011

C3.5.2 cidb Standard for Developing Skills through Infrastructure Contracts, No. 36760 Government Gazette, 23 August 2013

C3.5.3 cidb Standard for Indirect Targeting for Enterprise Development through Construction Works Contracts, No 36190 Government Gazette, 25 February 2013

C3.5.4 cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts, No. 41237 Government Gazette,10 November 2017

C3.5.5 cidb Standard for Minimum Requirements for Engaging Contractors and Sub-Contractors on Construction Works Contracts, No. 41237 Government Gazette, 10 November 2017

C3.5.6 cidb Standard for Minimum Requirements for Engaging Contractors and Sub- Contractors on Construction Works Contracts, No. 42021 Government Gazette, 9 November 2018

C3.5.7 cidb Standard for Developing Skills through Infrastructure Contracts, No 48491 Government Gazette, 23 April 2023.

C3.6 CONTRACT PARTICIPATION GOALS AND CIDB BUILD PROGRAMME

Provision has been made within the Contract Participation Goal section in the Bill of Quantities for the respective CPGs. Prescribed Profit and Attendance percentages have been stipulated, all inclusive of associated costs to the contractor for implementation and allowance for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

Monthly progressive reports to be submitted to the Employer's representative indicating the percentage targets achieved which must be reconciled upon completion of the project and to form part of the final account.

The contractor shall achieve in the performance of this contract the following Contract Participation Goals (CPGs) as indicated below.

C3.6.1 Minimum Targeted Local Material Manufacturer Contract Participation Goal

The Minimum Targeted Local Building Material Manufacturers CPG is *"not applicable"* to this project.

C3.6.2 Minimum Targeted Local Building Material Suppliers Contract Participation Goal

The Minimum Targeted Local Building Material Suppliers CPG is *insert "applicable" or "not applicable"* to this project.

It is the requirement of the employer that the contractor enhances the use of local Small, Micro and Medium Enterprise Local Material Suppliers (SMME's) in executing this contract, irrespective whether a minimum percentage Participation Goals is applicable or not.

The Minimum Targeted Local Supplier of Material Contract Participation Goal shall be achieved in accordance with the cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract..

A targeted supplier is a targeted enterprise that

a) owns, operates or maintains a store, warehouse or other establishment in which goods are bought, kept in stock and regularly sold to wholesalers, retailers or the public in the usual course of business; and
b) engages, as its principal business and in its own name, in the purchase and sale of goods.

Note: Adapted from SANS 10845-7:2015, definition 2.14

Preference shall be given to the local material suppliers where feasible in the **"Kai! Garib, Municipality**, and provided that:

(a) Such materials comply in all respects with the specific requirements of PW371 and SANS specifications,
(b) The none availability of such materials shall not adversely affect the desired progress of the specific works,
(c) The use of such suppliers shall not constitute grounds for any claim for increased cost in respect thereof,
(d) Materials of at least **one percent (1%)** of the total value of materials purchased excluding VAT to be sourced from within **100km** of the project site,

(e) Material of at least **two percent (2%)** of the total value of materials purchased excluding VAT to be sourced from within **500km** of the project site.

Failure to achieve the minimum specified value as indicated in the CPG Bill of Quantity Section for Targeted Local Material Supplier participation will result in a **thirty percent (30%)** penalty of the prorate targeted value of materials not complied with, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

The bidder shall submit monthly reports in terms of monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative.

C3.6.3 Minimum Targeted Local Labour Skills Development Contract Participation Goal

The Minimum Targeted Local Labour Skills Development CPG is *"applicable"* to this project.

It is the requirement of the employer that the contractor enhances the use of local labour in executing this contract. This is required to be done through the use of both traditional building techniques and labour-intensive construction techniques careful and considered construction planning and implemented in the project irrespective whether a minimum percentage Participation Goal is applicable or not.

The Minimum Targeted Local Skills Development Contract Participation Goal shall be achieved in accordance with the cidb Standard for Contract Participation Goals for Targeting Enterprises and Labour through Construction Works Contracts as published in the Government Gazette Notice No. 41237 of 10 November 2017, as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract..

Targeted labour: individuals who:

a) are employed by the principal contractor, sub-contractor or targeted enterprises in the performance of the contract;
b) are defined as the target group in the targeting data; and
c) permanently reside in the target area or who are recognized as being residents of the target area on the basis of identification and association with and recognition by the residents of the target area.

Adapted from SANS 10845-7:2015, definition 2.12

Targeting of labour by skills categories is only permissible within categories of semi-skilled and unskilled labour.

Contract participation goals for semi-skilled and unskilled labour shall be limited to on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract and in a manner that does not compromise worker health and safety. In the case of targeted labour, the certification of records shall be in accordance with SANS 10845-8.

Beneficiaries will be sourced from the **Kai! Garib Municipality** for the full duration of the Construction Period, employed by either the principal contractor, sub-contractors or targeted enterprises. The total number of working days to complete the Works amount to **600** working days. The minimum CPG participation for Targeted Local Labour Skills Development is **30% (thirty percent)**, expressed as a percentage of the total number of working days required to complete the Works. The contractor shall attain or exceed the CPG in the performance of the contract. Failure to achieve the minimum Targeted Local Labour Skills Development CPG will result in a payment reduction of **R5 000** (Excluding VAT), per working day which training has not been provided to the workforce in attendance, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

The bidder shall submit monthly reports in terms of monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative.

C3.6.4 CIDB BUILD PROGRAMME: Minimum Targeted Enterprise Development Contract Participation Goal

The Minimum Targeted Enterprise Development Contract Participation Goal is *"applicable"* to this project.

The aim of this best practice standard for indirect targeting for enterprise development in accordance with the Standard for Indirect Targeting for Enterprise Development (published in Government Gazette 36190 of 25 February 2013), as amended in cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract. is to promote enterprise development by providing for a minimum Contract Participation Goal (CPG) of ***5%*** of the contract amount as defined in the Standard (Tender amount, excluding allowances and VAT) on selected contracts to be undertaken by joint-venture partners or to be sub-contracted to developing contractors that are also to be beneficiaries of enterprise development support from the main contractor.

The bidder shall submit monthly reports in terms of monthly achievement and accumulative targets achieved including audited supporting documentation to the Employer's Representative.

The lead partner or main contractor shall dedicate a **minimum *5%*** of the tender value at the time of award, excluding allowances and VAT, to provide developmental support to targeted subcontractor or joint venture partner applicable to contracts in Grades 7 to 9, General Building and Civil Engineering contracts. Preference will be given to **ELECTRICAL AND MECHANICAL ENTERPRISES. It could be either or any combination of all**.

Failing to achieve the targeted Contract Skills Development Goal will result in A) a thirty percent (30%) penalty of the value of the portion not achieved, excluding VAT, and B) the issuing of completion certificates only after the completion certificate of achieving the skills development goal, counter-signed by the relevant individuals has been submitted, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

C3.6.4.1 Criteria

The main or lead partner of the successful bidder shall:

(a) There must be a needs analysis for indirect targeting and development or skill standard and should be development in at least any two developmental areas namely;

- Administrative and cost control systems
- construction management systems and plans
- **planning, tendering and programming**
- business; technical; procurement skills
- **legal compliance**
- credit rating/history; financial loan capacity/history
- contractual knowledge

(b) The above needs analysis shall be mutually agreed upon between contractor and targeted enterprise

(c) The contractor shall appoint an enterprise development coordinator to:

- perform needs analysis on the targeted enterprise to identify developmental goals
- develop a project specific enterprise development plan to improve the targeted enterprise/s performance in the identified developmental areas
- provide internal mentorship support to improve the targeted enterprise/s performance

- monitor and submit to the employer's representative a monthly enterprise development report thereby reporting on the progress of the agreed development areas with the targeted enterprise/s
- submit a project completion report to the Employer's representative for each targeted enterprise.

C3.6.4.2 Management

The contractor shall provide a competent person/s to provide internal mentorship to the Targeted Enterprise/s in the two agreed developmental areas.

C3.6.4.3 Competence Criteria for an Enterprise Development Co-ordinator

The enterprise development co-ordinator shall have the following competencies:

- Minimum experience of 5 years in the construction industry at Managerial level as a Site Agent, Contracts Manager, Site Manager, Construction Manager, Business Development Manager or Enterprise Development Manager.
- Minimum experience of 2 years in training and development in Building or Construction; and
- National Diploma or B Degree in the Built Environment or Business Management

C3.6.4.4 Format of Communications

The contractor shall submit to the Employer's Representative:

- *Project interim reports* in the specified format **(ED105P)** detailing interim values of the CPG that was achieved together with an assessment of the enterprise development support provided should be tabled and discussed at least monthly at progress meetings between employer's representative and the contractor;
- *Project completion report* in the specified format **(ED101P)** to the Employer's Representative for acceptance within 15 days of achieving practical completion. The report shall include the value of the CPG that was certified in accordance with the contract, cidb registration numbers of each and every targeted enterprise, and the value of the subcontracted works or of the joint venture entered into; and the participation parameter
- *Enterprise development declaration (**ED104P**).*

C3.6.4.5 The Key Personal

The contractor shall appoint an Enterprise Development Co-ordinator and a competent person/s to provide internal mentorship.

C3.6.4.6 Management Meetings

The contractor shall report to the Employer's Representative on the implementation and progress of the targeted enterprise development and CPG at monthly progress site meetings.

C3.6.4.7 Forms for contract administration

The contractor shall submit to the Employer's Representative the following proformas:

- Form ED 105P Project Interim Report
- Form ED 104P Enterprise Development Declaration
- Form ED 101P Project Completion Report

C3.6.4.8 Records

The contractor shall:

- keep records of the targeted enterprise development
- keep records of the payments made to the targeted enterprises in relation to the CPG.
- ensure all the documentation required in terms of the Standard is provided with each monthly progress payment certificate and according to a prescribed format where applicable.

C3.6.4.9 Payment Certificates

The contractor shall:

- achieve the measurable CPG and providing enterprise development support to the targeted enterprise/s as per the Standard.
- submit payment certificates to the Employer Representative at intervals determined in the Contract.

C3.6.4.10 Compliance requirements

Non-compliance with the Best Practice Project Assessment Scheme

The wording of regulation 27A of the cidb regulations makes provision for the Board to enforce the cidb code of conduct in the event of clients being found to be in breach of the best practice project assessment scheme.

- Not including the requirements of the cidb standards in the conditions of tender
- Not registering the award of contract on the cidb Register of Projects (RoP)
- Not reporting practical completion on the cidb Register of Projects (RoP)

3.6.5 **CIDB BUILD PROGRAMME: Minimum Targeted Contract Skills Development Goal (CSDG)**

The Minimum Targeted Contract Skills Development CPG is *"applicable"* to this project.

The contractor shall achieve or exceed in the performance of the contract the Contract Skills Development Goal (CSDG) established in the Standard for Developing Skills through Infrastructure Contracts (published in Government Gazette No 48491 of 23 April 2023 and the cidb Best Practice Project Assessment Scheme Notice No. 43726 of 18 September 2020 – Condition of Contract.

Failing to achieve the targeted Contract Skills Development Goal will result in A) a **thirty percent (30%)** penalty of the value of the portion not achieved, excluding VAT, and B) the issuing of completion certificates only after the completion certificate of achieving the skills development goal, counter-signed by the relevant individuals has been submitted, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

The contractor shall apportion the learners in the different construction activities based on the scope of work. The cost of accommodating learners will be determined by using Table 3 in the Standard and this cost will be used to determine the value in Rand and will be added to the provision for training as provided for in the Preliminary and General section in the Bill of Quantities/Pricing schedules/Activity schedule.

C3.6.5.1 Methodology

The contractor shall achieve the measurable contract skills development goal by providing opportunities to learners requiring structured workplace learning using one or a combination of any of the following in relation to work directly related to the contract or order:

Method 1: structured workplace learning opportunities for learners towards the attainment of a part or a full occupational qualification;

Method 2: structured workplace learning opportunities for apprentices or other artisan learners towards the attainment of a trade qualification leading to a listed trade (GG No. 35625, 31 August 2012) subject to at least sixty percent (60%) of the artisan learners being holders of public TVET college qualifications;

Method 3: work integrated learning opportunities for University of Technology or Comprehensive University students completing their national diplomas;

Method 4: structured workplace learning opportunities for candidates towards registration in a professional category by a statutory council.

The contract skills participation goals, expressed in Rand, shall not be less than the contract amount multiplied by a percentage (%) factor given in Table 1 in the Standard for the applicable class of construction works.

Table 1: Contracting skills development goals for different classes of engineering and construction works contracts

Class of construction works as identified in terms of Regulation 25 (3) of the Construction Industry Regulations 2004		**Construction skills development goal (CSDG) (%)**
Designation	**Description**	
CE	Civil Engineering	0.25
CE and GB	Civil engineering and General Building	0.375
EE	Electrical Engineering works (buildings)	0.25
EP	Electrical Engineering works (infrastructure)	0.25
GB	General Building	0.5
ME	Mechanical Engineering works	0.25
SB	Specialist	0.25

The contractor shall apportion the learners in the different construction activities based on the scope of work. The cost of accommodating learners will be determined by using Table 2 in the Standard and this cost will be used to determine the value in Rand and will be added to the provision for training as provided for in the Preliminary and General section in the Bill of Quantities/Pricing schedules/Activity schedule.

Table 2: Notional Cost of Training per Headcount

Source: cidb Standard for Skills Development

Type of Training Opportunity	Provision for stipends (Unemployed learners only)	Provisions for mentorship	Provisions for additional costs*	Total costs	
				Unemployed learners	Employed learners
Method 1					
Occupational qualification	**R7 000**	**R0**	**R9 000**	**R16 000**	**R9 000**
Method 2					
TVET College graduates	**R14 000**	**R0**	**R9 000**	**R23 000**	**N/A**
Apprenticeship	**R14 000**	**R0**	**R12 000**	**R26 000**	**R12 000**
Method 3					
P1 and P2 learners	**R24 000**	**R20 000**	**R4 500**	**R48 500**	**N/A**
Method 4					
Candidates with a 3 year diploma	**R37 000**	**R20 000**	**R4 500**	**R61 500**	**R20 000**
Candidates with 4 year qualification	**R47 000**	**R20 000**	**R4 500**	**R71 500**	**R20 000**

Note: the required CPG will be recalculated based on the awarded tender amount and "Contract amount" once the beneficiaries have been appointed and actual costs are known. The notional cost of providing training opportunities will increase by CPI on an annual basis based on April CPI. Should the rates increase after bid award or during construction the rates will be adjusted as a remeasuarble item.

(a) The successful contractor may employ part/full trade qualification learners, work integrated learners or candidates directly or through a Skills Development Agency (SDA), (A1 - List of cidb accredited SDAs).

(b) The successful contractor must employ at least sixty percent (60%) of the learners from an FET / TVET college should the contractor select to have part/full occupational qualification learners and trade qualification learners contributing to the CSDG.

(c) The successful contractor shall employ at least **forty percent (40%)** from eligible part/full work integrated learners or candidates in the employment of the employer.

(d) The successful contractor shall ensure that no single method shall contribute more than seventy five percent (75%) of the CSDG for the contract.

(e) The successful contractor may only place thirty three percent (33%) employed employees or that of his subcontractors contributing to the CSDG.

(f) The contractor shall employ at least sixty percent (60%) of the learners from a Public FET / TVET college should the contractor select to have trade qualification learners (Method 2) contributing to the CSDG.

(g) One of the objectives of the project is to train work integrated learners – P1 and P2 learners and professional candidates.

C3.6.5.2 <u>Management</u>

(a) The successful contractor must keep site records regarding the part/full work integrated learners' or candidates' progress, site attendance, hours worked and other relevant information as required by the Standard.

(b) The successful contractor shall provide the required number of appropriately qualified mentors to the maximum number of part/full occupational qualification learners, trade qualification learners, work integrated learners in the proportion as specified in the Standard.

(c) The successful contractor shall provide a supervisor to manage the training of the part/full work integrated learners and candidates.

(d) The successful contractor shall submit to the employer's representative a baseline training plan in the specified format (Pro-forma A2) for the part/full work integrated learners and candidates within 30 days of start of the contract.

(e) The successful contractor shall submit to the employer's representative project interim report in the specified format (Pro-forma A3) on the progress of each of part/full work integrated learner and candidate every three months.

(f) The successful contractor shall submit to the employer's representative the names and particulars in the specified format (Pro-forma A4) of the supervisor, mentors for the part/full work integrated learners or candidates within 30 days of start of the contract.

(g) The successful contractor shall keep a daily record of all the part/full work integrated learners and candidates on site and their daily activities and shall be made available to the employer's representative on request.

(h) The successful contractor shall submit to the employer's representative the reports on the progress and status of the part/full work integrated learners or candidates with the monthly invoice for the payment certificate.

(i) The successful contractor shall have health and safety inductions for all part/full work integrated learners or candidates.

(j) The successful contractor shall conduct entry and exit medical tests of all part/full work integrated learners or candidates.

(k) The successful contractor shall provide personal protective equipment (PPE) to all part/full work integrated learners or candidates at the start of their employment on site.

(l) Based on the agreed skills methods the contractor may employ part/full Work Integrated Learners and/or Candidates directly or through a Skills Development Agency (SDA), training provider or skills development facilitator (Form A1 - List of cidb accredited SDAs). The contractor shall ensure that no more than one Method shall be applied to any individual concurrently in the calculation of the CSDG for the contract.

C3.6.6 NATIONAL YOUTH SERVICE TRAINING AND DEVELOPMENT PROGRAMME (NYS)

The National Youth Service Training and Development Programme is *"applicable"* to this project.

The programme shall be implemented in terms of the Implementation of the National Youth Service Programme under the Expanded Public Works (EPWP) and shall be priced in the CPG section of the Bills of Quantities. Monthly reports are to be submitted to the Employer's Representative.

Failure by the contractors to achieve the specified number to be trained in the NYS section of the CPG section within the Bills of quantities will result in a Payment reduction as per bill of quantities per person, excluding VAT, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

C3.6.7 LABOUR-INTENSIVE WORKS

Labour Intensive Works is *"appliacble"* to this project.

Where labour intensive work is specified in the Bill of Qualities and specified by "LI" the contractor must price for and include in rates. Contractors are expected to use their initiative to identify additional activities that can be done labour-intensively to comply with the set minimum labour intensity target. Allowance must be made for submitting monthly reports illustrating the value of the works executed under Labour Intensive Works.

Failure by the contractor to achieve the specified value of the Labour Intensive Participation Goal as stipulated within the Bills of Quantities will result in a **thirty percent (30%)** penalty of the value of the works not done by means of labour intensive methods, excluding VAT, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

Employer's objectives:
The employer's objectives are to deliver public infrastructure using labour-intensive methods in accordance with EPWP Guidelines.

Labour-intensive works:
Labour-intensive works shall be constructed/maintained using local workers who are temporarily employed in terms of the scope of work.

Labour-intensive competencies of supervisory and management staff:
Contractors shall only engage supervisory and management staff in labour-intensive works that have completed the skills programme including Foremen/ Supervisors at NQF level 4 "National Certificate: Supervision of Civil Engineering Construction Processes" and Site Agent/ Manager at NQF level 5 "Manage Labour-Intensive Construction Processes" or equivalent QCTO qualifications (See Appendix C) at NQF outlined in Table 1

C3.6.7.1 GENERIC LABOUR-INTENSIVE SPECIFICATION

Contractors are referred to the Guidelines for the Implementation of Labour-intensive Infrastructure Projects under the Expanded Publics Works Programme (EPWP) for the generic labour-intensive specification applicable to the contract.

This specification establishes general requirements for activities which are to be executed by hand involving the following:

- trenches having a depth of less than 1.5 metres
- stormwater drainage
- roads
- sidewalks and non-motorised transport infrastructure
- water and sanitation

Precedence
Where this specification is in conflict with any other standard or specification referred to in the Scope of Works to this Contract, the requirements of this specification shall prevail
.

Hand excavateable material
Hand excavateable material is:
a) granular materials:
i) whose consistency when profiled may in terms of Table 3 be classified as very loose, loose, medium dense, or dense; or
ii) where the material is a gravel having a maximum particle size of 10mm and contains no cobbles or isolated boulders, no more than 15 blows of a dynamic cone penetrometer is required to penetrate 100mm;
b) cohesive materials:
i) whose consistency when profiled may in terms of Table 3 be classified as very soft, soft, firm, stiff and stiff / very stiff; or

ii) where the material is a gravel having a maximum particle size of 10mm and contains no cobbles or isolated boulders, no more than 8 blows of a dynamic cone penetrometer is required to penetrate 100mm;

Note
1) A boulder is material with a particle size greater than 200mm, a cobble and gravel is material between 60 and 200mm.
2) A dynamic cone penetrometer is an instrument used to measure the in-situ shear resistance of a soil comprising a drop weight of approximately 10 kg which falls through a height of 400mm and drives a cone having a maximum diameter of 20mm (cone angle of 60° with respect to the horizontal) into the material being used.

Table 3: Consistency of materials when profiled

GRANULAR MATERIALS		COHESIVE MATERIALS	
CONSISTENCY	**DESCRIPTION**	**CONSISTENCY**	**DESCRIPTION**
Very loose	Crumbles very easily when scraped with a geological pick.	Very soft	Geological pick head can easily be pushed in as far as the shaft of the handle.
Loose	Small resistance to penetration by sharp end of a geological pick.	Soft	Easily dented by thumb; sharp end of a geological pick can be pushed in 30-40 mm; can be moulded by fingers with some pressure.
Medium dense	Considerable resistance to penetration by sharp end of a geological pick.	Firm	Indented by thumb with effort; sharp end of geological pick can be pushed in up to 10 mm; very difficult to mould with fingers; can just be penetrated with an ordinary hand spade.
Dense	Very high resistance to penetration by the sharp end of a geological pick; requires many blows for excavation.	Stiff	Can be indented by thumb-nail; slight indentation produced by pushing geological pick point into soil; cannot be moulded by fingers.
Very dense	High resistance to repeated blows of a geological pick.	Very stiff	Indented by thumb-nail with difficulty; slight indentation produced by blow of a geological pick point.

Trench excavation
All hand excavateable material in trenches having a depth of less than 1,5 metres shall be excavated by hand.

Compaction of backfilling to trenches (areas not subject to traffic)
Backfilling to trenches shall be placed in layers of thickness (before compaction) not exceeding 100mm. Each layer shall be compacted using hand stampers;
a) to 90% Mod AASHTO;
b) such that in excess of 5 blows of a dynamic come penetrometer (DCP) is required to penetrate 100 mm of the backfill, provided that backfill does not comprise more than 10% gravel of size less than 10mm and contains no isolated boulders, or
c) such that the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a DCP.

Excavation
All excavateable material including topsoil classified as hand excavateable shall be excavated by hand. Harder material may be loosened by mechanical means prior to excavation by hand. Any material which presents the possibility of danger or injury to workers shall not be excavated by hand.

Clearing and grubbing
Grass and bushes shall be cleared by hand.

Shaping
All shaping shall be undertaken by hand.

Loading
All loading shall be done by hand. Haulage equipment should be selected in a manner that allows loading by hand to the greatest extent possible.

Haul
Excavation material shall be hauled to its point of placement by means of wheelbarrows where the haul distance is not greater than 150m.

Offloading
All material, however transported, is to be off-loaded by hand, unless tipper-trucks are utilised for haulage.

Spreading
All material shall be spread by hand.

Compaction
Small areas may be compacted by hand provided that the specified compaction is achieved. Appropriate rollers should be used where higher (than can be achieved by hand) levels of compaction are required or for large areas.

Grassing
All grassing shall be undertaking by sprigging, sodding, or seeding by hand.

Stone pitching and rubble concrete masonry
All stone required for stone pitching and rubble concrete masonry, whether grouted or dry, must to be collected, loaded, off loaded and placed by hand.
Sand and stone shall be hauled to its point of placement by means of wheelbarrows where the haul distance is not greater than 150m.
Grout shall be mixed and placed by hand.

Manufactured Elements
Elements manufactured or supplied by the Contractor, such as manhole rings and cover slabs, precast concrete planks and pipes, masonry units and edge beams shall not individually, have a mass of more than 320kg. Where the mass of an element exceeds 55 kg, consideration should be given to the size of the element relative to its total mass related to the number of workers who would be needed to lift such mass

C3.7 Submission of Accrual Reports

The Contractor shall submit accrual reports to the client representative at the end of March and September each year for the duration of the Service Contract period from the date of appointment up to and including project closeout. This is to ensure that PMTE complies with the accounting framework GRAP, which requires that PMTE disclose all its accruals as at the end of each reporting date.

C3.8 Submission of Monthly Local Material Utilisation Report (Local Content)

Submission of Monthly Local Material Utilisation Report (Local Content) *"not applicable"* to this project.

The Contractor shall when applicable to this project, be responsible for record keeping, documenting and submission of monthly local material utilization report with supporting documentation to the Employer's representative within 7 working days of the beginning of the successive month, in terms of DTI&C designated industry/sector/sub-sector schedule as per the PA36 and Annexures C attached to the tender document. The final percentage achievement to be reconciled upon completion of the project and form part of the final account.

Failure by the contractor to achieve the specified percentage of local content per designated industry/sector/sub-sector as listed will result in a thirty percent thirty percent (30%) penalty of the value not achieved, excluding VAT, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control.

C3.9: Annex A: Examples of calculating CPGs and related penalties

Examples of calculating CPGs and related penalties

CPGs values are based on the Tender Amount at the time of the award. Determining the actual values is based either on the Tender Amount including allowances and Vat or the Tender Amount at the time of award excluding allowances and VAT, where Allowances include the following:

- Provisional amounts
- CPG allowances
- Nominated and/or selected subcontractors
- Contract price adjustment (Not provided for within the B of Q by NDPWI)
- Contingency amounts (Not provided for within the B of Q by NDPWI)

CPG values in the CPG Bill of Quantities Section will be recalculated based on the "Tender Amount" or the "Contract Amount" which ever applicable and the provisional amounts adjusted accordingly. Sanctions (penalties) are applicable to all CPGs where the contractor fails to achieve the minimum specified requirements, unless the contractor can prove to the Employer's satisfaction that the non-achievement was beyond his/her control. No penalties will be applied should the CPG value, based on the original "Tender Amount" or the "Contract Amount", has been achieved.

1.1 Targeted Local Building Material Manufacturers CPG

When applicable, the CPG is expressed as a percentage of the "Contract Amount", i.e. the Tender Amount at the time of award excluding allowances and VAT.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG to be achieved = 5% as specified in the Scope of Works (PG01.2)
CPG target value = R130 Mil x 5% = R 6,5 Mil (Value of material to be purchased from local manufacturers, excluding VAT)

Calculation of penalty:
Percentage penalty applicable = 10% as specified in the Scope of Works (PG01.2)
CPG target value = R6,5 Mil excluding VAT
CPG Achieved = R5,5 Mil (R1 Mil shortfall) excluding VAT
Penalty = R1 Mil x 10% = R100 000 excluding VAT

1.2 Targeted Local Building Material Suppliers CPG

When applicable, the CPG is expressed as a percentage of the "Contract Amount", i.e. the Tender Amount at the time of award excluding allowances and VAT.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG to be achieved = 5% as specified in the Scope of Works (PG01.2)
CPG target value = R130 Mil x 5% = R 6,5 Mil (Value of material to be purchased from local suppliers, excluding VAT)

Calculation of penalty:
Percentage penalty applicable = 20% as specified in the Scope of Works (PG01.2)
CPG target value = R6,5 Mil excluding VAT
CPG Achieved = R5,5 Mil (R1 Mil shortfall) excluding VAT
Penalty = R1 Mil x 20% = R200 000 excluding VAT

1.3 Targeted Local Labour Skills Development CPG

When applicable, the CPG is expressed as a percentage of the total number working days required to complete the Works.

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
Number of working days required to complete the Works based on the construction period = 600 days
CPG percentage participation to be achieved = 30% as specified in the Scope of Works (PG01.2)
Required number of working days training to be provided = 180 days (600 x 30%)

Calculation of penalty:
Payment reduction = R 5 000 per day for not providing training as specified in the Scope of Works (PG01.2)
CPG = 600 working days x 30% = 180 working days training to be provided
CPG Achieved = 160 days (20 days shortfall where no training was provided)
Penalty = 20 days x R5 000 payment reduction per day= R100 000 excluding VAT

1.4 Cidb BUILD Programme: Enterprise Development

When applicable, the Enterprise Development CPG expressed as a percentage of the "Contract amount" = Tender amount at the time of award excluding allowances and VAT. Failure to achieve the minimum Targeted Local Labour Skills Development CPG will result in a payment reduction of an amount specified in the Scope of Works (PG01.2) per working day where training was not provided.

The monetary value of training to be provided is stipulated in the CPG BoQ section. The number of beneficiaries to be trained is dependent on the "Contract Amount" as well the number of beneficiaries appointed which will generally resort under the Grade 1 and 2 cidb categories. The provisional amount will therefore be adjusted in terms of the "contract Amount", the number of beneficiaries to be trained and the actual cost for providing the training.

Part 1: Calculation of 5% CPG example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG percentage participation to be achieved = 5% as specified in the Scope of Works (PG01.2) CPG value = R6,5 Mil (Value of work to be subcontracted to emerging enterprises)

Calculation of penalty
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.2)
CPG Minimum 5% = R6,5 Mil
Achieved = R5,5 Mil (Only subcontracted work to the value of R5,5 Mil, i.e. R1 Mil shortfall)
Penalty = R1 Mil x 30% = R300 000 Excl. VAT

Part 2: Calculations in terms of training to be done:
The number of enterprises to be developed is subject to the contract amount and the apportionment of the work as per Example 1 below.
Number of enterprises to be trained = 6 x 1 GB subcontractors
Total cost for training = R 1 660 000

Calculation of penalty
Total number of enterprises to be trained = 6
Total number trained = 4 (2 Shortfall)
Training cost per beneficiary = R1 660 000 / 6 = R 276 666,67 per beneficiary
Penalty = R 276 666,67 x 2 x 30% = R166 000 Excl. VAT

B of Q Item	Description	Unit	Rate	Quantity	Amount (R)
5	**Enterprise Development**				
5.1	Enterprise Development of Targeted Enterprise or JV partners				

B of Q Item	Description	Unit	Rate	Quantity	Amount (R)
5.1.1	Appointment of training co-ordinator	Per Quarter	45 000	8	360 000
5.1.2	Appointment of Mentor /Training Service provider	Per Quarter	135 000	8	1 080 000
5.1.3	Needs Analysis and Enterprise Development Plan per Targeted Enterprise	No.	5 000	6	30 000
5.1.4	Monitoring and Interim reporting per targeted enterprise	Per Quarter	20 000	8	160 000
5.1.5	Project Completion report per Targeted Enterprise	No.	5 000	6	30 000
	Provisional Sum to be carried over to CPG bill of quantities				**1 660 000**
	"Contract amount" Tender amount excl. allowances and VAT,	130 000 000			
	CPG Monetary value (5%) to be subcontracted to beneficiaries for training	6 500 000			
	No of enterprises based on the CPG value	6	Grade 1 / 2 GB/CE,ETC.		
	Contract period (months)	24			

Note: Rates to be determined by PQS and adjusted to accepted quotation amounts

1.5 Cidb BUILD Programme: Skills Development (Principal contractor including subcontractors and consultants)

When applicable, the contract skills development participation goals, expressed in Rand, shall be no less than the "contract amount" multiplied by a percentage (%) factor for the applicable class of construction works.

The monetary value of training to be provided is stipulated in the CPG BoQ section. The number of beneficiaries to be trained is dependent on the "Contract Amount" as well the number of beneficiaries appointed which will generally resort under the Grade 1 and 2 cidb categories. The provisional amount will therefore be adjusted in terms of the "Contract Amount", the number of beneficiaries to be trained from which *Method* and the actual cost for providing the training.

CPG Calculation

Table 2: Contracting skills development goals for different classes of engineering and construction works contracts

Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 43495 of 3 July 2020 (Page 7)

Class of construction works as identified in terms of Regulation 25 (3) of the Construction Industry Regulations 2004		Construction skills development goal (CSDG) (%)
Designation	**Description**	
CE	Civil Engineering	0.25
CE and GB	Civil engineering and General Building	0.375
EE	Electrical Engineering works (buildings)	0.25
EP	Electrical Engineering works (infrastructure)	0.25
GB	General Building	0.5
ME	Mechanical Engineering works	0.25
SB	Specialist	0.25

"Contract amount" = Tender amount at the time of award excluding allowances and expenses, and VAT

Contractor CPG:

CPG calculation
"Contract amount" x factor from Table 3 above.

CPG calculation example:
"Tender Amount" = R150 Mil for GB, all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
Factor for GB = 0,5% (as per Table 2 above)
CPG in R value = R130 Mil x 0,5% = R650 000 i.e. total notional cost of training to amount to R650 000

Calculation of penalty:
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.2)
CPG value = R650 000
Achieved = R550 000 = R100 000 Shortfall
Penalty = R100 000 x 30% = R30 000 Excl. VAT

Calculations based on "Contract Amount" after bid award and appointment of beneficiaries
Actual CPG training requirement value after award upon selecting method/s of training and appointment of beneficiaries = R676 000 (Table 4 below) and the provisional amount allowed for to be adjusted accordingly. The new monetary value of training required will then form the basis for determining penalties applicable. No penalties will be applied should the CPG value, based on the "Contract Amount" be achieved.

Table 4: Notional cost recalculation upon appointment of beneficiaries.
Source: cidb Standard for Developing Skills through Infrastructure Contracts as published in the Government Gazette Notice No. 43495 of 3 July 2020 (Page 10)

Skills Types	Number of learners	Notional Cost / Learner / Quarter	Notional cost / learner / year	Total Notional Cost over 12 months Contract
Method 2: Workplace learning opportunities, with unemployed TVET graduates	2	R23 000	R92 000	R184 000
Method 3: Candidacy for an unemployed learner with a 3-year qualification	2	R61 500	R246 000	R492 000
Total	4			R676 000

Note: the required CPG will be recalculated based on the awarded Tender amount and "Contract Amount" once the beneficiaries have been appointed and actual costs are known

Note: The notional cost of providing training opportunities will increase by CPI on an annual basis based on April CPI as published by Stats SA. The rates will be adjusted as an adjustment to the provisional amounts should the rates increase after bid award or during the construction period

1.6 National Youth Service Programme (NYS) CPG

When applicable, a separate NYS Bill of Quantities will be included in the tender documentation will indicate the number of beneficiaries to be trained.

Calculation of penalty:
Payment reduction per person not trained as stipulated in the NYS Bill of Quantities = R 2 500 per person.
Total number of NYS Beneficiaries as stipulated in the NYS Bill of Quantities = 25
Total Number of NYS beneficiaries trained = 20 (shortfall of 5 beneficiaries)
Penalty = 5 x R2 500 = R12 500 Excl. VAT

1.7 Labour Intensive Works CPG

When applicable, the work to be done by way of Labour intensive methods are specified in the Bills of Quantities with a "LI".

CPG calculation example:
"Tender Amount" = R150 Mil all inclusive of allowances and VAT
"Contract Amount" = R130 Mil (Tender Amount at the time of award excluding allowances and VAT)
CPG value = R10 Mil (Total value of labour-intensive works specified in the Bills of Quantities)

Calculation of penalty:
CPG value = R10 Mil
Percentage penalty applicable = 30% as specified in the Scope of Works (PG01.2)
CPG Achieved = 9 Mil (R1 Mil shortfall)
Penalty = R1 Mil x 30% = R300 000 Excl. VAT

DRAWINGS

C3.10: Annex B: Drawings

The following drawings are issued together with these Tender Documents:

Architectural

Locality and Site plan	25716-A1000-00 & A25716-1001-00
Basement Floor plan	25716-A2000-00
Ground Floor plan	25716-A2001-00
First Floor plan	25716-A2002-00
Sections	25716-A3002-00
Elevations	25716-A4000-00 & A4001-00
Workstation's layouts, wall units, etc	25716-A5034 to A5039
Stainless steel handrails, notice boards & toga	25716-A6004, A6015 & A6016
Court Furniture	25716-A6017 to A6020

Structural & Civil

Isometric view	1237-S-000-Rev000
Timber roof Layout	1237-S-017 to 1237-S-022
Speed Hump	STE/P-31A

Electrical

DB's & Access Control layouts	EE10742-E-300-01 to -08, E-327-01 to -03,
Tel & Data and Fire detection layouts	EE10742-E-330-01 to -02, E-340-01 to -03,
Power point and Lightning layouts	EE10742-E-370-01 to -02, E-380-01 to -02,
Single line diagram, sleeves & cable markers	EE10742-E-400-01, E-402-01, E-411-01,
Cable trays & channel layouts	EE10742-E-701-01 to -02
HVAC power points layouts	EE10742-E-747-01 to E-04

Mechanical

HVAC	ME 304128-01 to ME 304128-04
Fire Protection	ME 304128-05 to ME 304128-07 & -10
Gas suppression	ME 304128-09

The following are in the complete set of Contract drawings:

Architectural drawings

Locality and Site plan	25716-A1000-00 & 25716-A1001-00
Basement, Ground-, First Floor and Roof plans	25716-A2000-00 to 25716-A2021-00
Sections	25716-A3000-00 to 25716-A3004-00
Elevations	25716-A4000-00 & 25716-A4001-00
Large scale layouts of kitchens, bathroom & other	25716-A5000-00 to 25716-A5054
Construction detail and assembly drawings	25716-A6000-00 to 25716-A6016
Schedules: doors, windows, finishes, sanitary ware, etc	25716-A8000-00 to 25716-A8012

Engineers drawings

Structural drawings

Isometric view	1237-S-000-Rev000
Foundations, basement, ground-, first floor & roof	1237-S-001-Rev000 to -S-012-Rev000
Staircase layout & grid	1237-S-013-Rev000 to -S-016 &-S-023
Timber roof Layout	1237-S-017 to 1237-S-022

Civil drawings

Stormwater Layout	C5874-00 to C5874-01
Water Layout	C5874-02 to C5874-04
Sewer layout	C5874-05
Details	DT06-ST, DT25-ST & STE/P-31A

Electrical drawings

DB's & Access Control layouts	EE10742-E-300-01 to -08, E-327-01 to -03,
Tel & Data and Fire detection layouts	EE10742-E-330-01 to -02, E-340-01 to -03,
Power point and Lightning layouts	EE10742-E-370-01 to -02, E-380-01 to -02,
Single line diagram, sleeves & cable markers	EE10742-E-400-01, E-402-01, E-411-01,
Cable trays & channel layouts	EE10742-E-701-01 to -02
HVAC power points layouts	EE10742-E-747-01 to E-04

Mechanical drawings

HVAC	ME 304128-01 to ME 304128-04
Fire Protection	ME 304128-05 to ME 304128-07 & -10
Gas suppression	ME 304128-08 to ME 304128-09

SPECIFICATION

ELECTRICAL WORK

public works
& infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

SPECIFICATION

FOR THE

ELECTRICAL INSTALLATION

OF

KEIMOES MAGISTRATES COURT

MAY 2021

INDEX **PAGE NO.**

SPECIFICATION FOR ELECTRICAL WORK

PART 1 - GENERAL

CONTENTS

PART 1 - GENERAL

1 TESTS

After completion of the works and before practical completion is achieved, 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 installations will be inspected and the Contractor shall make good, to the satisfaction of the Principle Agent/Electrical Engineer or the employer, any defects which may arise.

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 installations at completion.

2 MAINTENANCE OF INSTALLATIONS

With effect from the date of the Practical completion Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the maintenance period and shall make all adjustments necessary for the correct operation thereof.

If during the said period the installations is not in working order for any reason for which the Contractor is responsible, or if the installations develops defects, he shall immediately upon being notified thereof take steps to remedy the defects and make any necessary adjustments.

Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Principle Agent/Electrical Engineer or the Employer, at his own expense replace the whole of the installations or such parts thereof as the Principal Agent/Electrical Engineer or the Employer may deem necessary with apparatus specified by the Principal Agent/Electrical Engineer or the Employer.

3 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works

4 NOTICES AND FEES

The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority.

On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains, will be refunded to the Contractor by the Employer.

5 SCHEDULE OF FITTINGS

In all instances where schedule of light, socket outlet and power points are attached to or included on the drawings, these schedules are to be regarded as forming part of the specification.

6 QUALITY OF MATERIALS

Only materials of first class quality shall be used and all materials shall be subject to the approval of the Employer. Departmental specifications for various materials to be used on this Contract are attached to and form part of this specification.

Wherever applicable the material is to comply with the relevant South African Bureau of Standards, specifications, or to IEC Specifications, where no SANS Specifications exist.

Materials wherever possible, must be of South African manufacture.

7 CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall

be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification.

Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

The conduit and conduit accessories shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

a) Screwed metallic conduit and accessories: SANS 61386-1 and 21.

b) Plain-end metallic conduit and accessories: SANS 61386-1 and 21.

c) Non-metallic conduit and accessories: SANS 61386-1 and 21.

All conduit fittings except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit shall be brass and shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in part 2 of this specification or indicated on the drawings.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

All metallic conduit shall be manufactured of mild steel with a minimum thickness of 1,2mm for plain-end conduit and 1,6mm in respect of screwed conduit.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screed laid on top of concrete slabs.

Bending and setting of conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the Department's inspectorate staff, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

All conduit and accessories used in areas within 50 km of the coast shall be galvanised to SANS 32 and SANS 121.

Tenderers must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender. Under no circumstances will consideration be given by the Department to any claim submitted by the Contractor, which may result from a lack of knowledge in regard to the supply authority's requirements.

8 CONDUIT IN ROOF SPACES

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5m by means of saddles screwed to the roof timbers.

Nail or crampets will not be allowed.

Where non-metallic conduit has been specified for a particular service, the conduit shall be supported and fixed with saddles with a maximum spacing of 450 mm. The Contractor shall supply and install all additional supporting timbers in the roof space as required.

Under flat roofs, in false ceilings or where there is less than 0,9m of clearance, or should the ceilings be insulated with glass wool or other insulating material, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit runs from distribution boards shall, where possible terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards.

9 SURFACE MOUNTED CONDUIT

Wherever possible, the conduit installation is to be concealed in the building work; however, where unavoidable or otherwise specified under Part 2 of the specification, conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

The use of inspection bends is to be avoided and instead the conduit shall be set uniformly and inspection coupling used where necessary.

No threads will be permitted to show when the conduit installation is complete, except where running couplings have been employed.

Running couplings are only to be used where unavoidable, and shall be fitted with a sliced couplings as a lock nut.

Conduit is to be run on approved spaced saddles rigidly secured to the walls.

Alternatively, fittings, tees, boxes, couplings etc., are to be cut into the surface to allow the conduit to fit flush against the surface. Conduit is to be bedded into any wall irregularities to avoid gaps between the surface and the conduit.

Crossing of conduits is to be avoided, however, should it be necessary purpose-made metal boxes are to be provided at the junction. The finish of the boxes and positioning shall be in keeping with the general layout.

Where several conduits are installed side by side, they shall be evenly spaced and grouped under one purpose-made saddle.

Distribution boards, draw-boxes, industrial switches and socket outlets etc., shall be neatly recessed into the surface to avoid double sets.

In situations where there are no ceilings the conduits are to be run along the wall plates and the beams.

Painting of surface conduit shall match the colour of the adjacent wall finishes.

Only approved plugging materials such as aluminium inserts, fibre plugs, plastic plugs, etc., and round-head screws shall be used for fixing saddles, switches, socket outlets, etc., to walls, wood plugs and the plugging in joints in brick walls are not acceptable.

10 CONDUIT IN CONCRETE SLABS

In order not to delay building operations the Contractor must ensure that all conduits and other electrical equipment which are to be cast in the concrete columns and slabs are installed in good time.

The Contractor shall have a representative in attendance at all times when the casting of concrete takes place.

Draw-boxes, expansion joint boxes and round conduit boxes are to be provided where necessary. Sharp bends of any nature will not be allowed in concrete slabs.

Draw and/or inspection boxes shall be grouped under one common cover plate, and must preferable be installed in passages or male toilets.

All boxes, etc., are to be securely fixed to the shuttering to prevent displacement when concrete is cast. The conduit shall be supported and secured at regular intervals and installed as close as possible to the neutral axis of concrete slabs and/or beams.

Before any concrete slabs are cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

11 FLEXIBLE CONNECTIONS FOR CONNECTING UP OF STOVES, MACHINES, ETC.

Flexible tubing connections shall be of galvanised steel construction, and in damp situations of the plastic sheathed galvanised steel type. Other types may only be used subject to the prior approval of the Department's site electrical representative.

Connectors for coupling onto the flexible tubing shall be of the gland or screw-in types, manufactured of either brass or cadmium or zinc plated mild steel, and the connectors after having been fixed onto the tubing, shall be durable and mechanically sound.

Aluminium and zinc alloy connectors will not be acceptable.

12 WIRING:

Except where otherwise specified in Part 2 of this specification, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduits to be clear of moisture and debris before wiring is commenced.

Unless otherwise specified in Part 2 of this specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain light points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches throughout the installation.

Wiring for lighting circuits is to be carried out with 1,5mm² conductors and a 1,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 4mm² conductors and a 2,5mm²-earth conductor. In certain instances, as will be directed in Part 2 of this specification, the sizes of the aforementioned conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

The wiring shall be done in PVC insulated 600/1000 V grade cable to SANS 1507.

Where cable ends connect onto switches, luminaires etc., the end strands must be neatly and tightly twisted

together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

13 SWITCHES AND SOCKET OUTLETS

All switches and switch-socket outlet combination units shall conform to the Department Quality Specifications, which form part of this specification.

No other than 16 A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed at 1,4m above finished floor level and all socket outlets as directed in the Schedule of Fittings which forms part of this specification or alternatively the height of socket outlets may be indicated on the drawings.

14 SWITCHGEAR

Switchgear, which includes circuit breakers, iron-clad switches, interlocked switch-socket outlet units, contactors, time switches, etc., is to be in accordance with the Departmental Quality Specifications which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

For uniform appearance of switchboards, only one approved make of each of the different classes of switchgear mentioned in the Quality Specifications shall be used throughout the installations.

15 SWITCHBOARDS

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the Employer before installation.

In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

Any construction or standard type aboard proposed, as an alternative to that specified must have the prior approval of the Employer.

All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear shall be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

Clearly engraved labels are to be mounted on or below every switch. The working of the labels in English, is to be according to the lay-out drawings or as directed by the Electrical Engineer and must be confirmed on site. Flush mounted boards to be installed with the top of the board 2,0m above the finished floor level.

16 WORKMANSHIP AND STAFF

Except in the case of electrical installations supplied by a single-phase electricity supply at the point of supply, an accredited person shall exercise general control over all electrical installation work being carried out.

The workmanship shall be of the highest grade and to the satisfaction of the Employer.

All inferior work shall, on indication by the Employer's inspecting officers, immediately be removed and rectified by and at the expense of the Contractor.

17 VERIFICATION AND CERTIFICATION OF ELECTRICAL INSTALLATION (CERTIFICATE OF COMPLIANCE AND TEST REPORT

On completion of the service, a certificate of compliance must be issued to the Principal Agent/Electrical Engineer or Employer in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) in the format as set out in SANS 10142-1 & 2.

18 EARTHING OF INSTALLATION

Main earthing

The type of main earthing must be as required by the supply authority if other than the Employer, and in any event as directed by the Principal Agent/Electrical Engineer, who may require additional earthing to meet test standards.

Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of 4mm diameter hard-drawn bare copper wires at 250mm centres, brazed at all intersections.

Alternatively or additionally earth rods or trench earths may be required as specified or directed by the Electrical Engineer.

Installations shall be effectively earthed in accordance with the "Wiring Code" and to the requirements of the supply authority. All earth conductors shall be stranded copper with or without green PVC installation.

Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other local electrode by means of 12mm x 1,60 mm solid copper strapping or 16 mm² stranded (not solid) bare copper wire or such conductor as the Department's representative may direct. Main earth copper strapping where installed below 3m from ground level, must be run in 20 mm diameter conduit securely fixed to the walls.

All other hot and cold water pipes shall be connected with 12mm x 0,8mm perforated for solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipework with brass nuts and bolts and against walls with brass screws at 150-mm centres. In all cases where metal water pipes, down pipes, flues, etc., are positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each distribution board.

Roofs, gutters and down pipes

Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purlin and connected to the main earth conductor and each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12mm X 0,8mm copper strapping (not conductors) and galvanised bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

Sub-distribution boards

A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised where specified or approved.

Sub-circuits

The earth conductors of fall sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142.

Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SANS 10142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall by connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

Non-metallic Conduit

Where non-metallic conduit is specified or allowed, the installation shall comply with the Department's standard quality specification for "conduit and conduit accessories".

Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

Flexible Conduit

An earth conductor shall be installed in all non-metal flexible conduit. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

Connection

Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

19 MOUNTING AND POSITIONING OF LUMINAIRES

The Contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, close co-operation with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned with regard to the ceiling pattern.

The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Department's representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be ¾ of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed ¾ of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

Incandescent luminaires are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings the luminaires shall be secured to the brandering or joists by means of two 40mm x No. 8 round head screws.

PART 2: INSTALLATION DETAILS

CONTENTS

PART 2: INSTALLATION DETAILS

1 CABLE SLEEVE PIPES

Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in earthenware or high-density polyethylene pipes.

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

2 NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, and S.A. Transport Services, Provincial or National Road Authorities and other authorities as may be required with respect to the installation.

3 ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the attached quality specification (Part 3 of this document), suitable for the relevant supply voltage, and frequency and must be approved by the Employers Electrical Engineer.

4 DRAWINGS

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being built in.

5 BALANCING OF LOAD

The Contractor is required to balance the load as equally as possible over the multiphase supply.

6 SERVICE CONDITIONS

All plant shall be designed for the climatic conditions appertaining to the service.

7 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 13 of Part 1 of this specification.

8 LIGHT FITTINGS AND LAMPS

The installation and mounting of luminaires must conform to clause 19 of Part 1 of this specification.

All fittings to be supplied by the Contractor shall have the approval of the Employer.

The light fittings must be of the type specified in the Schedule of Light Fittings.

9 EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of the building and installation. The earthing and bonding is to be carried out strictly as described in clause 18 of Part 1 of this specification and to the satisfaction of the Employer/s Electrical Engineer.

10 MAINTENANCE OF ELECTRICAL SUPPLY

All interruptions of the electrical supply that may be necessary for the execution of the work, will be subject to prior arrangement between the Contractor and the Client and the Employer's Electrical Engineer.

11 EXTENT OF WORK

The work covered by this contract comprises the complete electrical installation, in working order, as shown on the drawings and as per this specification, including the supply and installation of all fittings and also the installation of such equipment supplied by the Employer.

12 SUPPLY AND CONNECTION

The supply will be at 400/230 Volt 50Hz

The Contractor must arrange in good time with the local Municipality (KHAI GARIP) for the connection to the existing 630kVA mini sub-station and low-tension meter point and submit the account to the Employer's Quantity Surveyor for payment.

The Contractor will be responsible for the supply and installation of the supply cable from the meter box to the main low-tension distribution board (DB M). The size and length of the cable is listed in the Schedule of Cables and measured in the Bills of Quantities.

Standby Plant

The 315kVA standby plant complete with automatic changeover control panel forms part of the contract and shall be supplied, installed and commissioned by the Electrical sub-contractor.

13 CONDUIT AND WIRING

Conduit and conduit accessories shall be black enameled/galvanized screwed conduit or black enameled/galvanized plain end conduit in accordance with SANS 61386.

All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 4 to 8 of Part 1 of the specification. Wiring of the installation shall be carried out as directed in clause 9 part 1 of this specification.

Where plain end conduit is offered all switches and light fittings must be supplied with a permanent earth terminal for the connection of the earth wire.

Lugs held by switch fixing screws or self tapping screws will not be acceptable.

13.1 Telephone Installation

The Contractor shall allow for the complete installation of all conduits, outlet boxes, the communication service provider Distribution boards, sleeve pipes, etc., required for the telephone system as shown on the drawings.

The sizes of all telephone conduits shall be determined by contractor and the electronics contractor and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits.

End boxes must consist of a 50mm x 100 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted 0,4m above floor level.

The communication service provider Distribution Board must consist of a 150mm x 600mm x 600mm metal box and hinged door with a 20mm thick wooden backboard. The board must be flush mounted, 1,37m above the floor.

13.2 Intercom Installation

The supply and installation of the intercom system is not included in this Contract.

The Contractor shall allow for the complete supply and installation of all conduits and outlet boxes required for the intercom installation as shown on the drawings.

The size of all conduits, boxes and mounting heights of the end boxes are indicated on the drawings. Galvanized steel draw-wires shall be installed in all conduits and the boxes fitted with suitable blank cover plates.

13.3 Power Trunking

The Contractor shall be responsible for the supply and installation of all 2 channel steel power trunking complete with corner pieces, end pieces, junction pieces, supply conduits, cover plates and power outlets as specified and indicated on the drawings.

The power trunking must comply with SANS 61084. The Contractor must ensure that the power trunking is installed to satisfaction of the Employer's Electrical Engineer before commencing with the wiring of the power trunking.

14 POWER POINTS

Allow for the installation of power points and equipment as listed in the indicated on the sub-distribution board & layout drawings.

15 CABLES

The Contractor shall supply and completely install all distribution cables as indicated on the drawings, and listed in the Schedule of Cables.

The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

The cable-trenches shall be excavated to a depth of 0,9m deep below ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clean and the bottom and sites free from rocks or stones liable to cause damage to the cable.

The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage.

In the trenches the cables shall be laid on a 75mm thick bed of earth and be covered with a 150-mm layer of earth before the trench is filled in.

All joints in underground cables and terminations shall be made either by means of compound filled boxes according to the best established practice by competent cable jointers using first class materials or by means of approved epoxy-resin pressure type jointing kits. Epoxy-resign joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions. Low tension PVCA cables are to be made off with sealing glands and materials designed for this purpose which must be of an approved make. Where cables are cut and not immediately made off, the ends are to be sealed without delay.

The laying of cables shall not be commenced until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical

damage is caused and must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required.

On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 500 V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

15.1 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

1. The use of the term "Inspector", includes the engineer or inspector of the Department or an empowered person of the concerned supervising consulting engineer's firm.

2. No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the Contractor and inspector.

3. After the cable has been laid and before the cable trench is back-filled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.

4. All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.

5. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure:

5.1 That he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor,

5.2 That the joint pit is dry and that all loose stones and material are removed,

5.3 That the walls and banks of the joint pit are reasonable firm and free from loose material which can fall into the pit,

5.4 That the necessary coffer-dams or retaining walls are made to stop the flow of water into the joint pit,

5.5 That the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,

5.6 That the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided,

5.7 That the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed,

5.8 That the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,

5.9 That the heating of cable oil, cable compound, plumbers metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessary exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating)

Flow temperatures of cable oil and compound must be determined with suitable thermometers. Cable oil and compound must not be heated to exceed the temperatures given on the containers and precaution must be taken to ensure that the tin is not overheated in one position. The whole mass must be evenly and proportionally heated.

(Temperatures of solder and plumbers metal may be tested with brown paper (testing time: 3 seconds). The paper must colour slightly - not black or burnt).

6. Before the paper-insulated cables are joined, they must be tested for the presence of moisture by the cable jointers test. This consists of the insertion of a piece of unhandled insulated impregnated paper tape in warm cable oil heated to a temperature of 130 ± 5°C.

Froth on the surface of the oil is an indication that moisture is present in the impregnated insulation and the amount of the froth gives an indication of the moisture present.

7. If the cable contains moisture or is found to be otherwise unsuitable for jointing or making of the inspector is to be notified immediately and he will issue the necessary instruction to cope with the situation.

8. The joint or making off of paper insulated cables must not be commenced during rainy weather.

9. Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.

10. The jointer must ensure that the material and his tools are dry at all times, reasonably clean and absolutely free from soil.

11. Relating to the jointing of the cable the following requirements apply:

11.1 All jointing must be carried out in accordance with recognized and tried techniques and comply strictly with the instructions given by the supplier of the jointing kit.

11.2 The cables must be twisted by hand so that the cores can be joined according to the core numbers. If necessary the cable is to be exposed for a short distance to accomplish this. Under no circumstances may the cores in a joint be crossed so as to enable cores to be joined according to the core numbers. If it is not possible to twist the cables so that the preceding requirements can be met, then cores are to be joined in the normal way without any consideration of the core numbers.

11.3 Normally the cables will have profile conductors. The conductors shall be pinched with gas pliers to form a circular section, bound with binding wire so that they do not spread, and then tinned before jointing.

11.4 Jointing ferrules, the length of which are at least 6 times the diameter of the conductors, must be slid over the conductor ends to be joined and pinched tightly. Then they are soldered by means of the ladle process whilst being pinched further closed.

Use resin only as a flux. The slot opening in the ferrule must be completely filled, including all depressions.

Remove all superfluous metal with a cloth dipped in tallow. Work during the soldering process must be from top to bottom. Rub the ferrule smooth and clean with aluminium oxide tape after

it has cooled down to ensure that there are not any sharp points or edges.

NB: The spaces between the conductor strands must be completely filled by soldering process and must be carried out quick enough to prevent the paper insulation from burning or drying out unnecessarily.

11.5 After the ferrules have been rubbed smooth and clean, they and the exposed cores must be treated with hot cable oil (110℃) to remove all dust and moisture. These parts are to be thoroughly basted with the oil.

11.6 The jointer must take care that his hands are dry and clean before the joint is insulated. Also the insulating tape which is to be used must first be immersed in warm cable oil (110℃) for a sufficient period to ensure that no moisture is present.

11.7 After the individual cores have been installed they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.

11.8 The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.

11.9 The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is completely filled to compensate for the compound shrinkage.

11.10 The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.

12. As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

16. DISTRIBUTION BOARDS

In addition to clause 14 and clause 15 of Part 1 of this specification the following shall also be applicable to switchboards required for this service.

The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the distribution Board Schedule. All distribution boards shall comply with the quality specification in Part 3 of this specification, and be approved by the Employer's Electrical Engineer.

The following types of distribution boards are required for the service, see schematic layouts:

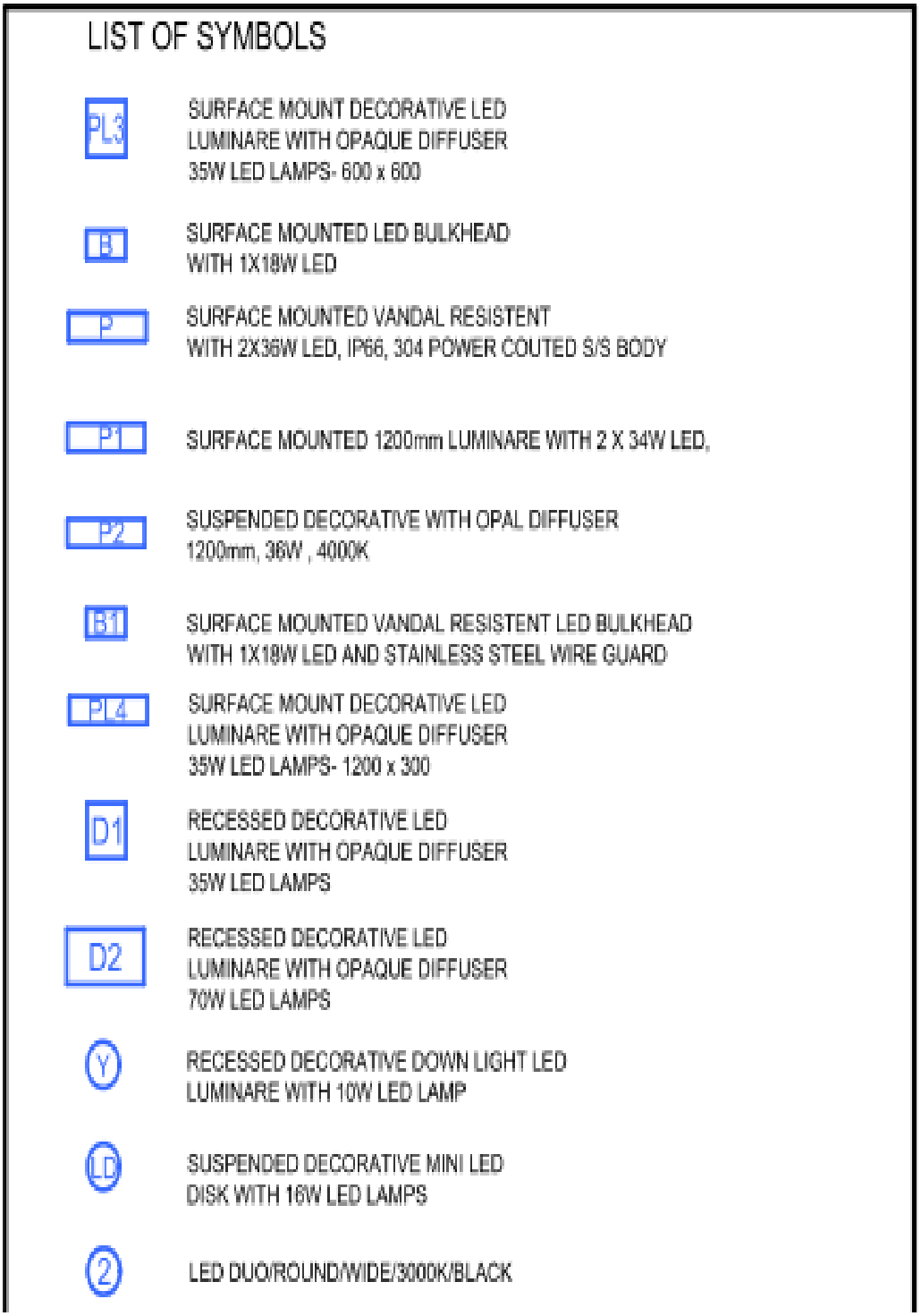
DB- M: Main Distribution Board (Ground floor Electrical room): Standby & UPS section
DB-1: Sub-distribution (Ground floor): Standby & UPS section
DB-2: Sub-distribution board (Ground floor): Standby & UPS section
DB-3: Sub-distribution board (Ground floor): Standby & UPS section
DB-4: Sub-distribution board (Ground floor): Standby & UPS section
DB-G: Sub-distribution board (Ground floor): Standby & UPS section
DB-B: Sub-distribution board (Ground floor): Standby & UPS section
DB-Plant: Sub-distribution board (Ground floor): Standby section

17. SUBSTATION

Not applicable to this contract

18. SCHEDULE OF LIGHT FITINGS

The light fittings and accessories are to be according to the quality specifications in Part 3 and shall be approved by the Employer.



Type PL3 -Surface mount LED panel 595mmx595mm 40W 4500K.	Supply	No	25.00
Type D1- Recessed LED panel 595mmx595mm 40W 4500K.	Supply	No	35.00
Type D2 - Surface mount LED panel 1200mmx600mm 70W 4500K.	Supply	No	55.00
Type D2 - Recessed LED panel 1200mmx600mm 70W 4500K.	Supply	No	89.00
Type B - IP65 Bulkhead 8W Rectangular b/head, steel body 4500K	Supply	No	4.00
Type P - Vandal resistant 56W, 4000K, LED light for prison cell with tamper proof screws	Supply	No	22
Type P1- IP65, 36W LED linear light for plant rooms, 4500K	Supply	No	2.00
Type B1 - Vandal Resistant IP65 Bulkhead 18W Rectangular b/head, steel body 500K + Wire gaurd	Supply	No	21.00
Type Y - Decorative 10W LED downlight, 4500K	Supply	No	26.00
Type LD - Decorative LEDDISK-MIDI 16W, 4500K	Supply	No	13.00
Type2 -IP65 UP & Down light LEDDUO 7W/7W, 4500K	Supply	No	13.00
Type D1- Ressed LED panel 595mmx595mm 40W 4500K with Emergency backup battery supply.	Supply	No	3.00
Type D2 - Ressed LED panel 1200mmx600mm 70W 4500K with emergency Backup battery supply	Supply	No	9.00
Type P - Vandal resistant 56W, 4000K, LED light for prison cell with tamper proof screws with emergency backup battery supply	Supply	No	3.00

19. SCHEDULE OF POWER POINTS

BOARD	POWER POINT	LOAD (Amps)	Isolator (Amp)	SIZE OF CABLES, CONDUIT AND WIRING
DB1	AC 1A	2.272727273	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 1B	2.272727273	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 2	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 3	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 4	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 5	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 6	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 7	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 8	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 9	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC10	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 11	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 12	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 13	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 14	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 15	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 16	1.136363636	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 17	1.136363636	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 18	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 19	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 20	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 21	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 22	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 23 A	2.272727273	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 24 B	2.272727273	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 25	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 26	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 27	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 28	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 29	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 30	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 31	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire

DB1	AC 32	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 33	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB1	AC 34	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 35	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 36	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 37	2.272	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 38	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 39	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 40	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 41	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 42	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 43 A	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 43 B	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 44	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 45	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 46	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 47	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 48	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB2	AC 49	0.227272727	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB Plant	CU 1	24.25	60 Amp,3P	10mm² 4-core PVCA cable with 6mm² earth wire
DB Plant	CU 2	24.25	60 Amp,3P	10mm² 4-core PVCA cable with 6mm² earth wire
DB Plant	CU 3	24.25	60 Amp,3P	10mm² 4-core PVCA cable with 6mm² earth wire
DB Plant	CU 4	24.25	60 Amp,3P	10mm² 4-core PVCA cable with 6mm² earth wire
DB3	AC 10 A	1.136	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB3	AC 10 B	1.136	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB3	AC 33 A	1.136	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB3	AC 33 B	1.136	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 1A	8.08	60 Amp,3P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 1A	8.08	60 Amp,3P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 2	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 3	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 4	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 5	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 6	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 7	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 7	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire

DB4	EF 8	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 9	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 10	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 11	1.36	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 12	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	EF 13	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	FA 1	0.3	20Amp, 2P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	FA 2	8.08	60 Amp,3P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB4	FA 3	8.08	60 Amp,3P	25mm dia. conduit with 4mm² conductors and 2,5mm² earth wire
DB - Basement	CW 1 (DUTY)	5	20Amp, 2P	10mm² 4-core PVCA cable with 6mm² earth wire
DB - Basement	CW 2 (STANDBY)	5	20Amp, 2P	10mm² 4-core PVCA cable with 6mm² earth wire
DB - Basement	FW JOCKEY	5	20Amp, 2P	10mm² 4-core PVCA cable with 6mm² earth wire
DB - Basement	FW (DUTY)	40.43	80 Amp,3P	25mm² 4-core PVCA cable with 16mm² earth wire
DB - Basement	FW (STANBY)	40.43	80 Amp,3P	25mm² 4-core PVCA cable with 16mm² earth wire

20. SCHEDULE OF CABLES

Supply, install and connect the following PVC SWA armoured cables from main distribution board DB M:
Cable ID1 is the main supply connection from mini sub-station via the generator ATF panel to DB M.

LV CABLE SCHEDULE				
ID	CABLE SIZE	TYPE	LENGTH	DB
①	3x120mm²x4 ; 2x95mm²BCEC	PVC SWA NORMAL	50 m	Mini-Sub Station
②	35mm²x4 ; 25mm Earth	PVC SWA STANDBY	43.7 m	DB2 GF
③	10mm²x4 ; 6mm Insulated Earth	PVC SWA UPS	43.7 m	DB2 GF
④	35mm²x4 ; 10mm Insulated Earth	PVC SWA STANDBY	35.8 m	UPS-IN
⑤	35mm²x4 ; 10mm Insulated Earth	PVC SWA UPS	35.8 m	UPS-OUT
⑥	25mm²x3 ; 16mm Earth	PVC SWA STANDBY	41 m	DB3 GF
⑦	35mm²x4 ; 25mm Earth	PVC SWA STANDBY	18.4 m	DB4 FF
⑧	25mm²x4 ; 16mm Insulated Earth	PVC SWA UPS	18.4 m	DB4 FF
⑨	16mm²x4 ; 10mm Earth	PVC SWA STANDBY	39.9 m	DB-B
⑩	70mm²x4 ; 35mm Earth	PVC SWA STANDBY	39.9 m	HVAC PLANT
⑪	6mm²x4 ; 4mm Earth	PVC SWA STANDBY	8.6 m	DB-G

21. SCHEDULE OF DISTRIBUTION BOARDS

The front panels of normal supply, standby power and no-break supply sections shall be painted in distinctive colours as follows:

Normal supply : Light Orange, colour B26 of SANS 1091.
Standby power : Signal Red, colour A11 of SANS 1091.
No-break supply: Dark Violet, colour F06 or Olive Green, Colour H05 of SANS 1091.

Refer DB schematic layout drawings which form part of the contract and is measured in the bills of quantities.

CIRCUIT NUMBER	DB1	DB2	DB3	DB4	DB-B	DB-G	UPS-OUT	DB-PLANT
CONDUCTOR IN mm	16	35	25	35	16	6	10	70
EARTH WIRE IN mm	10	25	16	25	10	4	6	35
CONDUIT SIZE IN mm / IN POWER SKIRTING AMOUNT OF POINTS	CABLE	CABLE	CABLE	CABLE	CABLE	CABLE	CABLE	CABLE
LOAD IN WATTS	29 098	46 557	11 000	58 196	29 100	11 639	29 400	74 000
DESCRIPTION	SUB-DB	SUB-DB	SUB-DB	SUB-DB	SUB-DB	SUB-DB	UPS SUPPLY	SUB-DB

PART 3: QUALITY SPECIFICATION FOR MATERIALS AND EQUIPMENT OF ELECTRICAL INSTALLATIONS

"Part 3: Quality specification for materials and equipment" manual of the Department of Public Works is applicable for this Contract and the manual can be obtained from the Department of Public Works.

ADDITIONAL REQUIREMENTS OR SPECIFICATIONS NOT COVERED IN QUALITY SPECIFICATIONS MENTIONED ABOVE

LED LIGHTS

All Light fittings installed for this project is to be of the LED type, unless otherwise stated.

The following international standard specifications and South-African Bureau of Standards shall apply to the LED luminaire specification:

SANS 475	Luminaires for interior lighting, street lighting and floodlighting – Performance and requirements
SANS 10114-1	Interior lighting part 1: Artificial lighting of interiors
SANS 10114-2	Interior lighting part 2: Emergency lighting
SANS 60598-1	Luminaires part 1: General requirements and tests
SANS 60598-2.1	Luminaires part 2: Particular requirements section 1 – Fixed general purpose luminaires.
SANS 60598-2.2	Luminaires part 2: Particular requirements section 2 – Recessed luminaires.
SANS 60598-2.3	Luminaires part 2: Particular requirements section 3 – Luminaires for road and street lighting.
SANS 60598-2.5	Luminaires part 2: Particular requirements section 5 – Flood lighting.
SANS 61347-1 to 13	Lamp control gear
SANS 62031	LED modules for general lighting – Safety specifications
SANS 62384	DC or AC supplied electronic control gear for LED modules – Performance requirements.
SANS 62560	Self-ballasted LED lamps for general lighting services with supply voltages > 50V – Safety specification.
SANS 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50V – Performance requirements
EN 55015	Limits and methods of measurement of radio disturbance of electrical lighting or equipment.
EN 61000-3.2	Electromagnetic compatibility (EMC) limits for harmonic current emissions.
EN 61000-3.3	Electromagnetic compatibility (EMC) limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.
EN 61547	Equipment for general lighting purposes: EMC immunity requirements.

IEC-EN 62471	Photo biological safety of lamps and lamp systems for LEDs
IES LM-79-08	Approved method: Electrical and photometric measurement of solid-state lighting products.
IES LM-80	Approved method: Measuring lumen maintenance of LED light sources.

General requirements:

The luminaire shall be suitable for operation with mid-power LEDs. **Note that no LED tubes are allowed to be used.**

The luminaire shall be suitable for operation on a 230V single phase 50Hz mains supply.

Power factor capacitors shall be supplied to correct the power factor to at least 0.95 of higher.

The luminaire shall be marked with identification labels stating the brand name and model and shall bear the SANS approval mark.

The driver shall comply with IEC 61347-1 and IEC 61347-2B as applicable and shall be suitable for operation on 230V +-10%, 50Hz single phase system and it must be insured that harmonics filter is provided as per SANS 61000-3-2. The drivers and LED circuitry shall be protected against lighting and power surges. Suitable surge arrestors with a 10kA rating shall be provided for indoor installations and 20kA for outdoor installations.

Colour rendering (Ra) shall be not less than 80 and lumen depreciation of not more than 30% L70 at 50 000 hours @ Tq 25℃. Colour temperature of the LED lamp shall be 4000K, unless otherwise stated.

Thermal requirements:

The luminaire must be able to withstand an ambient temperature of 35℃. Storage temperature of this luminaire should be able to handle -40℃ < T < 60℃.

To this end internal electrical and mechanical components shall not be allowed to exceed their maximum temperature ratings of 75℃. Test reports from an independent authorised testing facility proving this requirement shall be made available on request.

Noise requirements:

The noise level emitted from the luminaire shall be kept as low as possible. Drivers/electronic components shall therefore fully comply with the latest edition of SANS 55015.

PART 4.1: UPS EQUIPMENT REQUIREMENTS

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

(A) Input to the UPS

(a)	Input voltage	:	420/231V ± 10%
(b)	Frequency	:	50Hz ± 4%
(c)	System	:	3 phase 4 wire with operative earth conductor, supplied from utility network or standby generator set.
(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	:	40kVA, with battery backup at full load for 30 minutes
(b)	Output voltage	:	420/231V ± 10%
(c)	Frequency	:	50 Hz ± 0,5 Hz.

(d)	System	:	3 phase 4 wire with operative earth conductor.
(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) Sealed Battery Cabinet with batteries.

(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.

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 the 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.
Sealed Battery Cabinet

(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.

(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.

(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 5 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 battery 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.

PART 4.2 GENERATOR INSTALLATION REQUIREMENTS:

SECTION 1 – GENERAL

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1. SECTION 1 – GENERAL

1.1. Intent of Specification

The specification is intended to cover the complete installation and commissioning of the generator plant. 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.

1.2. Standards and Codes

All standards referenced shall be the latest editions.

SANS 10142-1	the wiring of premises: Low Voltage Installations
SANS 8528	Reciprocating internal combustion engine driven alternating current generating sets.
SANS 60034	Rotating electrical Machines
SANS IEC 60947	Low Voltage Switchgear
OHSACT	Occupational Health and Safety Act.

Department of Public Works Quality Specification Parts A, B and C.
Local municipality by-laws for generator installations. (To be obtained from local municipality)

1.3. Compliance with Regulations

The installation shall be erected and tested in accordance with the following Acts and regulations:

a) The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,
b) The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority,
c) The Fire Brigade services Act 1987 (Act 99 of 1987) as amended,
d) The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as emended,
e) The Electricity Act 1984 (Act 41 of 1984) as amended.
f) The environmental Act and regulations

1.4. Scope of Work

Included in this Outdoor Generator Specification

Supply, delivery, installation and commissioning of the complete outdoor emergency generator inside an IP65 canopy/container set on a concrete plinth as specified in this document.

The successful tenderer shall supply, deliver and install a complete single enclosed diesel driven standby generator set in a position indicated on site layout drawings. The machine shall be totally enclosed in a 3CR12 stainless steel housing powder coated or within 50km from the coast with grade 316 steel housing powder coated. The exhaust shall be manufactured from stainless steel.

The housing is to be provided on galvanized 3CR12 stainless steel skids so that the generator set can be transported to site and placed in position on a concrete plinth, casted by the successful tenderer. The skids must be of sufficient height to allow for the passage of storm water under the set.

The unit shall be equipped with a skid type diesel tank.

1.5. Co-ordinating

The Contractor shall familiarise himself with the requirements of the other professional disciplines and shall examine the plans and specifications covering each of these sections.

The generator space, noise and vibration requirements shall be carefully checked with other professional disciplines to ensure that the equipment can be installed in the proper sequence in the space allotted.

1.6. Tests Certificates and Inspections

The following tests are to be carried out:

a) At the supplier's premises, before the generating set will be delivered to site Representatives of the Department must be present during the test to satisfy themselves that the generating set complies with the specification and delivers the specified output. The test must be carried out in accordance with SANS 8528. The Representative/Agent must be timeously advised of the date for the test.

b) After completion of the works and before practical completion 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.

c) 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.

d) Test reports of both tests as specified under (a) and (b) are to be submitted to the Representative/Agent.

The total costs for these test shall be included in the tendered amount.

In the event of the plant, equipment or installation not passing the test, the Representative/Agent shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer and/or the Representative/Agent attending the test.

1.7. Operating and Maintenance Manuals

The Contractor shall be responsible for the compilation of a complete set of Operating and Maintenance manuals.

This shall be done in accordance with Section 4 – Operating and Maintenance manuals.

All information shall be recorded and reproduced in electronic format as well as supplying the Representative/Agent with three sets of hard copies.

Approval of the final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Practical Completion of the installation.

1.8. Guarantee

After works completion of the installation have been achieved, there will follow a 12-month free maintenance period. The contractor shall allow for 12-month free maintenance in his pricing.

During this period the generator contractor shall maintain the generator installation as per the requirements of the Occupational Health and Safety Act. This maintenance shall include systematic examinations, adjustments and lubrication of all generator equipment. Electrical and mechanical parts shall be repaired or replaced whenever it is required to maintain optimum performance without additional cost to the Department, unless the condition was caused by misuse or vandalism of the generator equipment or natural hazards/force majeure.

The work under this section shall be performed by competent, qualified accredited personnel under the supervision and in the direct employment of the Contractor and shall not be transferred to any non-affiliated agent. Contract maintenance and repair work shall be done during normal working hours and shall further provide emergency call-back service twenty-four (24) hours a day, seven (7) days a week.

During the guarantee/maintenance period the Department will invite tenders for the comprehensive maintenance of the generator, which will commence after the final completion has taken place, i.e. after the twelfth month guarantee period is over and all defects are corrected.

1.9. 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 Representative/Agent.

b) All work shall be executed in a first-class manner by qualified accredited tradesman.

c) The Contractor shall be fully responsible for his work and shall replace any of the work which may be damaged, lost or stolen. The Contractor shall protect the building and its contents against damage by him, his employees or sub-contractors and shall make good any damage thereto.

d) The Contractor shall indemnify the Employer of all liability for damages arising from injuries or disabilities to persons or damage to property occasioned by any act or omission of the Contractor or any of his sub-contractors, including any and all expenses, legal or otherwise, which may be incurred by the Employer or Representative/Agent in the defence of any claim, action or suit.

e) 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.

f) The Contractor shall thoroughly acquaint himself with the work involved and shall verify on site all measurements necessary for proper installation and commissioning 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.

g) The Contractor shall inspect and verify that the existing power feeder system is compatible with the equipment offered and any changes or upgrading of the electrical supply shall be brought to the attention of the Representative/Agent.

h) Material and equipment damaged in transit shall be replaced with undamaged material without additional cost to the Department.

i) 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.

j) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

k) The Contractor shall make sure that all safety regulations and measures and environmental regulations are applied and enforced during the installation and guarantee period to ensure the safety of the public and the User Client.

1.10. Brochures

Detailed brochures of all equipment offered shall be presented together with the tender documents.

SECTION 2 – EQUIPMENT REQUIREMENTS

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2. SECTION 2 – EQUIPMENT REQUIREMENTS

2.1. Engine

2.1.1. General

The engine must comply with the requirements laid down in SANS 8528 and must be of the atomized injection, compression ignition type, running at a speed not exceeding 1500 r.p.m. The engine must be amply rated for the required electrical output of the set, when running under the site conditions. The starting period for either manual or automatic switching-on until the taking over by the generating set, in one step, of a load equal to the specified site electrical output, shall not exceed 15 seconds. This must be guaranteed by the Tenderer.

Turbo-charged engines will only be accepted if the Tenderer submits a written guarantee that the engine can deliver full load within the specified starting period.

Curves furnished by the engine makers, showing the output of the engine offered against the speed, for both intermittent and continuous operation as well a fuel consumption curves when the engine is used for electric generation, must be submitted with the Tender.

2.1.2. Rating

The set shall be capable of delivering the specified output continuously under the site Conditions, without overheating. The engine shall be capable of delivering an output of 110% of the specified output for one hour in any period of 12 hours consecutive running in accordance with SANS 8528.

2.1.3. De-Rating

The engine must be de-rated for the site conditions as set out in the Technical Specification, Section 3 of this document.

The de-rating of the engine for site conditions shall be strictly in accordance with SANS 8528 as amended to date. Any other methods of de-rating must have the approval of the Department and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful Tenderer at the site test.

2.1.4. Starting and Stopping

The engine shall be fitted with an electric starter motor and be easily started from cold, without the use of any special ignition devices under summer as well as winter conditions.

Tenderers shall ensure easy starting in cold weather and unit shall be fitted an electrical water jacket heater thermostatically controlled. The electrical circuit for such heaters shall be taken from the control panel, and must be protected by a suitable circuit breaker.

2.1.5. Starter Battery

The set must be supplied a fully charged maintenance free type battery, complete with necessary electrolyte. The battery must have sufficient capacity to provide the starting torque stipulated by the engine manufacturer. The battery capacity shall not be less than 120 Ah and shall be capable of providing three consecutive start attempts from cold and thereafter a fourth attempt under manual control of not less than 20 seconds duration each. The battery must be of the heavy duty “low maintenance” type, house in a suitable battery box.

2.1.6. Cooling

The engine may be either of the air or water cooled type. In the case of water-cooling, a built-on heavy duty, tropical type pressurised radiator must be fitted. Only stand-by sets that are water cooled shall have electric heaters.

For either method of cooling, protection must be provided against running at excessive temperatures. The operation of this protective device must give a visual and audible indication on the switchboard. Water-cooled engines shall in addition be fitted with a low water cut-out switch, installed in the radiator, to switch the set off in the event of a loss of coolant. The protection shall operate in the same way as the other cut-outs (e.g. low oil pressure). All air ducts for the cooling of the engine are to be allowed for. The air shall be supplied from the cooling fan cowling/radiator face to air outlet louvers in the enclosure.

2.1.7. Lubrication

Lubrication of the main bearings and other important moving parts shall be by forced feed system. An automatic low oil pressure cut-out must be fitted, operating the stop solenoid on the engine and giving a visible and audible indication on the switchboard.

2.1.8. Fuel Pump

The fuel injection equipment is suitable for operation with the commercial brands of diesel fuel normally available in South Africa.

2.1.9. Fuel Tank

The fuel tank shall be an integral part of the base frame of the generator set. The tank shall have sufficient capacity for standby sets to run the engine on full load for a period of 24 hours.

The diesel fuel storage system / tank which will be provided with the standby generator installation must be fitted with a fuel filtration and water separation system (filter & separator) which is entirely separate from the fuel supply line and line filter to the engine. This filtration and water separation system must be dedicated to purifying the content of the storage system / tank by way of the cleaning processes which are applied while circulating the fuel through the filter & separator unit.

The filtration system must be able to handle diesel fuel of “high” and of “low” sulphur content for an indefinite period. The suction line of the system must be connected to the lowest part of the storage system / tank. The return line must be connected in the top section of the storage system / tank in such a position and in such a way that the flow of fuel within the storage system / tank between the fuel return point and the fuel suction point will induce scouring of the bottom of the system / tank to effectively capture sediment and water in the to be filtered fuel.

The filtration unit must filter the diesel fuel, removing suspended particles of effective diameters down to 5 micron. In addition, it must separate all water from the fuel and the fuel storage system and automatically dispose of / dump such water into an open, removable receptacle for disposal at the installation or in a suitable position outside the building. Separation of the fuel and water must be sufficiently effective that the discharged water will meet the standard required for it to be disposed of into a municipal drain and sewer system.

The filter and water separator unit must draw its power from the DC batteries used to power the relevant generator set. The circulating pump shall be provided with a controller programmed to switch the pump through not more than three complete on and off cycles of equal time (i.e. 50% on; 50% off) , per hour, with a deviation of not more than 10 % ±. The pump must be capable of a duty cycle of not less than 60% running time. The flow rate through the circulating pump must be between 1 L/min and 1.25 L /min.

The filter cartridge of the filter and water separator unit must be replaceable, and, in normal operational conditions, not require replacement within periods shorter than three months. The replacement units must be readily available.

The filtration & separator system may be mounted against the wall of the plant room or on the inside of a container, which may house the installation as may be specified elsewhere in this document.

The tank shall be fitted with a suitable filter, a full height gauge glass, “low fuel level” alarm, giving an audible and visible signal on the switchboard as well as a low-low fuel level cut-out.

An electrically operated pump with sufficient length of oil resistant hose to reach 2m beyond the door of the canopy/container, shall be supplied, for each set for filling the fuel tank/s from 200 litre drums.

The interconnection fuel piping shall consist of copper tubes and the connection to vibrating components shall be in flexible tubing with armoured covering.

The contractor shall allow for the supply and installation of a fuel shut off fusible link in the container. The fusible link shall shut off the fuel at a temperature of 130 degrees in an event of a fire in the self-contain enclosure. The fusible link shall be mounted above the engine and coupled to the shut off valve by means of a 2mm stainless steel cable. The cable shall be installed to the shut off valve without any possibility of kinking the cable which may cause malfunctioning of the protection device.

2.1.10. Governor

The speed of the engine shall be controlled by a governor in accordance with ECM of SANS 8528 if not otherwise specified in the Detailed Specification.
The permanent speed variation between no load and full load shall not exceed 4.5% of the nominal engine speed and the temporary speed variation shall not exceed 10%. External facilities must be provided on the engine, to adjust the nominal speed setting by ± 5% at all loads between zero and rated load.

2.1.11. Flywheel

A suitable flywheel must be fitted, so that lights fed from the set will be free from any visible flicker.

The cyclic irregularity of the set must be within the limit laid down in SANS 8528.

2.1.12. Exhaust Silencer

It is essential to keep the noise level as low as possible. An effective exhaust silencing system of the residential type must be provided and shall be capable of providing 20 to 30 decibels of suppression.

The exhaust system shall consist of 3CR12 steel for inland areas (greater than 50km from the coast) or Grade 304 stainless steel in coastal areas.

The exhaust pipe shall be installed in such a way that the expulsed exhaust fumes will not cause discomfort to the public. The exhaust pipe must be flexibly connected to the engine to take up vibrations transmitted from the engine, which may cause breakage. The exhaust piping and silencer shall be lagged and then cladded in stainless steel sheet to reduce the heat and noise transmission in the generator enclosure and shall be protected against the ingress of driving rain at 45° to the horizontal. The exhaust pipe must extend 1.5m above the canopy.

2.1.13. Accessories

The engine must be supplied complete with all accessories, air and oil filters, 3 instruction manuals, spare parts lists, the first fill of all lubricating oils, fuel, etc.

2.1.14. Exhaust emissions

The exhaust emissions shall comply with US Tier III/EU stage III standards.

2.2. Alternator

2.2.1. General

The alternator shall be of the self-excited brushless type, with enclosed ventilated drip-proof housing and must be capable of supplying the specified output continuously with a temperature rise not exceeding the limits laid down in SANS 60034-1 for rotor and stator windings.

The alternator shall be capable of delivering an output of 110% of the specified output, for one hour in any period of 12 hours consecutive running.

Both windings must be fully impregnated for tropical climate and must have an oil resisting finishing varnish.

2.2.2. Regulation

The alternator must preferably be self-regulated without the utilisation of solid state elements. The inherent voltage regulation must not exceed plus or minus 5% of the nominal voltage specified, at all loads with the power factor between unity and 0,9 lagging and within the driving speed variations of 4,5% between no-load and full load.

2.2.3. Performance

The excitation system shall be designed to promote rapid voltage recovery following the sudden application of the load. The voltage shall recover to within 5% of the steady state within 300 milli-seconds following the application of full load and the transient voltage dip shall not exceed 18%.

2.2.4. Coupling

The engine and alternator must be directly coupled by means of a high quality flexible coupling, ISO 9001:2000 approved and must be designed and manufactured to this quality system.

2.3. Switchboard

2.3.1. General

A switchboard must be supplied and installed to incorporate the equipment for the control and protection of the generating set and battery charging.

The switchboard must conform the specification as set out in the following paragraphs.

2.3.2. Construction

The switchboard shall be enclosed in the steel enclosure complete with automatic main failure switch.

All equipment, connections and terminals shall be easily accessible from the front. The front panels may be either hinged or removable and fixed with studs and chromium-plated cap nuts. Self-tapping screws shall not be used in the construction of the board.

All pushbuttons, pilot lights, control switches, instrument and control fuses, shall be mounted on hinged panels with the control wires in flexible looms.

The steelwork of the boards must be thoroughly de-rusted, primed with zinc chromate and finished with two coats of signal red quality enamel, or a baked powder epoxy coating.

Suitably rated terminals must be provided for all main circuits and the control and protection circuits. Where cable lugs are used, these shall be crimped onto the cable strands. Screw terminals shall be of the type to prevent spreading of cable strands. All terminals shall be clearly marked.

For the control wiring, each wire shall be fitted with a cable or wire marker of approved type, and numbering of these markers must be shown on the wiring diagram on the switchboard. Control wiring shall be run in PVC trunking. The trunking shall be properly fixed to the switchboard steelwork. Adhesives shall not be acceptable for the fixing of trunking or looms.

The modular generator set controller and protection equipment shall be mounted on a separate easily replaceable panel.

All equipment on the switchboard, such as contactors, isolators, busbars, etc., shall have ample current carrying capacity to handle at least 110% of the alternator full load current.

Access to the cubicle will be such that all components can be conveniently reached for testing and maintenance purposes.

The necessary bushes and a screen over the terminals will be provided where the power feeds enter and leave the cubicle.

The cubicle will be so constructed that the ac and dc components are screened from one another.

2.3.3. Protection and Alarm Devices

All switchboards shall be equipped with protection and alarm devices as described below.

A circuit breaker and an adjustable current limiting protection relay must be installed for protection of the alternator. The protection relay shall be of the type with inverse time characteristics. The relay shall cause contactor to isolate the alternator and stop the engine.

Protection must be provided for overload, high engine temperature, low lubricating oil pressure, over speed, start-failure, and low water level.

Reset push buttons are required on the modular generator set controller and a visible signal are required and the engine must stop when any of the protective devices operate. In the case of manual operation of standby sets, it shall not be possible to restart the engine.

The indication on the modular generator set controller must be in ENGLISH.

"OVERLOAD"
"TEMPERATURE HIGH"
"OIL PRESSURE LOW"
"OVERSPEED"
"START FAILURE"
"LOW WATER LEVEL"

In addition an audible and visible flashing signal shall be provided, when:

a) The fuel level in the service tank is low. The indication on the modular generator set controller shall be "FUEL LOW".
b) The battery charger failed. The indication on the modular generator set controller shall be “CHARGER FAIL”

A low-low level sensor must be provided. At this level the engine must stop to prevent air entering the fuel system.

This is also applicable to the engine driven generator/alternator.

All alarm conditions must operate an alarm hooter. A pushbutton must be installed in the hooter circuit to stop the audible signal, but the fault indicating light on the control panel must remain lit until the fault has been rectified.

An on/off switch is not acceptable. After the hooter has been stopped, it must be re-set automatically, ready for a further alarm.

The hooter must be of the continuous duty and low consumption type. Both hooter and protection circuits must operate from the battery.

Potential free contacts from the alarm relay must be brought down to terminals for remote indication of alarm conditions.

A test pushbutton must be provided to test all indicators lamps.

2.3.4. Modular Generator Set controller

The modular generator set controller shall be an electronic unit to match those of the other modular generator set controllers and of a high quality i.e. Levato, Deep Sea Electronics, Circom. It must be provided with IO and communication facilities.

The modular generator set controller will be supplied with all its functions and shall be mounted on a separate easily replaceable panel with plug in termination blocks for easy installation and replacement.

The modular generator set controller interface will be implemented with relays, contactors etc.

The modular generator set controller will have a mimic display of the alternator/mains/ change over contactors configuration with LED's showing the status of the mains, alternator and change over contractors.

Configuration software shall be supplied with the system. The software will be capable of the following:
- Fault management (event log)
- Configuration management (software upgrades and function changes)
- Account management (energy management)
- Performance management (generator set point changes)
- Security management (passwords)

The modular generator set controller will have a standard RS 232/485 or Ethernet interface suitable for TCP I/P transport medium. All communication including configuration management will be done through this port. Equipment connected at each end of the RS 232 or Ethernet cable shall be adequately protected against transient over-voltages, lightning effects (particularly if the set and remote alarms are in separate buildings), switching surges, power system surges or mains and alternator borne noise/interference.

The controller will incorporate the following functions:
- Mains sensing
- Alternator output-voltage sensing
- Alternator over- frequency sensing
- Control of processor unit (self-diagnostics)
- Alarm/ Status indications
- Control selector and operation
- Phase rotation monitor

A 4-position control selector on the controller will be provided to facilitate the following modes of operation:
- OFF: Diesel/ alternator generator set switched off
- MANUAL: Mains bypassed: Diesel/ alternator will not take load
- AUTO: Diesel /alternator takes load on mains failure

• TEST: Diesel /alternator takes load on mains failure
• A standby failure alarm (SF) will be given on the controller and to the output alarms when “Not in Auto” is selected.

The modular generator set controller must monitor the following

When the voltage of the incoming mains varies by more than a pre-program value (default +- 10%) from the normal voltage on any phase, the controller will signal that the incoming mains will be disconnected and the engine-starting sequence initiated.

When the frequency of the incoming mains varies by more than pre- program value (default +-5%) from the normal frequency, the controller will signal that the incoming mains will be disconnected and the engine-starting sequence initiated.

Upon restoration of the incoming mains to the pre-program value (default +-10%) of the normal voltage on all phases, the monitor will signal that the load will be disconnected from the alternator and reconnected to the incoming mains.

If the alternator has been disconnected from the load and the incoming mains within the voltage limits of +- 10% on all phases, the controller will signal that the load will be reconnected to the incoming mains.

Should the incoming mains fail or not in the specified limits while the engine is running under control of the cooling-off timer, the control for the cooling –off timer in the controller will be cancelled and the load connected to the alternator.

When the output voltage of the alternator varies by more than the pre-program value (default value +- 10 %) on ANY phase, the controller will signal that the load will be disconnected from the alternator and the engine stopped.

A software over and under-frequency monitor will be provided in the controller if the frequency exceeds or drop below pre-programmed values. It will meet the requirements of class G2 governing. The monitor will not be influenced by harmonics.

Note: Software monitors will include adjustable overshoot and undershoot timers to be fully compatible with Class G2 governing.

All timers will be implemented in software.

Incoming supply failure timer
It is essential that incoming supply failures, occurring at short intervals, do not cause a series of starts and stops.
A timer adjustable from 1 s to 10 s required
The timer default value will be generator set to 3 s
The signal generated by the mains voltage monitor will start the timer. If the duration of the signal is less than the generator setting on the timer, the signal is suppressed to that the switching and starting sequence is initiated. However, if the duration of the signal is more than the generator setting on the timer, the signal will be transmitted to initiate the switching and starting sequence.

Incoming supply restoration timer
It is essential that incoming supply failures, occurring at short intervals, do not cause a series of starts and stops.
A timer adjustable from 1 s to 10 s required.
The timer default value will be generator set to 3 s.
The signal generated by the mains voltage monitor will start the timer. If the duration of the signal is less than 150 sec, the signal is suppressed and the timer is regenerator set. However, if the duration of the signal is more than 150 sec, the signal will be transmitted to initiate the switching sequence.

Alternator supply/ incoming supply change-over timer
It is essential that the supply be disconnected from the load before the incoming supply is reconnected to the load. This will be software generator settable in the controller with a minimum of 5 seconds and maximum of 20 seconds.
On receipt of the switching signal, the alternator supply will be disconnected from the load and timer started. After 5 sec, the incoming supply will be reconnected to the load.

Engine cooling-off timer
After the load has been transferred to the incoming supply the engine will run without load for a period to cool off and then stop.
A timer, software adjustable in the controller from 5 to 10 min is required.

Repeat- start control
A repeat- start control is required in the controller software adjustable so that in the event of the engine falling to start on the first start attempt, the starter motor will be released and repeat the start attempt.
The repeat-start attempt will be repeated 3 times.
The duration of each start attempt will be 6 sec with a period of 15 sec between successive start attempts.
Should the engine fail to start after the third start attempt, the controller will transmit a signal for alarm purposes.

In addition to the requirement for the switchboard instruments listed elsewhere in this document metering will also form part of the modular generator set controller and must be accessible on the software.

The modular generator set controller shall display the following alarm/status indications:

- High engine temperature.
- Low Oil pressure
- High/low alternator output voltage
- Over and under speed (frequency)
- Low water level
- Emergency stop activated
- Mains fail
- Battery charger fail
- Dummy load in operation (When provided)
- Unit not in Auto
- Engine running
- Low fuel alarm
- Engine start failure

Conditions one to six above will stop the engine.

The Contractor shall provide a remote alarm mimic panel and the associated control wiring for the set. The panel shall be installed in the duty/security room at the entrance to the building approximately 70m from the generator set position.

The mimic panels must fit into furniture and blend with the design. Before manufacture, the Contractor shall submit and obtain the approval, from the Engineer, for the mimic panel.

The remote alarm must have potential free relay contacts which shall indicate the following on each set:
1) Mains on/off
2) Alternator running
3) Common fault alarm
4) Buzzer which can only be reset at the generator panel
5) Fuel low

The cable between the remote alarms is to be a signal cable with a screen and this option must be able to operate from a 12 / 24 V dc supply so that it can be powered from the generator set batteries.

A facility to originate a fault message should a warning or shutdown fault occur.

A facility to allow the mode of the control system to be changed to any of the four modes to allow the set to be run from a remote location.

A facility to originate a call to the control cellular and to transfer a fault message should a warning or shutdown fault occur. The alarm conditions above from the controller will be extended to four relays with a make and break contact and terminal strip to allow for remote monitoring of the following alarms:

- Mains fail
- Standby run
- Standby fail
- Low Fuel

A remote start facility must be supplied, software controllable in the controller.

All events relating to the status of the generator set shall be logged with date and time in a non-volatile memory (which can retain information for a period of 6 months in the absence of power to the controller) and the user shall be able to contain a hard copy on site.

The modular generator set controller system must be able to operate with a minimum DC supply voltage of 4 volts (without making use of either an internal or an external auxiliary battery) to allow cranking and starting under conditions of low battery capacity. Control cables between the set and the control panel shall be fitted with sockets for ease of undoing in the event the modular generator set controller has to be removed.

2.3.5. Manual Starting

Each switchboard shall be equipped with two pushbuttons marked “START” and “STOP” for manual starting and stopping of the set.

2.3.6. Battery Charging Equipment

Each switchboard shall be equipped with battery charging equipment.

The charger shall operate automatically in accordance with the state of the battery and shall generally consist of an air-cooled transformer, a full wave solid state rectifier, and the necessary automatic control equipment of the constant voltage system.

The charger must be fed from the mains. An engine driven alternator must be provided for charging the battery while the set is operational. Failure of this alternator must also activate the battery charger failure circuit.

The starter battery voltage will be software monitored by the modular generator set controller. The voltage will be digitally displayed.

2.3.7. Switchboard Instruments

Each generating set shall have a switchboard equipped as follows:

a) One flush square dial voltmeter, reading the alternator voltage, scaled as follows:

(i) 0-300V for single phase generators.
(ii) 0-500V for three phase generator. In this case a six position and off selector switch must be installed for reading all phase and phase to neutral voltages.

b) A flush square dial combination maximum demand and instantaneous ampere meter for each phase, with resettable pointer suitably scaled 20% higher than the alternator rating. A red arc stripe above scale markings from 0-20A and a red radial line through the scale at full-load current, shall be provided. This instruments shall be supplied complete with the necessary current transformer.
c) One flush square dial vibrating type frequency meter, indicating the alternator frequency.
d) A six digit running hour meter with digital counter, reading the number of hours the plant has been operating. The smallest figure on this meter must read 1/10 hour.
e) Fuses or m.c.b.'s for the potential voltage circuits of the meters.
f) One flush square dial ampere meter suitably scaled for the battery charging current.
g) One flush square dial voltmeter with a spring loaded pushbutton or switch for the battery voltage.

2.3.8. Marking

All labels, markings or instructions on the switchgear shall be in English.

2.3.9. Earthing

An earth bar must be fitted in the switchboard, to which all non-current carrying metal parts shall be bonded.
The neutral point of the alternator must be solidly connected this bar by means of a removable link labelled "EARTH". Suitable terminals must be provided on the earth bar for connection of up to three earth conductors, which will be supplied and installed by others.

2.3.10. Operation Selector Switch

A four position selector switch must be provided on the switchboard marked "AUTO", "MANUAL", "and TEST" and "OFF".

With the selector on "AUTO", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "TEST", it shall only be possible to start and stop the set with the pushbuttons, but the running set shall not be switched to the load.

With the selector on "MANUAL", the set must take the load when started with the pushbutton, but it must not be possible to switch the set on to the mains, or the mains onto the running set.

With the selector on "OFF", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

2.3.11. Automatic Change-over System

A fully automatic change-over system must be provided to isolate the mains supply and connect the standby set to the outgoing feeder in case of a mains failure and reverse this procedure on return of the mains.
The contactors for this system must be electrically and mechanically interlocked.

2.3.12. By-pass Switch and Main Isolator

The switchboard shall be equipped with an on-load isolator to isolate the mains and a manually operated on-load 4 pole 4 position by-pass switch, which shall switch the connected loads as follows:

NORMAL: will allow for the normal connection i.e. connects the incoming mains to the Automatic control gear or directly to the outgoing feeder.
In the GEN BY-PASS position the switch will disconnect the automatic changeover control gear, and will connect the municipal mains directly the essential supply busbar which will allow for the maintenance of either or both the generator and the automatic changeover equipment.

MAINS BY-PASS switching position would allow the generator to be connected directly to the essential supply busbar. This is when there is a problem with the automatic changeover equipment and there is no municipal power available.
The final position is an OFF position which will remove all power downstream of this switch.

It is required that this by-pass switch and mains isolator be mounted away from the automatic control gear, in a separate compartment, either on the side or in the lower portion of the switchboard cubicle, and that the switches are operated from the front of the compartment.
Contractor to note: The by-pass and mains isolator switch shall also break the main neutral.

2.3.13. Start Delay

Starting shall be automatic in event of a mains failure. A 0-15 second adjustable start delay timer shall be provided to prevent start-up on power trips or very short interruptions.

2.3.14. Stop Delay

A stop delay with timer is required for the set, to keep the set on load for an adjustable period of one to sixty seconds after the return of the mains supply, before changing back to the supply. An additional timer shall keep the set running for a further adjustable cooling period of 5 to 10 minutes at no-load before stopping.

2.4. Installation

The tenderer must include for the complete installation and wiring of the plant in running order, including the connection of the incoming cable and outgoing feeder cables.

The connecting of the cable and control cabling to the generator and the control terminals in the LV board remains the responsibility of the tenderer.

2.5. Warning Notices

Notices, in English, must be installed on the outside of the steel enclosure.

The successful tenderer must consult the Occupational Health and Safety Act 83 of 1993 and get approval of the wording from the Department's representative, prior to ordering the notices.

The notice shall be made of a non-corrodible and non-deteriorating material, preferable plastic, and must read as follows:

DANGER: This engine will start without notice. Turn selector switch on control board to "OFF" before working on the plant.

An engraved label shall be installed next to the fuel cap that indicates the following:
Base Tank Capacity
Bulk Tank Capacity (if provided)
Full load litres per hour consumption

2.6. Construction

The engine and alternator of the set shall be built together on a common frame, which must be mounted on a skid base on anti-vibration mountings. The set must be placed inside an IP65 canopy/container. A drip tray must be fitted under the engine. The tray must be large enough to catch a drip from any part of the engine.

The frame must be of the 'DUPLEX' type.

2.7. Operation

The set is required to supply the lighting and power requirements in the case of a mains power failure.

The set shall be fully automatic i.e. it shall start when any one phase of the main supply fails or get switched and shall shut down when the normal supply is re-established. In addition it shall be possible to manually start and stop the set by means of pushbuttons on the switchboard.

The automatic control shall make provision for three consecutive starting attempts. Thereafter the set must be switched off, and the start failure relay on the switchboard must give a visible and audible indication of the fault.

To prevent the alternator being electrically connected to the mains supply when the mains supply is on and vice versa, a safe and fail proof system of suitably interlocked contactors shall be supplied and fitted to the changeover switchboard.

SECTION 3 – TECHNICAL SPECIFICATION

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3. SECTION 3 – TECHNICAL SPECIFICATION

3.1. General

Supply, deliver, install, commission, test and maintain an 350kVA Prime power emergency generating set at the New Keimoes Magistrate Court in the Northern Cape.

This installation must comply fully with all the sections and drawings of this document. This technical specification is supplementary to the Equipment Requirements, Section 2, and must be read together where they are at variance the Technical Specification shall apply.

Supply, delivery, installation and commissioning of the complete outdoor emergency generator set inside an IP65 canopy/container on a concrete plinth with bund wall as specified in this document and indicated on the drawings.

Concrete plinth with bund wall to be provided as per generator manufactures requirement.

The surface of the concrete plinth shall be 50mm higher than the existing ground level. The thickness and strength of the plinth shall be designed by the consulting engineer and are detailed on the drawings.

A tap to be provided to drain all the water that accumulates inside the bund wall. Final position of the tap will be determined on site. It is the engineer's responsibility to ensure plinth design complies with generator dimensions and weights. The bund wall shall contain 110% of the fuel, oil and water capacity of the generator. The bund wall shall not constrain the canopy doors from opening completely.

The contractor shall install an earthing system in the concrete plinth. The contractor shall install two (2) earth studs 1.8 meters long on opposite corners of the concrete plinth into the ground. The earth studs shall be connected by means of a 70mm2 bare copper earth wire to the main earth bar in the control panel. The earth conductor shall be connected to the earth bar, canopy, bass, skid and earth bar by means of suitably crimping lugs and brass bolts.

3.2. Site Information and Conditions

3.2.1. Location

The site is at the New Keimoes Magistrates Court in the Northern Cape

3.2.2. Site Conditions

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

a)	Height above sea level	: 750.02 Meter
b)	Maximum ambient temperature	: 39.5 ℃
c)	Maximum ambient humidity at lowest temperature	: 38 %

3.3. Output and Voltage

After the de-rating factors for the engine and generator due to site conditions have been taken into account, the set must have a site output and voltage as follows: -

No load voltage	:	420 Volt
Rating	:	350kVA
Power at 0.9 power factor :	280kW	

Frequency	:	50Hz
Fault Level	:	5kA

The generating set is required to feed the following electrical load:

	Load KW	Power factor
Entire Building including air-conditioning	260	0.8

3.4. Switchboard/Control Panel Unit

All switch- and control gear shall be rated for a fault current level of 5kA.

The switchboard/control panel unit shall be enclosed in the IP65 canopy/container.

3.5. Cables

The contractor will be responsible for all electrical cable connections associated with the complete generating set installation.

The following cables will be supplied, installed and terminated at the Switchboard by others. Adequate provision shall be made for the termination of these cables at the Switchboard:

Existing 630 Mini substation	PVC Armoured SWA Cable	3x120mm² + 2x95mm² BCEC

3.6. Engine

A sump drainpipe must be fitted with a shut-off valve placed in a convenient position outside the base frame to facilitate drainage.

Recommended oil types must be indicated on the engine, or base frames, by means of suitable labels.

All engine instruments shall have clear markings on the faceplates, indicating the normal operating zone(s), maximum and minimum allowable values/limits and danger zone(s).

The flywheel shall be covered by approved hoods.

3.7. Alternator

The Alternator shall be of the low harmonic type.

3.8. Load Acceptance

The generator set shall be capable of accepting 75% of the specified site electrical output 10 seconds after the starter motor is energised and the remaining 25%, 5 seconds thereafter, i.e. 100% load acceptance shall not exceed 15 seconds.

3.9. Enclosure

The standby set is a free standing unit and shall be mounted in an enclosure as detailed below:-

3.9.1 General

The enclosure, shall be completely vermin-proof, powder coated and shall be constructed of 3CR12 stainless steel or within 50km from the coast with grade 316 steel housing of a minimum thickness of ±1.5 mm.

The enclosure shall allow easy access to the engine, alternator, radiator filler cap and control cubicle for maintenance purposes.

The door shall be flush with the rest of the canopy and of the side opening type. A minimum of four doors are required i.e. two on either side.

The door hinges and locking bars shall be of a heavy duty type and be manufactured of 3CR12 stainless steel or within 50km from the coast with grade 316 steel and shall be fitted with a grease nipple.

The doors and panels shall be suitably braced and stiffened to ensure rigidity and to prevent bending and warping.

Suitable door restraints shall be fitted to all the doors, enclosure including the control panel to prevent wind damage. The restraint shall consist of a steel rod in a steel groove or slide with a spring loaded catch, which is to be manually reset to close the door.

No flexible restraints will be accepted.

The diesel fuel level indicator and alternator rating plate shall be clearly visible with the doors open.

Unless specified the silencers shall be mounted within the enclosure.

Perforated sheeting shall be fitted over all the insulating material inside the canopy of all soundproof sets.

Rubber seals on doors shall be equal to or similar to rubber pinch weld, wind lace.

9.2 Design

The enclosure shall be designed to be weather-proof and sound-proofing as specified. Rivets or self-tapping screws will under no circumstances be allowed for fixing the various sections of the enclosure. Only cadmium coated nuts and bolts are acceptable.

9.3 Roof

The roof of the enclosure shall be constructed for proper drainage of water as per the drawing.

9.4 Lamp fitting

A lamp fitting and it's associated on/off door switch shall be provided inside the enclosure for illumination of the control panel. The power for the lamp shall be obtained from the starter battery.

9.5 Sound-proofing

The sound-proofing on canopy engine sets shall be such that the maximum noise level generated by the set under any load condition shall not exceed 65 dB measured in any direction at a distance of 5m from the centre of the set with the doors closed.
The supply and discharge air paths will require separate attenuators on soundproof sets.

9.6 Padlock and keys

The contractor shall supply padlocks and keys for all the doors of the enclosure. The padlock shall be off the "Viro A82 keyed alike with stainless steel shackles" type.

Suitable brass metal plates shall be installed behind each lock for the protection of the enclosure against scratching or damaging, where the locks are hanging.

3.10. Alarms

The successful tenderer must pay particular attention to the requirements of the alarms as described in the Equipment Requirements, Section 2.

One alarm hooter and red light shall be supplied and installed on the outside of the generator container in a position as indicated by the Department's Representative.

The hooter shall consist of an electronic unit similar and equal to a "Klaxon" - type SY2/725 hooter with a continuously rated output and 110 dB at a distance of 2 metres, and shall be IP55 weatherproof rated.

The warning light shall consist of a 40W flashing red light, which shall be mounted on a galvanised steel frame together with the hooter.

The hooter and light shall be switched on or off simultaneously after initiation or cancellation of an alarm condition. The supply and installation of the wiring between the control board and the alarm unit forms part of this contract.

The successful tenderer must ensure that the hooter control circuit resets automatically after cancellation due to a low fuel condition or battery charger failure, but the visible fault indication must remain, i.e. should the operator continue to run the set, the hooter must sound, should any other condition develop.

A remote alarm panel shall be supplied and installed by the contractor in the control room. This shall be of surface mounting, enamelled sheet metal (colour to approval), minimum depth construction, and shall incorporate a flashing red pilot alarm light, adjustable electronic sounder, and a silence push button. The silence button shall not switch off the pilot light - this shall only be switched off when the alarm is reset at the Generator Panel.

A 2,5mm^2 x 4-core PVC SWA PVC cable will be supplied, installed and terminated by others between the Generator Panel and the Charge Office. The Contractor shall connect this cable at both ends and shall supply and install all switch gear relays, etc. to ensure satisfactory operation of the Remote Alarm Panel.

3.11. Link to Building Management System

An interface controller shall be supplied and installed to enable the generator to be link to the building management system; the contractor shall coordinate the requirements with the building management system specialist contractor.

3.12. Fuel Drip Tray

A drip tray approximately 100mm deep shall be mounted below the generator and must be large enough to collect any fuel that drips from the generator fuel accessories. The drip tray shall be manufactured from black mild steel. The thickness of the drip tray sheet steel shall not be less than 2mm.

3.13. Completion Time

The Generator Set is required to be commissioned in conjunction with the main building contract.

3.14. Inform

The successful tenderer shall inform the Engineer when the set is ready for installation.

3.15. Fuel Supply Tank

The fuel tank shall be an integral part of the base frame of the generator set. The tank shall have sufficient capacity to run the engine on full load for a period of 24 hours. The base tank shall be an

open channel self-bund walled type that shall be of sufficient capacity to contain a spillage equivalent to 110% in volume of the base tank. The containment tank shall be manufactured from black mild steel with a thickness of not less than 2mm.
A float level alarm connected to the generator controller shall be incorporated into the bund area located such that the alarm will be activated when 50% of the volume of the bund area has been reached in the event of any diesel fuel leakage.

SECTION 4 – SCHEDULES OF TECHNICAL INFORMATION

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4. SECTION 4 – SCHEDULES OF TECHNICAL INFORMATION

4.1. Engine

NO	ITEM	REMARKS
1.	Manufacturer's Name	
2.	Country of Origin	
3.	Manufacturer's model No. and year of manufacture	
4.	Continuous sea level rating after allowing for ancillary equipment : a) In b.h.p. b) In kW	
5.	Percentage de-rating for site conditions, in accordance with SANS 8528 a) For altitude b) For temperature c) For humidity d) Total de-rating	
6.	Net output on site in kW	
7.	Nominal speed in r.p.m.	
8.	Number of cylinders	
9.	Strokes per working cycle	
10.	Stroke in mm	
11.	Cylinder bore in mm	
12.	Swept volume in cm^3	
13.	Mean piston speed in m/min	
14.	Compression ratio	
15.	Cyclic irregularity	
16.	Fuel consumption of the complete generating set on site in l/h of alternator output at : a) Full load b) ¾ load c) ½ load NOTE : A tolerance of 5% shall be allowed above the stated value of fuel consumption.	
17.	Make of fuel injection system.	
18.	Capacity of fuel tank in litres	

NO	ITEM	REMARKS
19.	Is gauge glass fitted to tank?	
20.	Is electric pump for filling the fuel tank included?	
21.	Method of starting	
22.	Voltage of starting system	
23.	Method of cooling	
24.	Type of radiator if water-cooled	
25.	Type of heater for warming cylinder heads	
26.	Capacity of heater in kW	
27.	Method of protection against high temperature	
28.	Method of protection against low oil pressure	
29.	Type of governor	
30.	Speed variation in % a. Temporary b. Permanent	
31.	Minimum time required for as assumption of full load in seconds	
32.	Recommended interval in running hours for : a. Lubricating oil change b. Oil filter element change c. Decarbonising	
33.	Type of base	
34.	Can plant be placed on solid concrete floor?	
35.	Are all accessories and ducts included?	
36.	Is engine naturally aspirated?	
37.	Are performance curves attached?	
38.	Diameter of exhaust pipe	
39.	Noise level in plant room in dBA	N/A
40.	Noise level at tail of exhaust pipe in dBA	
41.	BMEP (4 stroke) at continuous rating (kPa)	
42.	% Load acceptance to SANS 8528, with 10% transient speed drop	

4.2. Alternator

NO	ITEM	REMARKS
1.	Maker's name and model no.	
2.	Country of Origin and year of manufacture	
3.	Type of enclosure	
4.	Nominal speed in r.p.m.	
5.	Number of bearings	
6.	Terminal voltage	
7.	Sea level rating kVA at 0,9 power factor	
8.	De-rating for site conditions	
9.	Input required in kW	
10.	Method of excitation	
11.	Efficiency at 0,9 power factor and : a) Full load b) ¾ load c) ½ load	
12.	Maximum permanent voltage variation in %	
13.	Transient voltage dip on full load	
14.	Voltage recovery on full load application in milli-seconds	
15.	Is alternator brushless?	
16.	Class of insulation of windings	
17.	Is alternator tropicalised?	
18.	Symmetrical short circuit current at terminals n Ampere	
19.	Type of Coupling	

4.3. Switchboard

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Is board floor mounted?	
4.	Finish of board	
5.	Make of volt, amp, and frequency meters	
6.	Dial size of meters in mm	
7.	Scale range of voltmeter	
8.	Scale range of ammeters	
9.	Ration of current transformers	
10.	Make of hour meter	
11.	Range of cyclometer counter	
12.	Smallest unit shown on counter (Item 11)	
13.	Make of circuit breaker	
14.	Type of circuit breaker	
15.	Rating of circuit breaker in Amp and fault level in kA	
16.	Setting range of overload trips	
17.	Setting range of instantaneous trips	
18.	Make of change-over equipment	
19.	Make of voltage relay	
20.	Is control and protection equipment mounted on a small removable panel?	
21.	Type of control equipment	
22.	Make of mains isolator	
23.	Type of indicators for protective devices	
24.	Make of rectifier	
25.	Type of rectifier	
26.	Is battery charging	
27.	Are volt- and ammeters provided for charging circuit?	
28.	Is the alarm hooter of the continuous duty type?	
29.	Rating in Amps of : a. Change-over equipment b. Mains on load isolator c. By-pass switch	

	d. Circuit breaker to outgoing feed	
30.	Is manufacture of switchboard/control panel to be sub-let?	
31.	If yes, state name and address of specialist manufacturer	

4.4. Battery

NO	ITEM	REMARKS
1.	Maker's Name	
2.	Country of Origin	
3.	Type of battery	
4.	Voltage of battery	
5.	Number of cells	
6.	Capacity in cold crank amp	

4.5. Dimensions

NO	ITEM	REMARKS
1.	Overall dimensions of set in mm	
2.	Overall mass	
3.	Is the canopy/container adequate for the installation of the set, switch board and fuel tank	

4.6. Deviation from the Specification as an Alternative (State Briefly)

NO	DESCRIPTION

4.7. Spare Parts and Maintenance Facilities

NO	ITEM	REMARKS
1	Approximate value of spares carried in stock for this particular diesel engine and alternator	
2	Where are these spares held in stock	
3	What facilities exist for the servicing of the equipment offered	
4	Where are these facilities available	

PART 4.3 WHEEL CHAIR LIFT INSTALLATIONS REQUIREMENTS:

1) UNIT AND MANUFACTURER IDENTIFICATION

MANUFACTURER DETAILS AND CONTACT NUMBERS		
TYPE		E07
SERIAL Nr.	(N°)	- - - -
YEAR		- - - -
LOAD	(Kg)	420
POWER	(V / A / Hz)	230 / 13 / 50

LOAD
400 kg

SERIAL Nr.	SERIAL Nr.
_ _ _ _	_ _ _ _

2) SERVICE

RETAILER STAMP AND REFERENCE FOR AUTHORIZED SERVICE

3) DESCRIPTION OF THE UNIT

3.1) Main concept

The platform lift shall be designed to transport persons with limited mobility, wheel chair and an attendant.
The lift shall consists of a mobile part known as the platform and a part which contains and protects the
platform itself, known as the shaft .

The platform consists of an antislip floor, a roof and 3 vertical walls. It shall also contain a push-button control board.

The shaft is an enclosed masonry structure with the size of (1.47m x 1.51m) with 3 x floor doors at basement , ground floor and first floor level enabling the entrance at to the platform , the total travel from basement level to first floor is 7.9m.

In order to guarantee the safety of people and access control to lift the floor doors shall be locked by an electronic safety door lock. The opening of a door is allowed only when the platform is at a determined floor.

Upon request, floor doors can optionally be provided with a motorized opening and closing system. A push button control shall provided near each entrance door.

3.2) Description

Load equipment is composed of the following:
- Carriage
- Platform
- Side panels
- Push button control
- Electric system
- Roof with LED down lighting
- Safety systems

Rails and lifting devices is composed of:
- Rails
- Fastenings
- Lifting belts
- Safety devices
- Electric system
- Gear motor
- Brackets for flat wire

Shaft it is composed of:
- Doors
- Locks
- Electronic locked manual floor doors

3.3) Main precautionary measures against mechanical damages:

- Outside door releasing with relative triangular key switch
- Platform locking for maintenance operations inside the pit
- Platform block for works of maintenance in headroom.
- Photocell barriers
- Over speed governor

3.4) Main precautionary measures against electric damages:

- Stop push button on board
- Final limit switch device
- Feeding and auxiliary circuits in disjointed cables
- Door double check equipped with lock and ant tampering micro switch

- Anti blackout emergency descent
- Emergency light on board
- Alarm system on board
- Phone prearrangement telephone dialler with secondary handset is security office
- No mains voltage in the platform (only low voltage 24 Vdc or 20 Vac).

3.5) Main precautionary measures against hydraulic damages:
- Descent speed modulating valve
- Safety gear valve into the cylinder
- Check valve
- Pressure limiting device on the hydraulic circuit
- Emergency descent with manual push button on the hydraulic pack
- Hand pump

3.6) Standard finish:
- Rail sections with joint plates
- Complete wall fastenings
- Cylinder with anchorage brackets
- Spacing bar
- Cross
- Hydraulic pack
- Pipes for hydraulic pack-cylinder connection
- Removable contacts and deceleration sensor
- Flat cable with cable fixing accessories
- Sheaths for connecting electric parts
- Control board
- Landing doors with frame to be assembled
- Shaft with doors
- Lock kit
- Dismantled carriage
- Dismantled elevator car
- Antifreeze protection
- Alarm on board

4) TECHNICAL DATA

Lifting	With belts and pulleys & electric motor.
Performances	
Running direction	Up/Down
Speed (up/down)	Max 0,15 m/s
Max Capacity	1 person with limited mobility + attendant (400kg)
Safe working load panel	See identification plate placed on the on-board control and the plate placed at each floor
Installation	The unit is suitable for indoor.
- Electric installation	
Motor	230 V c.a. single-phase 50 Hz - 1,8 kW
Max Power consumption	2.5 kW
- Controls operation; work	On board: up and down buttons with continuous floor controls: with automatic operation. All the controls only with the doors closed and locked.
- Working cycles	Every 10 min, perform 2 min / work and 8 / break.

5) LIFT OPERATION AND CONTROLS

5.1) Starting up

The system is set in operation with the residual current circuit breaker supplied by others.
To switch off the system the user must both break the circuit-breaker contact and turn off the battery connector/switch and shall otherwise automatically disconnected after 2 hours.

5.2) Controls on the platform

A push button control board containing the following devices is installed on the platform
- Emergency STOP push button, red coloured. When pressed this push button immediately stops the unit in each travel direction and the alarm siren sounds.
- Alarm bell button this push button shall function to operate the alarm bell and the telephone dial pad call.
- Built-in roof emergency lamp.
- Emergency lamp
- Direction push buttons these buttons are used to control the platform lift and they are numbered in increasing order, starting from (0) which represents the ground floor. The buttons have a lit outer ring that is active only when the button function is available.
- Key switch influencing the direction push buttons use. Turn the key switch clock wise in vertical position to use the platform.
- Display showing the floor reached and the direction of movement.
- Telephone dial pad

5.3) Controls at floors

A call/send floor control containing the following devices is provided near each floor door.
- Call push button this push button allows the platform to reach that de-terminate floor enabling the entrance.
The button has a luminous outer ring that has the following functions.
- Green indicator light: machine available.
- Red fixed indicator light: machine busy.
- Red flashing indicator light: machine called.

5.4) Use & Operation

- Open the access door; if the door does not open, the lift is not at the floor to call the lift, simply press the call button.

- Lights during the platform use lights automatically switch on; they also turn off automatically when the platform is at a floor and not used for a period of time equal to 2 min.

- Alarm
The buzzers installed in the cabin and at floors are operated by pressing the “alarm bell” button.The system shall
designed to allow connection to a the Building Management System.

-Telephone dial pad
It must be programmed with numbers chosen by the user that ensure certain relief in case of breakdown.
It is operated by pressing the alarm bell button it also works in the event of a black-out (power failure) for a maximum time of 2h.

6) SAFETY SYSTEMS

6.1) Safety devices for the user:

a) Over speed governor, this device is placed on the carriage in case the speed increases, it operates the safety gear.
b) Safety gear device, the unit shall be provided with a safety gear device with gradual breaking approved. It operates during downward motion in case of traction belt breakage or loosening, or is operated by the over speed governor. Safety gear intervention causes the unit to stop and a micro switch shall simultaneously locks the unit -

c) Safety gear intervention test with over speed governor ,the unit shall equipped with a system allowing to test for operation of the safety gear from outside.

d) Over speed governor intervention test with load equal to 1.25 times the nominal load.

e) Locks the platform lift use shall depend on the locks if the doors are open in case of open doors or damaged locks the unit shall not function.

f) Electric and mechanical terminal switches, the terminal switches positioned on the rail and on the carriage allow the automatic stop of the platform in the landing positions at floor stops. In case of malfunction of the electrical floor limit switches, an electrical device called “over travel” shall causes the unit to stop.

b) Power supply, the unit is powered with 230 V a.c. single phase voltage, while the auxiliary circuit is powered with 24V c.c. voltage.

c) Controls
All controls are of the constant pressure type (it is sufficient to release the push button and the unit stops).

d) Emergency stop push button
A red coloured emergency STOP push button shall be installed on the unit. When it is pressed, it causes the stop
of all stair lift motions and the operation of an acoustic alarm.

e) Overload indicator
If an overload occurs, a load sensor shall prevent unit running. A red indicator light by the kg symbol in the cabin comes on until the overload on the platform ceases and the control in cabin is pressed again.

f) Overload pressure switch if an overload occurs, a pressure switch prevents running. A red indicator light by the kg symbol in the cabin comes on until the overload on the platform ceases.

PART 5: ELECTRICAL WORK MATERIAL SCHEDULE

The schedules will be scrutinised by the Electrical Engineer and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	Distribution boards		
2.	Circuit breakers 1P, 2P, 3P		
3.	On load isolators without trips		
4.	Contactors 1P, 2P, 3P		
5.	Earth leakage relays 1 & 3 phase		
6.	Daylight sensitive switch		
7.	Time switch		
8.	Conduit		
9.	Conduit boxes		
10.	Power skirting		
11.	Surface switches		
12.	Watertight switches		
13.	16A flush socket outlets		
14.	16A surface socket outlets		
15.	16A watertight socket outlets		
16.	Type PL3		
17.	Type C		
18.	Type B		
19.	Type P1		
20.	Type B1		
21.	Type PL4		
22.	Type D1		
23.	Type D2		
24.	Type Y		
25.	Type LD		
26.	Type P		
27.	Type P2		
28.	PVCA cable		
29.	Cable trays		
30.	UPS		

PART5.1 : PARTICULARS OF ELECTRICAL CONTRACTOR

PARTICULARS OF ELECTRICAL CONTRACTOR

NAME OF SUB-CONTRACTOR: ELECTRICAL

.....

.....

ADDRESS:

.....

……

TELEPHONE NO: ……

EMAIL: ……..

CELL PHONE: .....

CONTRACTOR REGISTRATION NUMBER:

.....

.....
SIGNATURE OF ELECTRICAL SUB-CONTRACTOR

PART 6: DRAWINGS

TEKENING NR. DRAWING NO.	TITEL EN BESKRYWING TITLE AND DESCRIPTION	SOORT TYPE	GROOTTE SIZE
EE-10742-E-327-01-0	ACCESS CONTROL LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-327-02-0	ACCESS CONTROL LAYOUT FIRST FLOOR	PAPER	A1
EE-10742-E-327-03-0	ACCESS CONTROL LAYOUT BASEMENT	PAPER	A1
EE10742-E-701-01-0	CABLE TRAY & CHANNEL LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-701-02-0	CABLE TRAY & CHANNEL LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-340-01-0	FIRE DETECTION LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-340-02-0	FIRE DETECTION LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-340-03-0	FIRE DETECTION LAYOUT BASEMENT	PAPER	A1
EE10742-E-747-01-0	HVAC POWER POINTS LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-747-02-0	HVAC POWER POINTS LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-747-03-0	HVAC POWER POINTS LAYOUT ROOF	PAPER	A1
EE10742-E-747-04-0	HVAC POWER POINTS LAYOUT BASEMENT	PAPER	A1

EE10742-E-370-01-0	POWER POINT LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-370-02-0	POWER POINT LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-400-01-0	SINGLE LINE DIAGRAM	PAPER	A3
EE10742-E-300-03-0	POWER POINT & LIGHTING LAYOUT BASEMENT	PAPER	A1
EE10742-E-380-01-0	LIGHTING LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-380-02-0	LIGHTING LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-402-01-0	SLEEVES & LV LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-330-01-0	TEL & DATA LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-330-02-0	TEL & DATA LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-300-01-01-0	DISTRIBUTION BOARD 1: PAGE 1 OF 2	PAPER	A3
EE10742-E-300-01-02-0	DISTRIBUTION BOARD 1: PAGE 2 OF 2	PAPER	A3
EE10742-E-300-02-01-0	DISTRIBUTION BOARD 2: PAGE 1 OF 3	PAPER	A3
EE10742-E-300-02-02-0	DISTRIBUTION BOARD 2: PAGE 2 OF 3	PAPER	A3
EE10742-E-300-02-03-0	DISTRIBUTION BOARD 2: PAGE 3 OF 3	PAPER	A3
EE10742-E-300-03-01-0	DISTRIBUTION BOARD 3	PAPER	A3
EE10742-E-300-04-01-0	DISTRIBUTION BOARD 4: PAGE 1 OF 4	PAPER	A3

EE10742-E-300-04-02-0	DISTRIBUTION BOARD 4: PAGE 2 OF 4	PAPER	A3
EE10742-E-300-04-03-0	DISTRIBUTION BOARD 4: PAGE 3 OF 4	PAPER	A3
EE10742-E-300-04-04-0	DISTRIBUTION BOARD 4: PAGE 4 OF 4	PAPER	A3
EE10742-E-300-05-01-0	DISTRIBUTION BOARD B	PAPER	A3
EE10742-E-300-06-01-0	DISTRIBUTION BOARD G	PAPER	A3
EE10742-E-300-07-01-0	DISTRIBUTION BOARD M: PAGE 1 OF 2	PAPER	A3
EE10742-E-300-07-02-0	DISTRIBUTION BOARD M: PAGE 2 OF 2	PAPER	A3

SPECIFICATION

ELECTRONIC WORK

public works
& infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

KEIMOES MAGISTRATES COURT:

FIRE ALARM SYSTEM, PUBLIC ADDRESS SYSTEM, TELEPHONE AND DATA SYSTEM, BUILDING MANAGEMENT SYSTEM, ACCESS CONTROL SYSTEM,CCTV, X-RAY MACHINE and METAL DETECTOR INSTALLATION

Electronic Installation Specifications

TABEL OF CONTENTS **Page**

PART 1-STANDARD TECHNICAL SPECIFICATION

GENERAL INFORMATION

This Specification covers the general requirements regarding the material, equipment, installation, testing and commissioning of the Fire Alarm, Public Address, CCTV, Telephone& Data, Building Management, Access Control Installations, XRAY Machine and Metal Detector

The standard specification shall be read in conjunction with the Requirements for Tendering, Drawings, etc. and the Technical Requirements in the Project Specification.

Should any differences or contradictions exist between the General Specification and the Project Specification, then the latter shall take preference.

The technical, construction and performance requirements contained in this general specification must be regarded as being the minimum standards required and therefore full compliance is a necessity.

These specifications are not exhaustive and full compliance with these requirements does not release the *Contractor* from his contractual undertaking to provide an installation that complies in all aspects with the operational requirements specified.

The installation shall include all necessary items, whether specified in detail or not, and shall be carried out in the best possible way to ensure a complete, high quality installation, to the approval of the *Engineer.*

On being requested to do so by the *Engineer*, the *Contractor* shall supply a Certificate of Compliance issued by a recognised Research Laboratory, or the South African Bureau of Standards, for material or equipment used.

Should any material and apparatus used comply with or be in accordance with the standard of any other recognised standards institution, this must be clearly stated at the time of the tender.

STANDARDISATION

Individual components or apparatus shall be of the same make, type or series for each item used throughout the installation.

Standardisation and mutual interchangeability of parts and components is essential and must be considered in the Sub-*Contractor's* approach to the interpretation of the specification.

The aim must be to standardise component types, series and makes, thus reducing the number of items to be held as spare parts.

Equipment shall be readily available and imported equipment shall be available in South Africa on a well established agency basis proof of which shall be submitted with the tender.

Preference to locally manufactured equipment shall be given.

Manufacture of sub-units or sub-assemblies shall be "jigbuilt" to ensure uniformity.

COMPLIANCE WITH REGULATIONS

The installation shall be erected and commissioned in compliance with the regulations and the conditions as set out in the Conditions (terms) of Contract, which include the following in particular:

The Occupational Health and Safety Act of 1993, as amended, which include the Code of Practice for the Wiring of Premises: SABS 0142 of 1987, as amended, in terms of regulation C175 of the aforementioned act.

The regulations of the local Municipality.

The regulations of the local Supply Authority.

The regulations of the local Fire Brigade.

The regulations of Telkom SA Inc.

The regulations of the Post Office.

The regulations of any Government Department or public service company, where applicable.

Government Notices.

Radio Act No. 3 of 1952.

It must clearly be understood that where there are differences in standards in the requirements as set out above, the higher standard and stricter requirements shall apply. In the instance of direct discrepancies, the requirements as stipulated in the specification must be given first priority, and thereafter the requirements as decided by the *Engineer.*

Should any requirement, by-law or regulation which contradicts the requirements of this specification, 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 any variations to the installation in terms of such contradictions without obtaining the written permission to do so from the *Engineer*.

STANDARDS

All materials and apparatus used shall comply in respect of quality, manufacture, test and performance with the relevant current specification of the following standards institutes:

The South African Bureau of Standards (SABS).

The Fire Offices Committee of the United Kingdom (FOC).

The Underwriter's Laboratories. (UL)

Should material and apparatus used comply with or be in accordance with the standard of any other recognised standards institution, this must be clearly stated in the schedules at the end of this specification.

Imported materials must comply with the requirements of the appropriate SABS or BS specification although these materials need not necessarily bear the SABS mark.

All material shall be suitable for the conditions on site. These conditions shall include weather conditions, altitude, as well as conditions under which the materials are installed and used.

Should the materials or components not be suitable for use under temporary adverse site conditions then the *Contractor* shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

STANDARDS AND SAMPLES

Equipment, materials and apparatus used in the installation shall be of best commercial quality with a high reliability and shall be selected for ease of maintenance.
Throughout these documents, the words - "Approved", "Approval", "Suitable", "Equal", "Necessary" and "Required", wherever they may occur, shall respectively have the special meaning "Approved/approval in writing by the *Engineer*" and "suitable/equal/necessary/required in the opinion of the *Engineer*", and all materials or equipment so described shall be submitted to the *Engineer* for his approval.

Samples of all items of equipment used and the relevant SABS or BS test reports or certificates shall be submitted to the *Engineer* on his request before installation is commenced.

All such samples may be retained until completion of the contract. All such samples shall have securely attached thereto labels designating the contract by name and number (if any), the name of the *Contractor*, and any further relevant information.

IDENTIFICATION OF SUBSECTIONS AND COMPONENTS

Equipment should be delivered to site in the largest subassemblies which are practical.

Components, equipment and subassemblies shall be assembled in the *Works*hop, after manufacture.

Individual units shall be clearly marked by employing an identification code in such a manner that re-assembly, erection and installation on site could be done in the shortest time and with the minimum adjustment on site.

Where practical, completed electronic and other control units shall be assembled in the *Works*hop for preliminary tests, this shall be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results.

The *Engineer* may upon request of the *Contractor* visit existing installations or prototype assemblies in the factory to determine whether such units and workmanship are of the required standard for this installation.

AVAILABILITY OF COMPONENTS

All components used in the system shall be readily available in the Republic of South Africa. A list of suppliers shall be compiled and submitted with the Tender.

RADIO AND TV INTERFERENCE

The *Contractor* must allow for the provision of interference suppression components, where required, to ensure that the installation shall not cause interference to radio, television and paging systems.

All necessary steps are to be taken to ensure compliance with the Telkom Regulations.

DELIVERY

The Sub-*Contractor* must satisfy himself that the delivery date for all items of equipment put forward by him will allow the complete installation to be installed, energised and capable of operation in time to allow full commissioning and testing prior to contract completion.

It will be the Sub-*Contractor's* responsibility to place orders timeously so as to meet the programme. No substitution to the tendered items will be allowed due to the *Contractor* not having placed orders timeously.

METHODS OF FIXING

The size of bolts and screws shall be the largest permitted by diameter of the hole in the apparatus concerned and are to be of adequate length. When fixing any item of equipment, all bolt or screw holes provided therein shall be used and the fixing in each hole is to be secure.

LIGHT WEIGHT EQUIPMENT

All light weight fixing to brick or concrete shall be made with steel screws and "Fischer" or other approved plugs. Plugs made of wood shall not be allowed. Holes of the requisite size for the plug which shall suit the screw used, are to be neatly drilled in the concrete or brickwork (not in the joints between bricks) to a depth excluding plaster or soft wall finish, equal to at least the length of the plug to be used. The plug length shall be such that when the screw is in place all the threaded length is in the plug. Fixing to timber shall be made with greased brass wood screws. For fixing to hollow tiles, etc., screw anchor type fixing shall be used, fitted as above as far as possible.

Fixing to soft or hard fibre boards, etc., which are inaccessible to the back shall be made with sheradised self-tapping screws of appropriate size or with springs or gravity toggles.

HEAVY EQUIPMENT

All heavy weight fixing to brick or concrete shall be by means of mild steel bolts of appropriate size of the grouted bolt type or by one of the various types of suitable expanding bolt fixings. After erection of equipment all exposed metalwork or fixing shall be treated with two coats of paint to match the finish of the equipment.

PROTECTIVE PAINTING

The paint work of all equipment and plant which is damaged during the course of erection and prior to acceptance by the *Engineer*, must be satisfactorily made good by the *Contractor* at his own expense.

WIRING

Unless otherwise specifically stated or arranged between the Sub-*Contractors*, all conduit, trunking, ducting, sleeves for cables, wire ways etc., shall be supplied and installed by the Electrical Contractor.

GENERAL WIRING

All cabling shall be looped from point to point. There shall be no joints in cabling or wiring. Not more than three conductors shall be looped together in any one terminal. Where multi-way terminations are necessary, these may only be made off in suitable junction boxes, appropriately labelled.

There shall be no cutting away or nicking of wire strands.

The junction of main cables and branch cables shall be made with suitable junction blocks to facilitate the isolation of various sections in the event of fault location.

Ends should all be plier twisted and firmly terminated in approved junction blocks, which shall be fitted with built in cable protectors.

EQUIPMENT WIRING

Equipment shall be wired in PVC insulated annealed copper wire.

The internal wiring of equipment shall be neatly done. All soldered connections shall be neatly and carefully made. All cable runs shall be neatly laced and tied to suitable supports. The capacity, type, and insulation of each conductor shall be adequate for its function and excessive compressive stress shall be avoided in looms.

Cable entries shall be provided, and so designed that no damage to the cable can result during normal use.

High quality heat resistant plastic cables must be used to minimise damage to adjacent wiring in the event of electrical faults causing high currents and heating of the faulty circuits.

All terminations are to be via numbered terminals, and all wires are to be numbered at both ends to correspond with the wiring diagrams. Should any particular wiring Colour Code be adopted, this is to be kept standard throughout the installation.

All soldered joints are to be fixed so that there is no strain on the joints.

SIGNAL WIRING

Wiring of the various parts of the systems carrying ac or dc signals shall be by means of multi-core, stranded cabling comprising PVC insulated annealed copper wires combined as coded twisted pairs and sheathed with extruded PVC.

The cable shall be such that cross-talk isolation between wires at audio frequency shall be less than 50dB and the insulation shall be rated at 300V.

In general, all low voltage signal cables shall be spaced at least 150mm from supply mains cables.

Wiring at VHF & UHF frequencies shall be in black UV resistant co-axial cable, of the low loss type, 6dB per 100m loss or less and of an impedance, to match the equipment.

IDENTIFICATION OF WIRING

All wiring is to be uniquely identified by means of numbered ferrules in the case of single core wiring or by means of numbered cores or a strictly adhered to colour coding system in the case of colour coded multicore wiring. Where colour coding is used the International accepted code of Blue, Orange, Green, Brown, Slate shall be strictly adhered to and the same colour shall be used throughout for a specific circuit.

WIRING TERMINALS

All terminals shall be clearly identified by using plastic label tags.

Cable ends shall be terminated in approved terminal blocks as supplied by MS², Klippon, Wago or other approved type, "chease blocks" are not acceptable. Terminals shall be easily accessible, clearly labelled, well supported and easy to wire using a spring mechanism to grip the wire.

Tenderers must take note that it is a special request that all PLC and I/O's, loudspeaker lines to outside building installations, shall be wired to fused terminals or where this requirement is not feasible surge arrestors shall be fitted so as to provide adequate and efficient lightning protection.

Identification shall be such that any circuit can be clearly identified and traced from the wiring diagrams. These wiring diagrams shall clearly show all terminals, draw boxes, joints, points of termination etc. and shall be such that a circuit can easily be traced from point to point throughout the system.

CONSTRUCTING OF FREE STANDING EQUIPMENT RACKS/CONTROL BOARDS

FRAMEWORK

Free standing equipment racks/control boards shall be manufactured from angled, channel or folded steel metal sections and metal framework with a solid U-channel baseframe, sufficiently braced to support all equipment and span floor and access holes.

Separate sections of the framework shall be bolted together with rubber packings installed between joints to provide a finished appearance.

Depending upon the number and size of components, a common front panel may be installed over one or more groups of equipment.

GROUPING OF SWITCHGEAR AND CONTROL EQUIPMENT

Switchgear and control equipment shall be logically arranged and grouped.

INTERNAL WIRING

Type of conductors

Standard 600V grade PVC insulated stranded annealed copper conductors manufactured to SABS 150 shall be employed for the internal wiring of control boards.

Except in cases where cables are specified, all wiring shall be done with PVC-insulated, single core stranded copper conductors and bare stranded or green PVC-insulated copper conductors for earth continuity in compliance with SABS 150.

The PVC-insulated copper conductors shall be compounded and stabilised to comply with SABS 175.

If the internal ambient temperature is likely to exceed 60°C, SABS approved stranded 600V grade asbestos or silicone rubber insulated stranded copper conductors shall be used.

The wiring of low voltage systems and circuits (less than 50 V) may be done by means of multi-core single conductor PVC-insulated and PVC shrouded cables.

Wiring

Wiring shall be arranged in horizontal and vertical rows and may be:

bunched and strapped using "HELLERMANN" or similar strapping and studs which are fixed to tubular harness supports.

bunched and flat mounted using PVC covered steel tape fixed directly to the chassis .

open cleat wired in a "WIRAC" or similar cleat bunch.

installed according to the "SIEMENS X" or similar wiring system, or

may be installed in "EGADUCT" or similar PVC wiring channels

Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors.

Conductors leaving harnesses shall be so arranged that they are adjacent to the chassis.

These conductors shall first be led in the same direction as the conductors in the harness and shall then be bent over the top of the harness and progress to its final destination.

Bunched conductors may not be grouped into smaller bunches within the large harness.

Wiring across hinged panels

Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points.

The loop shall be arranged to produce a twisting motion when the door is opened or closed.

A flexible protection sleeve shall be installed over the conductors.

Flat multiple cables

The wiring in the desk section of desk type consoles shall, where possible, be by means of flat multiple PVC-insulated cables.

These cables shall serve as connections between equipment mounted on hinged panels, the electronic racks and the terminals.

Flat multicore PVC-insulated conductors shall be installed between equipment mounted on hinged panels and equipment mounted within these consoles and the terminals in the consoles.

Flat multicore flexible PVC-insulated conductors shall be neatly arranged and clamped at both ends to prevent strain on the individual conductors connected to the terminals.

Where necessary the flexible cables shall be fitted with socket connectors to allow for the withdrawal of racks from the control consoles.

Current Rating of Conductors

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous

current that can occur in the circuit.

This value shall be determined from the circuit breaker or fuse protection of the circuit.

Conductors ratings for PVC-insulated, single core conductors are specified in the table below for maximum internal ambient temperatures of 35°C.

NOMINAL CROSS-SECTION (mm^2)	CONDUCTOR CURRENT RATING (A) NUMBER OF CONDUCTORS BUNCHED TOGETHER				
	1	2-3	4-5	6-9	10 & MORE
1.5	13	12	10	9	8
2.5	17	16	14	12	10
4.0	22	20	18	16	13

Wiring Channels

Where wiring channels are used, they shall be installed horizontally and vertically.

UNDER NO CIRCUMSTANCES MAY POWER AND CONTROL CIRCUIT WIRING BE INSTALLED IN THE SAME WIRING CHANNEL.

Channels containing control circuit wiring shall not be more than 60% full.

Channels in which power circuits are installed shall not be more than 40% full.

Terminal Strips

All external wiring such as power, control interlocking, alarm, measuring and DC circuits shall terminate on numbered terminal strips of the "KLIPPON" or other approved manufacture.

The correct terminal size as recommended by the manufacturer for each conductor to be connected, shall be used throughout.

Terminals for power wiring shall be separated from other terminals.

Terminals for internal wiring shall not be interposed with terminals for external circuits.

Springloaded snap or pin type terminals attached to glassfibre or artificial resin reinforced isolator boards may only be used for electronic control circuits where the current rating does not exceed 0.1 A.

Termination of Conductors

All conductors terminating on meters, fuse holders and other equipment with screwed-on terminals, shall be fitted with lugs.

The lugs shall be soldered or crimped to the end of the conductor.

The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of equipment and strands may not be cut from the end of the conductor.

Conductor terminals connected to "KLIPPON", or other approved type terminals need not be soldered or ferruled. When more than one conductor enters a terminal, the strands shall be securely twisted together.

Connections to circuit breakers, isolators or contactors shall be installed by one of the following methods:

a ferrule of the correct size.

soldering the end of the conductor, or

winding one conductor strand around the end to totally cover the end.

External cable connections shall be secured by cable glands fixed to gland plates installed within the rack/consoles.

Identification of Conductors

Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.

The colour of the insulation material of conductors for all 220 V circuits shall correspond to the colour of the supply phase for the circuit and the colour of the insulation material of all neutral conductors for 220 V circuits shall be black.

All other conductors, supplying control circuits, etc., shall be coded in colours other than those specified above and a colour code shall be devised for the installation of the other conductors that will enable positive identification on the wiring diagrams.

BUSBARS

Unless specified to the contrary, busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross-section in accordance with SABS 784 as amended and BS 159 where applicable.

Busbars shall be supplied for the following applications:

Distribution of supply voltage.

Connection bars for parallel cubes.

Connection bars for neutral conductors.

Earth busbars.

The maximum allowable temperature of busbars (including joints) carrying full load current in an ambient temperature as specified shall not exceed 80°C.

MOUNTING OF EQUIPMENT

Access

All equipment, busbars and wiring shall be completely accessible when the front and/or back panels are removed.

Space Requirements

In designing control boards or racks, the following requirements shall strictly be adhered to:

A minimum of 75 mm between any piece of equipment and the frame or internal partitioning. This minimum space is required above, below and on the sides of the equipment.

A minimum of 75 mm between horizontal rows of equipment. The maximum outside dimensions of equipment shall be considered.

Instrumentation

All metering instruments shall be mounted flush in the front panel unless otherwise specified.

In certain instances it may be required that instruments be mounted flush in the door. In these instances the back of the metres shall be covered by removable covers of isolating material fixed to the door to protect the terminals of instruments and to prevent accidental contact.

Fuses

Fuses for instrumentation shall be mounted in an easily accessible position with a label clearly indicating the fuse rating.

Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel.

FINISH

Paint Finish

Metal components of the framework, panels and chassis shall be finished with a high quality paint applied according to the best available method.

Baked enamel, electrostatically applied powder coating or similar proven methods shall be used.

Care shall be taken to ensure that all edges and corners are properly covered.

Baked Enamel Finish

Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill-scale, grease and foreign matter to a continuous metallic finish.

Sand or shot blasting, or acid picking and washing may be employed for this purpose.

Immediately after cleaning, all surfaces shall be covered by an electrolytically applied rust inhibiting tough, unbroken metal phosphate film and then thoroughly dried.

Within forty eight (48) hours after phosphating, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two coats of high quality baked enamel to SABS 783.

The minimum paint thickness after baking shall be 0,06 mm in diameter.

The paint shall have a minimum shock resistance of 25 kg/cm on 1 mm mild steel and a scratch resistance of 2 000 grams.

Powder Coated Finish

Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill-scale, grease and foreign matter to a continuous metallic finish.

Sand or shot blasting, or acid picking and washing may be employed.

The metal parts shall be pre-heated and then covered by a micro-structured paint powder applied electrostatically.

The paint shall be baked on and shall harden within 10 minutes at a temperature of 190°C.

The minimum paint thickness after baking shall be 0,05 mm.

The paint shall have a minimum shock resistance of 25 kg/cm on 1 mm mild steel plate and a scratch resistance of 2 000 grams.

Colour

The colour used shall correspond to the colour specified in the project specification.

If no colour is specified the colour shall be dark grey, code G12 of SABS 1091 on the outside and white on the inside or a light grey code G80 or G54 of SABS 1091 inside and outside.

Should metal hinged panels be used, these shall be finished in a lighter grey colour paint than the surrounding framework unless otherwise specified in the project specification.

Should stainless steel type panels be specified, these shall be brushed in 150 grit the grain orientated parallel to the side of the console.

Should aluminium type panels be specified, these shall be of the anodised satin finished type.

IDENTIFICATION LABELS

Material

Identification labels shall be installed for all control equipment.

The labels shall be in both official languages.

Engraved plastic or "IVORENE" type labels shall be installed.

The labels shall bear white lettering on a black background or vice versa.

Method of Labelling

Boards shall be supplied with the following labels:

Number and allocation of board -

Example: DB.S-G1

These labels shall be fixed to the outside of the board in a prominent position.

The lettering shall be a minimum of 10 mm high.

In each control board an identification label shall be installed on the front panel stating which equipment or group of control equipment is housed in that particular section or subsection of the board -

Example: POWER SUPPLY 24 V DC

Individual control components such as push buttons, switches, relays, contactors, etc., shall each have an identification label corresponding to the identification letter and/or code number shown on the schematic diagrams.

The function of the equipment and circuits shall be clearly identified.

Flush mounted equipment within doors or front panels shall be identified with labels fixed to doors or front panels respectively.

The labels for all equipment, installed behind panels shall be fixed to the chassis close to the equipment.

Fixing of Labels

Engraved labels shall be secured by means of brass nuts and bolts or slotted label holders.

A sufficient number of bolts shall be installed to prevent labels from warping.

Self-tapping screws will not be allowed.

EARTHING

The installation shall be earthed properly in accordance with the latest edition of SABS 0142, and the by-laws of the local authority.

All earth conductors shall be bare stranded copper conductors or stranded conductors with green and yellow PVC-insulation, unless specified otherwise in the project specification.

EARTH CONNECTION

A separate earth connection shall be supplied between the earth busbar in each rack/control board and the earth busbar in the main electrical board. These connection shall consist of bare, stranded copper conductors supplied along the same routes as the interconnecting supply cables or wiring. The size of the incoming earth wire shall be in relation to the main incoming power supply conductors complying with the requirements of SABS 0142.

Under no circumstances shall general connection points, bolts, screws, etc., be utilised for earthing purposes but it will be the responsibility of the *Contractor* to provide separate earth terminals or clamps.

All earth connections shall be tin-plated and fixed with approved ferrules. The entire connection shall then be soldered.

The earth conductors of all sub-circuits shall be connected to the earth busbar of the supply board.

The ends of all metal channels and cable trays containing cables and conductors under load shall be earthed to the nearest control board with copper strapping or 2.5 mm^2 stranded conductors.

Adjoining rack sections shall be connected at joints with copper strapping or 2,5 mm^2 conductors, unless the method of joining the racks is sufficient for earth continuity.

All metal conduits shall, where installed by the *Contractor*, terminate on the rack/boards or junction boxes.

Where this cannot be done the conduit end shall be earthed separately with a stranded conductor.

An earth conductor shall be installed in all types of flexible conduit.

The earth conductor shall be connected securely to the metal parts at both ends.

In order to avoid formation of earth loop currents in electronic circuits, printed circuit layouts must be designed such that a common earthing track or point is established.

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.

Feedback loops in earth potential tracks and stray capacitance between pointed tracks must be avoided in radio frequency (RF) in the VHF or UHF spectrum.

Common earthing bars or points should be utilised 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 insulated (by making use of an insulating transformer from the supply earth potential).

The resistance between the earth electrode and earth on electronic equipment shall be less than 2 ohms.

Any conducting material that has been anodised, 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.

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.

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.

The conductor size shall be determined according to SABS 0142, must be sufficient for that particular rack and must be soldered to the terminal(s) of the edge connector(s) on that rack.

All connections between racks or sub-racks for the conveying of signals in the VHF, UHF or microwave frequency range shall be made using co-axial cable with matching impedance.

Terminations of co-axial cable shall be in proper connectors (plugs and sockets) of the BNC or RG8U or equivalent type depending on the particular application.

CABLES

Cables shall generally be of the PVC-insulated type, individual cores of multicore cables being identified by means of distinctive colouring of the PVC-insulated material of the individual cores.

All cables shall be supplied and installed WITHOUT JOINTS unless written approval has been obtained from the Administration.

VOLTAGE RATINGS

All cables shall be suitable for the voltage to be applied between the conductors and between the conductor and earth.

All cables to be used in systems with a system voltage between 50 Volt and 500 Volt, shall have a volt rating of 600/1 000 Volt.

TERMINATION OF PVC-INSULATED, ARMOURED CABLES

All ends of PVC SWA PVC cables shall be terminated with approved glands ensuring a watertight connection between the sheath, gland and equipment.

In cases where copper earth conductors are joined to the armouring, special glands complying to SABS 150-1970, shall be used.

The glands to be used shall be constructed so that the armouring of the cable is clamped between two bevelled cores with a screw-clamp.

The cable gland shall be screwed to the gland plate or equipment and fixed with a locknut.

A neoprene or PVC shroud shall be used to seal the gland and sheath watertight.

Cable cores shall be connected to equipment with suitable lugs.

Exposed armouring shall be covered with bitumen-base paint.

CABLES IN FALSE FLOOR AREAS

Cables shall preferably be installed in the false floor space below equipment racks, control boards or control consoles if so provided.

Cables shall be installed in groups parallel and adjacent to each other in straight line and/or in groups at 90° to each other.

Generally the cables shall be installed directly on the concrete floor and groups shall be bound together by means of steel straps approximately 12 mm wide.

Groups of cables crossing each other at 90° shall be approximately 50 mm apart vertically.

For this purpose, the *Contractor* shall supply and install "O-LINE" or similar type cable trays manufactured and bent in the shape of a bridge spanning the lower group of cables.

The two cable tray approach section of the bridge shall be inclined at an angle of 30° to the horizontal.

Cable tray bridge sections shall be bolted to the concrete floor at both ends by means of 12 mm diameter "RAWL" or similar bolts and nuts.

CABLES FIXED TO WALLS AND VERTICAL DUCTS

Cables to be installed and fixed to walls and in vertical ducts, shall be clamped to galvanised "O-LINE" or similar type channels fixed to the wall face.

The "O-LINE" channels shall be installed at vertical distances not exceeding 600 mm and shall be secured to the walls by means of "RAWL"-bolts or by means of a self-drilling anchoring system.

Cables shall be arranged parallel and adjacent to each other and each cable shall be supported and fixed to the "O-LINE" or similar type clamps.

The size of the clamp (and the corresponding catalogue number) shall be determined from the diameter of the cables.

All cables larger than 35 mm^2 4-core shall be clamped to the "O-LINE" or similar channel by means of J type cleats.

Cables installed on horizontal distribution sections other than in false floor areas shall be installed on cable trays.

Cables for the installation of other services including communication systems and other low voltage systems (less than 50 V), shall be separated from power cables.

In vertical building ducts, a physical barrier shall be provided between power cables and cables for low voltage systems.

Where armoured cables are used for low voltage services, they shall be installed in separate cable trays or shall otherwise be at least 1 metre away form power cables.

Where unarmored cables are used for these other services, they shall be installed in separate conduits or metal channels.

IDENTIFICATION OF CABLES

All cables shall be identified at both ends and at all joints and as otherwise specified according to a code or number system.

These numbers shall appear on the drawings to be submitted when the installation has been completed.

Cables shall be marked with non-deteriorating bands with raised or punched numbers.

The marking may be done by means of lettering punched into aluminium foil.

The foil shall be wrapped around each respective cable and bound with aluminium tape.

The cables shall be marked as follows:

At both terminations.

At T-sections or four-way joints of cable trays and/or metal channels.

At entries to vertical ducts should cables extend up and down at the particular point of entry, the cables shall be marked directly above and below such a point of entry.

INSTALLATION OF CONDUIT SYSTEM

GENERAL

In general, the conduit for interconnecting wiring to various types of outlets for electronic installations shall be installed by the Electrical *Contractor,* unless specified to the contrary in the Project Specification.

Generally all interconnections between boards, consoles, sockets and power distribution equipment shall be done by means of PVC-insulated cables.

Conduit and fittings shall in general comply with the requirements of SABS 162, as amended.

OUTLETS

All accessories such as detector outlets, break glass units, microphone input points etc., shall be accurately positioned.

It is the responsibility of the *Contractor* to ensure that all accessories are installed level and square at the correct height from the floor, ceiling or roof level as specified.

It shall be the responsibility of the *Contractor* to determine the correct final floor, ceiling and roof levels.

DRAW BOXES

Draw boxes shall not be installed in positions where they will be inaccessible after completion of the installation.

All installed draw boxes shall be pointed out to the *Engineer* and the positions of all draw boxes shall be indicated on the "as installed" drawings.

WALL OUTLETS

Where more than one outlet is connected to the same circuit, the conduit shall be looped from one outlet box to the following on the same circuit.

Where a metal channel is used, the conduit may be installed from the channel directly to the outlet box on condition that the conductors can be looped from one outlet to the next without making any joints in the wires.

CEILING OUTLETS

Where the conduit end is used to support detectors, sirens, loudspeakers, etc., a ball-and-socket type lid shall be fitted to the ceiling outlet box in all cases where the conduit from the concrete or ceiling is longer than 500 mm.

In all other cases, a dome lid may be used.

Where equipment is specified as ceiling mounted it shall be fixed directly to the draw box, this shall be

done by a minimum of two screws screwed to the box or alternatively by screws fixed directly to the concrete ceiling.

FLUSH MOUNTED OUTLET BOXES

The edges of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface.

Where this is not the case, an extension box which ends flush with the surface, shall be screwed to the outlet box.

This method shall be used in partitions and cladded surfaces.

EXCESS HOLES

All excess holes in draw, distribution boxes, control boards, cable ducts or trunking, power skirting, etc., shall be securely blanked off to render the installation vermin proof.

Brass stopping plugs shall be used in conduit accessories.

All conductors shall be installed in conduits, cable channels (trunking) or powerskirting and shall under no circumstances be exposed to the atmosphere. Cable channels and powerskirting shall be of metal construction unless specifically approved otherwise.

SEQUENCE OF THE WORK

Wiring shall only be carried out after the conduit installation and plaster have been completed, but before painting has commenced.

No conductors shall be installed before the conduits have been cleaned of all debris and moisture.

CIRCUITS

Conductors that are connected to different control boards, shall not be installed in the same conduit.

In the case of power distribution, the wiring of one circuit only will be allowed in 20 mm diameter conduit with the exception of the wiring between control boards and fabricated sheet metal boxes close to control boards. In this case more than one circuit will be allowed.

LOOPING

All wiring shall be carried out according to the loop-in-system. If a conductor joint is found necessary in an isolated case, jointing will only be accepted in cable channels or draw boxes and not in conduits.

Conductor jointing shall be executed by approved ferruling properly covered with heat shrink.

NUMBER OF CONDUCTORS

The number of conductors that may be drawn through a conduit, shall comply with the requirements of SABS 0142.

DRAWING IN OF CONDUCTORS

When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted.

Care shall also be taken that the conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the durability of the conductor.

ELECTRICAL EQUIPMENT AND COMPONENTS, ELECTRONIC COMPONENTS AND CIRCUITS

GENERAL

Electronic components such as IC's shall be of a type and model obtainable in the RSA and not specifically designed for the equipment in which it is used.

The *Contractor* shall clearly indicate to the *Engineer* which of the equipment offered does not comply with this requirement before approval shall be granted.

RELAYS

The coil, contacts and operating mechanism of all relays shall be contained in a transparent, dust proof enclosure of plastic or other suitable synthetic material.

Relays shall be supplied with plug-in bases of "bakelite" or other insulating material.

Bases shall be fixed to the equipment rack, control board or console frame in a fashion to facilitate removal or insertion of the relay and enclosure.

Relays bases shall be fitted with wire-spring type retaining clips to ensure positive relay contact even when the relay is subjected to severe vibrations.

Relay contact ratings shall be sufficient for the current drawn through the contacts taking the impedance of the load into account.

PUSH BUTTONS

Impulse type push buttons shall be of robust construction and shall be suitably rated for the switching duty and for the control functions specified.

The push buttons shall be suitable for flush mounting in control boards, consoles or in outlet boxes in walls.

Push buttons shall be fitted with screw-on-retaining rings.

RED push buttons shall generally be used for tripping, stopping or switching of functions and GREEN push buttons for starting or switching on functions.

Push buttons installed in walls or on other non-metallic surfaces, shall be mounted in purpose-made flush or surface mounted boxes equipped with a mounting plate with slotted holes and a suitable cover plate.

Self-locking type push buttons shall be similar in construction to impulse type push buttons. When such a push button is depressed a second time, it shall cancel the original switching state.

Illuminated push buttons, key-operated push buttons, buttons plates, legend plates etc., shall be supplied as specified. Economy resistors shall be provided with illuminated push buttons.

Push buttons shall comply with the requirements of the relevant clauses of BS 3955, part 1 or VDE 0660.

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 function of push buttons.

INDICATING LIGHTS

Indicating lights to be installed on equipment racks, control boards and consoles shall be similar in construction to the shroud of push buttons, and shall illuminate internally when indicating a switching state.

The colour of the shroud shall be green and red respectively for indicating an "ON" and "OFF" switching state or any other colour specified for a particular control function indication.

PROTENTIOMETER TYPE CONTROLLER

Controllers shall be of the quadrant type with linear movement.

Each controller shall be fitted with a scale marked as specified with unit divisions indicated numerically.

The quadrant controller shall rotate about a swivel operating through an arc of approximately 90° with the "OFF" position at the bottom end nearest to the operator and the maximum at the top.

TESTING OF SYSTEM AND TRAINING

FACTORY ACCEPTANCE

A Factory Acceptance Test of the various components of the systems shall be provided on request.

COMMISSIONING

After installation and run-up, a commissioning and hand- over procedure shall be followed by the Sub-*Contractor* to demonstrate proper operation of the system, in accordance with this specification.

TRAINING

The Sub-*Contractor* shall be required to train technical personnel in the proper operation and maintenance of the system. A total of 4 people will be nominated for this purpose. Training shall be done on site. *Tenderers* shall indicate the time allowed for this purpose, but the minimum period acceptable will be 1 day.

It is the intention to obtain a very thorough understanding of the system. To this end, training shall be done in three ways:

Formal hands-on training sessions of the operating personnel in system operation, covering all software and hardware operational aspects.

During the installation phase, a person will be designated to be closely involved with the installation and commissioning process. The intention is not to interfere with the *Contractors*' installation team, but to observe in order to obtain the maximum possible information regarding the installation.

Software instruction

During these sessions the operators will be familiarised with the software regarding the generation of reports by the system, set-up of analogue limits, modification of displays, configuration, as well as other operational requirements, of the software.

DRAWINGS

The specification drawings are in diagrammatic form and are not manufacturing drawings and the dimensions given are only sufficient for tendering purposes or to enable the *Contractor* to complete his working drawings. Due allowance must be made in the tender for such items not shown or detailed on the drawings, but which are nevertheless necessary for the proper execution of the *Works* and operation of the system.

The *Contractor* shall submit for approval:

Builder's Work Drawings

Builder's work drawings shall include positions, sizes and masses of major pieces of equipment, as well as all other building requirements such as shelves, cupboards, etc., necessary for the successful installation of equipment and operation of the system.

Electrical Drawings, such as:

General arrangement drawings of the equipment in the relevant area.

Line Diagrams of each part of the system.

Interconnection Diagrams.

Cable and Equipment Schedules.

All cable routes shall be shown on the site plan drawings.

Two prints of manufacture/erection shop drawings for approval.

The *Engineer* requires two (2) weeks from the date of receipt to check drawings submitted. Drawings shall be submitted in sufficient time to permit the *Contractor* to meet his fabrication programme, since no claim for extension of the contract will be considered should drawings not be submitted timeously.

It is the *Contractor's* responsibility to ensure that all drawings conform to the specification and to correct any errors, omissions or deviations. If *Works*hop drawings differ from the specification, the *Contractor* shall make specific mention of each deviation in a letter accompanying the submission, giving the reasons for the deviations, and any cost implications, if any.

Should the drawing indicate work which does deviate from the specification and is not pointed out, the Consulting *Engineer* reserves the right to amend such *Works*hop drawings at any stage when the deviation is discovered i.e. even after installation, at the *Contractor's* expense.

Where it is necessary to consider the building and electrical details of the project when compiling *Works*hop drawings, the *Contractor* must refer to the detailed Architectural drawings produced by the Architect and the drawings of the electrical details produced by the *Engineer* Both these sets of drawings are in the possession of the Client.

The accuracy and practicability of all shop dimensions necessary for the manufacture and installation of the equipment remains the responsibility of the *Contractor*. Approval of submitted information shall not be construed as a complete check and shall not relieve the *Contractor* of his responsibilities as defined elsewhere.

VARIATIONS TO THE CONTRACT

The Sub-*Contractor* shall, upon a written request from the *Engineer*, price the variation intended to his *Works* within seven (7) days of such request.

Failing to submit prices to such variations within the stipulated period, may result in them being priced by the *Engineer* and issued officially as variation orders.

The *Contractor* shall state on his priced variations the extra time required to carry out the work intended. Should the *Contractor* fail to inform the *Engineer* of extra time required it shall be assumed that such work will be carried out within the contract period and no later claim for extension of time will be considered.

The *Contractor* shall perform no work that involves a cost implication or a variation in price to the original contract amount unless the *Contractor* is in possession of:

an approved variation order.

A letter of definite instruction from the *Engineer* advising him to proceed without the approved variation order.

MANUALS AND LITERATURE

At the stage of performance testing, the Sub-*Contractor* shall submit to the *Engineer*, three (3) copies of maintenance and operating instructions each containing the following:

A full set of electrical drawings of the final installation.

A full set of control drawings of the final installation.

Manuals as detailed in Clause 34.

Test certificates for the installed system.

All *Works*hop drawings of the system as installed.

Trouble-shooting check list and spare parts list.

All wiring diagrams.

Wiring diagrams are to be correct in every respect and checked before being submitted.

All the above relevant information shall be properly filed and indexed in appropriate files.

TESTS AND REPORTS

GENERAL

Where practical according to the discretion of the *Engineer*, complete electronic and other control units shall be assembled in the *Works*hop for preliminary tests. This shall be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results. It is in the interest of the *Contractor* to notify the *Engineer* when the installation reaches various stages of completion in order that he may inspect the installation and point out any discrepancies. These inspections shall be considered informal and under no circumstances will they in any part or in whole invalidate the requirements of the specification. Any costs incurred in correcting discrepancies shall be to the *Contractors* account.

PRE-FINAL INSPECTION

A pre-final inspection of the installation shall be made at the *Contractors* request at least seven days prior to the official testing and acceptance of the installation once the installation is, in the *Contractor's* opinion, complete and ready to operate. After this pre-final inspection the installation must be set into trial operation. The installation shall only be deemed ready for official acceptance subject to its having maintained the specified performance without any failure for a period of seven consecutive days. Upon completion of the installation and the trial run, the *Contractor* must conduct tests and submit the results to the *Engineer* for evaluation before requesting the *Engineer* to take first delivery of the entire, or any part, of the installation. The *Engineer* shall be informed 7 days in advance prior to the actual tests being done.

FINAL ACCEPTANCE

On the day of the first delivery inspection, the *Contractor* shall be ready and fully equipped to repeat the tests in the presence of the *Engineer*. The system will be considered for acceptance only after satisfactory tests of the entire system has been accomplished by a representative of the *Contractor* in the presence of the *Engineer*. The *Contractor* shall provide on-site services of an authorised technical representative of the manufacturer/s, to supervise all connections and fully test all devices and components of the complete installation as installed. The *Engineer* shall witness all tests conducted by the *Contractor* or the manufacturer/s in accordance with the final acceptance test plan. Properly calibrated standard test equipment shall be utilised to complete tests that shall confirm the compliance of the complete system with the requirements of the specification.

WARRANTY

All equipment and wiring supplied and installed under this specification shall be warranted from inherent mechanical or electrical defects for a period of 12 (twelve) months.

GUARANTEE OF INSTALLATION

The *Contractor* shall guarantee that the entire system complies with the major applicable codes and standards, as well as with the specified and implied qualities and that the operation of the system shall be proper and faultless.

The *Contractor* shall guarantee all system components in hardware and software and the whole of the installation against any defect of materials or workmanship for a period of 12 months (one year) after acceptance of the installation.

During the stated period of guarantee the *Contractor* shall replace free of charge all components failing or malfunctioning. However, system components damaged or stolen on site prior or after installation by negligence of the client shall be exempted from this guarantee.

CONTRACTOR'S LIABILITY IN RESPECT OF DEFECTS

Any defects or faults which may appear within 12 months from the date of completion of the installation due to materials or workmanship not being in accordance with the specification shall be made good by the *Contractor* within such period as may be determined by the *Engineer*

Should the Sub-*Contractor* fail to rectify the defects or faults within the predetermined period, the Client shall be entitled to rectify such defects or faults or to arrange for the rectification thereof and to recover from the *Contractor* any damages and costs as a result of the *Contractor's* failure to comply with these terms.

MAINTENANCE

The *Contractor* will be required to maintain the complete system in good working order for a period of twelve months after the installation has been taken over. The Sub-*Contractor* shall supply free maintenance during the one year guarantee period inclusive of spares and labour. The maintenance shall include standard maintenance during normal working hours (08:00-17:00) at three months intervals and a 24-hour service on request.

After the lapse of this twelve months period, the Sub-*Contractor* may be required to enter into a prolonged maintenance agreement in the form of a maintenance contract for a further period of one calendar year. The agreement will initiate before one calender year, and may subsequently be renewed for yearly periods.

The *Contractor* shall prepare and submit a pro-forma maintenance and service contract The contract shall be a formal service agreement signed by an authorised employee and shall include the monthly cost of the services to be provided and to what extent the price quoted will be subject to variation.

The service contract shall include the following minimum provisions:

To provide regular scheduled preventive maintenance and service of at least one man-day per three months period, i.e. at least four man-days per year, by trained service representatives of the *Contractor* or suppliers.

At each visit which shall be arranged in advance with the Client, a record of all maintenance carried out shall be kept. The time and date of visits shall be entered in a logbook, kept by the Client.

To check the mechanical soundness of all parts.

To replace all defective parts.

To clean all equipment.

To carry out a thorough system check with the use of all the testing equipment and instruments required. A detailed report comparing the system performance at the time of testing and at the time of handing over shall be prepared and handed to the Client along with comments.

To comment on improved system reliability and system design changes as it becomes available from the manufacturers, enabling the Client to keep up with the latest trends.

Entering into a prolonged maintenance and service contract shall in no way invalidate the one year guarantee and maintenance as stated above.

The *Contractor* must state the details in the schedules of this specification for the cost of the year maintenance, the prolonged maintenance over the following year period and over five years after the prolonged maintenance period has expired.

The *Contractor* shall keep adequate stocks of spares for the equipment offered, for a minimum period of ten (10) years and the submission of a tender will imply that the *Contractor* guarantees adequate stock for the minimum period.

REPAIR OF FAULTS

The Sub-*Contractor* shall respond on site within four (4) hours after notification of a system fault. The corrective action or maintenance shall, if necessary, occur during normal working hours immediately hereafter.

The technical staff and spares required for this fault rectification shall preferably be locally available in Kimberley and proof of this arrangement shall be supplied at tender stage.

MATERIALS AND PACKING

The successful *Contractor* is urged to order materials as early as possible as he will be held responsible for any delay in the delivery thereof. The *Contractor* shall be responsible for packing all materials and goods in a manner that will ensure that no damage thereto occurs in transit.

CERTIFICATE OF COMPLIANCE FOR ELECTRICAL INSTALLATION

On completion of the electrical parts of the installation, the Sub-*Contractor* must issue a certificate of compliance to the client as described in the Machinery and Occupational Safety Act, Act No. 6 of 1983 of the RSA (as amended).

ELECTRONIC EQUIPMENT

All equipment must be protected from damage or faulty operation resulting from external factors such as static electricity, induced voltages, magnetic forces, radio waves, lightning, etc. in accordance with SABS requirements (Note must be taken in particular of SABS 03 and 03 A with regard to lightning protection). All electronic equipment inputs from power points, telephone wires, antenna feeder cables and data or signal lines, must be provided with in-line protection. The products of manufacturers that carry the SABS mark or that have CSIR approval, must be used (Examples hereof are ZAPTRAP, CLEARLINE, COPA AND IRENCO).

Equipment sensitive to interferences and spikes in electrical power, variance in the voltage and frequency as normally occurs and which is inevitable in the electricity distribution network and the municipal supply to the building, must be equipped with the necessary stabilisers, over and under voltage protection equipment, suppressers, etc. Equipment must be manufactured and installed (inter alia be provided with suppressers), so that it shall not cause any interference in respect of other equipment, or have an effect on the working thereof. Fully installed equipment/systems must meet SABS requirements in so far as interference is concerned that may arise as a result of this equipment (Static electricity, induced

voltages, magnetic forces, radio waves and sound levels are included herein). The *Contractor* must submit full explanations of his methods in order to comply with all the aforementioned. The onus is on the *Contractor* to provide proof after installation that the applicable standard or specified values have been complied with and any adjustments/additional equipment shall be for his own account.

SPECIAL EQUIPMENT

Any special instruments, equipment, software, components or terminations that may be required during calibration, initiation or programming/reprogramming, must be provided as part of the contract.

ELECTROMAGNETIC COMPATIBILITY

As the buildings will house a conglomeration of equipment together with radio frequency equipment, the *Contractor* must design electromagnetic compatibility into the system and ensure that the one system shall not affect the other adversely when operating, e.g. when a hand-held two-way radio is used it should not interfere in any way with the rest of the equipment.

MAKING GOOD

The *Contractor* shall be responsible for making good of all damages, disturbances to the building installations, finished surfaces and other services or trades, which he or his employees may have caused. The *Contractor* will be responsible for keeping the areas where installation work is performed tidy. The *Contractor* shall remove from the site all rubble and litter resulting from the installation of the system.

MANUALS

Deviations or alternatives under this heading may be offered after consent has been given by the *Engineer*. Each type of equipment/system must be issued with three full sets of manuals in English.

Each set must contain the following sections and information:

The equipment and function must be identified.

The working thereof must be described in full.

The prescribed and acceptable conditions of usage.

All applications and procedures must be set out in full.

The function and operation of all controls, indicators and adjustable components must be described.

Components with factory codes, or marked in any other way unclearly or in a manner not well known, must be given with generally available equivalents.

Complete electric circuit diagrams, functional diagrams and explanations of components as well as programming of components must be provided.

Any special installation/mounting or initiation procedures must be explained.

An abridged version of the abovementioned, or stated otherwise, a "Quick reference guide" hereof, aimed at the end-user, must be provided in a durable plastic cover along with every system/item of equipment.

Comprehensive fault detection procedures and diagrams must be provided on both use and maintenance levels.

This information must enable any suitably qualified technician to undertake urgent repairs and/or maintenance of the equipment.

WORKMANSHIP

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the *Engineer*. Should any material or workmanship not be to the satisfaction of the *Engineer*, it shall be rectified at the cost of the *Contractor* and all rejected material shall be removed from site. The *Contractor* shall be responsible for the correct and complete erection of the installation. Inspection by the *Engineer* shall not release the *Contractor* from this responsibility.

Before the installation is handed over, the *Contractor* shall ensure that all paint surfaces are clean and undamaged. Final coats of paint may be applied on site immediately prior to completion.

TRADE NAMES

Tenderers are asked to take note that where trade names and reference to catalogues appear in this specification, this is for the purpose of determining a standard for the materials needed. If approved material is used other than that tendered on, price adjustments shall be made and amendment instructions be issued so as to confirm such adjustments.

COMPLETION OF CONTRACT

The contract will only be considered complete when all the conditions and requirements stipulated in this document and the following have been carried out:

The work completed to the satisfaction of the *Engineer* and the *Employer*.

The system commissioned and functioning as intended by this document.

All operating and maintenance manuals and drawings, as specified, have been submitted and approved.

All commissioning results have been submitted, checked and approved by the *Engineer.*

Only when the above requirements have been fulfilled will the issuing of a completion and acceptance certificate be considered.

Should the *Contractor*, in the opinion of the *Engineer*, unnecessarily delay the completion of the *Works*, the *Employer* reserves the right to make use of the *Works* beneficially without any recourse from the *Contractor*. Such action will in no way implement the commencement or alter in any way the guarantee period.

PART 2-DETAIL PROJECT SPECIFICATION

1. GENERAL

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

This Specification, called the Project Specification, forms an integral part of the Contract Documentation and covers the detail requirements regarding material, equipment, installation, testing and commissioning of the complete installation. It shall be read in conjunction with The Bill of Quantities and The Drawings. Any contradictions shall be referred to the Engineer for final ruling.

The installation shall be carried out entirely by the Electronics Contractor and shall manage all the specialist installations and ensure all installations are in working order. The Electronics contractor will be a sub-contractor of the Principal Contractor (Builder), and will be appointed by the Principal contractor.

2. SCOPE OF WORK

The scope of work is for the supply, delivery, installation, testing, commissioning and handing over in good working order of a fully functional and approved Access Control System, CCTV, Fire Alarm System, Telephone and Data System, Building Management System , Court Recording Technology System, PABX System ,X-Ray Machine , Walk through Metal Detector Machine and a Public Address System for the new the Keimoes Magistrates Court.

3. EXTENT OF WORK

The extent of the work includes the supply and installation of all equipment, peripherals, software and sundries necessary for the proper completion of the installation, although not specifically mentioned or specified, encompassing:

The supply and installation of all cabling, wiring, connectors, distribution frames, mounting brackets, etc., and all the equipment required by the *Contractor* to install a complete and neat installation to the *Engineers* approval, but exclude all conducting, outlet boxes and sleeves indicated on the relevant drawings.

The supply and installation of all material and equipment that is not specifically stated in this Specification, but which is nonetheless necessary to execute the Contract in accordance with the requirements of this Specification, site conditions, regulations, statutes, codes of practice and standard practice which are applicable to the installation.

3.1 Access Control & Security Installations:

The supply, installation and wiring of all the components of an Access Control System, including:

i. Biometric Card Combination Unit Readers

All readers on the system shall be capable of making intelligent access decisions and logging transactions, even if temporarily disconnected from the controller by the use of non-volatile memory in the readers. No loss of data shall be experienced during power failure. The system shall allow or deny access to the area according to the access rights of the cardholder. Disc readers shall be installed at all the entrances as shown on the drawings. Door switch push buttons shall be installed at Control Points as shown on the drawings. **All reader controlled doors shall unlock in case of fire.**

ii. Magnetic Operated Door Locks

Magnetic operated door locks shall be installed at all the doors where Access Control is required. Both the double doors shall have double magnetic door locks,

hence having controlled access through both doors, as indicated on the drawing. At all other double doors, only one door shall have a magnetic door lock. **These locks shall be interfaced with the Fire Control System, hence all controlled doors shall be opened automatically in case of a fire.**

iii. Computer Hardware and Software

The system shall be able to cater for the installation of all computer hardware and software necessary to execute the Contract in accordance with the requirements of the Employer.

iv. Court Recording Technology System (CRT)

The supply and installation of CRT system for two court rooms', the system shall conform to the Department of Justice specification attached.
Only authorised JAVS installers shall supply and install the CRT system, refer to list of approved specialist contractors that forms part of this contract.

v. Intercom , Voice Evacuation

The supply and installation of a standard 2 way intercom systems as indicated on drawings at the prison drop off area .

Supply and installation of paging microphone equipment as indicated on drawings.

vi. CCTV Installation

Supply and install high quality CCTV equipment (cameras, monitors and cabling) complete as indicated on drawings and bill of quantities.

The interfacing of the CCTV system with the Building Management system complete.

vii. X-Ray Machine

The supply and installation of checkpoint security: Small Baggage and Parcel Inspection. System shall have a tunnel opening of 60.0 x 40.0 cm. The unit shall offer a compact design with increased dimensions to enable a wider range of placement and screening of more diverse objects.

The unit shall have 160 kV generator which provides crisp, high resolution images with advanced software and superior processing technology.

The unit shall feature, 6 Color imaging that enables operators to view screened objects in 6 colors, with each color correlating to a specific range of Atomic Z-Numbers. 6 Color Imaging enables operators to achieve optimal material identification.

General Specifications

- Tunnel Size: 60.0 cm x 40.0 cm (W x H)
- Dimensions: 142.0 cm x 84.9 cm x 125.5 cm (L x W x H)
- Conveyor Speed: 23 cm/s Forward or Reverse
- Conveyor Height: 72.5 cm from Floor
- Conveyor Capacity: 165 kg Evenly Distributed Load
- Construction: Custom stainless steel frame / panels

Technical Specification
- Sensitivity: 40 AWG Typical, 38 AWG Standard
- Spatial Resolution: 1.0 mm Horizontal, 1.0 mm Vertical
- Steel Penetration 1: 39 mm Typical, 37 mm Standard
- Contrast Sensitivity: 24 Visible Levels, 4096 Grey Level

X-Ray Generator Specification
- Voltage: 160 kV Operating at 150 kV
- Tube Current: 0.7 mA
- Cooling: Sealed Di-Electric Oil Bath with Forced Air
- Duty Cycle: 100%, No Warm-Up Procedure Required
- Beam Direction: Diagonally Upward
- Detector: 1152 Channels in an L-Shaped Array

Computer Specification
- Processor: Intel Core2 Quad, 2.66 Ghz, 1333 MHz
- Memory: 2 GB RAM at 1333 MHz
- Storage: 2T HDD
- Video Card: 256 MB Video Card, Dual Digital Display
- Platform: Windows
- Backup: Uninterrupted Power Supply (20 min)

Video Specification
- Display Type: Single 19" LCD Color Monitors
- Display Resolution: 1280 x 1024; 24 bit/pixel Color

Environmental Specification
- Operating Temperature: 0°C - 40°C \ 32°F - 104°F
- Humidity: Up to 95% Non-Condensing

Standard Specification
- 6 Color Imaging
- Image Review (100 Images)
- 9 Quadrant Zoom
- Manual Bitmap Archive
- Atomic Z-Number Measurement
- Material Discrimination
- Auto Image Archiving (50,000 Images)
- Multi-Tier Accessibility
- Baggage Counter
- Network Ready
- Color and Black / White Imaging
- Organic/Inorganic Imaging
- Continuous Scanning
- Operator Training Program
- Continuous Zoom 2x to 32x
- Picture Perfect
- Density Alert
- Print Image Capable
- Edge-Enhancement Imaging
- Pseudo Color
- Geometric Image Distortion Correction
- Real-Time Image Manipulation
- High Penetration Function
- Real-Time Self Diagnostics
- Heavy Duty Roller Casters
- Reverse Monochrome
- Image Annotation
- Vertical Zoom Panning
- 24" LCD Monitors

• ASTM 10 Stepwedge/ASTM F0792-01E2 Test Case
• Climate Variable Operating Kit
• Entry / Exit Roller Tables, 0.5 m increment
• Extended Image Archiving (100,000 Images)
• Foot mat Operator Interlock
• Local Language Support (Arabic, Chinese, French, Spanish, and more)
• Radiation Meter
• Remote Configuration
• Screener Assist Threat Detection Software
• Supervisor Workstation
• Suspect Search Station
• Threat Image Projection Software

viii. Walk-Through Metal Detector Machine

Supply and install of a Walk-Through Metal Detector.
The walk-through metal detector shall accurately identify ferrous and non-ferrous weapons utilizing superior target detection.

The unit shall be equipped with a Digital Signal Processor (DSP) which offers greater sensitivity, noise immunity, metal discrimination, detection uniformity, and overall product reliability. The metal detector shall pinpoint targets the left, centre and right side of the body from head to toe.

The walk-through metal detector shall detect the smallest metals regardless of shape or orientation.
The unit shall have a LED light columns on the exit side of the walk-through to directly locate the threat object.

The unit shall have pacing lights with symbols “Wait” or “Proceed” for timed precision.

The unit shall have a counter that tracks the number individuals that have passed through the detector, alarm rates, and calculates alarm percentage.

The unit shall have analogue and digital filtering, that eliminates potential electrical interferences from the environment to ensure detection accuracy when the unit is placed in close proximity to the x-ray machine.

General Specifications
• Interior Dimensions: 58.4 cm x 76.2 cm x 203 cm (D x W x H)
• Outer Dimensions: 58.4 cm x 88.9 cm x 221 cm (D x W x H)
• Construction: Scratch Resistant Laminate Heavy Duty Aluminium

Standard Features
• 22 Screening Programs
• 33 Pinpoint Zones
• Analogy and Digital Filtering for Inference Supervision
• Audio / Visual Alarm
• Control Outputs
• Digital Signal Processor (DSP) Based Technology
• Directional counter with multiple settings
• Entry Pacing Lights
• Key Lock Security and Multi-Tier Access Codes
• Meets IP 55 IEC Standard
• Overhead Control Unit – LCD Display, Alarm Lights, LED Bar Graphs and Control Touchpads Battery Back Up Module
• Control Monitor Analyser (CMA)
• Desktop Remote Control with Zone Indication
• Floor Mount Kit
• Flat Test Piece (FTP)

• Operational Test Piece (OTP)
• Remote Control

Health And Safety
• Meets electrical safety and compatibility requirements for CE, FCC, CSA, IEC (CB certification), ICNIRP and IEEE
• Meets RSA and International regulatory requirements for electromagnetic safety
• Research indicates no adverse effects on pregnancy or medical devices

Environmental
• Operating Temperature: -4º F (-20º C) to +140º F (60º C)
• Humidity: Up to 95% Non-Condensing

3.3 Fire alarm:

i. The supply and installation of a Central Fire Detection System (multi state addressable type), connected to the relevant break glass units, smoke detectors, heat detectors, sirens, etcetera. A LCD display unit that can display the room description of each detector or break glass unit shall form part of each Detection Panel, in the area as indicated. The detection of devices in all the buildings shall be operated from one Main Control Board in the Security Server Room. The system shall be a Category P1 system.

ii. The supply and installation of a fire resistant, two-core transmission medium (PH30), connected to the detectors or break glass units.

iii. The supply and installation of a fire resistant, two-core transmission medium (PH30), connected to the sirens, etc., enabling an audible alarm during a fire condition.

iv. The interfacing of the central fire detection control board with the fire doors, as to automatically close all the fire doors, when a fire detection device is activated.

v. The interfacing of the central fire detection control board with the Access Control System, as to allow access through all the controlled doors, when a fire detection device is activated.

vi. The interfacing of the central fire detection control board with the Building Management System.

vii. The supply and installation of heat-, optical smoke detectors, break glass units and sirens, as indicated on the drawings.

viii. The supply and installation of a printer at the Fire Detection Control Board.

ix. The testing, commissioning and handing over of all the systems that form part of this Contract.

x. Supply and Install RF link to Upington Fire Department.

xi. Removing of existing equipment (sensors, brake glass units, ect.) where required.

xii. Supply and Installation of site plan / block plan adjacent main fire panel in control room. Plans shall be in a frame with glass protection.

xiii. Issuing a fire safety log book with the system

xiv. Ensuring the fire detection installation is compliant with South African standards by issuing a FSIB compliance certificate to the Engineer.

3.4 Building Management System

Design, supply and install a Graphics application programme. The programme shall include a create/edit function and a runtime function. An unlimited number of graphics definition files shall be able to be generated and executed. The graphics shall be able to display and provide animation and monitored points and conditions based on real-time data that is acquired, derived or entered.

Graphics shall be compiled by the BMS specialist for all the systems listed in the bills of quantities.

3.5 Telephone and Data Installation:

The supply and installation of a VOIP PBX system complete with MAN system, IP telephones and Switchboard.
Rerouting of existing TELKOM lines from existing court to new building.
Supply and install CAT7A FUTP wiring and RJ45 outlet points.
Supply and install WIFI AP devices.

4. GENERAL REQUIREMENTS

Tenderers shall supply full detail of the equipment software and system offered at Tender Stage and shall make full allowance for the design, supply, wiring, installation and commissioning of the total systems. Approval of equipment shall only be considered after samples have been approved and/or a working installation inspected. The cost of this inspection shall be for the *Contractors* account.

For calculating his Tender Price, the Tenderer must take the following into consideration:

[i] It is essential that a layout showing the equipment positions and any changes that the Sub-*Contractor* requires, shall be submitted for approval within one week after the Tender has been awarded. Changes at a later stage required by the *Contractor*, due to bad planning at this point in time, shall be for his own account.

[ii] During the time of installation there will be a number of other Contractors and workers on site and Tenderers must make ample allowance for co-ordination with others.

[iii] Unless otherwise specifically stated or arranged between the Contractors, all conduit, trunking, ducting, sleeves for cables, wire ways, etcetera shall be supplied and installed by the Electrical Contractor except for the last 1.5meter to the device.

5. WORKING DRAWINGS AND TECHNICAL INFORMATION

5.1 *GENERAL*

Only the main equipment and devices have been shown on the drawings and specific wiring or cabling between equipment has not been shown and is the Sub-*Contractor's* responsibility to determine and price.

It shall be the responsibility of the *Contractor* to ensure that the method of installing wiring or cabling, and the wiring used, between the equipment shall optimise the use of such equipment and that the optimum parameters specified can be obtained.

5.2 *SUBMITTALS DURING TENDER PERIOD*

All Tenderers shall submit the following information with their Tenders:

{a} Shop drawings showing the dimensions (size) and configurations of all equipment in the spaces allocated to these equipment.

{b} Any information that may have a direct effect on the Architectural or Structural features of the building, which features may upon the proposal of the *Contractor,* is subject to modification.

{c} Certification of ISO compliance for the equipment and cabling that will be used during the execution of the Contract.

{d} Brochures and specifications of all equipment offered for the execution of the Contract.

{e} Brochures and specifications of all software offered for the execution of the Contract.

{f} Full details regarding the proposed training to be given on the hardware, software and the operation and maintenance of the systems.

{g} A letter of compliance, also indicating which of the items offered does not comply with this Specification, and what the differences are and the implications thereof.

5.3 *SUBMITTALS DURING CONTRACT PERIOD*

The *Contractor* shall submit complete documentation showing the type, size, rate, style, catalogue number, manufacturer's names, photos, and/or catalogue data sheets for all items offered, enabling the *Engineer* to ensure compliance of the equipment with this Specification.

This information shall be submitted to the *Engineer* within fourteen (14) calendar days after award of this Contract and shall be subject to his approval.

Equipment must not be ordered without this approval.

Furthermore, the *Contractor* shall submit for approval the complete layout of the entire system, showing wiring and all equipment.

All equipment proposed as equal to that specified herein, shall conform to the standards herein.

For equipment other than specified, the *Contractor* shall supply proof that such substitute equipment does in fact equal or exceed the features, functions, performance and quality of the specified equipment. However the *Engineer* shall have the final decision of acceptance and his decision shall be final.

5.4 *SUBMITTALS ON COMPLETION OF THE INSTALLATION*

Detail "As-Built" transparent drawings of each part of the complete installation shall be submitted to the *Engineer* on completion of the installation.

Such detail drawings shall include complete and fully dimensional drawings of the equipment, full schematic diagrams of all circuits, terminal numbers, resistance values, capacities of all equipment, supply voltages, component characteristics and values, block diagrams and line diagrams, etc.

Three user manuals as specified in this Specification, bound in hard cover ring binders, shall be submitted to the *Engineer* on completion of the installation.

5.5 *APPROVAL OF DRAWINGS*

The approval of drawings shall not relieve the *Contractor* of his responsibility to supply the installation according to the requirements of this Specification, or to obtain the highest quality of craftsmanship possible.

6. **ENVIRONMENTAL CONDITIONS**

The installation shall operate satisfactorily in the following environmental conditions:

Average monthly maximum temperature (Summer condition)	:	38°C
Average monthly minimum temperature (Winter condition)	:	3°C
Absolute minimum temperature	:	-5°C
Absolute maximum temperature	:	42°C
Altitude above sea level	:	800m

(The aforementioned figures are the prevailing outside weather conditions)

7. **SUPPLY VOLTAGE**

The Low Voltage power distribution system in the building will be a 400/231 Volt ± 10%, 50 Hz AC supply.

All the equipment offered shall be able to function at this Voltage and at these tolerances.

All the equipment associated with the system shall be able to operate from the Low Voltage power distribution system for twenty-four hours per day, without overheating or degradation.

8. **SITE AMENITIES**

The Sub-*Contractor* shall provide and maintain temporary sheds and offices for site accommodation and storage facilities and should allow for all costs in this Tender, including the storage and safe keeping of materials, as well as insurance against loss or damage. These sheds must be removed on completion of the Contract. The Sub-*Contractor* will be responsible for removal of all own waist and rubbish, etc. during the scope of the contract.

9. **CONTRACT MANAGEMENT**

The Sub-*Contractor* shall provide adequate Contract Management and supervision during the installation, implementation and training period.

The Contract Management shall at least include:

[i] The provision of a full time Contract Manager for the management of employees during the complete installation, implementation and training period.

[ii] Supervision over the implementation of the systems.

[iii] Daily on site support until the system is operating effectively.

[iv] Weekly progress reports, including reports on items and incidents that may affect the implementation of the systems.

[v] Arrangements for and the training of the *Employer's* personnel.

10. **QUALITY CONTROL OF MATERIAL**

All materials shall be the best of their respective kinds described in the Specification and shall in every way be suitable for the purpose for which they are intended to be used.

All materials and equipment supplied shall fully comply with the requirements laid down in this Specification and the latest editions of the relevant SABS, BS, IEEE, CCITT, EIA, ISO and DIN specifications, or as otherwise specified.

Any item not complying with the following shall be substituted with an approved new component at no cost to the *Employer*, the acceptance or rejection of such work being determined by the *Engineer*.

The *Contractor* shall maintain adequate and effective quality control standards while manufacturing or installing the specified equipment.

The *Engineer* shall have the prerogative of inspecting the equipment in the *Contractor's* factory or on site, or to call for Manufacturer's test certificates of such equipment at any reasonable time. The *Engineer* shall ensure accuracy of dimensions, completeness, configuration, quality of workmanship, correct identification, proper use of and type of materials, equipment used and finishes to equipment.

Samples of all equipment must be submitted for approval before installation is commenced.

Such approval shall not relieve the *Contractor* of his responsibility for design, detail and dimension and shall in no way exonerate him from his liability to carry out the work in accordance with the terms of the Contract and Specification.

All such samples may be retained until completion of the Contract. All such samples must have labels securely attached thereto, designating the Contract by name and number, the name of the *Contractor* and any further relevant information.

11. WORKMANSHIP

The Sub-*Contractor* shall only employ competent Technicians and Artisans to erect the installation on site.

The Sub-Contract shall be executed with the best workmanship in a workmanlike manner, to the satisfaction of the *Engineer*.

The Sub-*Contractor* must maintain a high quality of workmanship and the *Engineer* shall be in full control to determine whether the installation or individual portions thereof are acceptable or not.

The Sub-*Contractor* shall be informed, in writing, should the equipment or workmanship not be to the satisfaction of the *Engineer* and thus not acceptable. In such a case the Sub-*Contractor* shall replace the equipment and/or perform the remedial work immediately, at the cost of the Sub-*Contractor*. All rejected material shall be removed from site.

The *Engineer* may, upon request of the *Contractor,* visit existing installations or prototype assemblies in the factory to determine that the workmanship is of the required standard.

If required, the *Contractor* shall provide the *Engineer* with equipment or facilities to examine all equipment and if necessary, test this equipment, to preclude malfunctioning of the equipment.

The Sub-*Contractor* shall be held liable for all damage to other services and if such damage is not repaired to the satisfaction of the *Engineer* within a reasonable period, the *Engineer* shall be entitled to appoint another Sub-*Contractor* to repair such damage and debit the account of the Sub-*Contractor*.

12. COMPETENCY OF WORKMEN

The *Employer* reserves the right to call upon the Sub-*Contractor* to remove any Workman or Representative whom, in his opinion, is incompetent or whose presence would have a deleterious effect on the progress of the *Works*.

13. TRAINING OF OPERATORS

A suitable qualified person, preferably one who has been involved with a similar installation, or the installation on site and who is conversant with the Afrikaans language, shall train and instruct operators employed by the *Employer* in operating the installation.

Such a person shall be available to instruct and train the persons involved by means of lectures and practical instructions on site for a period of one day minimum, commencing two days before the commissioning and handing over of the installation.

The *Contractor* shall supply full details of the proposed training to be given on all hardware and software as specified in this specification detailed as follows in the *Bill of Quantities*:

[i] Cost per person
[ii] Duration of the course
[iii] Course outline

The training cost shall cover training for two (2) persons on the premises of the *Employer*.

The *Contractor* shall supply additional training and support for any problems and questions asked by the trained personnel during the one year guarantee period.

14. TRAINING OF TECHNICAL PERSONNEL

If so instructed by the *Employer*, then a suitable qualified person, preferably one who has been involved with a similar installation, or the installation on site and who is conversant with the English and Afrikaans language, shall train and instruct technical personnel employed by the *Employer* in maintaining the functionality of the installation at the end of the guarantee period.

Such a person shall be available to instruct and train the persons involved by means of lectures and practical instructions on site with regards to operation, routine maintenance and inspection of the installation for a period of two days minimum, commencing two days before the commissioning and handing over of the installation.

Irrespective of the above, the *Contractor* shall perform revision training of the Technical Personnel six months after acceptance of the installation and the first training session. The *Contractor* shall determine whether the personnel are familiar with and adequately trained to utilise the installation fully and submit a report after this revision training to the *Employer*.

The Technical and 3 sets x Operational Manuals to be supplied by the Sub-*Contractor* must be explained fully to the personnel.

15. GENERAL REQUIREMENTS OF THE SYSTEMS

15.1 *EQUIPMENT MANUFACTURERS*

All references to Manufacturers, Supplies, model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

Equivalent equipment from other Manufacturers or Suppliers may be submitted for that specified, providing the submittals are of the same or higher quality, standards and performance, and conforms to this Specification.

15.2 *EQUIPMENT AND MATERIAL REQUIREMENTS*

All equipment and material shall be new and unused.

All equipment and material shall be designed for continuous duty without undue heating or degradation of function or performance.

All equipment, materials, accessories, and other facilities covered by this Specification or noted on the Contract Drawings, shall be the best suited for their intended use and shall be provided by a single manufacturer or, if provided by different manufacturers, recognised as compatible by both manufacturers (written proof/statement shall be provided by the manufacturers).

15.3 ***TERMINOLOGY***

The functions of the equipment or components of the equipment shall be indicated by means of identification labels.

Identification shall preferably be in the form of universally accepted symbols.

The terminology shall be in the English and Afrikaans language.

The Sub-*Contractor* shall submit a complete schedule of symbols and/or terms of the identification of equipment to the *Engineer* for approval, before any labels are engraved and installed.

15.4 ***ENGRAVING OF LOOSE EQUIPMENT***

All loose equipment and tools supplied under this specification shall be indelibly engraved in a suitable position with the words 'Keimoes Magistrates Court'.

16. ACCESS CONTROL

16.1 ***GENERAL***

This Specification is for the supply, delivery, installation, testing and commissioning of an Access Control System associated with the New Keimoes Magistrates Court. Where it deviates from any of the specifications listed or accepted as general practice, those deviations must be brought to the *Engineers* attention at Tender Stage.

16.2 ***BASIC SYSTEM***

The Access Control System shall basically consist of the following:

{a} Control panel / PC, magnetic door locks, biometric readers and all other devices as indicated on the drawings and schedules.

***NOTE*:** The system shall be capable of communicating with a desktop computer, which shall be installed under this Contract, to monitor movement of staff.

16.3 ***SYSTEM REQUIREMENTS***

The following are the basic system requirements, which requirements are the minimum and not exhaustive:

{a} The system needs to function properly so that proper access control can be accomplished in a sensible and logical way, without disruption of the flow of people entering or leaving the building.

{b} The system shall be designed in such a way that it is simple to operate and that no adjustments shall be required after installation.

{c} The equipment shall be manufactured in the RSA and all replacement equipment shall also be available in the RSA.

{d} Equipment offered shall have been installed in the RSA in a similar installation as the one specified, and shall have operated reliably and satisfactory for at least one year.

{e} All components for the system offered and installed shall be guaranteed to be available for a period of at least 10 years from the date of the Contract. A certificate of guarantee to this effect shall be submitted by the Supplier of such components, before ordering.

16.4 *EQUIPMENT SPECIFICATION*

This Specification is only for the major items of equipment incorporated in the system, as applicable.

16.4.1 Biometric/Card Reader Unit

16.4.1.1 Multiple On-line Readers

16.4.1.2 Biometric/Card Reader Mounting

- The reader shall cover the flush mounted round wall outlet box. Tamper-proof fixing screws or other approved fixing methods shall be employed to hold the reader in position.
- Readers mounted on surface of hollow, metal structures such as door frames, mullions or partitions shall be fixed by means of special clamp devices, which form part of the reader, or by means of drilled and tapped tamper-proof fixings.
- Cables leaving readers through back plates or hollow metal enclosures shall be protected with properly fitting grommets or other approved chafe protecting devices.
- Readers shall be installed at a maximum height of 1200 mm above finished floor level when mounted on a vertical surface.
- Readers shall be mounted in the immediate vicinity of the strike position of single doors and in a position next to double doors, on the strike side leaf of the double doors.
- The final mounting position of Readers must, however, be determined on site, taking site conditions into consideration.
- External readers shall have a weather proof casing protecting the reader from the elements.

16.4.1.3 Power Supplies of Readers

- The power supply for readers shall be in the form of low voltage supplies from a power pack placed in the ceiling void above the relevant door. Separate 230 Volt or other supplies will not be available at the reader positions.

16.4.1.4 Passive readers (Pre-programmed by Manufacturer)

- The reader shall be suitable for the pre-programming of data therein by the Manufacturer, to be read later by the readers specified and as such, the readers shall be supplied by the same Manufacturer.

16.5 *Electromechanical Locks*

16.5.1 General

This item is for the supply, installation and commissioning of all the Access Control Equipment associated with the doors of the Keimoes Magistrates Court, as indicated on the drawing, and includes the electro mechanical locks and all other equipment required to ensure a first class installation.

Tenderers should take note that it is a specific requirement that the Sub-*Contractor* shall provide full installation details to the *Engineer* and shall, at all times, ensure that the locks and other associated equipment are installed to his requirements and to the satisfaction of the *Engineer*.

16.5.2 **Types and Sets**

Security locks shall comprise the following lock types and lock sets only and shall be left-handed and/or right-handed to suit the door swings determined by the Sub-*Contractor* on site.

16.5.2.1 **Monitored double bolt mortise lock**

A lock type comprising a mortise lock fitted with double, spring-loaded bolts, one bolt (normally the smaller bolt) being a latch bolt for the main bolt.

16.5.2.2 **Reader Lock**

A magnetic lock system comprising of:

(a) an acceptable lock, fitted internally with a solenoid or operating in combination with an electrically operated striking plate;

(b) a reader mounted at the door at a maximum height of 1200 mm from the finished floor level.

16.5.3 **Construction**

The lock set shall be suitable for flush housing in the doors or frames supplied by others and shall not have any sharp edges or protrusions which can damage a person's clothing, hands or arms.

No components or part of the lock set shall be held in position by means of epoxy or contact adhesives.

Samples of lock types shall be submitted to the *Engineer*, for analysis, testing and acceptance **PRIOR** to the manufacture of any of these lock sets for this Project. Only written acceptance by the *Engineer* will be valid.

Failure to submit samples may result in rejection of equipment.

The housing shall be of robust construction, consisting of welded or pressed steel of adequate thickness.

A front cover plate is incorporated in the lock set housing construction, the cover shall be fixed to the lock set base plate by means of tamper-proof screws. The cover plate shall also be monitored by means of an internal micro-switch, which shall activate an alarm upon removal of the cover plate whilst the lock is in service.

The lock shall have an extended double cylinder of sufficient length so that the lock can be key operated from both sides of a standard door.

The withdrawing action of any bolt in a locking device, whilst being operated by means of a operating lever shall not be dependent on any spring-loaded device.

16.5.4 **Wiring**

The wiring in the lock set shall be neatly grouped and bound with spiral wiring harness binding and harness straps.

Loose wiring or wiring which can be disturbed when the casing is opened, is not acceptable.

Wiring in the lock shall be of the PVC covered, stranded, multi-core (automotive) type and shall comply with SABS 150 and shall be of 0.5 mm^2 minimum core size. Solid core wires are not acceptable.

The wiring tails which exit from the lock set shall be terminated in male crimping lug and shrouded ends so that wires on site can be terminated in female shrouded crimping lugs, so as to avoid the cutting of wires when a lock set is removed for maintenance purposes.

Wire ends shall be numbered with ring labels and a legend disc fixed to the lock set shall define the function of each wire.

The operating voltage of the lock set shall be clearly marked on the legend disc.

The *Contractor* shall be responsible for all wiring and cabling work associated with this Contract.

16.5.5 **Wiring Loops**

The electrical wiring between the lock or lock set on the door and the end box on the wall adjacent to the door frame shall run in a wiring loop of flexible tubing.

The one end of the wiring loop shall be suitably terminated for attaching it by means of screws to the surface of the door, over the opening where the lock or lock set electrical wiring emerges from the door.

The other end of the wiring loop shall terminate in a standard round outlet box, which shall be mounted flush with the wall, adjacent to the door frame.

The electrical wiring from the lock or lock set shall be without joints, shall run inside the wiring loop, and shall terminate in a suitably sized connection block in the outlet box.

A concealed type wiring loop between the hinged edge of the door and the inside edge of the door frame may be used. In this case the round outlet box shall be mounted flush with the wall.

The wiring loop type, the method of termination of the loop on or in the wall and the door, and the connection block in the end box shall all be acceptable to the *Engineer*.

16.5.6 **Electrical and Electronic Component Assemblies**

The electronic equipment circuit boards shall preferably be manufactured in the RSA and replacement unit shall be available off the shelf in the RSA. Equipment of which only a single unit has been imported or manufactured, will not be acceptable.

Equipment must be assembled in such a way that maintenance can be easily undertaken.

16.5.7 **Fixing of Locks to Building Elements**

Locks shall be mortised into standard, security and fire resistant doors. It shall not be possible to remove the lock from the door without first removing the front portion or cover plate of the lock set casing.

Fixings shall be robust and it shall be possible to remove the lock only with proper tools, after the lock has been isolated at the Control Panel. Any forced removal of the lock or lock set shall set off the alarm circuit and/or damage the lock beyond repair.

Locks and auxiliary equipment shall be mounted as shown on the drawings. Where the monitor facilities are required on site for the monitoring of remotely placed locks, the necessary conduits and wiring shall be installed by Access Control Contractor from the lock position to the particular monitor panel as detailed, in principle, on the drawings.

The Employer will determine the quantities and types of keys for the locks and lock sets on site to enable the Authorised User of the system to unlock alarm escape locks, and also to allow the Authorised User of the system to cancel any alarms, as specified earlier herein.

Each lock shall be supplied with one set of keys, but master key facilities shall be available.

Lock sets and any auxiliary equipment for the locks shall be fitted to the doors concerned strictly to the Specification of the lock and lock set supplier.

All lock sets shall be marked permanently on the lock set housing with the following information:

{i} Serial number
{ii} Year of manufacture

The supply voltage rating shall be marked on the circuit terminal legend disc inside the lock set casing.

17. INTERCOM AND VOICE EVACUATION SYSTEM

17.1 GENERAL INFORMATION

This part of the Specification is for the supply, delivery, installation, testing and commissioning of an Intercom and Voice Evacuation System, and must be read in conjunction with the Standard Specification. Where it deviates from any of the Specifications listed, or accepted as general practice, those deviations must be brought to the Engineer's attention at tender stage. Tenderers must take note of the following:

a) Control shall be from the Server Room as indicated on the drawing.

b) No wiring shall be surface, except where agreed upon with the Engineer. All conduit shall be provided by the Electrical Contractor.

c) Distribution boxes shall be provided if and where required.

d) The electronic equipment shall be installed in one free standing equipment rack. All this equipment shall be suitable for rack mounting with front access to the necessary controls.

e) The amplifier unit/s shall be manufactured in such a way to enable installation thereof in a standard 483 mm rack manufactured of extruded aluminium.

f) The console shall be properly ventilated and shall be dust, vermin and tamper proof.

17.2 BASIC SYSTEM

The Intercom and Voice Evacuation System shall basically consist of the following:

{a} PA amplifiers, fully equipped with evacuation signal generator, microphone pre-amp, volume control, etc., powerful enough to drive the loudspeakers that are offered to

the required sound level, with the building filled to capacity and with a background noise of at least 70 dbA.

{b} Wall and ceiling mounted loudspeakers.

17.3 SYSTEM REQUIREMENTS

The following are the basic system requirements, which requirements are the minimum and not exhaustive.

{a} The system needs to function properly so that the evacuation signal can be heard clearly at any place in the building, 10 dB above an ambient noise of 70 dbA.

{b} Speakers shall be spaced so that speech is clearly audible along the escape routes above a background noise of 70 dbA.

{c} The system shall be designed in such a way that it is simple to operate, that volume adjustments should not be critical to prevent feedback and should not require adjustment after installation.

{d} The frequency response of the system shall be between 170 Hz and 15 kHz, with no more than 3 dB fluctuation at the output power specified with 400 Hz as reference.

{e} At full power and at a rating 3 dB lower, the harmonic distortion shall not exceed 1% with 1 kHz as reference.

{f} The hum and noise level shall not be audible at any output and shall not exceed minus 60 dB at the output power specified.

{g} The working potential of all cables and conductors on the output circuits of amplifiers shall be 100 V RMS balanced to earth, for full modulation.

{h} All microphone cables and conductors on the input circuits of amplifiers shall be of the double conductor, double screened type, shall be balanced to earth and of an impedance that matches the equipment.

{i} The brightness of all indication lamps shall be such that they are clearly visible under normal ambient lighting conditions. The voltage at the terminals of each lamp shall not exceed the rated voltage of the lamp under working conditions.

{j} The equipment shall comply with the relevant requirements of SABS SV 106, but need not bear the SABS mark.

17.4 EQUIPMENT SPECIFICATION

17.4.1 GENERAL

This Specification is for the major items of equipment incorporated in the system as applicable, and should be read in conjunction with the Drawings.

17.4.2 AMPLIFIER

The amplifier/s shall be power amplifiers

These units shall be in accordance with the following minimum, general requirements:

{i} Rack - mountable.

{ii} 240 W RMS output power at 100 V into a 42 ohm load **(Note: <u>not</u> music power)**

{iii} Freq. Response : 40Hz - 16 kHz ± 2 dB at 20% and 80% of rated output.

{iv} Distortion : Less than 1% at rated output at 1,000 Hz.

{v} S/N Ratio : 80 dB

{vi} Output to be short circuit protected.

The amplifier/s shall be capable of delivering an output power of 40% higher than the power required to drive all loudspeakers, as specified.

Provision shall be made to adjust this value to an optimum level to suit the environmental conditions on site.

The output circuitry shall not be damaged if the load is changed between open and short circuit, or if one of the conductors of the wiring system is connected to earth.

The hum and noise level at the output power specified shall not be audible and shall not exceed -75 dB.

It is the sole responsibility of the Tenderer to ensure that the number of amplifiers offered is correctly sized for their specific application.

17.4.3 **<u>SWITCHING MODULE</u>**

This shall be a rack mountable unit equipped with all the required switching circuitry, or may form part of the amplifier/s. Basic requirements are as follow:

{i} Input : 4 Inputs *ie* Microphone, Siren module, fire alarm & background music (Radio/Tape Deck/CD)

{ii} Output : 3 Zones, individually or in any combination, and also an “All Call” selection.

{iii} Selection : Controlled from the desk mounted, remote microphone units,, positioned as indicated on the drawings.

The power loss through this switching panel shall be less than 1 dB and shall be accomplished by utilising solid state driven relays.

The CD, tape deck or radio set shall be supplied by others.

17.4.4 **<u>CONTROL UNIT</u>**

This item is for a desk mounted control unit, located at the point from where all the control functions shall be selected.

The control box shall be neat in appearance and constructed to blend in with the rest of the PA equipment.

Before any construction commences, the Contractor shall submit neatly, professionally prepared layout drawings and wiring diagrams for approval.

The control unit shall be equipped with:

{i} On/off key-switch with "Power On" light.

{ii} Input selector switch for Microphone, Siren and background music positions.

{iii} “All Call” and zone selection push buttons for 18 zones.

Switching from one position to the other shall not be heard over the loudspeakers.

The cable for the control wiring from this unit to the equipment rack shall terminate in a screw-on multi plug on either end and shall have at least 500 mm slack. Only a coded, stranded, multi-core cable shall be allowed.

17.4.5 **LOUDSPEAKERS**

As it is the sole responsibility of the Tenderer to provide a system ideally suitable for these applications, the following requirements regarding the loudspeakers shall not be regarded as exhaustive, but as minimum requirements only. However, any deviations from these requirements shall be clearly indicated at tender stage.

{i} The speakers shall be small, dust proof, indoor type loudspeakers ,flush mounted in suspended ceilings (200 mm max deep), or surface mounted against ceiling slab.

{ii} The speakers shall be mounted at positions as decided by the Contractor, so as to ensure good sound quality and uniform sound distribution.

{iii} To determine the optimum speaker positions, Tenderers are allowed to take scale measurements from the attached drawings. However, should there be any uncertainty, the Engineer shall be contacted at tender stage.

{iv} The loudspeakers shall be capable of producing a SPL of 90 dB at 1m.

HORN SPEAKERS SHALL NOT BE ALLOWED.

Speakers shall have a frequency response of not worse than 160 - 10,000 Hz.

A 100 Volt line shall be used throughout and each speaker shall be equipped with a high quality transformer and shall be adjusted to provide the required SPL for the position where the loudspeaker is installed.

17.4.6 **EVACUATION SIGNAL GENERATOR**

This signal generator shall produce the standard 2-tone "whoop and wail" evacuation signal. The evacuation tone shall only be heard once the power to the control base is turned on and the siren position selected.

17.5 **WIRING**

Wiring of the speakers shall be in a loop system to ensure that a break in the line shall not have an effect on any loudspeaker i.e. the circuit shall be fed from both ends.

Cabling to the loudspeakers shall be with stranded, high quality, two core 1.5mm² PVC cable with positive polarity indication markings. Wires shall not be soldered onto loudspeaker terminals, but shall be made off by crimping wiring terminals onto the wire, which shall then terminate onto the loudspeaker terminals.

No T-offs shall be allowed. Only approved connector blocks may be used, which shall be neatly installed in the conduit outlet box behind the speaker.

Cables shall be adequately sized to ensure a volt drop of less than 5% at full power, *ie* not less than 95 V at any speaker terminal at 1 000 Hz.

17.6 INSTALLATION

The equipment shall be placed on shelves in the Server Room, where indicated on site. Cabling between the control base amplifiers shall be neat and tidy. Slack shall be allowed for to enable equipment to be withdrawn out of their positions for maintenance purposes.

17.7 TESTING AND COMMISSIONING

After installation, the total system shall be tested in the presence of the Engineer. The Contractor shall supply all test equipment as requested by the Engineer for these tests.

The test shall consist of at least the following:

{a} **Syllable Articulation Test**: This test shall be conducted to determine the degree of understanding and shall consist of a syllable articulation test in which 100 syllables shall be pronounced at random and the number of correctly heard syllables, in various positions along the escaping routes, shall be recorded. A percentage syllable articulation of less than 70% at 30%, 60% and 100% volume shall not be accepted.

{b} **Siren Test**: This test shall be conducted at the same volume settings as for the speech test and the siren should be heard clearly throughout the building, with special attention given to isolated places, such as toilets, archives , store rooms, etc.

18. FIRE ALARM SYSTEM

The system shall be a commonly known "Addressable System", *ie* with addressable detectors and break glass units.

18.1 SYSTEM REQUIREMENTS

The following are the basic system requirements, which are the minimum and not exhaustive.

a) The system needs to function properly, so that a fire in any place in the building can be detected before it gets out of hand and before extensive damage is caused.

b) Detectors shall be optimally spaced and break glass units positioned for easy access along escape routes, while audible and visual sirens shall be spaced for total coverage.

c) The system shall be designed in such a way that it is simple to operate and that no adjustments shall be required after installation.

d) The equipment shall be manufactured in the RSA and equivalent replacement equipment shall also be available in the RSA.

e) Equipment shall have been installed in the RSA in a similar installation as the one specified and shall have operated reliably and satisfactory for at least one year.

f) All components for the system offered and installed shall be available for a period of at least 10 years from the date of the Contract. A Certificate of Guarantee to this effect shall be submitted by the Supplier of such components, and supplied to the Employer.

g) If the system offered is software driven, then the software program shall be burnt into EPROM, after all parties agree that the system is operating in a satisfactory manner. Backups of software shall be supplied to the *Employer,* for future use.

h) Devices shall be grouped into zones as indicated on the fire engineers drawings and each zone shall be wired separately. A wiring fault in one zone shall thus not disable any other zone or device throughout the building.

18.2 SYSTEM OPERATION

18.2.1 ACCESS CODES

The system shall be designed to operate at 4 security levels. These levels are defined as follows:

Level 1: No access code required - normal operator functions
Level 2: Access code required - maintenance functions access
Level 3: Access code required - commissioning functions access
Level 4: Access code required - supervisor functions access

Access codes shall be allocated and entered into the panel by the Supervisor, who shall have the ability to change codes at any time. Facilities shall be provided for entering operator names against each access code.

18.2.2 OPERATION

The system shall be designed to operate with the minimum of operator training. Basic fire alarm functions shall be completely self-explanatory, and shall be understood by a person with no training. The occurrence of a fire alarm shall indicate all relevant text and zone information, without Operator intervention.

Neither the operation of a fire or fault signal, nor a keyboard operation carried out by an Operator, shall inhibit or delay in any way the receipt of additional alarms.

Should any part of the system be isolated, disabled, or placed in maintenance mode, a lamp on the front of the panel shall illuminate to indicate the abnormal status of the system.

18.2.3 FIRE OPERATION

An alarm received from a fire sensor or other device shall cause the following actions to occur immediately:

a) Common Fire lamps to illuminate
b) Zone/super zone lamp to illuminate
c) Display to indicate in text:
   (i) **FIRE**
   (ii) Zone Number
   (iii) Detector Number
   (iv) Exact location
d) Panel buzzer to sound continuously
e) Common sounders to operate
f) Zone sounders to operate
g) Required control functions to operate
h) Remote text or lamp displays to operate
i) Graphics computers to indicate alarm status

- Pressing the "Accept" key must silence the alarms, except the panel buzzer, which must sound intermittently for 0.5 seconds, every 20 seconds.

- Pressing the "Reset" button shall reset the system to normal monitoring status.

- Should an alarm condition still exist after resetting, the above sequence of events shall be repeated.

18.2.4 FAULT OPERATION

A fault signal received from a fire sensor or other device, or from the panel or battery charger, shall cause the following to occur immediately, where appropriate.

a) Common Fault lamps to illuminate
b) Zone/super zone lamp to illuminate
c) Display to indicate in text:
   (i) **FAULT DESCRIPTION**
   (ii) Zone Number
   (iii) Detector Number
   (iv) Exact location

d) Panel buzzer to sound continuously
e) Common sounders to operate
f) Required control functions to operate
g) Remote text or lamp displays to operate
h) Graphics computers to indicate alarm status

- Pressing the "Accept" button must silence the alarms. The visual alarms are to remain. In the event of more than one fault signal occurring simultaneously, then the text display must rotate between the alarms.

- Should a fire alarm occur while a fault is displayed, then the fire alarm must replace the fault signal, which must restore after the fire alarm has reset.

- Pressing the "Reset" button shall restore the system to normal. Should a fault condition still exist, then the above sequence of events shall be repeated.

18.3 SOFTWARE CONTROL

18.3.1 GENERAL

The system shall at all times be under software control.

18.3.2 AUTO CONFIGURATION

Upon switch-on, the System shall, automatically and without manual intervention, go into a fully operational status. Automatic configuration shall include:

a) Be fully functional (Fire and Fault)
b) All device addresses present to be recorded in memory
c) All device types to be recorded in memory
d) Devices to be automatically calibrated
e) Common fire lamps must operate
f) Common sounder outputs (2) must operate
g) Common fault output must operate
h) Display must operate

18.3.3 MANUAL PROGRAMMING

Additional configuration data in order to tailor the system to the specific application must be able to be programmed into the system. It shall be possible to program the system via the panel keypad, and by means of an external computer. In both cases, it shall be possible to save the program to disk.

18.3.4 STORAGE OF SOFTWARE

All software, both the operating program and the configuration data, shall be held in solid state memories. In particular, software shall not be held on magnetic tapes, disks, or any device requiring mechanical moving parts.

3.4.1 OPERATING PROGRAMS

The operating program must be held in permanent, non-volatile, read-only, EPROM memory, which shall not be erasable or alterable. Each EPROM shall be permanently labelled with a part number, and a version and issue number, which shall be traceable to a software manual. The operating program shall provide all auto-start and self-programming features to provide an operational system, without any manual programming, as described above.

3.4.2 CONFIGURATION DATA

All Configuration data shall be stored in non-volatile, EPROM read-only memory, which can be electrically erased for editing purposes. The EPROM used shall retain all programmed data, even when the system is completely powered down.

Printed circuit mounted batteries, such as lithium cells, for retaining memory contents, are not acceptable. All configuration data must be able to be edited through the keyboard.

18.4 ADDRESS LINE

18.4.1 POLLING SYSTEM

The Fire Detection System is to incorporate a polling system, which polls each sensor individually and transmits information from each sensor to the Control Unit, or instructions from the Control Unit to each sensor.

The panel software shall make all decisions based upon the information received from each sensor and line device. No sensor or other line device shall make alarm decisions on its own.

The panel is to instruct each sensor or line device in an alarm state to switch on it's LED and, where applicable, it's remote LED. Even when a sensor is in alarm state, it shall continue to send variable information to the control unit, indicating changes in the smoke or heat level.

The idle value of each sensor shall be individually monitored and updated at regular intervals by the panel software, in order to compensate for contamination and environmental conditions.

System polling time shall be 3 seconds or less for each complete scan of all devices attached. Polling time shall remain at a fixed time, irrespective of the number of devices attached to a line. The panel software must be able to send self-test instructions to each fire sensor, and monitor the results.

18.4.2 SENSOR WIRING

A 2-wire circuit shall be used for power and communication between the panel and the sensors. Up to 127 sensors and line devices must be able to be connected to each line. It must be possible to add additional devices anywhere in the line at a later date, without affecting the addresses of existing sensors, or existing system configuration.

The wiring shall be arranged as a class "A" return loop and the system must be able to feed from both ends of the loop in the event of a wiring fault. The circuit must be able to accept tee-off's with full monitoring.

Field wiring must be protected from open and short circuits by means of line isolators. These isolators must sense a short circuit, and disconnect the portion of line with the wiring fault. Up to 16 line isolators must be able to connect with each line.

The system must be able to operate with up to 3000 metres of 2-core wiring. This represents a total of 6,000 metres of individual conductor length. Wiring must be screened, and must be sized to comply with the Systems Manufacturer's requirements. All screens must be continuous, and must be earthed at the control panel only.

The System Manufacturer shall provide a Wiring Manual, and the Tenderer shall prove that the proposed wiring complies with the system requirements.

18.4.3 SYSTEM CONTROL

All communication shall be under the control of the control panel, which shall sequentially poll each device in turn and authorise communication.

No device shall communicate with the control panel without authority. The control unit must be able to read information from a device or send instructions to a device.

18.4.4 DEVICE ADDRESS

Each device on the address line shall be uniquely identifiable by the Control Unit. This must be achieved by pre-setting the address of each device by means of a dip-switch.

Removal of a sensor head or base from the ceiling shall not affect any other sensors in the system, which must continue to function normally. The dip-switch is to be a sealed unit, with self-cleaning, gold-plated contacts, and rated for the life of the system.

It shall be a positive action lever switch and to ensure long-term reliability, shall be located in the sensor head.

The address setting must be unaffected by distortion caused by uneven ceilings, and must be guaranteed to retain it's address for the life of the system.

A dual-tab system must be used with the address of each sensor being labelled on both the sensor head and base, arranged so that it is possible to see at a glance that the head and base match.

18.4.5 DEVICE IDENTIFICATION

The identification of each type of address unit and each type of sensor (i.e. ionisation sensor, heat sensor, sprinkler switch, etc.) must be transmitted to the panel on each polling scan.

18.4.6 DEVICE STATUS

The condition of each sensor or other line device, including the state of it's circuit, it's calibration and the level of contamination must be transmitted to the panel on each polling scan.

18.4.7 NUMBER OF DEVICES IN ALARM

There shall be no limit to the number of devices which may be in alarm simultaneously.

When a sensor is in alarm, a led in its base shall flash. In this state, its variable analogue output must continue to function, and it shall continue to report its analogue status to the panel.

18.5 SYSTEM FEATURES

18.5.1 ALARM DECISIONS

All alarm decisions shall be taken by the Control Panel, after checking the data from each device several times. No decisions shall be taken by any sensors.

Fire alarm response times for automatic sensors must be less than 10 seconds. Manual call points must cause a response in 3 seconds. Fault and maintenance signal response times, including pre-alarm decisions, must take between 20 and 100 seconds, depending upon the type of event being monitored.

It must be possible to program an alarm verification feature to individual sensors or devices. In these cases, the above times are from the verification of the alarm.

18.5.2 DEVICE SENSITIVITY

Sensitivity of each sensor is to be individually adjustable from the Control Panel.

Four levels of adjustment are required for each device. All sensitivities shall comply with the requirements of specifications BS5839, BS5445, and EN54.

18.5.3 ALARM VERIFICATION

A facility shall be provided in the panel software for applying an Alarm Verification Feature (AVF) to individual sensors, zones of sensors, or globally to all sensors.

Upon receipt of an alarm, the AVF shall check that the alarm remains for 20 seconds before confirming it.

The default state shall be "AVF off".

18.5.4 AUTO CALIBRATION

The system shall check and automatically adjust the calibration of each analogue sensor on a regular basis, to compensate for changes caused by environmental contamination, voltage fluctuations, and ageing. This action shall take place every 24 hours and shall ensure that the sensitivity of each device remains constant, even when contaminated.

When the maximum calibration adjustment of a sensor is reached, the panel must indicate a "Maintenance Required" signal for that sensor. The type, calibration, sensitivity and status of each sensor must be able to be displayed at the panel on the LCD display.

18.5.5 SENSOR SELF-TEST

Analogue sensors shall incorporate a built-in, self-test function, which can be activated by the Control Panel. Every 24 hours, all sensors must be instructed to carry out the self-test routine.

The self-test feature in the sensors must be so arranged that it simulates the ingress of smoke, and causes the sensor to respond appropriately. The panel is to monitor the result from each sensor, and pass or fail each unit based upon a software algorithm.

The test shall involve the operation of all active components in each smoke sensor, and must not use secondary components reserved for the test function, as this would defeat the purpose of the test. After the test is done, the panel must print out a list of any devices which failed the test. Reporting on devices, which passed the test, is not required.

Manual initiation of the self-test via the panel keyboard shall be possible.

18.5.6 LINE MONITORING

Addressable lines shall be monitored for short circuit, open circuit and earth leakage.

A single open circuit shall result in all devices continuing to operate normally, with the panel indicating a line fault.

A single short circuit shall cause a maximum of 20 devices (sensors or call points) in the system to be disabled, with all remaining sensors functioning normally. This is to be achieved by the use of line isolator units. The panel must indicate a line fault, and must report the addresses and location of the disabled devices.

18.5.7 LINE ISOLATORS

Line isolators shall be located at intervals on the sensor line. In the event of a line short circuit, the isolators on each side of the short must open, and isolate the faulty section of wiring.

The system shall be able to support up to 16 line isolators per loop.

All isolators shall be under software control. In maintenance mode, it must be possible to open or close isolators manually from the panel for test purposes.

18.5.8 PANEL CAPACITY

The capacity of each address line shall be 127 addressable devices. These shall be input devices, such as smoke sensors, or output devices, such as sounders or relays.

The capacity of the Central Control Panel shall be four (4) lines, providing up to 508 addressable devices. It must be possible for panels to be interconnected to provide additional lines, as required. Each panel must support up to 512 addressable programmable switched outputs. These shall be either voltage-free contacts, solid-state outputs, or 24 Volt monitored sounder outputs, or a combination of these types.

It shall also be possible for one satellite panel to control the outputs in another satellite panel.

18.6 DEVICE TYPES

Control units shall be able to accept the following addressable devices on the address lines.

a) Ionisation smoke sensors
b) Optical smoke sensors
c) Heat sensors
d) Break-glass "call-point" units
e) Line relays
f) Line sounder drivers
g) Interface units
h) Line isolators
i) Conventional detectors
j) Extinguishing Gas control unit
k) Very early warning Smoke detectors
l) Linear beam smoke detectors
m) Ionisation sensors - Intrinsically safe
n) Heat Sensors - Intrinsically safe
o) Interface units - Intrinsically safe
p) Manual call points - Intrinsically safe

18.7 DEVICE IDENTIFICATION

During initial start-up, the panel must automatically identify every device on the address lines and record this information in memory. The following devices must be recognised by the panel:

a) Ionisation sensor (analogue)
b) Optical smoke sensor (analogue)
c) Heat sensor (analogue)
d) Break-glass "call-point" unit
e) Sprinkler flow switch
f) General interface
g) Security interface
h) Conventional detector interface
i) Gas control unit
j) Very early warning Smoke detectors
k) Line relays
l) Linear beam smoke detectors
m) Line sounder drivers
n) Ionisation sensor (analogue) - Intrinsically safe
o) Heat smoke sensor (analogue) - Intrinsically safe
p) Break-glass "call-point" unit - Intrinsically safe
q) Interface unit - Intrinsically safe

The panel must then check the sensor and device types on every subsequent scan, and indicate a type-fault signal should a device at a particular address be changed to a different type.

18.8 DEVICE STATUS

Each addressable device must be polled by the panel at least every 3 seconds. Analogue status and equipment condition shall be read and stored in the panel on every scan.

Software algorithms shall assess the varying status of each device, and indicate the following conditions:

a) For Analogue Addressable Sensors:

(i) Sensor healthy/Status normal
(ii) Fire alarm
(iii) Pre-alarm
(iv) Sensor contaminated
(v) Sensor faulty
(vi) Incorrect type of sensor
(vii) Faulty calibration
(viii) Sensor removed

b) For Addressable Interface Units:

(i) Device healthy/Contact status normal
(ii) Fire alarm
(iii) Fault: Contact wiring open circuit
(iv) Fault: Contact wiring short circuit
(v) Fault: Interface unit circuit
(vi) Incorrect type of interface unit
(vii) Interface unit removed

18.9 ALARM AND MAINTENANCE THRESHOLDS

The alarm thresholds of each analogue sensor shall be adjusted individually and automatically in accordance with it's idle status, so that the sensitivity of each sensor will remain constant even when contaminated, or subject to fluctuating supply conditions. The above shall also include pre-alarm thresholds, and maintenance signal thresholds.

18.10 SENSOR CONTAMINATED SIGNAL

Should a sensor become contaminated to the point where the software can no longer re-calibrate the device, the panel must indicate a "Maintenance Required" signal for that particular sensor. This shall be an unambiguous signal, separate from the "Pre-Alarm" signal.

The software shall have the facility for the "Maintenance" status to be displayed automatically, or alternatively, to be logged to memory, for later printout by a Service Technician.

18.11 SENSOR "NEAR-SERVICE" REPORT

The software shall cater for a facility for identifying sensors that are within 10% of being contaminated. It shall also be possible to print a report upon request.

18.12 PROCESSOR MONITORING

A hardware "watchdog" circuit shall be provided on the Central Processor Module. In the event of a microprocessor failure, the watchdog must cause an auto reset of the microprocessor.

Failure of the processor to restart shall cause a "Processor Failed" lamp to illuminate, and a buzzer to sound continuously.

The panel shall incorporate a permanent counter which records the number of "watchdog" restarts.

18.13 SIGNALLING AND ANNUNCIATION

.13.1 GENERAL

Fire, Fault, Maintenance and Pre-alarm signals shall be indicated visually and audibly in the Control Unit.

The indications must be arranged so that the different warnings are clearly distinguished. (*ie* amber for fault, red for alarm).

The internal audible signalling device may be the same for all alarms, but either tone variation or time switching shall be used to differentiate fire and fault signals.

Outputs shall be provided for audible alarms, control functions and connection for printer. In addition, outputs shall be provided for remote text display units, and remote operation units.

.13.2 ZONING

The panel shall have 128 zones indicated digitally, and 80 zones indicated by means of LEDs. The zones must be fully field programmable.

It must be possible to randomly allocate, by software, any device or sensor, from any line, to any zone.

.13.3 PANEL INDICATORS

All visual indicators shall be LEDs and no incandescent lamps are to be used.

The following LEDs must be provided:

a) Zone Fire
b) Definable Alarm
c) Supply Healthy
d) Supply Faulty
e) Common Alarm
f) Pre-Alarm
g) Common Fault

h) Maintenance
i) Processor Failed
j) Device Isolated

.13.4 PANEL DISPLAY

The panel shall have a plasma display of 2 lines, each 40 characters in width.

This is to be a bright text display, clearly visible from a distance of 4 metres. In addition, the text must be able to be clearly read from an angle of 45 degrees to the left or right of centre.

The first line must give the following information:

a) Alarm Type
b) Zone Number
c) Sensor/Device Number

The second line must be field programmable to provide a user-defined message for each sensor. The panel must have memory capacity for a message of 40 characters for each sensor connected to the system.

.13.5 PANEL CONTROLS

The panel shall incorporate a touch-button keypad with the following functions:

a) Numeric keyboard
b) System Reset button
c) Alarm Accept button
d) Alarm Sound button
e) Lamp Test function
f) Function buttons for maintenance/commissioning.

.13.6 COMMON OUTPUTS

The control panel is to be fitted with a number of common outputs, as described below. These outputs must operate in the event of a signal from any sensor or device on the system.

.13.7 ALARM SOUNDER OUTPUTS (FIRE)

The panel must incorporate 2 common monitored sounder outputs for bells or electronic sounders. These outputs must operate on receipt of a fire signal from any source, and must go off when the "Accept" button is pressed.

The sounder field wiring must be monitored for open/short circuit.

Each output must be rated 1,0 Amp at 24 Volts dc.

.13.8 ALARM CONTACT OUTPUTS (FIRE)

One common voltage-free changeover contact shall be provided. This must operate on a "Fire" condition, and is to remain "On" until the system is reset.

The contacts shall be rated at 2 Amps at 24 Volts dc.

.13.9 ALARM CONTACTS (FAULT)

One common voltage-free changeover contact shall be provided. This must operate on receipt of a fault signal from any source, and is to remain "On" until the system is reset.

The contacts shall be rated at 2 Amps at 24 Volts dc.

18.14 PROGRAMMABLE OUTPUTS

Each panel shall be able to operate up to 512 software-programmable outputs. It shall be possible to mix different type of outputs to obtain the functions required.

These outputs are for system configuration and must be able to be programmed to operate from any zone, sensor or function, individually or in any combination.

It shall also be possible to program the outputs to include functions such as time delays, de-energise on system reset, de-energise on alarm accept, co-incidence operation, steady operation or pulsing operation.

18.14.1 PROGRAMMABLE RELAYS

These shall be software programmed relays with voltage-free, single pole change-over contacts.

The relay contacts are to be silver plated, and rated at 2 Amps at 24 Volts dc.

18.14.2 PROGRAMMABLE SOUNDER CIRCUITS

These shall be software programmed monitored outputs for operating audible alarms such as bells or sounders.

These outputs are to monitor the sounder field wiring for open and short circuit. Each output must provide 24 Volts dc, at 1.0 Amp, for driving the sounders.

18.14.3 PROGRAMMABLE OUTPUT SWITCHES

These shall be software-programmed open-collector transistor outputs for operating low current devices such as lamps, LEDs and relays.

Each transistor output must be rated at 50 milli-Amps at 24 Volts dc.

18.15 DATA OUTPUTS PORTS

The panel shall have parallel and serial data outputs with compatible software for the operation of auxiliary system devices such as remote display panels, remote mimics and graphics computers, and printers.

Each panel must support up to 8 data ports, as described below.

18.15.1 RS232 PORTS

These shall be serial ports conforming to the RS232C standard, suitable for communication up to 10 metres. Baud rate, word size, stop bits and parity shall be adjustable.

Communication shall be bi-directional, and support handshaking.

18.15.2 RS485 PORTS

These shall be serial ports conforming to the RS485 standard, suitable for communication up to 2000 metres. Baud rate, word size, stop bits and parity shall be adjustable.

Communication shall be bi-directional, and support verification.

18.15.3 RS422 PORTS

These shall be serial ports conforming to the RS422 standard, suitable for communication up to 2000 metres. Baud rate, word size, stop bits and parity shall be adjustable.

Communication shall be bi-directional, and support verification.

18.15.4 PRINTER

A digital printer shall be provided as standard. The printer shall provide a hard copy of the following:

(i) Alarms
(ii) Faults
(iii) Maintenance data
(iv) Panel operations
(v) Outputs operated

Operation of the printer shall not inhibit, delay or affect the functioning of the detection polling system in any way. The printer shall indicate the following information for each alarm or signal:

(i) Type of Alarm or Fault
(ii) Device Type
(iii) Device Number
(iv) Zone Number
(v) User message (40 characters)
(vi) Day
(vii) Date
(viii) Time

It shall be possible to set the printer to print either alarms, faults, panel operations or outputs operated, or all of these, or any combination.

18.16 ALARM MANAGEMENT

18.16.1 GENERAL

The system shall have extensive alarm management facilities built into the software, to provide flexible configuration to suit the present application as well as for future updates to the building.

All alarm management and configuration functions shall be under software control, and must be able to be programmed and edited directly through the panel keyboard.

In addition to the above, facilities shall be provided for programming on a desktop computer, and for saving configuration programming to disk.
Programming must be held in memory, even during a panel power-down.

18.16.2 OUTPUT DEVICES

The following optional output devices must be available to connect to the system to provide the required control functions.

Programmable panel relays
Programmable panel transistor outputs
Programmable panel sounder outputs
Programmable line relays
Programmable line sounder drivers
Programmable line gas control units

18.16.3 INPUT/OUTPUT MAPPING

The system must support 254 inputs, 512 outputs, and 200 input-output programmed software links. It must be possible to program the outputs to be randomly allocated for operation of any of the following:

a) Any Zone
b) Any Sensor
c) Any Line Device
d) Any Panel function
e) Any Panel operating button
f) Any combination of the above

18.16.3 COINCIDENCE OPERATION

It shall be possible to program any of the outputs so that it must only operate upon an alarm from any 2 sensors in the programmed group.

18.16.4 SILENCING OPERATION

It shall be possible to program any of the outputs to operate in either "Silencing" mode or "Non-Silencing" mode.

In "Silencing" mode, the relay or output shall deactivate when the "Alarm Accept" button is pressed, or when the "Reset" button is pressed.

In "Non-Silencing" mode, the relay or output shall be deactivated only when the "Reset" button is pressed.

18.16.5 ACTIVATION DELAY

It shall be possible to program any of the outputs to activate after a delay period from receipt of the control signal.

This delay shall be 0 - 17 minutes, in 1 second acceleration.

18.17 SENSORS AND LINE DEVICES

18.17.1 GENERAL

Sensors and other line devices shall operate on a 2 wire circuit for both power and two-way communication between the device and the panel. Each device or sensor must be uniquely identifiable by the control panel. This is to be achieved by pre-setting the address in the sensor head.

All sensor circuits shall be conformally coated to provide protection from moisture and dust.

Sensors shall mount to a twist-lock base. The base shall be common to all sensor types and it shall be possible to interchange sensors from one base to another without special tools or equipment.

Both surface mount and recess mount bases must be available.

18.17.2 IONISATION SENSOR

The Ionisation Fire and Smoke Sensor shall be an addressable, analogue unit, which continuously measures the products of combustion in the air, and gives a proportional analogue output. It shall meet the requirements of specification EN54 Part 7.

The sensitivity of each sensor shall be individually adjustable from the Control Panel. It shall be possible to measure and display each sensor's sensitivity at the Control Panel.

When contamination causes a sensor's sensitivity to shift, the panel shall recalibrate to compensate. When contamination becomes excessive, the panel shall indicate a "Sensor Maintenance Required" signal.

The sensor shall be a dual-chamber type, fully compensated for temperature, humidity and barometric changes. The radioactive source shall be less than 1 micro-curie of Americium 241, and shall comply with all Atomic Energy Agency requirements.

A light emitting diode (LED) on the base must illuminate when a sensor is in alarm. Terminals shall be provided for remote LED indication.

18.17.3 OPTICAL SMOKE SENSOR

The Optical Smoke Sensor shall be an addressable, analogue unit, which continuously measures the smoke level in the air, and gives a proportional analogue output. It shall comply with the requirements of specification EN54 Part 7.

The sensitivity of each sensor shall be individually adjustable from the Control Panel. It shall be possible to measure and display each sensor's sensitivity at the Control Panel.

When contamination causes a sensor's sensitivity to shift, the panel shall recalibrate to compensate. When contamination becomes excessive, the panel shall indicate a "Sensor Maintenance Required" signal.

The sensor shall be an optical light scattering type sensitive to visible smoke and to be stable under all environmental conditions. The internal test and calibration circuits shall use the same optical elements as the smoke sensing circuits, to ensure reliability. A light emitting diode (LED) on the base must illuminate when a sensor is in alarm. Terminals shall be provided for remote LED indication.

18.17.4 HEAT SENSOR

The Heat Sensor shall be an addressable, analogue unit, which continuously measures the temperature of the air, and gives a proportional analogue output.

It shall comply with the requirements of specification EN54 Part 5. The sensitivity of each sensor shall be individually adjustable from the Control Panel. It shall be possible to measure and display each sensor's sensitivity at the Control Panel. Sensitivity must be 58°C – 82°C.

It shall be possible to set each heat sensor individually into "Standard" mode, or "Rate-of-Rise" mode, from the Control Panel via the keyboard.

A light emitting diode (LED) on the base must illuminate when a sensor is in alarm. Terminals shall be provided for remote LED indication.

18.17.5 CALL POINT UNITS

The Call Point shall be an addressable "Break-glass" unit which mounts to a wall mounting box. Breaking a glass panel shall operate the alarm.

Call points must bear the legend "FIRE - BREAK GLASS", and shall be moulded in red plastic. Dimensions shall be 80 x 80 mm, and the unit shall be suitable for surface mounting.

A light emitting diode (LED) must illuminate when a call point is in alarm.

Removal of a call point shall not cause disconnection of the wiring, and shall not interfere with the remaining devices on the on the line.

18.17.6 INTERFACE UNITS

The Interface Unit shall be an addressable device, which plugs in to a pre-wired wall mounting box. It shall monitor the status of an external voltage free contact.

The Interface Units are to be suitable for connection to an external contact (or contacts) by means of a pair of wires.

The wires between the interface and the contact are to be monitored for short circuit and open circuit. The Interface Unit must be able to report to the panel whether the contact is open or closed, and whether the wiring is in a normal, open or short circuit state.

In addition, Interface Units must report the type of contact being monitored i.e. Fire, Sprinkler, Auxiliary, etc. Interface units are to be mounted in a moulded plastic box, size 115 x 115 mm, and are to be suitable for surface or semi-flush mounting.

A light emitting diode (LED) must illuminate when an Interface Unit is in alarm. Terminals must be provided for a remote LED.

Removal of an Interface Unit shall not cause disconnection of the wiring, and shall not interfere with the remaining devices on the line.

18.17.7 CONVENTIONAL DETECTOR INTERFACES

The Conventional Detector Interface unit shall be an addressable device, which plugs in to a pre-wired wall mounting box. It shall connect conventional fire sensors of all types into the addressable fire detection system.

Conventional sensor interface units shall operate on a 4 wire circuit, two wires for the addressable system and two wires providing power for the conventional sensors.

Each interface unit is to be suitable for connection to up to 20 conventional sensors by means of a pair of wires. The wires between the interface and the sensors are to be monitored for open circuit, and sensor removal. The interface unit must be able to report to the panel whether the sensor is in a normal or alarm condition, whether the sensor is removed, and whether the wiring is in a normal, open circuit or short circuit state.

Interface units are to be mounted in a moulded plastic box, size 115 x 115 mm, and are to be suitable for surface or semi-flush mounting.

A light emitting diode (LED) must illuminate when an interface unit is in alarm. Terminals must be provided for a remote led.

Removal of an interface unit shall not cause disconnection of the wiring and shall not interfere with the remaining devices on the line.

18.17.8 LINE ISOLATOR

The line isolator shall be designed to connect into the sensor line, and monitor the line for short circuit. In the event of a short circuit occurring, the line isolators on each side of the short circuit are to disconnect and isolate that portion of line from the system, enabling the remainder of the system to function normally.

Each line isolator shall be under software control of the panel, but must not remove a line address from the system. It must be possible to selectively open or close line isolators from the panel when in maintenance mode.

Line isolators shall mount to a twist-lock base. Bases shall be available in surface or recessed models.

A light emitting diode (LED) must illuminate when an isolator is in an open or isolated condition.

18.17.9 INTRINSICALLY SAFE ANALOGUE SENSORS

A range of intrinsically safe analogue addressable sensors and line devices must be available for connection to the system address line. These devices must be approved by a certified test laboratory.

The following devices must be available:

a) Intrinsically safe analogue ionisation smoke sensor
b) Intrinsically safe analogue heat fire sensor
c) Intrinsically safe addressable interface unit
d) Intrinsically safe addressable manual call point unit

18.18 MAGNETIC DOOR RELEASE UNIT

The Magnetic Door Release Unit shall consist of two parts, a doorplate, which is fitted to the respective door, and a solenoid unit, which is positioned on the adjacent wall.

The solenoid, housed in a die cast aluminium back box with thermoplastic cover, shall be controlled by the fire alarm system so that it is continuously energised, thus magnetically attracting the doorplate and holding the door open. A relay shall interface the door release unit with the fire alarm control panel.

The solenoid unit shall have a manual release button that can be fitted to either side, as to enable the doors to be closed without operating the fire alarm system.

The magnetic door release unit shall have a minimum holding force up to 40 kg. The solenoid unit shall include a spring action as to eliminate residual magnetism.

18.19 MAINTENANCE FUNCTIONS

The system shall continuously monitor the condition of every field sensor or device, and all wiring, and give a signal, should any failure or calibration error occur.

The system shall be self-testing and self-adjusting. Extensive maintenance and test facilities are to be built into the software for the use of field maintenance technicians.

AUTOMATIC MONITORING

Each device shall be continuously monitored for the following:

a) Existence on line
b) Calibration
c) Contamination
d) Circuit failure
e) Device type
f) Line noise
g) Short circuit
h) Open circuit
i) Earth leakage

Should any of these parameters be out of specification, the panel shall give a fault signal, and a text description of the nature of the fault, as well as the location of the faulty device.

VISUAL MONITORING

It shall be possible to visually monitor, on the display screen, the status, in real-time, of each device connected to the system. All information transmitted from each device to the Control Panel shall be able to be called to the screen, and watched as it changes; for example, with the entry of smoke into the sensor or the change of a sensor from one type to another.

ARCHIVE FACILITY

The system shall be able to store the last 500 events. It shall be possible to print out these events selectively in either fire alarm events, fault events or panel operations.

DEVICE STATUS REPORT

It shall be possible to print out, upon demand, a technical level analogue status report of all devices and sensors attached to the system.

For each device, this report shall give the following information:

a) Calibration references
b) Base type
c) Head type
d) Analogue status

SYSTEM CONFIGURATION REPORTS

It shall be possible to print out, upon demand, the following information about each zone and device:

a) Device numbers
b) Device types
c) Zoning
d) Input-output mapping
e) Device messages

ZONE TEST MODE

It shall be possible to set the panel into a mode which will allow one person to test all sensors in a zone, without inhibiting any other zones.

Should an alarm occur in any zone other than the one being tested, then the panel is to cancel the test and respond to the alarm in the normal manner. If smoke remains in a sensor for longer than 90 seconds, the panel shall cancel the test and respond to the alarm in the normal manner.

When in this mode, all sensors in the defined zone will be tested using smoke, heat or freon. The panel is not to operate any relays or audible alarms, and is to record in memory each alarm as it occurs. At the end of the test, the panel shall print out, upon request, all devices that operated, and a list of all devices that did not operate.

ISOLATION OF INPUTS

It shall be possible to isolate any sensor or device, or any zone of sensors or devices. This shall be done via the panel keypad, and shall be subject to the entering of an access code.

It must be possible to connect key switches to the panel, programmed to isolate devices by address or zone, for those devices that are regularly isolated.

An isolated device must not cause any alarm or fault signal to be generated in the panel.

Isolating a device must not affect or inhibit any other device on the line.

If any device or group of devices is isolated, a lamp on the front of the panel, stating "isolated" must illuminate.

ISOLATION OF OUTPUTS

It shall be possible to isolate, for maintenance purposes, any or all of the system outputs. This shall be done via the panel keypad, and shall be subject to the entering of an access code.

If any device or group of devices is isolated, a lamp on the front of the panel, stating "isolated" must illuminate.

If sounder outputs are isolated, the panel buzzer must operate continuously

18.20 BUILDING MANAGEMENT SYSTEM

18.20.1 SCOPE OF WORK

i. The Building Management System (BMS) shall be a proven system of a reputable specialist company and shall form part of the Electronics sub-contract. The specialist subcontractor shall have at least 10 years' experience of a BMS of similar size and complexity.

ii. The BMS shall be Modbus & BACANET compatible and shall be fully integrated and installed as a complete package by the BMS specialist.

iii. The BMS architecture shall consist of products of a manufacturer regularly engaged in the production of BMS and shall be the manufacturers latest standard of design.

iv. In general, the BMS shall perform the following functions:

- Fault monitoring & controlling of the HVAC system (*Modbus*).
- Fault monitoring & controlling of the CCTV system (*Modbus*).
- Interface between Fire Detection and Air-conditioning and Ventilation systems.
- Fault Monitoring only of other building services:
  Fire sprinkler pump sets (dry contacts)
  Fire detection & voice evacuation system (dry contacts)
  Intruder Alarm system (dry contacts)
  UPS (Modbus)
  Generator (Modbus)
  Paraplegic Lift (Dry Contacts)
  Access Control (Modbus)
  Gas suppression systems in 2x sever rooms (Dry Contacts)
- General Alarm and Report logging and printing.

v. The operator Interface shall be by means of a personal computer workstation for command entry, information management, network alarm management and database management functions. The minimum requirements in respect of PC hardware shall be:

- Intel Core i9 9900K - 3.60GHz, Turbo @ 5.00 GHz, 8 Core , Socket 1151, 16MB Cache
- MSI/Asus/Gigabyte Z390 Motherboard
- GeForce RTX 2080Ti 11GB Graphics Card
- 16GB DDR4/3600MHz Ultra High Performance Memory
- 480GB M.2 NVMe SSD
- 960GB 2.5" SATA III SSD
- X72 120mm All-In-One Closed Loop CPU Cooler
- Dual SP120L PWM and adjustable noise levels Software
- Other hardware to include hard drive back-up system, serial and parallel parts, keyboard, 32" LED Monitor, LAN communications & WIFI.

The operating system software shall be Windows 10 Professional, as well as complete operator workstation software package.

One laser jet alarm printer and one laser jet reports printer shall be provided as part of the contract.

vi. A graphics application programme shall be supplied. The programme shall include a create/edit function and a runtime function. An unlimited number of graphics definition files shall be able to be generated and executed. The graphics shall be able to display and provide animation and monitored points and conditions based on real-time data that is acquired, derived or entered. Graphics shall be compiled by the BMS specialist for all the systems.

vii. The user shall be able to navigate from and between various systems and sub-systems.

viii. The BMS shall be capable of storing trend and point history data for all analogue and digital inputs and outputs. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name. A trend viewing ability shall also be provided.

ix. The gateway controllers for the VRF air-conditioning system shall be microprocessor based and procurement shall be coordinate with the mechanical contractor be ordering , the Sub-Contractor shall allow for this in his pricing.

x. The BMS shall be complete with all wiring and wire ways required for the installation.

xi. A dial in and dial out facility shall be provided.

xii. The BMS operator interface (PC and hardware) shall be installed in Security Control Room on the ground floor.

xiii. The BMS will provide the functions as specified in the tables below:

ITEM NO	DESCRIPTION	NUMBER REQUIRED	FUNCTION
1	**Hide Away AIR HANDLING UNITS (Court Rooms)**	**…4. NO TOTAL**	
1.1	Supply air	1 no per AHU	Temperature
1.2	Return air	1 no per AHU	Temperature
1.3	Space	1 no per AHU	Temp
1.4	Fire signal status	1 no per AHU	On (Alarm)/Off
1.5	Supply air fan status	1 no per AHU	On/Off
1.6	Supply air fan trip status	1 no per AHU	On (Alarm)/Off
1.7	Filter dirty pressure switch status	**1** no per AHU	On (Alarm)/Off
1.8	Space temperature set point	1 no per AHU	Temperature adjustment

1.9	Supply air fan start/stop	1 no per AHU	Start/Stop
2	**OUTSIDE AIR**		
2.1	Fresh Air ambient	1 no for Building	Temp
2.2	Humidity	1 no for Building	Humidity
3	**VENTILATION FANS (SA & EXH)**	**4… NO TOTAL**	
3.1	Fan status	1 no per fan	On/Off
3.2	Fan trip status	1 no per fan	On (Alarm)/Off
3.3	Fan start	1 no per fan	Stop/Start
3.4	Fire signal status	1 no per fan	Stop
4	**PUMP (FIRE WATER)**	**2… NO TOTAL**	
4.1	Pump status	1 no per pump	On/Off
4.2	Pump trip	1 no per pump	On (Alarm)/Off
4.3	Pump start	1 no per pump	Stop/Start
5	**SINGLE AIR CONDITIONING**	**39 NO TOTAL**	
5.1	Evaporator status	1 no per Evap	On/Off/fault
5.2	Condensing unit status	1 no per Cond	On/Off
5.3	Evaporator trip status	1 no per Evap	On (Alarm)/Off
5.4	Condensing unit trip status	1 no per Cond	On (Alarm)/Off
5.5	Space	1 no per Room	Temperatures
6	**COLD WATER SUPPLY**		
6.1	Incoming municipal water	1 no	Pressure
6.2	Incoming municipal water	1 no	Pressure Alarm
7	**ELECTRICAL MAINS**		
7.1	LV Incoming switches status	1 no	On/Off/Trip (Alarm)
7.2	Current drawn per phase	3 no	Amps
7.3	Voltage at each LV switch	1 no	Volts
7.4	Voltage at each LV switch	1 no	Volts Alarm

8	**STANDBY GENERATOR**		
8.1	Main switch status	1 no	On/Off/Trip (Alarm)
8.2	Current drawn per phase	3 no	Amps
8.3	Voltage	3 no	Volts
8.4	General fault condition	1 no	Fault (Alarm)
9	**UPS**		
9.1	Main switch status	1 no	On/Off/Trip (Alarm)
9.2	Current drawn per phase	3 no	Amps
9.3	Voltage	3 no	Volts
9.4	General fault condition	1 no	Fault (Alarm)
10	**ACCESS CONTROL**		
10.1	Biometric reader status	25 no	Faulty(alarm)
10.2	Magnetic lock status	25 no	Faulty(alarm)
10.3	Magnetic lock bypass (Break glass)	25 no	On /Off
11	**LIFTS**		
11.1	Lift motor status	1 no	On/Off
11.2	Lift motor trip	1 no	On (Alarm)/Off
11.3	Lift motor start	1 no	Stop/Start
12	**Intruder Alarm**		
12.1	System status	1 no	On/Off
12.2	System fault	1 no	Alarm
13	**FIRE & EVACUATION ALARM**		
13.1	Fire Alarm	1 no	Alarm
13.2	System fault	1 no	Alarm,
14	**GAS SUPPRESION**		
14.1	Server 1 Fire Alarm	1 no	Alarm
14.2	Server 1 System fault	1 no	Alarm,

14.3	Server 2 Fire Alarm	1 no	Alarm
14.2	Server 2 System fault	1 no	Alarm,
15	**CCTV**		
15.1	System fault	1 no	Alarm,
15.2	Surveillance Display duplication	1 no	Full control

18.21 TELEPHONE AND DATA SYSTEM

18.21.1 Background & Introduction

Bidders with Telecommunication and Internet Phone Configuration experience to provide a VOIP Hosted PABX Solution. Tenders must have 10 years' experience (similar scale) in Internet Phone setup and configuration. The objective of this bid is for the appointment of a service provider to provide a VOIP and least cost routing solution for the Magistrates Court. The system shall for a fully in-sourced hosted PBX/VoIP solution that will provide the Magistrates court with the following advantages:

- Reduce operational costs through by leveraging existing technologies already in place.
- Reduce maintenance costs through a single provider that covers all offices.
- Improve user experience by providing a true unified communications experience.
- Reduce telephony costs by providing least cost routing and zero cost for on private network calls.
- Reduce telephony wastage through better control of off private network calls.
- Improved customer experience through direct inward dial and auto attendance.

18.21.2 Scope

The successful bidder will be required to:

- Supply, Deliver, Install and configure PBX Solution that can support a capacity of more than => 400 IP phones
- Supply, Deliver and commission Internet Phones in all the 45 work stations
- Provide configuration and design documents and training to DOJ ICT staff
- Bidders must add required equipment / services that are not mentioned to ensure a workable solution.
- Supply and install POE switches and floor standing network U42 cabinets in server rooms.
- Supply and install CAT7 A FUTP wiring to IP Phone outlets, other IP Security devices; including the RJ45 connector complete with power skirting cradles or cradles for extension boxes in ceiling voids.
- Supply and install IP telephones at all work stations including fly leads.
- Supply and install a digital switch board.
- Provide a solution to manage extensions including software.

18.21.3 TECHNICAL CHARACTERISTICS

18.21.3.1 VOIP PABX UNIT installations shall have and cater for:

- Enterprise Software Licensing Package For All users.
- Programming (pick up groups)
- Connection to Voice Gateway

- Uninterrupted Power Supply (UPS) 2kVA
- Server Cabinet 27u
- Auto Attendant
- Voice Logging System
- Interactive Voice Recorder IVR
- Pre-announcement
- Music on Hold
- Electronic Lock Facilities
- PIN Numbers
- HARDWARE (=>400 users)
- Robust multi-service platform
- Flexible architecture
- Add up to 400 extensions, expandable to over 600 through a secure, private network.
- Functions over analogue or ISDN or VoIP lines using SIP Trunking *Compatible with analogue, digital and IP handsets as well as cordless DECT phones
- 4x Digital Extension Ports and
- 4x Analogue Extension Ports built-in
- Automatic Line Selection
- SIP Trunks (Licenses)
- Lightning Protection
- Speed dial numbers
- Facility for expected growth -20%
- Full featured transparent networking with single point of administration *SIP secure distributed networking
- ISDN QSIG networking
- ISDN virtual networking over PSTN
- PSTN-Overflow if network interruption or bandwidth problems in IP-Network
- Secure VoIP (SRTP/TLS, mTLS) for end points and trunks
- Voice mail with VM to email, voice mail box, multiple greetings, message forwarding, and group mailboxes

18.21.4 PABX PC based console (switchboard) shall:

- Enables operators to perform call handling tasks with the numeric keypad of a PC keyboard and customize tool bars with commonly used commands.
- Displays the results of an automatic and dynamic search for each caller, allowing Quick Transfer / Answer –Allows operators to select how they want to transfer calls
- All Console Call History – Provides all operators with a complete history of all calls that have been handled by the answer point
- Busy Lamp Field (BLF) – Allows operators to monitor up to 5,000 extensions or line appearance statuses
- Multiple BLF Lists, Customizable BLF Views and Tile-Based BLF *Provide at-a-glance phone status of contacts in a customizable view *Attendant Reports, Incoming Calls
- Computer
- Operator Console Headsets

18.21.5 TELEPHONE MANAGEMENT SYSTEM shall:

- Software – Web based with budget barring facility
- Computer
- TMS REPORTS
- Extension Summary reports, Extension outgoing cost reports, Extension detail report with budget usage, Directorate summary reports, Directorate detail reports
- Top 40/120/300 reports by: Cost, Duration, Number dialled
- Exchange summary reports, Exchange detail reports, Account code report, Staff member’s list reports, Memorized reports
- Graphs, Busy hour graph, History graph, Extension bar graph, Extension pie chart, Exchange line bar graph

18.21.6 Executive level IP Phones shall have:

- Touch screen LCD
- 2 x GigE Ethernet ports
- Built in Bluetooth 4.1 support
- 96 (16 x 6) programmable keys
- 6 softkeys
- Hi-Q Audio Technology
- Hearing aid compatible (HAC) handset
- Powered USB 2.0 Host port (500mA)
- Sidecar expansion port
- PoE Class 3 with automatic PoE Class

18.21.7 Entry level IP phones shall have:

- LCD display
- 3 programmable Personal Keys
- 3 context-sensitive soft keys
- Navigation cluster
- 12 fixed feature keys
- Incoming call / message waiting indicator
- Dual 10/100 Ethernet Ports
- Hi-Q Audio Technology
- Full duplex wideband handset and speaker phone
- HD wideband audio
- Hearing aid compatible (HAC) handset
- PoE Class 1

19. MAINTENANCE

Each Tenderer shall give full particulars of the maintenance, spare parts and service facilities which are available or in the RSA.

The Tenderer shall list the centres where maintenance facilities can be readily provided and shall state if repairs under guarantee or maintenance agreement can be undertaken at these centres. Local Companies or subsidiaries thereof, other than the main supplier, who only offer replacement of malfunctioned printed circuit boards, etc., cannot be considered to be maintenance centres under this clause.

When replacing faulty discs, the new discs, when inserted, must automatically initialise themselves.

20. LITERATURE REQUIRED

The installation shall not be handed over if any of the following are outstanding:

[i] Manuals and literature.
[ii] "As Built" drawings.
[iii] All outlets, cables and devices are labelled.

PART3- SCHEDULES OF INFORMATION

GENERAL

This section of the Specification forms part of, and must be read in conjunction with, Parts 1 to 2, as well as the drawings.

SCHEDULE OF ADDITIONAL LABOUR (Rand/hour)

These tariffs shall be used for the charging of labour costs not included in other tariffs. P & G amounts are excluded. These tariffs will be subject to negotiation by the Engineer during the installation phase.

	SUPERVISOR (R/H)	*FOREMAN (R/H)*	*ARTISAN (R/H)*	*REGISTERED APPRENTICE (R/H)*	*LABOURER (R/H)*
Normal Time					
Weekly Overtime					
Sunday Time					

SCHEDULE OF ADDITIONAL TRANSPORT (Travelling Costs)

Should the Contractor be successful in Tendering, the following costs per kilometre shall pertain to the cost of all additional travelling.

VEHICLE GROSS MASS	*COST PER KILOMETRE*	
	Tarred Surface Road	***Gravel Surface Road***
Car	R_____/km	R_____/km
1000 kg	R_____/km	R_____/km
3000 kg	R_____/km	R_____/km

SCHEDULE OF PROFIT FOR MATERIAL FOR VARIATIONS

The following profit percentage is applicable to all materials not included in other tariffs, P & G items excluded, and will be subject to negotiation by the Engineer during the installation phase.

If the Tender is successful, the following percentage profit shall be applicable on the cost of all materials specified for variation order purposes for which unit prices have not been included in this Tender Document.

The stated percentage profit is not fixed and the Engineer may negotiate for a lower percentage during variation.

The Engineer shall be at liberty to call for adjustment of individual prices, as considered necessary, on the basis of the average ruling prices as determined by the Engineer for similar work in the industry, in the area in which the work is being carried out.

VARIATIONS	*PERCENTAGE PROFIT*
Additions	……%

SCHEDULE OF EQUIPMENT

Should the Tender be successful, the following material/equipment will be used.

The Contractor shall submit full details regarding the information required when submitting the Tender.

This includes equipment that was not specified in this document, but may form part of the installation.

Failure to include full details regarding the information required will invalidate the Tender.

Access Control:

	DESCRIPTION	***MANUFACTURER OR TRADE NAME***
[a]	Access Control Software	
[b]	Biometric Readers	
[c]	Biometric Readers (Time & Attendance)	
[d]	Magnetic Locks	
[e]	Electric Door Strikes	
[f]	Reader Controller	
[g]	Printer	
[h]	Batteries for Backup	

Tel & Data:

	DESCRIPTION	***MANUFACTURER OR TRADE NAME***
[i]	POE Network switches	
[j]	CAT 7A Network cabling	
[k]	Fibre optic cabling	
[l]	RJ45 cradles and connectors	
[m]	VOIP PBX system	
[n]	IP phones	
[o]	Switch Board	
[p]	42U Data Cabinet	

Intercom & Voice evacuation:

	DESCRIPTION	***MANUFACTURER OR TRADE NAME***
[q]	Main Control Panel	
[r]	Speakers	
[s]	Volume Control	
[t]	Wiring	
[u]	Siren	

Fire Detection:

DESCRIPTION		*MANUFACTURER OR TRADE NAME*
[v]	Main Control Panel	
[w]	Sub-Indication Panel	
[x]	Bell/Siren	
[y]	Detectors	
[z]	Door Magnets	
[aa]	Printer	
[bb]	Heat Resistant Wiring	

Building Management System:

DESCRIPTION		*MANUFACTURER OR TRADE NAME*
[cc]	Software	
[dd]	Gate way controllers	
[ee]	Communication wiring	

SCHEDULE OF WORK COMPLETED BY TENDERER (Previous Contracts)

The Tenderer must, in the space below, supply a list of at least three Customer/s Contracts of a similar/comparable nature (reference sites) that were completed by him or where similar systems have been installed by him within the last three years.

Arrangements will be made with the Contractor during the evaluation period, to visit at least one of the sites, where a successful installation of a similar/comparable nature has been made.

PROJECTS COMPLETED				
CLIENT NAME AND TEL. NO.	*CONSULTING ENGINEERS NAME AND TEL. NO.*	*TYPE OF WORK (CONTRACT)*	*VALUE OF WORK*	*YEAR OF COMPLETION*

PROJECTS CURRENTLY UNDER CONSTRUCTION				
CLIENT NAME AND TEL. NO.	*CONSULTING ENGINEERS NAME AND TEL. NO.*	*TYPE OF WORK (CONTRACT)*	*VALUE OF WORK*	*YEAR OF COMPLETION*

SCHEDULE OF SUB-CONTRACTORS

The Contractor shall state in the schedule below the names of all Sub-Contractors he wishes to employ for the works, and shall define their duties and outline their experience.

Acceptance of this Tender should not be seen as acceptance of all or any of the Sub-Contractors. If any of the Sub-Contractors is not approved after acceptance of the Tender, it will not invalidate the Tender and the tender tariff for the various items will remain final and binding, even should the Engineer approve a Sub-Contractor who was not mentioned in the Tender Document.

NAME OF SUB-CONTRACTOR	*PROPOSED DUTIES*	*EXPERIENCE*

SCHEDULE OF PROPOSED PERSONNEL AND LABOUR

Tenderers must indicate the personnel and labour that will be utilised for the completion of the Contract.

PERSONNEL AND LABOUR	*NUMBER*
[a] Technical Personnel	
[b] Clerical Personnel	
[c] Artisan	
[d] Skilled Labour	
[e] Unskilled Labour	
TOTAL PERSONNEL AND LABOUR	

9. TRAINING

With regard to the training of the Employer's Operators and Technical Personnel, the Tenderer confirms the following fixed prices (including P&G's, but excluding VAT) and details.

9.1 OPERATOR / SECURITY STAFF TRAINING

{a} Cost/Person R_____

{b} Duration of course _____ Days

{c} Brief description of course outline:

_____

_____

_____

9.2 TECHNICAL / MAINTENANCE STAFF TRAINING

{a} Cost/Person R_____

{b} Duration of course _____ Days

{c} Brief description of course outline:

_____

_____

_____

SIGNATURE OF TENDERER: _____

EMAIL: _____

NAME OF TENDERER: _____

ADDRESS OF TENDERER: _____

_____

TELEPHONE NO.: _____

FAX NO.: _____

CELL NO.: _____

10. DRAWINGS

TEKENING NR. DRAWING NO.	**TITEL EN BESKRYWING TITLE AND DESCRIPTION**	**SOORT TYPE**	**GROOTTE SIZE**
EE-10742-E-327-01-0	ACCESS CONTROL LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-327-02-0	ACCESS CONTROL LAYOUT FIRST FLOOR	PAPER	A1
EE-10742-E-327-03-0	ACCESS CONTROL LAYOUT BASEMENT	PAPER	A1
EE10742-E-701-01-0	CABLE TRAY & CHANNEL LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-701-02-0	CABLE TRAY & CHANNEL LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-340-01-0	FIRE DETECTION LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-340-02-0	FIRE DETECTION LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-340-03-0	FIRE DETECTION LAYOUT BASEMENT	PAPER	A1
EE10742-E-747-01-0	HVAC POWER POINTS LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-747-02-0	HVAC POWER POINTS LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-747-03-0	HVAC POWER POINTS LAYOUT ROOF	PAPER	A1

EE10742-E-747-04-0	HVAC POWER POINTS LAYOUT BASEMENT	PAPER	A1
EE10742-E-370-01-0	POWER POINT LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-370-02-0	POWER POINT LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-400-01-0	SINGLE LINE DIAGRAM	PAPER	A3
EE10742-E-300-03-0	POWER POINT & LIGHTING LAYOUT BASEMENT	PAPER	A1
EE10742-E-380-01-0	LIGHTING LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-380-02-0	LIGHTING LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-402-01-0	SLEEVES & LV LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-330-01-0	TEL & DATA LAYOUT GROUND FLOOR	PAPER	A1
EE10742-E-330-02-0	TEL & DATA LAYOUT FIRST FLOOR	PAPER	A1
EE10742-E-300-01-01-0	DISTRIBUTION BOARD 1: PAGE 1 OF 2	PAPER	A3
EE10742-E-300-01-02-0	DISTRIBUTION BOARD 1: PAGE 2 OF 2	PAPER	A3
EE10742-E-300-02-01-0	DISTRIBUTION BOARD 2: PAGE 1 OF 3	PAPER	A3
EE10742-E-300-02-02-0	DISTRIBUTION BOARD 2: PAGE 2 OF 3	PAPER	A3
EE10742-E-300-02-03-0	DISTRIBUTION BOARD 2: PAGE 3 OF 3	PAPER	A3
EE10742-E-300-03-01-0	DISTRIBUTION BOARD 3	PAPER	A3
EE10742-E-300-04-01-0	DISTRIBUTION BOARD 4: PAGE 1 OF 4	PAPER	A3
EE10742-E-300-04-02-0	DISTRIBUTION BOARD 4: PAGE 2 OF 4	PAPER	A3
EE10742-E-300-04-03-0	DISTRIBUTION BOARD 4: PAGE 3 OF 4	PAPER	A3
EE10742-E-300-04-04-0	DISTRIBUTION BOARD 4: PAGE 4 OF 4	PAPER	A3
EE10742-E-300-05-01-0	DISTRIBUTION BOARD B	PAPER	A3
EE10742-E-300-06-01-0	DISTRIBUTION BOARD G	PAPER	A3
EE10742-E-300-07-01-0	DISTRIBUTION BOARD M: PAGE 1 OF 2	PAPER	A3
EE10742-E-300-07-02-0	DISTRIBUTION BOARD M: PAGE 2 OF 2	PAPER	A3

PART 4: Technical Specification

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, <u>without any corner cut-off.</u> 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

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. _____

3.13 **DEVIATIONS FROM SPECIFICATION AS ALTERNATIVE (STATE BRIEFLY)**

_____

_____

_____

SPECIFICATION

MECHANICAL WORK

HVAC INSTALLATION

DEPARTMENT OF PUBLIC WORKS

KEIMOES JUSTICE: CONSTRUCTION OF NEW MAGISTRATE OFFICE

HVAC INSTALLATION: SPECIFICATION

WCS 046641

MARCH 2021

COMPILED FOR: SANDISO COSA

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PROJECT ME304128 - KEIMOES JUSTICE: CONSTRUCTION OF NEW MAGISTRATE OFFICE

REV	DESCRIPTION	ORIG	REVIEW	IXENGINEERS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for internal review	M. Sebekedi	M. Smit	M Smit	2021-03-29	N/A	

CONTENTS

1. LIST OF ACRONYMS AND ABBREVIATIONS

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
BMS	Building Management System
BS	British Standard
CIBSE	Chartered Institution of Building Services Engineers
CO_2	Carbon Dioxide
db	Dry Bulb (Temperature)
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
EN	European Standard
EPDM	Ethylene Propylene Diene Monomer
IP (rating)	Ingress Protection (Rating)
ISO	International Standards Organisation
LED	Light Emitting Diode
NC	Noise Criteria
NR	Noise Rating
OBD	Opposed Blade Damper
ppm	Parts per Million
PVC	Polyvinyl Chloride
RSA	Republic of South Africa
rpm	Revolutions per Minute
SABS	South African Bureau of Standards
SANS	South African National Standard
SI	“Systeme International” – International system of units.
uPVC	Un-plasticised Polyvinyl Chloride
VRF	Variable Refrigerant Flow
wb	Wet Bulb (Temperature)
HVAC	Heating Ventilation and Air - Conditioning

2. UNITS OF MEASUREMENT

The SI system of metric units is applicable to this Project.

3. REGULATIONS AND STANDARDS

The air conditioning and ventilation installation shall be in accordance with the latest and current revision of:

BS 88-2	:	Low-voltage fuses. Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application). Examples of standardized systems of fuses A to K
BS 476	:	Fire tests on building materials and structures. Method for classification of the surface spread of flame of products
EN 12101	:	Smoke and heat control systems (Various Parts)
EN 62271-106	:	High-voltage switchgear and control gear. Alternating current contactors, contactor-based controllers and motor-starters
IEC 60034-1	:	Rotating electrical machines. Rating and performance
IEC 60051-1	:	Direct acting indicating analogue electrical measuring instruments and their accessories. Definitions and general requirements common to all parts
IEC 60068-2-6	:	Environmental testing. Tests. Test Fc. Vibration (sinusoidal)
IEC 60068-2-27	:	Environmental testing. Tests. Test Ea and guidance. Shock
OSHA	:	The occupational health and safety act (Act 85 of 1993)
SANS 193	:	Fire dampers
SANS 460	:	Plain-ended solid drawn copper tubes for potable water
SANS 1091	:	National colour standard
SANS 1125	:	Room air conditioners and heat pumps
SANS 1238	:	Air conditioning ductwork
SANS 1424	:	Filters for use in air conditioning and general ventilation
SANS 1453	:	Copper tubes for medical gas and vacuum services
SANS 10044	:	Welding

SANS 10147	:	Refrigerating systems including plants associated with air conditioning systems
SANS 10142-1	:	The wiring of premises Part 1: Low-voltage installations
SANS 10173	:	The installation, testing and balancing of air conditioning ductwork
SANS 10177	:	Fire testing of materials, components and elements used in buildings
SANS 60335-2-40	:	Household and similar electrical appliances - Safety. Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers
SANS 60335-2-80	:	Household and similar electrical appliances - Safety Part 2-80: Particular requirements for fans
SANS 62053-11	:	Electricity metering equipment - Particular requirements - Part 11: Electromechanical meters for active energy

4. DESIGN CRITERIA

External environmental criteria:		
External design temperature summer		38 °C db / 22 °C wb
External design temperature winter		10.9 °C saturated
Altitude above sea level		804 m
Internal environmental criteria:		
Summer Internal Temperature	All air-conditioned areas except where otherwise noted below	23 °C setpoint
	All electronic equipment rooms	22 °C setpoint
Winter Internal Temperature	All air-conditioned areas except where otherwise noted below	22 °C setpoint
	All electronic equipment rooms	22 °C setpoint
	Offices and Courtrooms	NR38

Max Internal Noise Levels	Toilets, Stairs & Circulation areas	NR40
	Plantrooms	NR50

5. DESCRIPTION/SCOPE OF HVAC SERVICES

This specification relates to the HVAC Installation for the new Keimoes Magistrate's Court project and shall be read in conjunction with the associated drawings, equipment schedules and all other relevant specifications and contract documents for this project.

The scope of the services in the specification includes the supply, installation, setting to work and commissioning of the following services:

- Air conditioning systems
- Ventilation systems
- Condensate drainage
- Control's systems
- Electrical works associated with the mechanical installation.

Air conditioning for the various offices and courtrooms shall generally comprise of a VRF heat recovery system. Outdoor condenser units shall be located on the roof level in a dedicated space allocated for plant.

Local split air conditioning units shall be provided for server rooms and other equipment rooms which may require 24hr air conditioning. These rooms will be equipped with duty/standby units which shall be of the rotary-backup type arrangement to automatically start the standby unit when the duty unit fails, through the split unit controller.

Ventilation shall comprise of filtered fresh air systems, fan-driven and conveyed with low pressure ductwork through the building. Fresh air fans shall be mounted on the roof.

Toilet extract systems shall extract air from toilet areas via low velocity ductwork and extract disc valves. The fans and attenuators shall be mounted in the ceiling voids.

6. GENERAL ITEMS

6.1 GENERAL

Conflicts, errors, or discrepancies found in the specification, drawings or any other documentation issued in connection with this contract shall be brought to the design engineer's attention for resolution. Any deviations from the specification, drawings and/or equipment specified shall be listed together with the alternatives offered. Failure to do this will not relieve the successful mechanical contractor of the obligation to execute such items in accordance with the intentions of the design package. If no deviations are listed, it will be assumed that the installation shall comply with all the relevant technical parts of this specification.

All installations shall be complete in all respects. The mechanical contractor shall allow for the installation and successful operation of the complete installation. All materials and components shall be provided as deemed to be good practice, logical, in accordance with the relevant standards/regulations and necessary to achieve the intended functional requirements of the installation. This shall apply irrespective of whether every single item is specified or not. All work shall be carried out by skilled personnel.

6.2 COMPLETION DATE AND PROGRAM

The Mechanical Contractor will be required to keep up with the main contract in accordance with the main Mechanical Contractor's program and to complete the mechanical installation concurrently with the main contract.

Directly after acceptance of his tender, the Mechanical Contractor shall submit time schedules for each activity for which he is responsible to the main contractor, for the inclusion thereof in the main contractor's program. A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items as a minimum shall be programmed in consultation with the Main Contractor:

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material

- First fix installation
- Approval of first fix
- Second fix installation
- Approval of second fix
- Electrical installation
- Commissioning and testing
- Production of O&M manuals and As-Built drawings
- Submittal of manuals and drawings for comment
- Final submittal of manuals and drawings to Client
- Final inspection

The Mechanical Contractor is required to maintain a rate of progress satisfactory, at all times, to the Main Contractor, in accordance with his Program, and carry out any particular section of the work when called upon to do so. He is also to co-operate in this respect with other Subtrades/Contractors employed on this project. The Mechanical Contractor must be prepared to lay on labour and materials in accordance with the Building Program.

6.3 FINISHING AND TIDYING

Progressive and systematic finishing and tidying will form an essential part of the mechanical works. On no account must spoil, rubble, materials, equipment, or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others or pose abnormal safety risks that are not managed and mitigated. Finishing and tidying must be done on a daily basis and not simply be left to the end of the contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole.

6.4 SCAFFOLDING AND PLANT

All plant required for the execution of the contract shall be supplied by the Mechanical Contractor under this contract. The Mechanical Contractor shall provide his own scaffolding. For installation purposes the Mechanical Contractor shall allow for his own lifting equipment, cranes etc. which may be necessary to complete the installation as none of these facilities will be available on site.

6.5 SUPERVISORY STAFF

The Mechanical Contractor is to appoint a representative in the form of a qualified engineer/technologist/technician, or other qualification and experience as approved by the engineer and design team, as Contract Manager in supervisory charge of all work carried out under this Contract.

This Contract Manager is to be experienced in work of a similar nature. He is to be in continuous attendance on site from the commencement of works under this Contract, until the date of Practical Completion and hand-over to the Employer. He shall not be transferred to other work without the prior consent of the Consulting Engineers and the Employer. The Mechanical Contractor is to vest in the Contract Manager the necessary authority to discuss with, accept from and execute, the Consulting Engineer's, or the Supervising Officer variation instructions as are found necessary from time to time. The Contracts Manager is to be supported by such staff as are appropriate and necessary for the proper execution of the works.

At all times while on the premises, all artisans and labour members of the mechanical contractor's and subcontractor's staff will wear clothing adequately marked with the relevant contractor's name and which complies with current Health and Safety Regulations.

Works of the specific trades involved under this contract shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trades.

6.6 SITE MEETINGS AND INSPECTIONS

The Mechanical Contractor's Contract Manager shall arrange to be present at all site meetings, to discuss the Contract with all interested parties.

The Mechanical Contractor's Contract Manager shall ensure that works are ready for inspection when a site inspection/visit is required from the engineer and shall arrange site inspections in a timely fashion with adequate notice to all involved parties.

At least 3 days prior to site inspections, all documentation applicable to the inspection, such as testing certificates and commissioning data etc., shall be provided to the engineer for evaluation.

6.7 QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged, and free from rust or other defects. Only approved material of the best quality shall be used. All materials shall have a minimum one-year guarantee. The equipment shall be of the model currently in production at the time of installation and there shall be no known obsolescence.

The Mechanical Contractor shall, upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the materials are of the quality specified. Samples of materials for testing, if required, shall be supplied by the Mechanical Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and/or the British Standard Specifications as relevant.

The installation shall be carried out according to the latest modern engineering practices.

All equipment offered shall operate well within the manufacturer's ratings, and equipment to be operated beyond these limits will not be considered.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Mechanical Contractor.

6.8 ORDERING AND RATINGS OF EQUIPMENT

The Mechanical Contractor shall supply the sizes and rating of all the equipment offered to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer's ratings, and equipment to be operated beyond these limits will not be considered.

The mechanical contractor shall ensure that procurement details of materials are duly submitted to the main contractor to be incorporated in the main contract program.

The Mechanical Contractor shall avoid delays by submitting details of alternative manufacturers or types of materials/products to the consulting engineer/principal agent in time to comply with the agreed program of the Works.

All materials/products necessary for the completion of the Works shall be ordered immediately after receipt of comments received and/or instructions to proceed. No delay to practical completion, or completion of any part thereof caused by delays in ordering will be accepted.

6.9 ROOM TERMINAL LOCATIONS

The positions of all connection points, accessories, apparatus, equipment, and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender.

The Mechanical Contractor shall agree with the main contract administrator/principal agent which terminals are subject to final on-site positioning and allow for the movement of all such terminals from the positions shown on the drawings.

Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the main contract administrator/principal agent before commencing work on site.

6.10 SPACE REQUIREMENTS AND ACCESS

Before ordering equipment, the Mechanical Contractor shall ensure that the equipment offered by them can be installed in the available space as shown on the construction drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Mechanical Contractor's account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

The Mechanical Contractor shall also ensure that the equipment offered by them will pass through available building openings. Large equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of equipment or to change the make of equipment in order to allow access shall be for the account of the Mechanical Contractor.

6.11 METHOD STATEMENTS

The Mechanical Contractor will be required to produce a Risk Assessment and Method Statement describing in detail his procedures for carrying out each aspect of the work. The documentation will be required prior to commencement of the works.

6.12 SUBMITTAL OF DRAWINGS AND OTHER DOCUMENTATION

6.12.1 Definitions

Schematic drawing:

A line diagram describing the interconnection of components in a complex system. A two-dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. The drawing includes all functional components which make up the system. The drawing includes appropriate services distribution sizes not shown elsewhere.

Detailed design drawing:

A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routing of the services.

Working drawing or installation drawing:

A drawing showing the inter-relationship of engineering services, their relation to the structure and building fabric and including all components of the works as required for the successful installation of the systems. These drawings are normally developed from the tender or detail design drawings. The drawings shall reflect the actual equipment and other material sizes and details that the contractor is proposing to order.

Working/installation drawings shall include provision for all supports and fixings, insulation, standard fittings, and components as necessary to install the works and shall incorporate shop drawing information and manufacturer's drawing information.

Floor plans and sections shall be provided in not less than a scale of 1:50, with plant rooms and details in a scale not less than 1:20. A minimum of 2 copies of these drawings shall be submitted to the Engineer for approval prior to installation and 2 copies of the drawings shall be submitted once approved.

Shop drawings:

Drawing prepared by a fabricator or supplier that the contractor is proposing to utilize. Including supplier's drawings for ductwork, prefabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.

Builder's work drawing:

Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site). All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Mechanical Contractor.

Controls Logic Diagrams:

Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

Electrical drawings:

Drawings showing the construction and internal wiring diagrams of the starters, panels and/or other devices. These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules as applicable to the installation.

These drawings shall clearly show the actual electrical loads and requirements of all final and actual equipment to be installed. Refer also to the electrical section in the specification.

As built drawings:

The drawings shall show the building and services installations as installed at the date of practical completion. The main features of the drawings should be as follows:

- Provide a record of the locations of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions of access points for operating and maintenance purposes.

6.12.2 **Drawings and other documentation to be submitted by the Contractor.**

Any work done by the Mechanical Contractor without an approved drawing shall be at the Mechanical Contractor's own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Mechanical Contractor.

The review of drawings by the consulting engineer shall not relieve the Mechanical Contractor of his responsibilities to carry out the work in terms of the contract documents.

The following drawings are to be submitted by the Mechanical Contractor, unless agreed otherwise with the consulting engineer.

Mechanical Working/Installation Drawings and Shop Drawings:

The Mechanical Contractor shall prepare his own set of working/installation drawings covering all aspects of the contract works and shall submit these and all shop drawings for comment and approval.

The drawings shall be submitted prior to any installation work commencing on site. A period of 5 working days upon receipt of drawings by the engineer shall be allowed for the commenting and evaluation of the drawings.

The Mechanical Contractor shall make any necessary amendments without delay. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.

The installation drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as "As Built" drawings.

Builder's Work Drawings:

Shall be submitted by the Mechanical Contractor to the main contractor and consulting engineer, within two (2) weeks of site handover or in the case where the mechanical contractor is appointed after site handover, within two (2) weeks of appointment.

Electrical Drawings (Relating to Mechanical Services Equipment):

Shall be submitted by the Mechanical Contractor to the consulting engineer, within two (2) weeks of site handover or in the case where the mechanical contractor is appointed after site handover, within two (2) weeks of appointment.

6.13 MAINTENANCE AND GUARANTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Mechanical Contractor shall newly replace all consumables/parts such as filters, belts etc. at the start of the maintenance period, i.e., the practical completion date, as well as at the end of the maintenance period, i.e. final completion date.

The Mechanical Contractor is responsible for all material and labour during the maintenance period.

The Mechanical Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within seven (7) days from the visit.

In case of a breakdown, the Mechanical Contractor shall react within reasonable time and repair the installation to the satisfaction of the Engineer. Should the Mechanical Contractor, in the discretion of the Engineer, not react within reasonable time, the Engineer shall commission another Mechanical Contractor and the cost thereof shall be recovered from the defaulting Mechanical Contractor.

6.14 PAYMENT CLAIMS

In addition to the conditions of contract, the Mechanical Contractor shall attach to his application for payment an explanation of material cost and labour cost.

The following information is required with respect to material and labour:

- Estimated percentage delivered/completed at date of the previous claim.
- Estimated percentage delivered/completed at date of current claim.
- Total cost claimed at date of previous claim.

6.15 PAINTING WORK

Where applicable the painting specifications as described below shall apply.

Iron and steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

Galvanised surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use. Equipment shall be painted according to the National Colour Standards for Paint, SANS 1091.

6.16 DAMAGE AND PROTECTION OF WORKS AND EQUIPMENT

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held completely responsible for any damage of equipment during transport and installation, as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an “as new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

6.17 STEELWORK AND SUPPORT SYSTEMS

The mechanical contractor shall provide all secondary steelwork support systems, frames, steelwork plant bases, access ladders/steps and distribution services support systems associated with the HVAC installation under this contract.

6.18 WELDING WORK

Welding shall be carried out in accordance with the current edition of SANS 10044 and all other relevant SANS document relevant to the specific type of welding to be undertaken. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

6.19 TESTING AND COMMISSIONING

The mechanical contractor shall perform the following duties related to the testing and commissioning of services under this contract:

- The installation shall be commissioned in accordance with a recognised commissioning procedure or code.
- Agree the commissioning program with the main contractor to include for pre-commissioning checks, setting to work, commissioning and performance testing, commissioning witnessing and allow for all costs incurred.
- Give duly notice and state any requirements for the attendance and co-operation of others. This notice shall be a period of no less than 10 working days.
- Provide all necessary facilities and access to enable tests to be witnessed and inspections to be carried out either on site or at manufacturer's works.
- Allow and arrange for the validation/data checking of all systems being commissioned to be witnessed and random checks to be performed. This shall include the checking of performance, duties and operation of all system components including water and air flow rates, temperature, pressure, etc. at all terminals and strategic points within the system. No acceptance of any commissioning data shall be given without the above checks having been performed. All commissioning data sheets and associated documentation required for the proper validation of the systems shall be made available at least 5 working days before requested site visits and commissioning witnessing dates.
- The mechanical contractor shall provide full method statements for all testing and commissioning and agree these prior to commencing any testing and pre-commissioning. These shall include all water and chemical treatment, pressure testing, flushing, chemical clean, setting to work, balancing, commissioning and acceptance procedures.
- Appoint an "approved and qualified representative", to supervise the whole of the testing, commissioning, performance testing and instruction of future maintenance staff.
- Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

- Test all equipment, material, and systems. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

- Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.

- Ensure all requirements such as cleanliness, protection from harmful external and internal elements, etc. are provided prior to commencement of commissioning.

- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.

- Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.

- Provide test equipment that has been subject to a quality assurance procedure and complies with national and local standards.

- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed.

- Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.

- Provide all certification documents for approval before any system is offered for final acceptance.

6.20 OPERATING AND MAINTENANCE MANUALS

General:

The Mechanical Contractor shall submit one (1) draft hard copy and one (1) digital copy of the Operation and Maintenance Manuals and As-built drawings to the Engineer prior to commissioning or at an alternative agreed date, for checking, evaluation and comment purposes and shall allow at least ten (10) working days for the commenting process. The Mechanical Contractor shall incorporate all comments and re-submit the revised manuals. The Mechanical Contractor shall allow for temporary

inserts and clearly list items such as commissioning data that are not yet available for inclusion in the manuals. Such information shall be submitted as soon as possible and no later than one (1) week before the planned practical completion date.

The Mechanical Contractor shall submit the commented, approved and finalized Operation and Maintenance Manuals and As-Built drawings at or prior to Practical completion. Three (3) hard copies and three (3) digital copies shall be submitted. The comment and approval of the manuals shall be a pre-requisite for Practical Completion and no Practical Completion shall be given without fully approved Operating and Maintenance Manuals inclusive of all relevant drawings and other documentation as stated in this specification.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well-arranged and provided with an index.

- Documentation shall clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Documentation shall make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Documentation shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Documentation shall provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.

Information in the documentation shall be correlated so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

The Mechanical Contractor shall show, as required, throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

Content:

The operating and maintenance manuals shall include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Full size and reduced A3 copies of all drawings together with an index.
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.

- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out (e.g., water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programs.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, engineers, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.
- The manuals must contain all commissioning datasheets and certification.

- Provide electronic copies of all Operating and Maintenance documentation in disk format, fully indexed.

6.21 LATE SUBMITTAL OF OPERATING AND MAINTENANCE MANUALS AND DRAWINGS

The Mechanical Contractor shall provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the As-Built drawings and Operation and Maintenance Manuals are not available when the works would, in the opinion of the principal agent and consulting engineer, otherwise qualify for Practical Completion.

In the event of the Mechanical Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

6.22 CLIENT STAFF TRAINING

The Mechanical Contractor shall be responsible for the training of the Client's site staff after the commissioning has been completed. The site staff shall receive enough instructions to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training. Upon completion of training exercise the Mechanical Contractor is to obtain the proprietor's representative's written acceptance of this handover tuition, thus acknowledging his complete understanding of the operation procedures for this installation. Site staff shall be instructed on:

- the general operating method of the plant;
- starting and stopping instructions;
- stopping the plant in an emergency and warning against restarting after an emergency;
- positions and normal settings of control equipment;
- safety measures;
- operational checks on gauges, flow switches, indicator lights, etc.;
- name, address and telephone number of competent person responsible for the maintenance of the plant.

6.23 IDENTIFICATION AND LABELLING OF SERVICES AND EQUIPMENT

All services shall be clearly and appropriately identified and labelled.

Reticulation services such as piping and ducting shall be fitted with colour bands, the service identification and directional arrows.

Equipment shall be fitted with identification labels.

Samples of identification methods that the contractor proposes, shall be submitted to the engineer for review, prior to ordering and installation.

All identification and labelling methods shall be in accordance with the relevant SANS, British Standards or better.

6.24 METER READINGS

If applicable and where meters form part of this contract, the Mechanical Contractor shall record readings of all utility meters immediately on completion of the Works and submit, via the Main Contractor, to the Employer/Employer's representative.

TECHNICAL SPECIFICATION

7. LOCAL SPLIT TYPE AIR CONDITONING UNITS

7.1 GENERAL

The units shall be of the heat pump inverter driven type and shall be standard factory assembled, piped and wired. The refrigerant shall be of the R410A type. The units shall be thoroughly tested for all operating conditions.

The air-conditioning units and installation in general shall be in accordance with the manufacturer's recommendations and stipulations.

The electrical power requirements to all indoor and outdoor units shall be:

- Single phase when the cooling capacity of the unit is less than 10 kW.
- Three phase when the cooling capacity of the unit is more or equal to 10 kW.

Cooling and heating capacities are room conditions and the mechanical contractor shall perform de-rating to compensate for the following:

- Altitude above sea level.
- Refrigerant pipe lengths.
- Design conditions specified.

All units shall be capable of meeting total and sensible cooling requirements. All capacities specified are to be achievable at medium evaporator fan speed.

All indoor and outdoor units shall have noise levels so as not to exceed the limiting indoor room noise ratings and any limiting external noise criteria.

The indoor unit and condensing unit shall be interconnected with refrigerant piping, electrical wiring and interlocking control cabling. The pipe and cable connections shall be made in accordance with the unit supplier's recommendations.

Each condensing unit with connected evaporator unit shall be clearly labelled to identify different split units.

Indoor units shall have factory fitted, electrically operated condensate pumps with a drainpipe connection. Integral safety switches shall be provided to prevent the pump from running dry, and to prevent the ceiling suspended unit from operating when the condensate pump has failed.

7.2 INDOOR UNITS

Indoor units shall consist of a direct expansion, indoor fan coil evaporator unit and a separate, remote, externally located, air-cooled, condensing unit. Indoor unit casings and finish shall be the manufacturer's standard, with adequate access to filters, fans and motors.

Heating shall be by means of a heat pump action by the reversal of the cooling cycle. All the necessary control equipment, valves and piping required to perform this function shall be supplied as part of this work.

A defrosting system shall be provided that will defrost the condensing coil during the winter months when heating is required. The defrosting system shall be a proven system that functions automatically without affecting the room temperature.

The evaporator unit shall be equipped with an easily accessible synthetic fibre washable long-life filter, a 3 speed adjustable cross flow fan driven by an induction motor and evaporator coils manufactured from seamless copper tubing mechanically bonded to aluminium.

Split indoor units shall have integral condensate drain pans with drain hose connections. Indoor units shall have condensate drain pumps. Indoor units serving the server rooms shall have secondary drip trays.

7.3 OUTDOOR UNITS

The compressor unit shall be powered by an induction motor and installed with anti-vibration mounts such as rubber or spring isolators. The compressor shall be equipped with crankcase heater.

The condenser cooling fan shall be of the direct driven multi-wing, dynamically balanced propeller type axial flow fans. The outdoor unit shall be of the horizontal blow type.

The outdoor unit casing shall be manufactured from mild steel plate and shall be corrosion protected and colour coated.

For reverse cycle units, a proper galvanised steel drip pan with drainage piping or drain piping connected to the integral drain pan shall be provided for the condensing units.

The control system shall be such that the unit will automatically change from heating to cooling and vice-versa. A time delay relay shall prevent the compressor from restarting immediately when changing from heating to cooling and vice versa.

The “auto restart after power failure” option shall be available for all units. The units shall also be able to operate in a “fan only” mode.

Electrical interlocking shall be provided to ensure that:

- Compressor cannot run without both evaporator and condenser fans running.
- It shall not be possible to switch cooling and heating on simultaneously.

Units shall be installed as per the manufacturer's recommendations and installation criteria.

During installation, care shall be taken to ensure that no vibrations are carried over to structures to which the outdoor units are fixed.

Outdoor condensing units shall be installed on wall mounted brackets and / or a concrete slab as relevant to the project / installation scenario.

Where installed on wall mounted brackets, the condensing unit shall properly bolted to the mounting bracket with adequately sized fasteners.

Where installed on a concrete slab, the condensing unit shall be fitted on top of neoprene vibration isolating pads and 450mm square concrete paving slabs or builder's plinth.

Thermal protection shall be provided for the compressor, indoor and outdoor fan motors. Over current relay shall be provided for the compressor, indoor and outdoor fan motors to ensure over current protection. Reverse phase, three phase overload, overload during start-up, phase imbalance, phase loss and low voltage protection shall be provided for all three phase motors.

Protection fuses shall be provided for all control circuits.

The compressor shall have high and low refrigerant pressure protection.

7.4 CONTROLS

Refer to controls section in the specification.

7.5 REFRIGERANT PIPING CONDENSATE DRAINAGE

Refrigerant piping shall be in accordance with the following standards:

- SANS 1453: Copper tubes for medical gas and vacuum services
- SANS 10147: Refrigerating systems including plants associated with air conditioning systems.

Refrigerant piping shall be seamless copper. Fittings shall be copper based capillary solder fittings.

All soldered joints on proprietary manufactured units shall be carefully checked and remade if found damaged in transit.

Pipe size selections shall be to the supplier's recommendation and shall be such as to produce moderately low velocities whilst:

- Ensuring proper oil return to the compressor and minimising lubricating oil being trapped in the system.
- Ensuring practical lines without excessive pressure drops and with proper feed to evaporators.
- Preventing liquid refrigerant from entering the compressor during operation and at shutdown.

Refrigerant piping shall be sized and fitted with the necessary oil traps strictly in accordance with the unit manufacturer's requirements.

Suction and liquid pipelines shall be insulated separately and joints on insulation shall be glued with the insulation manufacturer's recommended adhesive to create a vapour barrier.

Where soft drawn material is used, bends shall be with a long radius formed with the proper tools. Where hard drawn material is used only long radius brazed bends shall be used. All refrigerant piping shall be properly sealed against moisture and dirt at all times.

Refrigerant piping shall be arranged so that normal inspection and servicing of the compressor and other equipment is not hindered. Locations where copper tubing will be exposed to mechanical damage

shall be avoided. Hangers and supports where piping passes through walls shall be installed to prevent transmission of vibration to the building.

All refrigeration pipes shall be sized to the supplier's method. The refrigerant charge shall be accurately calculated by the same method. The recommended maximum pipe lengths as set out by the manufacturer shall be adhered to.

Only synthetic oil compatible with the refrigerant shall be used to lubricate any cutting, reaming and flaring tools.

Only phosphor copper brazing rods shall be used without any flux on the piping joints. The pipework shall be continuously purged with low pressure nitrogen during all brazing operations.

Simple purging of the refrigerant pipes between the indoor and outdoor units shall not be acceptable. Refrigerant pipes shall be correctly pressure tested with nitrogen and a small amount of refrigerant to 3.8MPa for R410A and left for 24 hours to ensure that the pressure does not drop. A vacuum pump shall then be used to purge the piping for longer than 2 hours to -100kPa. The system shall be capable of holding this vacuum for 1 hour or to the satisfaction of the design engineer.

The system shall then be charged in the liquid state with the calculated amount of additional refrigerant by using an accurate charging scale (charging cylinder shall not be used). Only once the system is correctly charged shall the refrigerant valves on the outdoor units be opened.

The mechanical contractor shall make use of colour coding (insulation type straps) to differentiate between refrigerant pipes running from refrigerant risers to different thermal zones.

Refrigerant pipes for multiple outdoor units shall be correctly arranged to meet manufacturer's requirements. Where multiple outdoor units are used, insulated oil equalisation line shall be installed between the units.

Support all pipework and control cabling throughout their length using cable tray, firmly fixed to the building fabric - refer to section regarding trunking for further details. The installation of trunking and trays shall form part of this mechanical contract.

Arrange all exposed pipe runs to present and neat appearance, parallel with other pipe or service runs and building structure.

Ensure all vertical pipes are plumb or follow building line. Provide lifting loops where called for by system manufacturer.

Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.

Take precautions to prevent the discharge of refrigerant gases to atmosphere.

Longest possible lengths of copper pipe should be utilised to minimise joints on site.

Appropriate refrigeration installation tools must be utilised. Dry nitrogen must be utilised at all times in the system during brazing.

Refrigerant (R410A) charge weight must be calculated, based on the actual installed length of pipework in accordance to manufacturer's recommendations.

All joints installed horizontally shall be mounted with branch piping in a horizontal plane.

7.6 CONDENSATE DRAINAGE

Outdoor units shall be provided with a galvanised drain tray with suitable drain pipe connection. Drain pipes that run from the drain tray to the nearest drainage point shall be installed to ensure positive drainage of condensate. Piping shall be galvanised steel where exposed to weather elements.

Where possible, the condensate drain pipes from indoor units shall be run together with refrigerant pipes and be installed in the same trunking and on the same cable trays for as far as the installation permits.

uPVC pipes shall be used for drain piping from indoor units. Drain pipes shall run and connect via a suitable U-type trap to waste water pipes as indicated on the project drawings. The connection between the drain pipe and waste water pipe shall be an airtight sealed connection that allows positive drainage of condensate.

In ceiling voids, drain pipes shall be installed on galvanised cable trays. Where drain piping does not run with refrigeration piping in the same cable trays, galvanised “Cabstrut” light duty cable tray shall be used. Drain piping shall be fixed to the cable tray with suitably sized cable ties installed at 500mm intervals.

Horizontally mounted drain pipes shall be installed at a slope of 20mm per 1000mm ensuring positive drainage.

Surface mounted drain piping shall be secured to the wall by means of galvanised steel saddles at no more than 1m intervals.

Where drainage piping or control cabling is required to be installed flush-mounted, positioning and chasing shall be done in good time to meet the construction program.

8. VARIABLE REFRIGERANT FLOW (VRF) SYSTEMS

8.1 GENERAL

The VRF system shall be of the inverter heat recovery type. The VRF system shall be capable of operating continuously at ambient temperatures between -5 °C and 40 °C. Refrigerant piping shall be capable of being extended up to 150 m with level difference without oil traps of 50 m.

All air conditioning VRF indoor and outdoor units shall be standard factory assembled, piped wired and charged with refrigerant. The units shall be thoroughly tested for all operating conditions. The air conditioning units and the installation of the VRF-system shall generally be in accordance with the VRF-system supplier's recommendations.

The indoor and outdoor units shall be interconnected with refrigerant piping, control cabling, the relevant REFNET joints and headers. The pipe and cable connections shall be made in accordance with the unit supplier's recommendations. The refrigerant shall be of the R410A type.

The electrical power requirements to all indoor and outdoor units shall be:

- Single phase when the cooling capacity of the unit is less than 10 kW.

- Three phase when the cooling capacity of the unit is more or equal to 10 kW.

Cooling and heating capacities are room conditions and the mechanical contractor shall perform de-rating to compensate for the following:

- Altitude above sea level.
- Refrigerant pipe lengths.
- Design conditions specified.

All units shall be capable of meeting total and sensible cooling requirements. All capacities specified are to be achievable at medium evaporator fan speed.

VRF/VRV systems shall have the following functionality in addition to what was specified:

a. The system must remain operational under the following condition – for a multi-module outdoor unit, if a module goes offline (for whatever reason), the other module/modules must remain operational. Same applies for compressors in a single module outdoor arrangement.

b. The system shall remain operation under the following condition – if any indoor unit is faulty, or if power supply to any indoor unit is lost, the system shall remain operational.

8.2 INDOOR UNITS

All indoor units shall have electronic control valves that shall control refrigerant flow in response to the load requirements. All fans installed in the indoor units shall be statically and dynamically balanced to ensure low noise and vibration.

Indoor unit casings and finish shall be the manufacturer's standard, with adequate access to filters, fans and motors. Room side fan motors shall be centrifugal with a direct coupled motor.

Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminium fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

The units shall have factory fitted, electrically operated condensate pumps with a drain pipe connection. Integral safety switches shall be provided to prevent the pump from running dry, and to prevent the unit from operating when the condensate pump has failed.

The units shall be provided with synthetic fibre washable long-life filters.

Access through demountable ceiling tiles or dedicated ceiling access panel shall be provided for ceiling concealed units to allow access for maintenance. The mechanical contractor shall inform the architect/design engineer if any additional ceiling access measures or panels are required, based on the final selection, size and accurate location of equipment.

In cases where a fresh air connection is to be provided to ceiling mounted indoor units, the units shall be supplied with a fresh air intake kit.

Ceiling concealed hide-away units shall be provided with supply and return air plenums with fresh air connection spigots, as relevant and shown on the project drawings. Filtration shall be achieved through filters as fitted to return air grilles. Should return air grilles not be part of the installation, the hide-away unit shall be provided with washable filter media on the suction side of the unit.

Ceiling mounted cassette type units shall be of the 4-way blow type discharging air in the directions as indicated on the project drawings. The mechanical contractor shall fix the sealing material to the air outlets in accordance with the discharge requirements.

All cassette units shall be complete with a decoration panel.

All ceiling mounted built-in units shall be equipped with long-life primary filters.

8.3 BRANCH SELECTOR UNITS

Branch selector units / distribution controllers shall be provided to link indoor and outdoor units. Spare connections for 2No indoor units shall be included. The selector units shall be insulated as per the manufacturer's standard and shall be installed to the manufacturer's stipulations and recommendations. The selector units shall be complete with cover panels and no exposed wiring or piping shall be accepted.

8.4 OUTDOOR UNITS

The outdoor unit/s shall be of the heat recovery type running on R410A refrigerant and shall have sufficient capacity to meet the cooling/heating requirements of the indoor units. The outdoor unit shall be equipped with inverter control capable of changing the speed of the compressors in accordance with the cooling and heating load requirements.

Outdoor unit casing and finish shall be the manufacturer's standard.

The outdoor unit/s shall be equipped with a drain pan kit for operation in the reverse (heat pump) cycle.

Units shall be installed as per the manufacturer's recommendations and installation criteria.

During installation, care shall be taken to ensure that no vibrations are carried over to structures to which the outdoor units are fixed.

Outdoor condensing units shall be installed on wall mounted brackets and / or a concrete slab as relevant to the project / installation scenario.

Where installed on wall mounted brackets, the condensing unit shall be properly bolted to the mounting bracket with adequately sized fasteners.

Where installed on a concrete slab, the condensing unit shall be fitted on top of neoprene vibration isolating pads and 450mm square concrete paving slabs or builder's plinth.

8.5 PROTECTION DEVICES/MEASURES

Thermal protection shall be provided for the compressor and indoor and outdoor fan motors. Over current relay shall be provided for the compressor and indoor and outdoor fan motors to ensure over current protection. Reverse phase, three phase overload, overload during start-up, phase imbalance, phase loss and low voltage protection shall be provided for all three phase motors.

Protection fuses shall be provided for all control circuits.

The compressor shall have high and low refrigerant pressure protection.

The indoor and outdoor units shall comply with the safety requirements as set out in SANS 60335-2-40.

8.6 REFRIGERANT CIRCUITS

Refrigerant piping shall be in accordance with the following standards:

- SANS 1453: Copper tubes for medical gas and vacuum services
- SANS 10147: Refrigerating systems including plants associated with air conditioning systems.

Refrigerant piping shall be seamless copper. Fittings shall be copper based capillary solder fittings.

All soldered joints on proprietary manufactured units shall be carefully checked and remade if found damaged in transit.

Pipe size selections shall be to the supplier's recommendation and shall be such as to produce moderately low velocities whilst:

- Ensuring proper oil return to the compressor and minimising lubricating oil being trapped in the system.
- Ensuring practical lines without excessive pressure drops and with proper feed to evaporators.
- Preventing liquid refrigerant from entering the compressor during operation and at shutdown.

Refrigerant piping shall be sized and fitted with the necessary oil traps strictly in accordance with the unit manufacturer's requirements.

Suction and liquid pipelines shall be insulated separately and joints on insulation shall be glued with the insulation manufacturer's recommended adhesive to create a vapour barrier.

Where soft drawn material is used, bends shall be with a long radius formed with the proper tools. Where hard drawn material is used only long radius brazed bends shall be used. All refrigerant piping shall be properly sealed against moisture and dirt at all times.

Refrigerant piping shall be arranged so that normal inspection and servicing of the compressor and other equipment is not hindered. Locations where copper tubing will be exposed to mechanical damage shall be avoided. Hangers and supports where piping passes through walls shall be installed to prevent transmission of vibration to the building.

All refrigeration pipes shall be sized to the supplier's method. The refrigerant charge shall be accurately calculated by the same method. The recommended maximum pipe lengths as set out by the manufacturer shall be adhered to.

Only synthetic oil compatible with the refrigerant shall be used to lubricate any cutting, reaming and flaring tools.

Only phosphor copper brazing rods shall be used without any flux on the piping joints. The pipework shall be continuously purged with low pressure nitrogen during all brazing operations.

Simple purging of the refrigerant pipes between the indoor and outdoor units shall not be acceptable. Refrigerant pipes shall be correctly pressure tested with nitrogen and a small amount of refrigerant to 3.8 MPa for R410A and left for 24 hours to ensure that the pressure does not drop. A vacuum pump shall then be used to purge the piping for longer than 2 hours to -100kPa. The system shall be capable of holding this vacuum for 1 hour or to the satisfaction of the design engineer.

The system shall then be charged in the liquid state with the calculated amount of additional refrigerant by using an accurate charging scale (charging cylinder shall not be used). Only once the system is correctly charged shall the refrigerant valves on the outdoor units be opened.

The mechanical contractor shall make use of colour coding (insulation type straps) to differentiate between refrigerant pipes running from refrigerant risers to different thermal zones.

Refrigerant pipes for multiple outdoor units shall be correctly arranged to meet manufacturer's requirements. Where multiple outdoor units are used, insulated oil equalisation line shall be installed between the units.

Support all pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric - refer to section regarding trunking for further details. The installation of trunking and trays shall form part of this mechanical contract.

Arrange all exposed pipe runs to present and neat appearance, parallel with other pipe or service runs and building structure.

Ensure all vertical pipes are plumb or follow building line. Provide lifting loops where called for by system manufacturer.

Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.

Take precautions to prevent the discharge of refrigerant gases to atmosphere.

Longest possible lengths of copper pipe should be utilised to minimise joints on site.

Appropriate refrigeration installation tools must be utilised. Dry nitrogen must be utilised at all times in the system during brazing.

Refrigerant (R410A) charge weight must be calculated, based on the actual installed length of pipework in accordance to manufacturer's recommendations.

All joints installed horizontally shall be mounted with branch piping in a horizontal plane.

8.7 CONDENSATE DRAINAGE

Outdoor units shall be provided with a galvanised drain tray with suitable drain pipe connection. Drain pipes that run from the drain tray to the nearest drainage point shall be installed to ensure positive drainage of condensate. Piping shall be galvanised steel where exposed to weather elements.

Where possible, the condensate drain pipes from indoor units shall be run together with refrigerant pipes and be installed in the same trunking and on the same cable trays for as far as the installation permits.

uPVC pipes shall be used for drain piping from indoor units. Drain pipes shall run and connect via a suitable U-type trap to waste water pipes as indicated on the project drawings. The connection between the drain pipe and waste water pipe shall be an airtight sealed connection that allows positive drainage of condensate.

In ceiling voids, drain pipes shall be installed in galvanised cable trays. Where drain piping does not run with refrigeration piping in the same cable trays, galvanised “Cabstrut” light duty cable tray shall be used. Drain piping shall be fixed to the cable tray with suitably sized cable ties installed at 500mm intervals.

Horizontally mounted drain pipes shall be installed at a slope of 20mm per 1000mm ensuring positive drainage.

Surface mounted drain piping shall be secured to the wall by means of galvanised steel saddles at no more than 1m intervals.

Where drainage piping or control cabling is required to be installed flush-mounted, positioning and chasing shall be done in good time to meet the construction program.

8.8 PIPEWORK INSULATION

Refrigerant pipe insulation:

Ensure the entire length of pipework is insulated for thermal insulation and to avoid contact between copper and galvanising of tray.

The mechanical contractor shall apply “Armaflex” type, lightweight, elastomeric nitrile rubber tube insulation on all refrigerant piping in such a manner as not to cause leaking. The wall thickness of the insulation shall be min 13mm and as per the following table:

The wall thickness of the insulation shall be to the following table:

Refrigerant Pipe Diameter (mm)	Wall Thickness (mm)
6.34	13
9.53	13
13.70	13
15.88	19
19.05	19

Drain pipe insulation:

All internally routed condensate drain piping shall be insulated with “Armaflex” type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13mm.

8.9 PIPEWORK TRAYS AND TRUNKING

Refrigerant piping in ceiling voids and mounted internally against walls shall be installed in galvanised steel light duty cable trays of adequate size to cope with the pipe load. Pipes shall be strapped over insulation to cable trays at 500mm intervals. Where drain pipes run together with refrigerant pipes,

cable trays shall be to a size of 30% excess capacity of the condensate and refrigerant piping the tray carries.

Externally mounted refrigeration pipes and drain pipes shall be mounted in cable trunking. Cable trunking shall be complete with clip-on covers. Pipes and cables shall be strapped together every 500mm and loosely fitted in the trunking. The trunking shall be manufactured from galvanised steel and epoxy powder coated.

Any insulation material not covered by the trunking and exposed to the elements shall be neatly strapped to minimise the possibility of dirt and water entering between the insulation and refrigeration pipes.

8.10 PRELIMINARY TESTING

The equipment manufacturer's authorised representative shall perform preliminary commissioning on the VRF system.

Electrical power to all indoor and outdoor units shall be turned on after the system has been charged with refrigerant. Power shall be supplied to all units for duration of 9 hours before initial testing shall commence.

The equipment test sequence shall be run and the errors displayed on the controller shall be rectified.

The system as a whole as well as individual equipment shall be adjusted to give the specified performance. Control systems shall be adjusted and placed in operation

9. VENTILATION FANS

9.1 GENERAL

All ventilation systems shall be provided such that limiting room noise criteria are not exceeded during operation. The mechanical contractor shall be responsible for re-calculating and checking fan pressures to suit the actual equipment offered for the installation. Dirty filter pressure ratings shall be used. Fans shall be selected to operate at or as close to maximum efficiency as possible.

Attenuators shall be mounted directly onto the fan casing with flexible connections between the ducts and attenuators, unless this is impossible due to spatial restrictions.

Fans shall be fitted with the manufacturer's nameplates permanently fixed to the casing in a prominent position, clearly indicating manufacturer, model number, size, speed, maximum operating speed, maximum power absorbed and serial number.

Fan air in/outlets not connected to ducting or equipment shall be protected with easily removable safety wire mesh screens.

Indicating arrows for both direction of rotation and direction of air flow shall be provided on fan casings.

All fans shall be installed in accordance with the manufacturer's requirements and recommendations.

All fans shall be mounted on anti-vibration mountings or supported from anti-vibration hangers.

Bearings shall be of the ball or roller type and shall be quiet in operation. They shall be sized to give a long life (not less than 100 000 hours) at the loads imposed by the application.

Belt guards shall be arranged to permit lubrication and use of speed counters with the guards in position. Belt guards shall have adequate ventilation for belt cooling.

9.2 IN-LINE MIXED FLOW FANS

In-line mixed flow fans shall be suitable for duct installation as indicated on the project drawings for the relevant ventilation and/or extraction system(s). Mixed flow fans shall be manufactured from a self-extinguishing material, be IP 54 protected and be equipped with fan motor overload protection. Fans shall have compact overall dimensions with the overall diameter only slightly larger than the ventilation duct.

In-line mixed flow fans shall have two speed settings and shall be sized and selected so as to meet the required fan duty at the lower speed setting. In-line mixed flow fans with their adjoining attenuators shall satisfy the required noise criteria.

To minimise the transmission of vibration and fan noise, fans shall be resiliently mounted on rubber cushions or anti-vibration hanger rods.

9.3 IN-LINE AXIAL FLOW FANS

Axial flow fans shall be of the non-overloading, aerofoil type with peak power requirements occurring at normal operating pressure range. The fan motor shall have a rating exceeding this requirement. Axial flow fans shall operate at the highest possible efficiency at the lowest possible blade tip speed.

Impeller blades shall be manufactured from a die-cast aluminium alloy clamped in a split steel or aluminium cast hub. Hubs on larger fans shall be manufactured from hot dipped galvanised steel. The blade pitch shall be adjustable at the hub. Cast steel hubs shall be electro-coated.

Axial flow fan casings shall be manufactured from hot dipped galvanised mild steel with pre-drilled flanges on both ends of the fan. An access panel of ample size shall be provided in the casing. All fasteners shall be zinc plated.

Fan motors shall be totally enclosed and shall be of the squirrel-cage induction type with protection to IP 55 standard. An external weatherproof terminal box forming part of the casing shall be included in the design for motor connections. Where belt driven fans are used, belts shall be of the V-belt type with grooved pulleys. Belts shall be oil resistant, non-sparking and non-static. Belt drives shall comply with OHSA requirements.

Axial flow fans shall be statically and dynamically balanced in accordance with ISO 1940 within grade G6.3.

Axial flow fans shall always be resiliently mounted on anti-vibration mountings to prevent carry- over of vibration to the structure to which the unit is fixed.

9.4 WALL / WINDOW BUILT-IN FANS

Wall/window built-in fans shall be of the reversible type capable of moving the specified air volume at the specified air pressure. Wall/window built-in fans shall be complete with sleeves to allow the installation in varying wall thicknesses, time delay automatic shutters to prevent backdraughts and splash proof external grilles. The fan shall be protected against the ingress of water from both indoor and outdoor.

Fans shall be installed with anti-vibration gaskets around the perimeter of the casing to prevent vibration carry-over and to minimise noise levels.

Fan motors shall be single phase complete with thermal overload protection.

Wall/window built-in fans shall have double insulated shaded pole type motors with self-aligning, permanently lubricated and sealed long-life ball bearings.

10. DUCTING

10.1 GENERAL

Sheet metal ductwork shall be hot-dipped galvanised and manufactured in accordance with SANS 1238, and installed balanced and tested as set out in SANS 10173. The installation and manufacture of ductwork shall strictly be in accordance with SANS standard specifications with specific attention given to the following:

- Changes in size and shape of ducting: refer to SANS 1238, Section 6.3.
- Access openings, doors and covers: refer to SANS 1238, Section 5.3.
- Sealant requirements: refer to SANS 1238, Section 5.6.
- External ducting insulation: refer to SANS 10173, Section 5.4.

Material thickness and duct stiffening for low pressure ductwork: refer to SANS 1238, Section 6 for rectangular ductwork and SANS 1238, Section 7 for circular ductwork.

Radius and square bends as well as turning vanes: refer to SANS 1238, Section 6.4. Unless the sheet metal ductwork is inherently corrosion protected, all sheet metal shall be protected against corrosion as outlined in SANS 1238, Section 8.

It shall be the responsibility of the mechanical contractor to ensure proper assembly and sealing of sheet metal ductwork and insulation strictly in accordance with SANS specifications.

The air duct system shall be of the low-pressure type and the ductwork shall be manufactured of galvanised mild steel with general material requirements as set in section 5.1 and 5.2 of SANS 1238. The ductwork shall be circular or rectangular in cross-section as indicated on the project drawings.

The first dimension given on the drawings for rectangular ductwork shall be read as the width on plan and the depth on section, and the second dimension shall be read as the depth on plan and the width on section.

The duct dimensions shown on the drawings are sheet metal dimensions. All final dimensions shall be checked on site, or verified by means of architect's working drawings and structural drawings, before the fabrication of the ducting.

Sealing membranes and adhesives for affixing insulation shall meet the indexes for surface spread of flame, heat contribution and smoke production as set out in Section 4 of SANS 1238.

The inner surfaces of ducting shall be smooth and no internal insulation shall be used. Dampers, sound attenuators, duct splitters and turning vanes shall be installed where indicated on the drawings.

Flexible connections shall be provided between all fans, sound attenuators and ducting. Flexible connections exposed to weather shall be provided with protecting galvanised sheet steel cover strips. The material used for flexible joints shall comply with the requirements as set out in SANS 1238, Section 5.5. Flexible connections shall be provided on both sides of the equipment as indicated in the figures shown in SANS 1238.

Ducting shall always be installed in such a way, that, especially in plant rooms, maximum height between the floor and the underside of ducting is achieved.

The installation and testing of hangers shall comply with the requirements as set out in SANS 10173. All hangers shall be treated against corrosion and shall be painted.

Reinforcement, duct stiffening and fastening accessories shall be galvanised and installed where required. Only duct accessories manufactured from compatible materials, which comply with SANS 10173, shall be installed with the ductwork. Tie rods shall be manufactured from galvanised steel. Rivets, screws, bolts and other fastening equipment shall be corrosion proof and be hot-dipped galvanised.

10.2 LONGITUDINAL SEAMS AND TRANSVERESE JOINTS

Pieces of ductwork shall be joined with the necessary sealants, as applicable, as set out in SANS 10173, Section 5.

Rectangular Ductwork:

Longitudinal seams and transverse joints for rectangular ductwork shall be in accordance with SANS 1238, Section 6 and the associated figures shown in SANS 1238.

As an alternative to transverse joints specified in SANS 1238, other flanged joints such as MEZ-flanges will also be considered provided that they meet the SANS requirements. MEZ-flanges or equivalent products shall be manufactured from cold rolled steel and hot dipped galvanised after manufacture.

Circular Ductwork:

Longitudinal seams and transverse joints for circular ductwork shall be according to SANS 1238, Section 7 and the associated figures shown in SANS 1238.

10.3 HANGING AND SUPPORTING OF DUCTWORK

Ducting with Insulation and Vapour Barrier:

Hangers and supports for rectangular and circular ductwork shall comply with SANS 10173, Section 5.3 “Ductwork with a vapour barrier”.

Ducting with No Insulation:

Hangers and supports for rectangular and circular ductwork with no insulation shall comply with SANS 10173, Section 5.3 “Ductwork with no vapour barrier”. The hanger and support types used for ducting with insulation may be used.

10.4 DUCTING INSULATION

All air ducts carrying heated or cooled air, except where specifically stated to the contrary shall be externally thermally insulated. Internal insulation shall not be acceptable. All joints, valves, dampers, etc. shall also be adequately insulated. All ducting insulation material and installation shall comply with the requirements as set out in SANS 10173, Section 5.4.2.1.

External duct insulation shall be highly resistant, organic glass fibre blanket bonded with resin, faced and vapour protected with an aluminium foil cover laminate. The external insulation shall as a minimum satisfy the properties as given in the table below.

Type	Thickness (mm)	Volumetric Mass (kg/m³)	Thermal Conductivity (W/mºC)	Temperature Limits	Fire Rating
Duct Wrap 40	40	16	0.040 @ 35 ºC	120 ºC	Class 1

Insulating material shall be fixed to the duct with adhesive and strapped or clamped at intervals not exceeding 300mm. Mechanical fastener pins may also be used on the bottom and sides of the duct. The integrity of the vapour barrier shall be reinstated after the pins have been fixed. Joints in the insulation shall be taped by means of an aluminium type of the same quality as the foil facing with a minimum overlap of 50 mm. No vapour seal shall be left punctured.

All insulated ductwork shall be provided with a vapour barrier to the requirements as set out in SANS 10173, Section 5.4.2.3. If an alternative insulation material is used that is not faced with an aluminium foil then a continuous vapour barrier shall be secured to the insulation and adequately sealed with an adhesive aluminium tape or equal method. The vapour barrier material shall comply with the requirements for flammability of sealing membranes of SANS 1238.

Flexible ducting conveying cooled or heated air for air conditioning purposes shall be of the pre-insulated type with reinforced multiple layer aluminium laminated outer vapour barrier.

Exposed/Externally Routed Ducting:

Ducting running in areas exposed to the weather elements shall be provided with an additional protective layer applied over the existing vapour barrier.

Galvanised sheet metal shall cover the insulated ductwork to shed water and provide protection against physical damage. The galvanised sheet metal cladding shall be at least 0.6 mm in thickness and secured tightly to the insulation. In the case of a vapour barrier, care shall be taken to ensure that the vapour barrier is not damaged in any way. If the vapour barrier is damaged in the process of installing the cladding then the mechanical contractor shall repair, seal and reinstate the integrity of the vapour barrier as needed.

10.5 FLEXIBLE DUCTING

Flexible ducting shall comply with the requirements as set out in SANS 10173, Section 5.7. Flexible ducting shall be proprietary manufactured with a fire rating to SANS 10177 Part 3 Class 1. The flexible ducting shall have an adequate working pressure and temperature range to suit the application of the installation.

Flexible ducting shall at all times be kept to a length not exceeding 1.5m. Flexible ducting shall not have more than the equivalent of one 90° bend and bends shall be of maximum possible radius.

Flexible ducting shall be supported with sufficient and correct brackets that will ensure maintenance of shape.

Flexible ducting shall be provided between air terminals, diffusers and all locations as indicated on the project drawings.

The inner core shall be of aluminium laminate with a heavy-duty steel helix core.

10.6 TESTING OF DUCTWORK

All ducting shall be leak tested in accordance with SANS 10173, Section 4.3. No ducting shall have leakage rates in excess of 5 % of the required air flow rate in any section of ductwork or in excess of the SANS permissible leakage rates, whichever is the smallest.

11. AIR TERMINALS, DAMPERS AND OTHER DUCT ACCESSORIES

11.1 GENERAL

Air diffusion equipment shall be selected in accordance with the manufacturer's recommendations, capable of passing the specified air quantity at the appropriate throw without creating excessive resistance, noise, or local draughts. All air diffusing equipment shall be capable of meeting the noise level requirements for the space environment where the equipment is installed.

In all instances where spigot boxes (plenums) are used for the connection of air diffusion equipment, the inside surfaces shall be painted black to prevent visibility of the internal surface from ground level.

During commissioning of the system, each grille, diffuser, valve etc. shall be set to deliver the specified air quantity. Regenerated noise levels of grilles offered shall be checked against the overall acoustic performance of the system required.

11.2 RETURN AIR GRILLES, TRANSFER AIR GRILLES AND DOOR GRILLES

Return air grilles shall be manufactured from extruded type anodised aluminium, naturally anodised or epoxy powder coated to a colour as specified by the architect/design engineer and shall be of the hinged type. Return air grilles shall in all instances have fixed blades with a curved blade profile. Return air grilles shall have a fixed outer frame and a hinged inner frame with grille section, handle and securing clips. A wire mesh with clips shall be located behind the hinged inner frame to allow the insertion of filter media. The design of the return air grille shall be such as not to allow the bypass of any unfiltered air.

Return air grilles shall be capable of meeting the air flow requirements, as set out on the project drawings, with a face velocity not exceeding 2.5m/s.

Transfer air grilles shall be complete with fixed curved blades and outer frame on both sides of the wall or partition. Transfer air grilles shall be of aluminium extruded type, naturally anodised or epoxy powder coated to a colour as specified by the architect/design engineer. Openings in walls where transfer grilles are to be installed shall be provided by the main contractor.

Door air grilles shall be installed in wooden doors only. In cases where steel and glass doors are used, transfer grilles or transfer ducting as an alternative shall be installed. Door air grilles shall be of the chevron-blade type. Door air grilles shall be manufactured from extruded type 5OS anodised aluminium, naturally anodised or epoxy powder coated to a colour as specified by the architect/design engineer.

Transfer ducting shall comprise of galvanised sheet metal ducting and aluminium curved blade intake and outlet transfer grilles. Flexible ducting shall not be used as transfer ducting.

Return, transfer and door air grilles shall be provided where indicated on the project drawings and shall be installed to the supplier’s recommendation.

Return air grilles shall be installed directly on the ducting where indicated on the project drawings unless specified otherwise. The connection between return air grilles and ducting shall be airtight and sufficiently strong to handle the duct pressure.

11.3 WEATHER LOUVRES

Weather louvers shall be manufactured of extruded aluminium, naturally anodised or epoxy powder-coated to a colour as indicated in the equipment schedules and on the drawings. Weather louvers shall be constructed with drip edges to blades and rigid frames to enable building in. The top and bottom

blade of each weather louver shall be fitted flush with the frame and shall be smooth without grooves, channels or recesses where dirt or water can accumulate. Weather louvers shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3m/s. Wire mesh screens shall be fitted behind the blades with maximum 12mm opening sizes.

11.4 FIXING OF WALL- MOUNTED GRILLES AND LOUVRES

All wall-mounted grilles and louvres shall be fixed to a hardwood frame. The timber frames shall be supplied with the grilles as part of this installation.

The timber frames shall be manufactured in such a way that the flanges of the grilles are mounted flush with the wall and extend past the outer edge of the timber frames by approximately 5mm. The timber frames shall be provided with the necessary cleats with which to mount them in brick or concrete walls. The depth of the timber frames shall be similar to the walls in which they are fitted.

11.5 SUPPLY AIR GRILLES AND DIFFUSERS

Where linear blade type grilles are specified on the project drawings, the supply air grilles shall be manufactured of extruded type anodising grade aluminium and shall be provided with opposed blade volume control dampers, unless specified otherwise on the project drawings. Volume control dampers fitted with supply air grilles shall conform to SANS 1238, Section 6.5 requirements. The blades shall be adjustable from the front of the grille.

Where louvre-faced ceiling diffusers are specified on the project drawings, diffusers shall be manufactured from extruded type aluminium, naturally anodised or epoxy powder coated to a colour as specified by the architect/design engineer. Ceiling diffusers shall be complete with an opposed blade damper, plenum box with spigot and ceiling plate.

Where flat plate disc type diffusers are specified on the project drawings, diffusers shall be manufactured from steel and powder coated to a colour as specified by the architect/design engineer. Diffusers shall be equipped with a locking bracket to lock the adjustable radial disc once the system has been balanced.

Diffusers shall be installed at the locations where indicated on the project drawings. Where diffusers or grilles are connected to flexible ducting, the flexible ducting length shall not exceed 1.5m. Spigots shall be attached to the ducting and sealed with silicone sealer around the outer perimeter of the joint.

Flexible ducting shall be strapped to the diffuser and spigots with steel straps to form an airtight connection.

Alternatively, where indicated on the project drawings, diffusers shall be “hard” connected to ducting with rivets or taper screws and sealed with silicone sealer to form an airtight connection. All diffusers shall be capable of meeting the discharge pattern and throw requirement as set out on the project drawings.

11.6 EXTRACT AIR DISC VALVES

Disc valves shall be supplied and installed in the ceilings of the ablution areas and connected to the extract ducts by means of sheet metal spigots and flexible ducting.

The disc valves shall consist of a ring and central disc, which when rotated shall adjust the volume through the outlet. During commissioning of the system, each disc valve shall be set to exhaust the specified air quantity.

Disc valves in ceilings shall be of the polypropylene type, in a finish to match the ceiling colour, unless otherwise specified.

11.7 VOLUME CONTROL / BALANCING DAMPERS

Volume control or balancing dampers shall be installed in branch ducting to ensure a balanced air flow to all duct sections.

Damper blades, links and damper frames shall be of rigid construction and manufactured from galvanised steel. Dampers shall comply with SANS 1238.

Dampers for positive volume control purposes shall be manual or electric actuator driven as specified. Dampers shall be of the link or gear type.

A manually adjustable damper shall be fitted with an external adjusting lever in an accessible position. All volume control dampers shall have manually quadrant operation. The lever shall be mounted on a square shaft and fitted with a locking mechanism that clearly indicates the current position of the blade. "OPEN", "CLOSED" and "OPERATING POSITION" shall also be clearly marked on each damper.

The inside cross-sectional area of the damper shall be equal to that of the connecting ductwork, and shall conform to the same standards of air-tightness as the rest of the ductwork system. The damper shall be fitted to the ducting in which it is installed by means of a flanged connection.

Volume control dampers shall be of the opposed multi-blade damper (OBD) type or alternatively be of the butterfly-valve type suitable for use in circular ducting.

The ducting system shall be balanced after installation to achieve the required flow rates to the various air terminals. The entire duct system shall be tested, balanced and adjusted as prescribed in SANS 10173.

All dampers, whether it is an OBD or a butterfly valve, shall in all cases comply with requirements of SANS 1238, Section 6.5. The damper frames and blades shall be constructed of galvanised mild steel, assembled with galvanised bolts, nuts and washers. Extruded aluminium blades shall also be acceptable. Blades shall have a mill, anodised or epoxy powder finish.

11.8 FIRE DAMPERS

Fire dampers shall be installed according to the manufacturer's and SABS requirements and recommendations. Fire dampers shall be located where indicated on the project drawings.

Fire/smoke control dampers shall in all instances comply with the requirements of SANS 193 as amended, and shall bear the SABS mark with proven low leakage in the closed position. Each fire damper shall be clearly marked as per clause 5 of SANS 193. Fire dampers shall have at least a 2 hour resistance rating when tested in accordance with SANS 193.

Fire dampers shall be flanged both sides, and an access panel shall be provided in the ducting at each fire damper, preferably on the upstream side of the damper. The open or closed status of the damper shall be clearly indicated outside the casing for inspection purposes.

Where fire dampers are actuated by means of an electrical solenoid (power on: damper closes), a fusible link shall always be incorporated in the assembly to provide normal closure in the event of increasing temperature within the duct. Actuation by means of electro-magnets (power off: damper closes), will not be accepted. Solenoids and electrical actuators shall be provided within an enclosure. Open electrical connections shall not be accepted.

Each fire damper shall be wired to the switchboard with a LED signal to show if the damper has been closed. Alternatively, a red LED shall be installed in the ceiling below each fire damper to indicate closure of damper. All fire dampers shall be clearly identified on a synoptic drawing at the control board as to indicate the installed position of each fire damper in the controlled area. Labels shall be installed on the ceiling grid below all fire dampers indicating their positions, and reading: "Fire damper above".

Dampers shall be sized so that the nominal free air area when in the open position is not less that the connected duct free air area.

Fire dampers shall be installed as to form part of a continuous barrier to passage of fire when in a closed position. Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between the damper and the wall shall be of at least the same metal thickness and fire rating as the damper casing.

Dampers shall be self-supporting in case of duct destruction due to heat. Care shall be exercised that the supporting frame be installed so that the closing device is accessible.

Sheet metal sleeves shall be provided for housing the fire dampers where fire dampers are mounted in walls. These sleeves shall be built into the walls by the main contractor. Retaining angles shall be installed on the four sides of the fire damper sleeve on both sides of the wall. The angles shall be fastened to the sleeves only, and not to the wall. The retaining angles shall lap the masonry by a minimum of 25mm around the entire opening.

Recommended minimum angle sizes are:

Largest Dimension of Fire Damper	Angles
Up to 1200mm	38 x 38 x 3.2mm
1200mm to 1800mm	44 x 44 x 3.2mm
Over 1800mm	51 x 51 x 4.8mm

Clearance shall be provided between the sleeve and the masonry opening on the top and at the sides of the fire damper to allow for expansion. Allow a gap of 1mm for each 100mm of sleeve width or depth, but the gap shall not exceed 15mm.

All fixing and installation materials, i.e. bolts and nuts, rawl-bolts and mortar works shall be as per fire damper manufacturer's specification and shall not affect the fire rating of the fire damper installation. Combustible materials such as plastic or similar rawl-bolts and plugs are not permitted.

12. VENTILATION AIR FILTERS

General:

Air filters of the make, type and size as specified on the drawings shall be installed.

Filters installed close to exposed air inlets shall be protected by means of weather louvres and wire mesh screens.

Filter holding frames shall be of approved manufacturer with standardized dimensions to enable replacement with equivalent filters of all recognised manufacturers.

Construction and manufacture of all components shall be such that under no circumstances any unfiltered air can bypass filters or filter banks.

Sufficient space shall be allowed in front or behind filters, to enable inspection and servicing.

Return Air Filters:

Washable filter media shall be fitted behind hinged return air grilles where indicated on the project drawings. The filter media shall be at least 100 grams /m² density and 5mm thick. The filter media shall be of the synthetic type and shall be capable of arresting lint in the return air. The filter media shall fit and extend past the outer perimeter of the wire mesh in the return air grille such that the bypass of unfiltered air is avoided. The filter media shall be fire proof. Glass fibre filter media type shall not be acceptable

Primary filters:

Primary filters shall be of the pleated washable panel type with thickness as specified in the equipment schedules on the drawings, or 25mm where no thickness is stated. The media shall be synthetic and shall be of the self-supporting type. The media shall fit into and extend to seal all round the panel frame to ensure that no air bypasses the media. The filter outer panel frame shall be of galvanised steel.

All filter accessories including the channel filter holding frames and clips shall be standard products of the filter manufacturer. Filter holding frames shall be manufactured from galvanised steel. Filter holding

frames shall be bolted or riveted together, where necessary, and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions. An airtight seal shall be provided where filter holding frames are joined together. All metal parts shall be sufficiently protected against corrosion.

Primary filter panels shall fit into channel holding frames with sealing gaskets located between filter panel and channel holding frame. Where the channel holding frames are located on the downstream side of the filter, at least two spring loaded clips shall be used to ensure a positive seal against the edge gaskets and to keep filter panel in place. Where the channel holding frames are located at the upstream side of the filter, at least four spring loaded clips shall be used. All clips shall be stainless steel.

The primary filter shall be of filtration class G3 have an average ASHRAE arrestance of 90 %, SABS tested. The dust holding capacity shall not be less than 200 g per square meter. The initial (clean) and final (dirty) resistance of the filter shall be 50Pa and 100Pa respectively. The above-mentioned features shall be based on a rated face velocity of 2.5m/s.

13. SOUND ATTENUATORS

Attenuators shall be selected such that the pressure drop on both suction and discharge attenuators is minimised whilst meeting the noise level attenuation performance levels as required.

Acoustic material must not break up, erode or migrate up to and including 150% of full duty air flow and up to and including 100% relative humidity. An impervious envelope shall be fitted over the following acoustic fill:

a) Mineral fibre insulation.

b) Open-cell acoustic/thermal foam insulation that is not supplied complete with an inherent sprayed vapour barrier or flexible polyurethane film.

Inspection covers shall be provided at both ends of attenuators.

The dynamic insertion loss of attenuators shall include the effect of any facing materials.

Vapour barriers which are not an inherent part of the acoustic material, shall have a minimum thickness of 0.07mm and shall be installed unstressed. The material shall be inherently non-combustible and limit the surface spread of flame to Class 1 when tested in accordance with BS 476: Part 7 and shall not emit toxic or hazardous fumes if ignited. Membranes used shall be suitably supported and fixed. Any

loss of acoustic performance due to this treatment will be deemed to be accommodated in the overall performance of the noise control equipment selected by the mechanical contractor.

Splitter elements in straight rectangular attenuators shall stand vertically, and shall be a tight fit within the casing. L-section and T-section splitter attenuators shall be designed for smooth air flow. Splitters in bend attenuators shall be fitted perpendicular to the plane of the bend. Where splitter elements are horizontal, e.g. in ceiling spaces, adequate support and retention of acoustic infill must be provided.

The direction of air flow through each attenuator shall be clearly marked on the outer casing.

The silencers shall have an outer casing of not less than 22 gauge galvanised sheet steel.

Longitudinal joints shall be lock-formed and mastic sealed under construction. The infill shall be inorganic mineral wool or glass fibre, of a density sufficient to obtain the specified acoustic performance and packed under not less than 5% compression to eliminate voids due to settling.

The infill shall be insect, vermin, rot and moisture-proof and adequately protected. The acoustic material shall be secured and enclosed with a suitable facing secured to the material to prevent fibrous materials entering the airstream.

Each casing shall be constructed from galvanised sheet steel with drilled and galvanised angle flanges. Flanking transmission by sound leakage shall be kept to a minimum.

Where in-line mixed flow fans are installed, tubular sound attenuators shall be used, unless otherwise specified. These attenuators shall comprise of tubular liner manufactured from galvanised mesh, a thick layer of mineral wool sound absorbing material and galvanised sheet steel casing with end plates.

Where in-line centrifugal fans are installed, proprietary manufactured rectangular attenuators shall be used. Attenuator sizes shall be such that the combined pressure loss of both suction and discharge attenuators do not exceed 60 Pa.

Where in-line axial flow fans are used, cylindrical attenuators shall be used unless otherwise specified. These attenuators shall have casings constructed from pre-galvanised steel sheet, glass fibre absorbing material and a 1.6mm thick pre-galvanised wire mesh to retain the acoustic material.

14. CONTROLS AND BMS

All equipment shall have BMS interface.

This section shall be regarded as a performance specification to outline the design intent only. The contractor shall allow for the complete design, supply, installation, setting to work, testing, commissioning and warrantees related to the Automatic Controls and BMS (Building Management System).

A complete central DDC type control system and BMS shall be provided, including all associated control components and sensing devices the control functions.

Generally, the system will include the following main functions:

- Optimum stop/start routines
- Multiple time programmes
- Temperature monitoring and adjustment
- Status monitoring and fault alarms of all connected plant

For the VRF system, the supplier's proprietary BMS controls system will be accepted, provided that it enables interrogation of the system and can send a common fault signal to the main BMS head-end computer. Refer also to VRF controls section.

For the rest of the BMS installation, the mechanical HVAC contractor shall employ/utilize a qualified controls specialist with suitable credentials to design, procure, install and commission the system. Refer also to individual equipment controls sections to follow.

The contractor shall provide a minimum of five days training and instruction of the Client's maintenance staff prior to handover.

14.1 LOCAL SPLIT AIR CONDITIONING CONTROLS

Controls shall be of the hard wired, wall-mounted electronic type. Controls shall be of the same manufacture as the air-conditioner. Controls shall be mounted over a flush-mounted 100 mm x 50 mm electrical box. Control wiring shall be installed in a 20 mm electrical conduit from the controller to the air conditioning unit. The conduit and outlet box shall be chased into the wall by the electrical contractor. The electrical contractor shall install the conduit from the outlet box to 100 mm above ceiling level directly above the controller.

Controls shall have the following minimum functionality:

- Manual ON/OFF
- ON/OFF by a 24 hour / 7 day timer
- Room temperature display
- Room temperature adjustment
- Cooling / heating / ventilation selection
- Automatic change-over between cooling and heating
- Auto change-over between units (for duty/standby applications)
- Fault indication

14.2 VRF SYSTEM CONTROLS

Each indoor unit shall be provided with a wired wall mounted controller complete with integral sensor, with the exception of multiple indoor units that serve the same space, in which case all the associated indoor units shall be controlled from a common wall mounted controller.

In addition to the individual zone remote controllers for the indoor units, the VRF system shall centrally be controlled with an intelligent touch controller. The controller shall be interlinked with the BMS system to provide a common fault alarm.

The centralised controller shall enjoy priority over the individual remote controller of each indoor unit. The centralised remote controller shall perform zone control and shall switch zones as required by the user. The centralised remote controller shall be capable of displaying error contents from all air conditioning units. The centralised remote controller shall monitor on/off, temperature settings etc. of each unit individually.

Wall mounted controllers shall be mounted over a flush-mounted 100mm x 50mm electrical box. Control wiring shall be installed in a 20mm electrical conduit from the controller / signal-receiver-unit to the air conditioning unit. The conduit and outlet box shall be chased into the wall, unless otherwise specified or agreed. The conduit from the outlet box shall run to 100mm above ceiling level directly above the controller.

Wireless remote controllers (if applicable) shall fit in a wall mounted holder neatly mounted next to the room light switch.

Control wiring to individual unit controllers shall be different in colour to the colour of the control wiring that interconnects air conditioning units and the central system controller.

The VRF system shall be interconnected with the BMS via the central controller with the relevant control connection interface suitably compatible with the BMS-Ethernet. The VRF controller shall send a common fault alarm to the BMS which shall refer the BMS operator to the VRF central controller for further detailed interrogation.

VRF equipment shall switch off upon a signal from the fire alarm system as described on the drawings and equipment schedules, by means of fire control boxes and daisy-chain cabling arrangements.

14.3 VENTILATION FAN CONTROLS

Main toilet extract fans and fresh air supply fans shall operate under dictates of a programmable 7 day / 24 hour timer control. All required fire interface switchgear and cabling shall be provided by the mechanical contractor.

Toilet areas served by a local individual in-line or wall-mounted fan shall have presence-detection control with minimum 20min run-on time. Hard wired controllers for these fans shall have control wiring installed in conduits chased into the wall or 15mm trunking neatly mounted from the fan to the controller.

For all ventilation fans, a pressure differential switch shall raise a fault alarm in a "no-flow" condition.

The following BMS monitoring features shall be made available for ventilation fans:

- On/Off indication
- Fault alarm
- Filter dirty alarm (as applicable for fresh air supply fans)
- Fan run/trip indication

15. ELECTRICAL WORKS RELATED TO THE MECHANICAL INSTALLATION

15.1 GENERAL

The services of qualified electrician shall be employed by the mechanical contractor. The mechanical contractor shall be responsible for the design, documentation, supply, installation and commissioning of the electrical system for the air conditioning installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of premises, SANS 10142-1 latest Edition. An electrical certificate of compliance shall be issued by the mechanical contractor after completion of the installation.

The mechanical contractor shall supply and install the distribution boards / control panels at the location where so indicated on the project drawings. The mechanical contractor shall also be responsible for the complete electrical installation extending from the distribution boards to the isolators and HVAC equipment.

The distribution boards shall have all the necessary main switchgear and instrumentation and other mechanical equipment where indicated on the drawings fully wired and connected. It is the mechanical contractor's responsibility to determine the correct fault level of the main distribution boards before manufacturing of the HVAC distribution boards.

The distribution boards shall be totally enclosed, vermin and insect proof, drip proof, dustproof to class IP55 of IEC144. The mechanical contractor shall ascertain the positions of the distribution boards timeously and ensure that provision is made in the structure for sleeves, pipes, access holes, etc. as required.

Before commencing manufacture of the distribution boards / control panels, shop drawings shall be submitted to the Engineer for approval. The distribution board shall be thoroughly tested before leaving the factory and copies of the manufacturers test certificate shall be submitted to the Engineer for approval before installation.

The electrical contractor shall supply main supply cables to the position of the HVAC distribution boards. The supply cables shall be connected to the distribution boards by the mechanical contractor.

The mechanical contractor shall supply and install all cables and galvanised conduit from the distribution boards to all the HVAC equipment. The connecting of cables in the distribution boards shall be executed by the mechanical contractor.

An electrical point in the form of a surface mounted weatherproof isolator shall be supplied at each of the pieces of equipment by the mechanical contractor. The feed from the isolators to the units shall run

in galvanised conduits, installed by the mechanical contractor, and shall be neatly connected to the units.

Labelling of the electrical system shall be of engraved laminated plastic with 4mm high white lettering on black background or equal. Labels shall be securely fitted, and labels glued into position shall not be acceptable.

15.2 DISTRIBUTION BOARDS AND CONTROL PANELS

The distribution boards and control panel / panels shall be of the wall-mounted type, robustly fabricated of 16 SWG galvanised mild steel sheet, with fascia plates behind lockable doors.

All metalwork shall be suitably treated against corrosion and shall be coated with a self-etching primer, two coats of metal primer, and finished, internally one coat, externally two coats, with a good quality hard gloss enamel of an approved colour. The final coat colour shall be a standard B.S. colour readily matchable. No hammer tone or similar.

All control equipment is to be chassis mounted behind a hinged fascia plate through which only circuit breaker toggles, reset buttons, etc., protrude. Equipment shall not be fixed to the fascia plate. Alarm pilot lights, timing units and ammeters shall be mounted on the doors, all other equipment being behind the doors. The control panels shall be complete with main isolator/s that can be operated without opening the doors. Access to equipment and wiring shall not be possible without switching off the main isolator.

The cable boxes to terminate the incoming cable will be mounted by others, but supports for this box are to be provided. Where PVC insulated cable is indicated, a gland plate only is required.

Busbars are to be located in a separate chamber. The busbars shall be of solid copper, rated at 155 amps per square centimetre, and shall be spaced and mounted to withstand the short circuit current, equal to the rating of the main isolator. All busbars and conductors shall be fully insulated in the respective phase colours. Each board it to be provided with neutral and bare earth busbar, with one way for each circuit and for each conductor.

Internal busbards, wiring, and terminals, shall be of suitable size and rating. Terminals shall be of brass and comply with SANS 60947-3. Wiring shall be neatly bunched and run in PVC wiring channels.

The electrical equipment to be provided on the switchboard shall comply with the detailed requirements.

Each control panel shall have red alarm pilot lights to indicate any malfunction or operation of any safety device. Normal running conditions of fans, pumps, etc., shall be indicated with green pilot lights. All pilot lights shall have a “lamp test” facility. This can be done either collectively or singly by means of a push button switch.

All exposed equipment and pilot lights are to be clearly labelled by means of plastic engraved labels, mounted on the fascia panels by means of screws or channelling. Each item of equipment in the board is to be labelled to correspond to its reference number on the wiring diagram. All wiring connections to equipment are to carry numbered ferrules corresponding to the connection number on the wiring diagram. All wiring to external equipment is to terminate in a numbered terminal block, to which the external wiring is to be connected. The terminals are to be of suitable rating for each circuit. No deviation from these requirements will be permitted.

The grouping of equipment on panels will be logical and neat and shall be done on the following basis:

- Main incoming breaker, main metering, and incoming cable access;
- Each motor circuit with sub-main breakers, starters, and contactors;
- Plant room auxiliaries and general control circuits.

A detailed drawing of the control panels, as well as an electrical component and connection diagram shall be submitted for approval before manufacture commences. A wiring diagram of each control panel is to be laminated and installed inside the panel with clips or hooks.

The following shall be provided as part of the distribution boards / control panels:

- One ampere meter with phase selector switch;
- One voltmeter with phase selector switch;
- Fault indication lights;
- Run indication lights;
- Lamp test push button;
- Circuit breakers;
- Main incoming isolators.

All circuit breakers within the distribution boards shall be of the CBI type. Each breaker, whether single or three phase shall be of curve 1 specification, and must be fitted with under voltage release (UVR). In the event of loss of power, these breakers shall trip, and remain switched off until such time as they are physically switched back into the network.

15.3 MOTORS

Motors shall comply with BS 2613 and dimensioned to BS 2960 as amended and be suitable for 400/230V, 3 phase, 50Hz a.c. supply, unless otherwise specified and shall be continuously rated for operation at the required altitude and ambient conditions.

The motors shall be suitably insulate to a minimum of class E, the speed not to exceed 1500rpm and should suit the speed of the plant offered.

The motors shall be of the approved squirrel cage type with a long starting current.

Frames shall generally be of the standard protected type, but in dirty and damp installations they shall be totally enclosed, fan cooled. Where operating and moist air conditions, motor windings shall be specially treated.

The motors shall be protected against overheating by three temperature sensing devices incorporated in the stator windings. The devices shall be connected and wired in such a manner that the power supply to the motor will be interrupted when the temperature in the windings exceeds the manufacturers rating.

Motors shall be able to start satisfactorily at a voltage of 10% below nominal voltage, as measured immediately after the starter is switched on. Motors shall be run up to full speed in the time given in BS 587 with the voltage reduced by 10% as above. Acceleration shall be smooth throughout the starting period with no signs of hesitation or “crawling”.

Motors shall have a rated brake horsepower at least 15% in excess of the maximum horse power required to drive the unit when working under normal maximum load.

The motors shall be provided with approved watertight cable glands to accommodate the cables to be supplied with the equipment.

On completion at the manufacturer’s works all motors shall be subjected to routine and type tests in accordance with BS 2613, and test certificates shall be submitted for approval before delivery to site is undertaken.

Tenderers shall supply wiring diagrams and efficiency, power factor and starting current curves of the motors at the time of tendering.

Where any motor is remote from/or obscured from view, from the panel, a separate isolator shall be provided for it. In the case of equipment, which is locate out of doors, weatherproof lockable isolators are to be supplied. Alternatively lockable type isolators shall be provided at the control panel.

15.4 STARTERS

The starters or switches for starting the electric motors shall be so designed, to limit the amount of current when starting and accelerating, to the current values set out below:

- 1,5kW to 3,7kW: four times full load current;
- 4,5kW to 11,0kW: twice full load current;
- 11,5kW to 18,5kW: one and three quarters full load current;
- Over 18,5kW: one and a half times full load current

Starters are to be of the magnetically operated type, preferable with thermal overload protection in each phase. For motors above 37kW thermal overloads are to be of the bi-metal indirectly heated type. Either type of starter is to be such that the correct overload settings, the starter will trip within 45 seconds when the motor is single phasing. Where this latter requirement cannot be met, separate single phasing preventers are to be fitted on all 3 phase motors.

On starters for motors above 75kW, protective relays shall be installed for overload, under and over-voltage, negative phase current, phase imbalance, etc.

After commissioning, the full load current of each circuit is to be measured and the overloads set to suit this loading.

All starters are to be suitable for a minimum of 15 operations per hour.

All starters are to incorporate at least two auxiliary contacts that can be arrange as either normally open or closed and shall be suitable for adding further contacts if required.

They shall be suitable for both local and automatic operation.

In the case of star delta or reversing starters, only units comprising both electrical and mechanical interlocks will be accepted.

Where starting resistors are used these shall be mounted above or remote from the control panel, or starter enclosure in the case of large drives, to allow for adequate heat dissipation. The resistance banks shall be protected against overheating by thermal sensors.

The starters shall be automatic and shall have “START” and “STOP” push buttons and shall be provided with reset buttons for the overload and over temperature trips.

The starters shall be fitted with approved terminal boxes and glands of ample dimensions to suit the cables to be supplied with this equipment. Provisions shall be made for easy access by means of doors to the starters for maintenance purposes.

An approved earth terminal shall be provided on the frame of each starter housing gear and provision shall be made for earthing each starter in accordance with the requirements of local regulations.

On completion a the manufacturer’s works, the starters shall be subjected to the routine and type tests in accordance with BS 587 and test certificates should be submitted for approval before delivery to site is taken.

15.5 CONTACTORS

All contactors shall be of highest quality and shall have easily removable contact and coils, such as Sprecher Shuh, Cutler Hammer or other approved.

All contractors shall have adequately rated contacts and continuously rate coils with a drop-off value of not more than 80% rated voltage.

15.6 SWITCHGEAR

All switchgear shall be rated for the anticipated load and the maximum rupturing capacity of the particular system.

15.6.1 Main isolators

All control panels shall be provided with a suitably rated main isolator, which is to be of the “on-load” type, and can be operated without opening the door. This isolator shall be mechanically interlocked so that no live components are exposed without the isolator in the off position.

15.6.2 Miniature and mounted case circuit breakers

Heinemann circuit breakers to SANS 556 shall be used with magnetic inverse time overcurrent tripping and in addition with magnetic instantaneous tripping on excessive over-currents or short circuit, of 250V rating for single and double pole and 380V rating for three pole, and shall be of the ampere rating and class of breaking capacity specified or shown on drawings. Where not otherwise specified or shown on drawings the breaking capacity shall be class C.

15.6.3 Miniature isolators

Miniature isolators shall be micro-gap type manually operated air break switches suitable for flush mounting and shall be to SANS 60947. Where individually mounted they shall be in galvanised steel boxes with brass dished cover plates finished to match switch cover plates.

15.6.4 Fused switches

The fuse-switch units shall be of the three phase and neutral arrangement having double break moving contacts supporting H.R.C. fuses, all housed in a robust metal toggle mechanism. Interlocks shall be provided to ensure that the cover cannot be opened when the switch is in the closed position.

The fuses shall be of the H.R.C. type and shall comply fully with BS 88 category of duty a.c. 4.

One set of spare fuses of each rating used in the switchboards shall be supplied and handed to the representative at the site.

15.7 METERING & INDICATION EQUIPMENT

15.7.1 kWh Meters

The meters shall be individually tested and shall comply with SANS 62053.

The scale shall be of the cyclometer type and definition down to one tenth of a unit shall be provided for.

15.7.2 Maximum demand ammeters

Moving iron ammeters suitable for 5 Amp secondary current transformers shall be used.

Ammeters shall indicate the instantaneous current and have a separate indication for a 15 minute average value, preferably of bi-metal element type.

The scale shall be clearly calibrated in black on a white background and both instantaneous and maximum demand readings shall be on concentric scales by means of different coloured pointers.

Meter shall be over-scaled with a suppressed over range corresponding to the starting current and where current transformers are used, the ratio of such transformers shall preferable be indicated on the ammeter fascia.

15.7.3 Voltmeters

The instrument shall be moving iron type, suitable for horizontal as well as vertical flush mounting.

The scale shall be clearly calibrated in black on a white background.

Calibration shall be up to 120% of rated voltage and suppressed scale at zero reading shall be preferable.

The instrument shall comply with BS EN 60051 and shall have an industrial grade accuracy.

15.7.4 Voltmeter switches

Voltmeter switches shall have one “OFF” and six measuring positions and shall be suitable for panel mounting in such a way that only the handle and labelling plate extends to the front of the panel.

The fascia inscriptions on the labelling plate shall be clearly marked.

The switch terminals shall be suitable for lug connections and shall be clearly marked.

The contact movement shall have a rolling or wiping action.

The voltage rating shall be suited to the installation.

15.7.5 Voltmeter fuses

The fuse base shall have a voltage rating suited to the particular installation and shall be suitable for either flush or projection mounting.

Cartridge type fuses shall be used with a nominal range of 2 amp at 400V, 50Hz and rupturing capacity of 20 000amps.

15.7.6 Current transformers

Current transformers shall be of the cooled type and shall have mounting facilities.

Split core current transformers shall not be acceptable.

Current transformers shall comply with SANS 61869 with an accuracy of 50 for indicating instruments, and for measuring instrument up to 200 amp 1.0, 250-600 amp 0.5 and 800 amp and above 0,2.

Transformation ratios, primary and secondary terminals and polarity of windings shall be clearly marked.

15.8 CABLE

Cables shall be 600V grade polyvinyl chloride (PVC) insulated steel wire armoured to SANS 1574 general purpose grade.

Tenderers are required to state in the schedule of prices the size of the cable between the various units to be supplied under this contract. The current ratings of PVC cables shall in accordance with the standard wiring regulations.

The Contractor will be responsible for measuring on his final layout plan for the plant room, the lengths of the different cables require. The tender price must include for the supply and installation of all the necessary cables.

No cable joints will be permissible within the plant room.

15.9 EARTHING

All motors, starters, switchboards and cable armouring are to be connected to earth by means of separate PVC covered stranded copper conductor the same size as the cable conductors, run

alongside cables and strapped thereto. Earthing conductors shall be fitted with sweated lugs at ends and are to be solidly bonded to each other, to the electrical plant and equipment and to earth.

The Contractor shall provide and install a suitable earth mat which must be connected to the switchboard and shall be responsible for the supply of all material for earthing the electrical gear to be supplied and installed under this contract.

15.10 RADIO & TV INTERFERENCE

An electrical installation shall comply with government and local government laws and regulations in respect of radio and television interference suppression. Interference suppression components shall not be used in any part of the circuit in such a way that their failure might cause an unsafe condition.

15.11 EARTH LEAKAGE PROTECTION

All general purpose power outlets and socket outlets shall be protected by an earth leakage unit.

Earth leakage protection shall be of the current-balance type. A static tripping arrangement, either a magnetic or a solid-state amplifier of simple design, shall be used.

The relay shall have sensitivity, such that immediate tripping will result from a total leakage of between 15mA and 20mA.

The relay shall have an integral tripping facility and shall also be temperature-compensated.

The relay shall stand up to high values of earth-fault current without damage to the tripping arrangement.

The relay shall be o fan approved type to SANS 767 and shall bear the SABS mark.

15.12 TESTING

The following tests will be carried out on the installation in the presence of the Engineer or his representative.

- Insulation resistance test using 500V insulation tester (Megoh-meter);
- Earth continuity test;
- Test for correct direction applied to every motor;
- Earth resistance test;
- Provide the correct connection and rotation of any energy meters;
- Settings of all overload and other adjustable protective devices shall be set to the requirements of the equipment.

15.13 DRAWING & INSTRUCTION BOOKS

The Contractor shall supply the following information:

- Plant room layout drawings showing the main items of equipment as well as cable and wiring runs;
- Switchboard and control board outline and equipment layout drawings and details of manufacturing;
- Single line wiring diagrams detailing all control, metering and indication circuits;
- Instruction and maintenance books for all major items or equipment.

15.14 ELECTRICAL SUPPLY

The electrical shall be 400V/230V, 50Hz, 3 phase plus neutral and all equipment shall be selected to operate at the appropriate 3 or single phase voltages.

The electricity supply shall be installed by others up to a point indicated on the project drawings and shall terminate in an open flush mounted draw box over which the Contractor shall mount the distribution board for plant room.

SPECIFICATION

MECHANICAL WORK

FIRE PROTECTION

DEPARTMENT OF PUBLIC WORKS

KEIMOES MAGISTRATE'S COURT

FIRE PROTECTION: SPECIFICATION

WCS 046641

MARCH 2021

COMPILED FOR: SANDISO COSA

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PROJECT ME304128- KEIMOES MAGISTRATE'S COURT

REV	DESCRIPTION	ORIG	REVIEW	IXENGINEERS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for tender	M. Sebekedi	M. Smit	M. Smit	2021-03-29	N/A	

CONTENTS

1. LIST OF ACRONYMS AND ABBREVIATIONS

BS	British Standard
db	Dry Bulb (Temperature)
ISO	International Standards Organisation
NFPA	National Fire Protection Association
BSRIA	Building Services Research and Information Association
CIBSE	Building Services Research and Information Association
ISO	International Organization for Standardization
RSA	Republic of South Africa
SABS	South African Bureau of Standards
SANS	South African National Standard
SI	"Systeme International" – International system of units.
wb	Wet Bulb (Temperature)

2. UNITS OF MEASUREMENT

The SI system of metric units is applicable to this Project.

3. REGULATIONS AND STANDARDS

The air conditioning and ventilation installation shall be in accordance with the latest and current revision of:

	:	Local Municipal Regulations, by-laws and Ordinances
	:	Local Fire Department Regulations
OSHA	:	The occupational health and safety act (Act 85 of 1993)
SANS 10105-1	:	Classification of firefighting equipment
SANS 543	:	Standard specification: Fire hose reel (with hose)
SANS 1910	:	Standard specification: Portable refillable fire extinguishers.

SANS 10252-1	:	Water supply and drainage for buildings
SANS 10400	:	The application of the National Building Regulations.
SANS 1128-1	:	Firefighting equipment: Components of underground and above-ground hydrant systems
SANS 1128-2	:	Firefighting equipment: Hose couplings, connectors, and branch pipe and nozzle connections.
SANS 1567	:	Portable rechargeable fire extinguishers: CO_2 type extinguishers.
SANS 62-1	:	Steel pipes: Pipes suitable for threading and nominal size not exceeding 150 mm.
SANS 1186-1	:	Symbolic safety signs: Standard signs and general requirements.
SANS 719	:	Electric welded low carbon steel pipes for aqueous fluids (large bore).
SANS 62053-11	:	Electricity metering equipment - Particular requirements - Part 11: Electromechanical meters for active energy

4. DESIGN CRITERIA

External environmental criteria:	
External design temperature summer	38 °C db / 22 °C wb
External design temperature winter	10.9 °C saturated
Altitude above sea level	804 m

5. DESCRIPTION/SCOPE OF FIRE PROTECTION SERVICES

This specification relates to the fire protection installation for the new Keimoes Magistrate's Court project and shall be read in conjunction with all other relevant contract documents for this project.

The scope of the services in the specification includes the design, supply, installation, setting to work and commissioning of:

- Fire water storage tank and booster pumps at the basement
- Hose reel installations in the building
- Portable Fire extinguisher installations.
- Fire hydrant installation on site.

6. GENERAL ITEMS

6.1 GENERAL

Conflicts, errors or discrepancies found in the specification, drawings or any other documentation issued in connection with this contract shall be brought to the design engineer's attention for resolution. Any deviations from the specification, drawings and/or equipment specified shall be listed together with the alternatives offered. Failure to do this will not relieve the successful contractor of the obligation to execute such items in accordance with the intentions of the design package. If no deviations are listed, it will be assumed that the installation shall comply with all the relevant technical parts of this specification.

All installations shall be complete in all respects. The contractor shall allow for the installation and successful operation of the complete installation. All materials and components shall be provided as deemed to be good practice, logical, in accordance with the relevant standards/regulations and necessary to achieve the intended functional requirements of the installation. This shall apply irrespective of whether every single item is specified or not. All work shall be carried out by skilled personnel.

6.2 COMPLETION DATE AND PROGRAM

The Contractor will be required to keep up with the main contract in accordance with the main Contractor's program and to complete the installation concurrently with the main contract.

Directly after acceptance of his tender, the Contractor shall submit time schedules for each activity for which he is responsible to the main contractor, for the inclusion thereof in the main contractor's program. A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items as a minimum shall be programmed in consultation with the Main Contractor:

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- First fix installation
- Approval of first fix
- Second fix installation
- Approval of second fix
- Electrical installation
- Commissioning and testing
- Production of O&M manuals and As-Built drawings
- Submittal of manuals and drawings for comment
- Final submittal of manuals and drawings to Client
- Final inspection

The Contractor is required to maintain a rate of progress satisfactory, at all times, to the Main Contractor, in accordance with his programme, and carry out any particular section of the work when called upon to do so. He is also to co-operate in this respect with other Subtrades/Contractors employed on this project. The Contractor must be prepared to lay on labour and materials in accordance with the Building Programme.

6.3 FINISHING AND TIDYING

Progressive and systematic finishing and tidying will form an essential part of the works. On no account must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others or pose abnormal safety risks that are not managed and mitigated. Finishing and tidying must be done on a daily basis and not simply be left to the end of the contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole.

6.4 SCAFFOLDING AND PLANT

All plant required for the execution of the contract shall be supplied by the Contractor under this contract. The Contractor shall provide his own scaffolding. For installation purposes the Contractor shall allow for his own lifting equipment, cranes etc. which may be necessary to complete the installation as none of these facilities will be available on site.

6.5 SUPERVISORY STAFF

The Contractor is to appoint a representative in the form of a qualified engineer/technologist/technician, or other qualification and experience as approved by the engineer and design team, as Contract Manager in supervisory charge of all work carried out under this Contract.

This Contract Manager is to be experienced in work of a similar nature. He is to be in continuous attendance on site from the commencement of works under this Contract, until the date of Practical Completion and hand-over to the Employer. He shall not be transferred to other work without the prior consent of the Consulting Engineers and the Employer. The Contractor is to vest in the Contract Manager the necessary authority to discuss with, accept from and execute, the Consulting Engineer's, or the Supervising Officer variation instructions as are found necessary from time to time. The Contracts Manager is to be supported by such staff as are appropriate and necessary for the proper execution of the works.

At all times while on the premises, all artisans and labour members of the contractor's and subcontractor's staff will wear clothing adequately marked with the relevant contractor's name and which complies with current Health and Safety Regulations.

Works of the specific trades involved under this contract shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trades.

6.6 SITE MEETINGS AND INSPECTIONS

The Contractor's Contract Manager shall arrange to be present at all site meetings, to discuss the Contract with all interested parties.

The Contractor's Contract Manager shall ensure that works are ready for inspection when a site inspection/visit is required from the engineer and shall arrange site inspections in a timely fashion with adequate notice to all involved parties.

At least 3 days prior to site inspections, all documentation applicable to the inspection, such as testing certificates and commissioning data etc., shall be provided to the engineer for evaluation.

6.7 QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged and free from rust or other defects. Only approved material of the best quality shall be used. All materials shall have a minimum one year guarantee. The equipment shall be of the model currently in production at the time of installation and there shall be no known obsolescence.

The Contractor shall, upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the materials are of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and/or the British Standard Specifications as relevant.

The installation shall be carried out according to the latest modern engineering practices.

All equipment offered shall operate well within the manufacturer’s ratings, and equipment to be operated beyond these limits will not be considered.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Contractor.

6.8 ORDERING AND RATINGS OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment offered to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer's ratings, and equipment to be operated beyond these limits will not be considered.

The contractor shall ensure that procurement details of materials are duly submitted to the main contractor to be incorporated in the main contract programme.

The Contractor shall avoid delays by submitting details of alternative manufacturers or types of materials/products to the consulting engineer/principal agent in time to comply with the agreed programme of the Works.

All materials/products necessary for the completion of the Works shall be ordered immediately after receipt of comments received and/or instructions to proceed. No delay to practical completion, or completion of any part thereof caused by delays in ordering will be accepted.

6.9 EQUIPMENT LOCATIONS

The positions of all connection points, accessories, apparatus, equipment and other locations shown on the tender drawings are approximate and for guidance in the preparation of the tender.

The Fire Services Contractor shall agree with the main contract administrator/principal agent which locations are subject to final on-site positioning.

Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the main contract administrator/principal agent before commencing work on site.

6.10 SPACE REQUIREMENTS AND ACCESS

Before ordering equipment the Contractor shall ensure that the equipment offered by them can be installed in the available space as shown on the construction drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Contractor's account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

The Contractor shall also ensure that the equipment offered by them will pass through available building openings. Large equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of equipment or to change the make of equipment in order to allow access shall be for the account of the Contractor.

6.11 METHOD STATEMENTS

The Contractor will be required to produce a Risk Assessment and Method Statement describing in detail his procedures for carrying out each aspect of the work. The documentation will be required prior to commencement of the works.

6.12 SUBMITTAL OF DRAWINGS AND OTHER DOCUMENTATION

6.12.1 Definitions

Schematic drawing:

A line diagram describing the interconnection of components in a complex system. A two dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. The drawing includes all functional components which make up the system. The drawing includes appropriate services distribution sizes not shown elsewhere.

Detailed design drawing:

A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routing of the services.

Working drawing or installation drawing:

A drawing showing the inter-relationship of engineering services, their relation to the structure and building fabric and including all components of the works as required for the successful installation of

the systems. These drawings are normally developed from the tender or detail design drawings. The drawings shall reflect the actual equipment and other material sizes and details that the contractor is proposing to order.

Working/installation drawings shall include provision for all supports and fixings, insulation, standard fittings and components as necessary to install the works and shall incorporate shop drawing information and manufacturer's drawing information.

Floor plans and sections shall be provided in not less than a scale of 1:50, with plant rooms and details in a scale not less than 1:20. A minimum of 2 copies of these drawings shall be submitted to the Engineer for approval prior to installation and 2 copies of the drawings shall be submitted once approved.

Shop drawings:

Drawing prepared by a fabricator or supplier that the contractor is proposing to utilize

Builder's work drawing:

Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site). All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Contractor.

Controls Logic Diagrams:

Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

Electrical drawings:

Drawings showing the construction and internal wiring diagrams of the panels and/or other devices. These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules as applicable to the installation.

These drawings shall clearly show the actual electrical loads and requirements of all final and actual equipment to be installed. Refer also to the electrical section in the specification.

As built drawings:

The drawings shall show the building and services installations as installed at the date of practical completion. The main features of the drawings should be as follows:

- Provide a record of the locations of all the systems and components installed.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions operating and maintenance purposes.

6.12.2 Drawings and other documentation to be submitted by the Contractor

Any work done by the Contractor without an approved drawing shall be at the Contractor's own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Contractor.

The review of drawings by the consulting engineer shall not relieve the Contractor of his responsibilities to carry out the work in terms of the contract documents.

The following drawings are to be submitted by the Contractor, unless agreed otherwise with the consulting engineer.

Working/Installation Drawings and Shop Drawings:

The Contractor shall prepare his own set of working/installation drawings covering all aspects of the contract works and shall submit these and all shop drawings for comment and approval.

The drawings shall be submitted prior to any installation work commencing on site. A period of 5 working days upon receipt of drawings by the engineer shall be allowed for the commenting and evaluation of the drawings.

The Contractor shall make any necessary amendments without delay. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.

The installation drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as “As Built” drawings.

Builder's Work Drawings:

Shall be submitted by the Contractor to the main contractor and consulting engineer, within two (2) weeks of site handover or in the case where the contractor is appointed after site handover, within two (2) weeks of appointment.

Electrical Drawings (Relating to Fire Services Equipment):

Shall be submitted by the Contractor to the consulting engineer, within two (2) weeks of site handover or in the case where the contractor is appointed after site handover, within two (2) weeks of appointment.

6.13 MAINTENANCE AND GUARENTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Contractor shall newly replace all consumables/parts at the start of the maintenance period, i.e. the practical completion date, as well as at the end of the maintenance period, i.e. final completion date.

The Contractor is responsible for all material and labour during the maintenance period.

The Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within seven (7) days from the visit.

In case of a breakdown, the Contractor shall react within reasonable time and repair the installation to the satisfaction of the Engineer. Should the Contractor, in the discretion of the Engineer, not react within reasonable time, the Engineer shall commission another Contractor and the cost thereof shall be recovered from the defaulting Contractor.

6.14 PAYMENT CLAIMS

In addition to the conditions of contract, the Contractor shall attach to his application for payment an explanation of material cost and labour cost.

The following information is required with respect to material and labour:

- Estimated percentage delivered/completed at date of the previous claim.
- Estimated percentage delivered/completed at date of current claim.
- Total cost claimed at date of previous claim.

6.15 PAINTING WORK

Where applicable the painting specifications as described below shall apply.

Iron and steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

Galvanised surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use. Equipment shall be painted according to the National Colour Standards for Paint, SANS 1091.

6.16 DAMAGE AND PROTECTION OF WORKS AND EQUIPMENT

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held completely responsible for any damage of equipment during transport and installation, as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an “as new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

6.17 STEELWORK AND SUPPORT SYSTEMS

The contractor shall provide all secondary steelwork support systems, frames, steelwork plant bases, access ladders/steps and distribution services support systems associated with the fire suppression installation under this contract.

6.18 WELDING WORK

Welding shall be carried out in accordance with the current edition of SANS 10044 and all other relevant SANS document relevant to the specific type of welding to be undertaken. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

6.19 TESTING AND COMMISSIONING

The contractor shall perform the following duties related to the testing and commissioning of services under this contract:

- The installation shall be commissioned in accordance with a recognised commissioning procedure or code.
- Agree the commissioning program with the main contractor to include for pre-commissioning checks, setting to work, commissioning and performance testing, commissioning witnessing and allow for all costs incurred.
- Give duly notice and state any requirements for the attendance and co-operation of others. This notice shall be a period of no less than 10 working days.
- Provide all necessary facilities and access to enable tests to be witnessed and inspections to be carried out either on site or at manufacturer's works.
- The contractor shall provide full method statements for all testing and commissioning and agree these prior to commencing any testing and pre-commissioning.

- Appoint an "approved and qualified representative", to supervise the whole of the testing, commissioning, performance testing and instruction of future maintenance staff.
- Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
- Test all equipment, material and systems. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.
- Complete all tests before any paint or similar materials are applied or before services are concealed.
- Ensure all requirements such as cleanliness, protection from harmful external and internal elements, etc. are provided prior to commencement of commissioning.
- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
- Provide test equipment that has been subject to a quality assurance procedure and complies with national and local standards.
- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed.
- Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
- Provide all certification documents for approval before any system is offered for final acceptance.

6.20 OPERATING AND MAINTENANCE MANUALS

General:

The Contractor shall submit one (1) draft hard copy and one (1) digital copy of the Operation and Maintenance Manuals and As-built drawings to the Engineer prior to commissioning or at an alternative

agreed date, for checking, evaluation and comment purposes and shall allow at least ten (10) working days for the commenting process. The Contractor shall incorporate all comments and re-submit the revised manuals. The Contractor shall allow for temporary inserts and clearly list items such as commissioning data that are not yet available for inclusion in the manuals. Such information shall be submitted as soon as possible and no later than one (1) week before the planned practical completion date.

The Contractor shall submit the commented, approved and finalised Operation and Maintenance Manuals and As-Built drawings at or prior to Practical completion. Three (3) hard copies and three (3) digital copies shall be submitted. The comment and approval of the manuals shall be a pre-requisite for Practical Completion and no Practical Completion shall be given without fully approved Operating and Maintenance Manuals inclusive of all relevant drawings and other documentation as stated in this specification.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well arranged and provided with an index.

- Documentation shall clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Documentation shall make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Documentation shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Documentation shall provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.

Information in the documentation shall be correlated so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

The Contractor shall show, as required, throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

Content:

The operating and maintenance manuals shall include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Full size and reduced A3 copies of all drawings together with an index.
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.

- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, engineers, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.
- The manuals must contain all commissioning datasheets and certification.
- Provide electronic copies of all Operating and Maintenance documentation in disk format, fully indexed.

6.21 LATE SUBMITTAL OF OPERATING AND MAINTENANCE MANUALS AND DRAWINGS

The Contractor shall provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the As-Built drawings and Operation and Maintenance Manuals are not available when the works would, in the opinion of the principal agent and consulting engineer, otherwise qualify for Practical Completion.

In the event of the Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

6.22 CLIENT STAFF TRAINING

The Contractor shall be responsible for the training of the Client's site staff after the commissioning has been completed. The site staff shall receive enough instructions to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training. Upon completion of training exercise the Contractor is to obtain the proprietor's representative's written acceptance of this handover tuition, thus acknowledging his complete understanding of the operation procedures for this installation. Site staff shall be instructed on:

- the general operating method of the equipment;
- starting and stopping instructions;
- stopping the equipment in an emergency and warning against restarting after an emergency;
- positions and normal settings of control equipment;
- safety measures;
- name, address and telephone number of competent person responsible for the maintenance of the plant.

6.23 IDENTIFICATION AND LABELLING OF SERVICES AND EQUIPMENT

All services shall be clearly and appropriately identified and labelled.

Equipment shall be fitted with identification labels.

Samples of identification methods that the contractor proposes, shall be submitted to the engineer for review, prior to ordering and installation.

All identification and labelling methods shall be in accordance with the relevant SANS, British Standards or better.

TECHNICAL SPECIFICATION

7. HOSE REELS

The fire hose reel outlets shall be of all bronze construction except for the hand wheel which shall be of cast iron or hard aluminium alloy.

The inlet and outlet fittings shall be supplied and manufactured to the quality of material, construction, and dimensions as listed below.

a) Globe & check valve of service rating PN40 to BS 5154.

b) All fittings shall be tested to at least 2000kPA or 1.5 times the working pressure, whichever is the greater.

Steel pipes and fittings connected directly to the Water Authorities water supply shall conform to the Authority's regulations and shall be uPVC/polyethylene lined.

Hose reels shall be of fixed or swinging type to suit the location shown on the drawings and shall meet Fire Department standard requirements as to construction, testing, performance, working pressures, etc. The length of hose shall be 30m and bore 25mm unless otherwise specified. Recessed hose reels in cabinets shall all be swinging type.

Drums shall be constructed of die cast light alloy, hydraulically balanced, free from denting and twisting, and finished in red enamel. The hub and shaft shall be of brass, fitted with a device to prevent overrun of the hose, having a glandless centre seal. The whole unit shall be drip free. Hoses shall be of reinforced rubber or PVC tubing approved by the Fire Department and shall be fitted with a copper alloy branch nozzle having a slow-closure type level-operated cock.

A hose guide complete with nylon or similar runners shall be provided adjacent to fixed type hose reels to enable the hose to be run out in any direction as required.

Wall fixed pattern shall have wall mounting brackets of substantial construction capable to support the whole weight of the hose reel and tubing.

A 25mm diameter isolating stop valve shall be provided on the feed pipe to each hose reel. The valves shall be operated by hand wheels which shall be permanently marked with the direction of opening by means of an embossed arrow. The isolating stop valve shall not be located more than 1350mm above the finished floor level.

A union shall be fitted between the isolating stop valve on the feed pipe and each hose reel to enable individual hose reels to be dismantled for maintenance or overhaul.

For a recessed type hose reel, the isolating stop valve and nozzle shall be positioned not more than 500mm from the surface of the wall.

All installation materials, fixing bolts etc. for mounting the equipment inside the cabinets or on walls as applicable shall be provided by the contractor.

7.1 PIPING AND FITTINGS

7.1.1 General

The fire hose reel reticulation piping shall be done in medium class galvanised steel piping according to SANS 62 or BS 1387.

Pipes above ground	Medium grade steel to BS 1387/SANS 62 (galvanised)
Buried or in Underground Sleeves	uPVC

All visible piping shall be painted in accordance with the painting specification elsewhere in this document. The final colour shall be signal red.

7.1.2 Pipe Joints And Fittings

Mild steel piping shall be joined by means of screwed sockets, navy unions or flanges. Red lead or other approved jointing compounds may be used sparingly and exposed threads shall be painted with zinc chromate primer or equivalent paint to prevent rusting.

Where it is required to remove sections of pipe or where pipe joints will need to be tightened after installation and testing, unions or flanges must be provided to facilitate the work.

Welding construction is only permitted for pipes of 50mm diameter or larger and then only when prefabricated and welded in the workshop of the installing contractor whose welding procedures are approved by the Engineer.

The edges of pipes to be welded shall be machined bevelled. Gas cuts shall be true and free of all burned metal. Before welding, the surface shall be thoroughly cleaned and degreased. Piping shall be carefully aligned. No metal shall project within the pipe. Mitred joints shall not be allowed.

Only welded fittings prefabricated by recognised manufactures will be permitted. No other prefabricated welded fittings shall be permitted without the approval of the Engineer.

For branch piping 65mm or larger, welded tees, with flanged outlets shall be used. For piping 200mm and larger, shaped spigots and welded neck flanges shall be used. Cracks, pinholes, excessive undercutting, etc. shall be removed and the joints re-welded. Welders and welding processes shall meet the requirement of the SANS Code for Welders.

Jointing of mild steel and galvanised piping using grooved pipe fittings and couplings may be used provided they have been approved by the Engineer. Proper gaskets, designed for the applications shall always be used. Approval by the Engineer must in all cases be obtained prior to the utilisation of such fittings.

7.1.3 Installation Of Piping

All piping shall be installed in an approved manner to meet structural and architectural requirements, to avoid interference with the work of other trades, and be finished in a neat and workmanlike manner with true alignments and grades. Piping shall be run to ensure sufficient access for inspection, testing, servicing, etc.

Where pipes cross expansion joints in buildings, suitable and approved flexible joints shall be installed.

In order to prevent air locks, all pipes shall be installed with a proper inclination. Sloping of pipes shall be such that the system can be thoroughly drained.

7.1.4 Internal Pipe Runs

All piping shall be installed parallel to, or at right angles with building walls and partitions.

In general, all pipes shall be supported from the building structure in a neat and workmanlike manner, and whenever possible, parallel runs of piping shall be grouped together.

- Where pipes pass through walls, floors, ceilings, etc. they shall be sleeved. The sleeves shall be of PVC material and allow for pipe thermal reactions.

- Where pipe sizes are reduced, proper reducing fittings shall be used. On no account will bushes be accepted.

- Horizontal take-offs from vertical pipes shall be long enough before the first fixing to take up any movement or shall have an expansion loop to allow for expansion and contraction.

- Every pipe section shall be installed to ensure expansion and contraction without restriction. Expansion loops or expansion joints and anchors shall be fitted in order to reduce the displacement of individual line elements and to deflect them to the points where they can act without damage.

7.1.5 Concealment Of Pipe Work

Hose Reel pipe work shall not be embedded in the concrete floors or roofs of the building, nor shall it be concealed in any other situation where difficulty or undue expense would be involved in making alterations or additions which may subsequently become necessary.

7.1.6 Pipe Hangers And Supports

All pipes shall be supported from the building structure in a neat and workmanlike manner and, wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers.

Vertical risers shall be supported at each floor with pipe clamps. The use of wire, perforated metal or metal straps, nails and so forth, to support pipes will not be permitted. Hanging of pipes from other pipes will also not be permitted.

Vertical runs shall be secured by means of rust-less holder bats or other clamps. Duckfoot supports shall be provided at the bottom of a vertical section of large piping (100mm and above) to support the weight of the pipe and water.

Under no circumstances shall a vertical pipe be supported from its highest point. Should any fittings be installed in the vertical sections, care shall be taken to ensure that these fittings are not in a state of tension due to the combined weight of the pipe and water.

Horizontal pipes shall be supported by means of galvanised hangers at close enough centres to prevent sagging. The minimum recommended spacings for supports and hanger rod size shall be as set out below:

Nominal pipe size – (mm)	20	25	32-50	60	80	100	150	200	250
Minimum spacing – (m)	1,5	2,0	2,0	2,5	3,0	4,0	4,0	5,0	5,0
Minimum Rod Diameter -(mm)	10	10	10	16	16	16	16	18	18

The hangers shall be protected against rust and shall be adjustable in height. They shall be manufactured from rods of the diameter as specified above, one end threaded and bolted to an angle iron cleat or Unistrut section suitably secured to the structure. The other end shall be formed into an eye and bolted to the pipe clamp.

7.1.7 Change In Material

Where piping material changes occur (i.e. uPVC to steel, etc.) relevant joints shall be used.

7.1.8 Threaded Pipes

Where threaded pipe connections are used, the pipe shall be cut square and fully threaded with clean cut tapering threads and shall be reamed after threading. All threaded connections shall be made with approved thread compound applied to male threads only and shall be such that not more 2 threads will be exposed.

7.1.9 Storage

All pipes and fittings shall be delivered and stored to the Supplier’s recommendations with plugged ends. Pipes shall be stored off the ground and under cover.

Pipe ends shall be kept closed during erection with temporary caps. Before any pipe is installed, it shall be opened and thoroughly cleaned.

7.2 PAINTING OF FIRE PROTECTION SERVICES

No untreated metal surfaces shall be permitted on the project. The surfaces of items to be painted which will be inaccessible after erection shall receive the full specified coating procedure before installation.

The minimum requirements for painting shall comprise the following consecutive processes:

- Thoroughly clean, de-scale and degrease all surfaces.
- Apply one coat of the appropriate primer.
- Apply one undercoat prior to erection.
- Touch up damaged undercoat after erection.
- Apply 2 coats of enamel or suitable weather and/or heat resistant paint.
- Undercoats and top coats shall be in contrasting colours.

Fire piping that are visible or exposed shall be painted signal red as per the relevant SABS colour codings.

7.2.1 Surface Treatment Prior To Painting

Paint shall not be applied over any surface containing traces of grit, grease, oil, loose rust, loose millscale or corrosion products of any kind, nor to within 50 mm of areas which are to be welded.

Welds and adjacent parent material shall be abrasive blasted and/or ground and all contaminants such as flux and weld spatter shall be removed prior to painting. Rust spots shall be removed by means of a wire brush or emery paper. The surrounding paint which is still intact shall be feathered for a distance of 50 mm beyond the damaged area.

Spot priming and repair shall consist of all the coats previously applied and shall overlap the damaged area.

7.2.2 Painting On Galvanised Surfaces

Where further protection against corrosion is necessary or is specified it shall be done according to SABS Requirements.

All paints used shall be by the same manufacturer and shall be approved by the Engineer. The Contractor shall ensure that the various paints are compatible.

Damaged galvanised surfaces through cutting, drilling and/or pipe grips shall be painted with Galvalloy or similar approved by the Engineer.

7.3 VALVES AND FITTINGS

7.3.1 Isolation Valves And Drain Cocks

The following types of valves shall be used:

a) General

Chromium plated brass high pressure screw down stop cocks with compression type pipe connections.

Chromium plated brass ball stop valves for shutoff duties in branches in exposed positions

b) Main Isolating Valves

Butterfly valves with flanged bodies or of the “wafer” type for fitting between flanges fixed to adjacent piping. These valves shall close drop tight against the prevailing pressure and shall be geared hand wheel operated. Indicators showing “open” and “closed” positions shall be provided. The valve disc shall be hydro dynamically stable and seated against renewable resilient seats. The spindle seal shall be drop tight and renewable under pressure. Valves adjacent to equipment, if of the “wafer” type, shall be furnished with spool pieces to permit equipment removal with the flange intact in the pipework.

These valves shall be suitable for 1.6 MPa working pressure.

7.3.2 Pressure Gauges

Pressure gauges shall be installed at the pressure vessel as indicated on the drawings.

The face plate shall be 100mm diameter and must be calibrated in kPa. Gauges shall read to at least twice the normal operating pressure of the system in which it is installed.

The face plate shall be red lined at the maximum operating pressure of the system.

Pressure gauges must be connected to the pipe or vessel by means of U-tubes with stop cocks.

7.3.3 Non-Return Valves

Valves shall be non-slam type non-return valves with internal perforated cone, rubber closing element and flanged cast iron bodies.

These valves shall be suitable for 1.6MPa working pressure.

7.4 BOOSTER PUMPS

Booster pumps shall consist of a multistage, end-suction, centrifugal inline type pump with close coupled direct drive motors. The pumps shall all be installed in parallel on a common stainless steel baseplate complete with a common suction and discharge header.

The pump sets shall contain 1 duty and 1 standby pump. The duty pump shall be able to deliver the total required maximum flow at the required pressure head as specified on the drawings and equipment schedules.

The pump sets shall be pre-tested and pre-assembled system complete with all manifolds, check-valves, isolating ball valves, pumps, motors, pressure gauges, pressure sensor and pump control panel.

The pump casing, impellers, shafts, valves and header pipes shall be manufactured from stainless steel metal.

The booster pumpset shall be able to maintain a constant preset delivery pressure for the range of flows required.

The control panel shall be able to automatically drive each pump separately and in pre-programmed sequence to obtain the required flow pressure. The control panel shall also monitor and switch between pumps to insure equal running time.

The contractor shall ensure the pumpset contains safety features to protect the pump against suction cavitation, including automatic shut-off feature if the suction reservoir/tank reached a minimum preset low water level.

The contractor shall supply all details, pump curves and supplier specifications regarding the booster pumpsets and obtain approval there-off from the Engineer prior to ordering the supply and installation of any pumpset.

7.5 PRESSURE VESSEL

The pressure vessel shall be in accordance with SANS 53831 and shall be installed together with the booster pump configuration as shown on the drawings.

The pressure vessel shall be of the diaphragm type and shall be charged with air. The vessels shall be complete with the necessary fittings and shall be internally and externally protected against corrosion.

The pressure vessel shall be rated and suitable for the temperatures and pressures at which the system operates. All components shall be suitable for the media and application of the system and shall be non-toxic.

The vessels shall be of a proprietary brand from a well-known supplier. The pressure vessels shall be of the same manufacture as the booster pumps.

7.6 FIRE WATER STORAGE TANK

The fire water storage tanks shall be a pressed steel tank according to SANS 10329:2004.

The tanks shall be manufactured from standard 1220 x 1220mm panels. The bottom and first row of panels in the walls shall be 6mm thick. The rows of panels thereafter in the walls shall be 4,5mm thick.

Connections shall be of the flanged bolted type according to SANS 1123. Bolts shall have a minimum diameter of 14mm for the tank panels and supports and 12mm diameter for the roof panels.

The tanks shall be supplied with a ventilated manhole cover with minimum dimensions of 450 x 450mm.

The tanks shall also be supplied with ladders on the inside and outside. The outside ladder shall be supplied with a safety ring every 900mm. Step spacing not more than 300mm.

Roof panels shall have a minimum thickness of 2,5mm.

The tanks shall be supplied with a float valve to regulate the water level. When the tank is full, the float valve shall shut off the water supply to the tank.

The tank shall come complete with vortex inhibitor for each supply outlet.

Provision shall be made for two inlets at the top, one outlet at the bottom with one blank flange, an overflow and a drain outlet as shown on the drawings.

All steelwork including ladders, bolts, nuts, pipes, etc. must be hot dipped galvanized in accordance with SANS 121 after manufacturing.

7.7 FIRE EXTINGUISHERS

7.7.1 Dry Chemical Powder

Supply and install DCP fire extinguishers as indicated on the drawings.

The extinguishers must be user-friendly, with operation instructions clearly visible on the side of the cylinder.

Proper signage must be provided as part of this installation. A large sign indicating the extinguisher must be fixed to the wall above the extinguisher. The centre of the signboard must be 1800mm above finished floor level.

7.7.2 Servicing And Mounting Of Extinguishers

All extinguishers must be serviced strictly in accordance with the latest code of conduct for maintenance of portable fire extinguishers (SANS 10105), prior to delivery. The engineer reserves the right to request a copy of the contractor's registration certificate and to have this verified as genuine.

Service labels reflecting the service details must be affixed to the extinguishers.

The contractor who supplies and services the extinguisher and related equipment must be:

- A member of the "South African Fire Protection Association of South Africa".
- Must be in possession of a "Diamond Mark" as issued by the SABS.

- Competent persons requirements: All servicemen must be competent and in the service of a company of good standing holding the mark of SANS 1475.

- No person shall fill, recondition, modify, repair, inspect or test any hand-held fire extinguisher unless he is a holder of a permit issued by the SABS, SANS 1475.

Each extinguisher must be sealed by means of a ripple wire and lead seal on the safety pin. Each extinguisher must be mounted on a SABS approved wooden wall plate with dimensions 600mm long x 100mm wide x 20mm thick and chamfered on all sides. It must have a smooth finish and covered with one coat water resistant varnish.

Each wall plate must then be fixed to the brick wall by means of 2 x counter-sunk screws 4mm in diameter x 50mm long. Care must be taken not to damage any wall, face brick surfaces or embedded electric wiring or water pipes. Holding brackets, to hook the extinguishers onto, must also be supplied and fixed onto the wooden wall plates. The extinguishers must be installed at a height of 1,5m from the floor to the top of the extinguisher handle.

7.8 GUARANTEE AGAINST DEFECTS

The contractor will be required to guarantee the fire extinguishers for a period of 12 months. If during this period the units are not in a proper working order, or do not work satisfactorily during a fire break-out, owing to faulty material, or workmanship, the contractor will be notified, and immediate steps must be taken by him to rectify the defects and/or replace the affected parts and damage to other material or equipment on site, at his own expense.

7.9 COMMISSIONING AND TESTING OF APPARATUS

The contractor must commission and test the extinguishers prior to final inspection by the consultant. The contractor must supply all the necessary apparatus to carry out the necessary tests. The testing instruments/tools must be of high quality.

8. SYMBOLIC SAFETY SIGNS

Symbolic safety signs shall be supplied and installed as part of this installation. The signage shall be in accordance with SANS 10400 and manufactured in accordance with SANS 1186 and shall bear the

standardisation mark. Signs shall be provided for hose reels and fire extinguishers as required. The indoor signage shall be of the photo-luminescent type pictograms, 190 x 190mm in size.

9. ELECTRICAL WORKS RELATED TO THE FIRE PROTECTION INSTALLATION

The services of qualified electrician shall be employed by the Fire Services Contractor. The Fire Services Contractor shall be responsible for the design, documentation, supply, installation and commissioning of the electrical system for the fire pumping installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of premises, SANS 10142-1 latest Edition. An electrical certificate of compliance shall be issued by the Fire Services Contractor after completion of the installation.

The main electrical contractor shall provide power to the pump distribution board. The DB itself and the rest of the electrical supply and controls for the pumps shall be by The Fire Services Contractor

Labelling of the electrical system shall be of engraved laminated plastic with 4mm high white lettering on black background. Labels shall be securely fitted with brass bolts, and labels glued or pop riveted into position shall not be acceptable.

SPECIFICATION

MECHANICAL WORK

AUTOMATIC FIRE SUPPRESSION

DEPARTMENT OF PUBLIC WORKS

KEIMOES MAGISTRATE'S COURT

FIRE SUPRESSION SYSTEM: SPECIFICATION

WCS 046641

MARCH 2021

COMPILED FOR: SANDISO COSA

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PROJECT ME304128 - KEIMOES MAGISTRATE'S COURT

REV	DESCRIPTION	ORIG	REVIEW	IXENGINEERS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for internal review	M. Smit	H.Esterhuizen	MC Heunis	2021-03-29	N/A	

CONTENTS

1. LIST OF ACRONYMS AND ABBREVIATIONS

BS	British Standard
db	Dry Bulb (Temperature)
ISO	International Standards Organisation
NFPA	National Fire Protection Association
RSA	Republic of South Africa
SABS	South African Bureau of Standards
SANS	South African National Standard
SI	"Systeme International" – International system of units.
wb	Wet Bulb (Temperature)

2. UNITS OF MEASUREMENT

The SI system of metric units is applicable to this Project.

3. REGULATIONS AND STANDARDS

The air conditioning and ventilation installation shall be in accordance with the latest and current revision of:

BS 88-2	:	Low-voltage fuses. Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application). Examples of standardized systems of fuses A to K
BS 476	:	Fire tests on building materials and structures. Method for classification of the surface spread of flame of products
EN 12101	:	Smoke and heat control systems (Various Parts)
IEC 60051-1	:	Direct acting indicating analogue electrical measuring instruments and their accessories. Definitions and general requirements common to all parts
OSHA	:	The occupational health and safety act (Act 85 of 1993)

SANS 193	:	Fire dampers
SANS 1091	:	National colour standard
SANS 10044	:	Welding
SANS 10142-1	:	The wiring of premises Part 1: Low-voltage installations
SANS 10139	:	Fire detection and alarm systems for buildings
SANS 10177	:	Fire testing of materials, components and elements used in buildings
SANS 60335-2-40	:	Household and similar electrical appliances - Safety. Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers
SANS 60335-2-80	:	Household and similar electrical appliances - Safety Part 2-80: Particular requirements for fans
SANS 62053-11	:	Electricity metering equipment - Particular requirements - Part 11: Electromechanical meters for active energy

4. DESIGN CRITERIA

External environmental criteria:	
External design temperature summer	38 °C db / 22 °C wb
External design temperature winter	10.9 °C saturated
Altitude above sea level	804 m

5. DESCRIPTION/SCOPE OF FIRE SUPPRESSION SERVICES

This specification relates to the fire suppression installation for the new Keimoes Magistrate's Court project and shall be read in conjunction with all other relevant contract documents for this project.

The scope of the services in the specification includes the design, supply, installation, setting to work and commissioning of the fire suppression systems for the following rooms:

- Ground floor server room
- Ground floor strong room
- Ground floor secured record room
- Ground floor archive room
- Ground floor security server room
- First floor server room
- First floor library
- First floor archive room
- First floor evidence room

The fire suppression systems shall be the FM 200 gas type suppression systems.

6. GENERAL ITEMS

6.1 GENERAL

Conflicts, errors or discrepancies found in the specification, drawings or any other documentation issued in connection with this contract shall be brought to the design engineer's attention for resolution. Any deviations from the specification, drawings and/or equipment specified shall be listed together with the alternatives offered. Failure to do this will not relieve the successful contractor of the obligation to execute such items in accordance with the intentions of the design package. If no deviations are listed, it will be assumed that the installation shall comply with all the relevant technical parts of this specification.

All installations shall be complete in all respects. The contractor shall allow for the installation and successful operation of the complete installation. All materials and components shall be provided as deemed to be good practice, logical, in accordance with the relevant standards/regulations and necessary to achieve the intended functional requirements of the installation. This shall apply

irrespective of whether every single item is specified or not. All work shall be carried out by skilled personnel.

6.2 DESIGN CALCULATIONS

The Sub-Contractor shall submit full mathematical calculations or computer model flow calculations, to justify the selection of components for the system. Where computer programme does not show all calculation steps it will be necessary for the Sub-Contractor to produce evidence that the computer programme produces a design that will perform in accordance with the specification as indicated by the Underwriters' Laboratory listing or approved by any similar widely recognized independent regulatory body acceptable to the engineer.

The calculations shall be based on the equipment offered.

6.3 GAS STORAGE PRESSURE

The gas extinguishing agent shall be stored in rechargeable cylinders to hold the pressurized agent in liquid form at ambient temperature.

The gas shall be pressurized to a corresponding nominal pressure of 25.84 bars at 21°C. The normal filling density shall not be in excess of 0.8kg/ℓ.

Gas cylinders, any pipework, valves, nozzles and fittings shall be manufactured to standards designed to withstand the maximum pressure of stored agent allowing for variations in ambient temperature.

6.4 GAS CYLINDERS

Gas cylinders shall be constructed in accordance with the appropriate part of NFPA 2001.

All extinguishing agent cylinders shall be of a type appropriate to the storage of such extinguishing agent.

Cylinders shall be wall or floor mounted in the protected space to suit the size of cylinder offered and its corresponding recommended method of mounting. Each cylinder shall be fitted with an automatic pressure release device for over pressure protection of the cylinder.

Each cylinder shall be complete with gas valve/actuator, pressure gauge, check valve and all other necessary accessories.

A reliable means of indication, other than weighing, shall be provided for measuring the amount of liquid in the cylinder at any time. The contents of the cylinders may be checked by the use of a liquid level indicator of a type approved by the engineer.

The pressure of the liquid stored in the cylinder shall be such that freezing cannot take place at the lowest possible ambient temperature.

Gas cylinders shall be painted signal red. The type of extinguishing agent, the tare weight, gross weight, liquid level at 21°C for Heptafluoropropane shall be clearly painted on each cylinder with white paint.

6.5 FIRE DETECTION AND SYSTEM CONTROL – AUTOMATIC RELEASE

Fire detection in the protected area shall be by means of optical smoke detectors as specified. The detectors of sufficient number and suitably positioned to give duplicate coverage of the whole of the protected area shall be connected in zones so that smoke generated in any part of the area will activate two zones. The fire detection control panel and the detectors shall be compatible and the fire detection system shall comply with relevant SANS codes.

The sequence of actions during an alarm and release is described in the Departmental Standard Specification.

The gas extinguishing control panel shall control and monitor the release system. It shall include an automatic/manual lock-off unit controlled by key switches at the entrance to the protected area. Any one key switch shall be capable of switching the automatic system on or off. The manual release mechanism shall remain operative whether the automatic system is on or off.

6.6 MANUAL RELEASE

A manual release unit shall be provided in a suitable position outside the entrance to the protected compartment. The manual release unit shall consist of a pull handle or push button mounted in a box with “break glass” cover. The box shall be so designed that its glass front may be readily replaced and that its front cover can be opened with a key for the purpose of operating the switch without breaking the glass.

6.7 EQUIPMENT TO BE SUPPLIED

The protected space shall be provided with the following in accordance with the Departmental Standard Specification and in compliance with NFPA 2001:

- Warning notices fixed above the entrance door, inside and outside.
- Automatic door closer with door loop
- Monitored door lock
- Warning lights inside and outside the protected space
- Alarm bell inside the protected space
- Siren inside and outside the protected space
- Gas release panel
- Fire panel
- 2 sets breathing apparatus mounted in cabinets
- 18 x 1286mm wide x 900 high window shutters activated by the fire panel prior to gas release.
- Radio-linked remote alarm in mimic panel described elsewhere and installed in Administration Building.

6.8 COMPLETION DATE AND PROGRAM

The Contractor will be required to keep up with the main contract in accordance with the main Contractor's program and to complete the installation concurrently with the main contract.

Directly after acceptance of his tender, the Contractor shall submit time schedules for each activity for which he is responsible to the main contractor, for the inclusion thereof in the main contractor's program.

A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items as a minimum shall be programmed in consultation with the Main Contractor:

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- First fix installation
- Approval of first fix
- Second fix installation
- Approval of second fix
- Electrical installation
- Commissioning and testing
- Production of O&M manuals and As-Built drawings
- Submittal of manuals and drawings for comment
- Final submittal of manuals and drawings to Client
- Final inspection

The Contractor is required to maintain a rate of progress satisfactory, at all times, to the Main Contractor, in accordance with his programme, and carry out any particular section of the work when called upon to do so. He is also to co-operate in this respect with other Subtrades/Contractors employed on this project. The Contractor must be prepared to lay on labour and materials in accordance with the Building Programme.

6.9 FINISHING AND TIDYING

Progressive and systematic finishing and tidying will form an essential part of the works. On no account must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others or pose abnormal safety risks that are not managed and mitigated. Finishing and tidying must be done on a daily basis and not simply be left to

the end of the contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole.

6.10 SCAFFOLDING AND PLANT

All plant required for the execution of the contract shall be supplied by the Contractor under this contract. The Contractor shall provide his own scaffolding. For installation purposes the Contractor shall allow for his own lifting equipment, cranes etc. which may be necessary to complete the installation as none of these facilities will be available on site.

6.11 SUPERVISORY STAFF

The Contractor is to appoint a representative in the form of a qualified engineer/technologist/technician, or other qualification and experience as approved by the engineer and design team, as Contract Manager in supervisory charge of all work carried out under this Contract.

This Contract Manager is to be experienced in work of a similar nature. He is to be in continuous attendance on site from the commencement of works under this Contract, until the date of Practical Completion and hand-over to the Employer. He shall not be transferred to other work without the prior consent of the Consulting Engineers and the Employer. The Contractor is to vest in the Contract Manager the necessary authority to discuss with, accept from and execute, the Consulting Engineer's, or the Supervising Officer variation instructions as are found necessary from time to time. The Contracts Manager is to be supported by such staff as are appropriate and necessary for the proper execution of the works.

At all times while on the premises, all artisans and labour members of the contractor's and subcontractor's staff will wear clothing adequately marked with the relevant contractor's name and which complies with current Health and Safety Regulations.

Works of the specific trades involved under this contract shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trades.

6.12 SITE MEETINGS AND INSPECTIONS

The Contractor's Contract Manager shall arrange to be present at all site meetings, to discuss the Contract with all interested parties.

The Contractor's Contract Manager shall ensure that works are ready for inspection when a site inspection/visit is required from the engineer and shall arrange site inspections in a timely fashion with adequate notice to all involved parties.

At least 3 days prior to site inspections, all documentation applicable to the inspection, such as testing certificates and commissioning data etc., shall be provided to the engineer for evaluation.

6.13 QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged and free from rust or other defects. Only approved material of the best quality shall be used. All materials shall have a minimum one year guarantee. The equipment shall be of the model currently in production at the time of installation and there shall be no known obsolescence.

The Contractor shall, upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the materials are of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and/or the British Standard Specifications as relevant.

The installation shall be carried out according to the latest modern engineering practices.

All equipment offered shall operate well within the manufacturer’s ratings, and equipment to be operated beyond these limits will not be considered.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Contractor.

6.14 ORDERING AND RATINGS OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment offered to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer’s ratings, and equipment to be operated beyond these limits will not be considered.

The contractor shall ensure that procurement details of materials are duly submitted to the main contractor to be incorporated in the main contract programme.

The Contractor shall avoid delays by submitting details of alternative manufacturers or types of materials/products to the consulting engineer/principal agent in time to comply with the agreed programme of the Works.

All materials/products necessary for the completion of the Works shall be ordered immediately after receipt of comments received and/or instructions to proceed. No delay to practical completion, or completion of any part thereof caused by delays in ordering will be accepted.

6.15 ROOM TERMINAL LOCATIONS

The positions of all connection points, accessories, apparatus, equipment and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender.

The Contractor shall agree with the main contract administrator/principal agent which terminals are subject to final on-site positioning and allow for the movement of all such terminals from the positions shown on the drawings.

Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the main contract administrator/principal agent before commencing work on site.

6.16 SPACE REQUIREMENTS AND ACCESS

Before ordering equipment the Contractor shall ensure that the equipment offered by them can be installed in the available space as shown on the construction drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Contractor’s account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

The Contractor shall also ensure that the equipment offered by them will pass through available building openings. Large equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of

equipment or to change the make of equipment in order to allow access shall be for the account of the Contractor.

6.17 METHOD STATEMENTS

The Contractor will be required to produce a Risk Assessment and Method Statement describing in detail his procedures for carrying out each aspect of the work. The documentation will be required prior to commencement of the works.

6.18 SUBMITTAL OF DRAWINGS AND OTHER DOCUMENTATION

6.18.1 Definitions

Schematic drawing:

A line diagram describing the interconnection of components in a complex system. A two dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. The drawing includes all functional components which make up the system. The drawing includes appropriate services distribution sizes not shown elsewhere.

Detailed design drawing:

A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routing of the services.

Working drawing or installation drawing:

A drawing showing the inter-relationship of engineering services, their relation to the structure and building fabric and including all components of the works as required for the successful installation of the systems. These drawings are normally developed from the tender or detail design drawings. The drawings shall reflect the actual equipment and other material sizes and details that the contractor is proposing to order.

Working/installation drawings shall include provision for all supports and fixings, insulation, standard fittings and components as necessary to install the works and shall incorporate shop drawing information and manufacturer's drawing information.

Floor plans and sections shall be provided in not less than a scale of 1:50, with plant rooms and details in a scale not less than 1:20. A minimum of 2 copies of these drawings shall be submitted to the Engineer for approval prior to installation and 2 copies of the drawings shall be submitted once approved.

Shop drawings:

Drawing prepared by a fabricator or supplier that the contractor is proposing to utilize

Builder's work drawing:

Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site). All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Contractor.

Controls Logic Diagrams:

Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

Electrical drawings:

Drawings showing the construction and internal wiring diagrams of the panels and/or other devices. These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules as applicable to the installation.

These drawings shall clearly show the actual electrical loads and requirements of all final and actual equipment to be installed. Refer also to the electrical section in the specification.

As built drawings:

The drawings shall show the building and services installations as installed at the date of practical completion. The main features of the drawings should be as follows:

- Provide a record of the locations of all the systems and components installed.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions operating and maintenance purposes.

6.18.2 Drawings and other documentation to be submitted by the Contractor

Any work done by the Contractor without an approved drawing shall be at the Contractor's own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Contractor.

The review of drawings by the consulting engineer shall not relieve the Contractor of his responsibilities to carry out the work in terms of the contract documents.

The following drawings are to be submitted by the Contractor, unless agreed otherwise with the consulting engineer.

Working/Installation Drawings and Shop Drawings:

The Contractor shall prepare his own set of working/installation drawings covering all aspects of the contract works and shall submit these and all shop drawings for comment and approval.

The drawings shall be submitted prior to any installation work commencing on site. A period of 5 working days upon receipt of drawings by the engineer shall be allowed for the commenting and evaluation of the drawings.

The Contractor shall make any necessary amendments without delay. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.

The installation drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as "As Built" drawings.

Builder's Work Drawings:

Shall be submitted by the Contractor to the main contractor and consulting engineer, within two (2) weeks of site handover or in the case where the contractor is appointed after site handover, within two (2) weeks of appointment.

Electrical Drawings (Relating to Fire Services Equipment):

Shall be submitted by the Contractor to the consulting engineer, within two (2) weeks of site handover or in the case where the contractor is appointed after site handover, within two (2) weeks of appointment.

6.19 MAINTENANCE AND GUARENTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Contractor shall newly replace all consumables/parts at the start of the maintenance period, i.e. the practical completion date, as well as at the end of the maintenance period, i.e. final completion date.

The Contractor is responsible for all material and labour during the maintenance period.

The Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within seven (7) days from the visit.

In case of a breakdown, the Contractor shall react within reasonable time and repair the installation to the satisfaction of the Engineer. Should the Contractor, in the discretion of the Engineer, not react within reasonable time, the Engineer shall commission another Contractor and the cost thereof shall be recovered from the defaulting Contractor.

6.20 PAYMENT CLAIMS

In addition to the conditions of contract, the Contractor shall attach to his application for payment an explanation of material cost and labour cost.

The following information is required with respect to material and labour:

- Estimated percentage delivered/completed at date of the previous claim.
- Estimated percentage delivered/completed at date of current claim.

- Total cost claimed at date of previous claim.

6.21 PAINTING WORK

Where applicable the painting specifications as described below shall apply.

Iron and steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

Galvanised surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use. Equipment shall be painted according to the National Colour Standards for Paint, SANS 1091.

6.22 DAMAGE AND PROTECTION OF WORKS AND EQUIPMENT

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held completely responsible for any damage of equipment during transport and installation, as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an “as new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

6.23 STEELWORK AND SUPPORT SYSTEMS

The contractor shall provide all secondary steelwork support systems, frames, steelwork plant bases, access ladders/steps and distribution services support systems associated with the fire suppression installation under this contract.

6.24 WELDING WORK

Welding shall be carried out in accordance with the current edition of SANS 10044 and all other relevant SANS document relevant to the specific type of welding to be undertaken. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

6.25 TESTING AND COMMISSIONING

The contractor shall perform the following duties related to the testing and commissioning of services under this contract:

- The installation shall be commissioned in accordance with a recognised commissioning procedure or code.
- Agree the commissioning program with the main contractor to include for pre-commissioning checks, setting to work, commissioning and performance testing, commissioning witnessing and allow for all costs incurred.
- Give duly notice and state any requirements for the attendance and co-operation of others. This notice shall be a period of no less than 10 working days.
- Provide all necessary facilities and access to enable tests to be witnessed and inspections to be carried out either on site or at manufacturer's works.
- The contractor shall provide full method statements for all testing and commissioning and agree these prior to commencing any testing and pre-commissioning.
- Appoint an "approved and qualified representative", to supervise the whole of the testing, commissioning, performance testing and instruction of future maintenance staff.

- Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
- Test all equipment, material and systems. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.
- Complete all tests before any paint or similar materials are applied or before services are concealed.
- Ensure all requirements such as cleanliness, protection from harmful external and internal elements, etc. are provided prior to commencement of commissioning.
- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
- Provide test equipment that has been subject to a quality assurance procedure and complies with national and local standards.
- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed.
- Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
- Provide all certification documents for approval before any system is offered for final acceptance.

6.26 OPERATING AND MAINTENANCE MANUALS

General:

The Contractor shall submit one (1) draft hard copy and one (1) digital copy of the Operation and Maintenance Manuals and As-built drawings to the Engineer prior to commissioning or at an alternative agreed date, for checking, evaluation and comment purposes and shall allow at least ten (10) working days for the commenting process. The Contractor shall incorporate all comments and re-submit the

revised manuals. The Contractor shall allow for temporary inserts and clearly list items such as commissioning data that are not yet available for inclusion in the manuals. Such information shall be submitted as soon as possible and no later than one (1) week before the planned practical completion date.

The Contractor shall submit the commented, approved and finalised Operation and Maintenance Manuals and As-Built drawings at or prior to Practical completion. Three (3) hard copies and three (3) digital copies shall be submitted. The comment and approval of the manuals shall be a pre-requisite for Practical Completion and no Practical Completion shall be given without fully approved Operating and Maintenance Manuals inclusive of all relevant drawings and other documentation as stated in this specification.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well arranged and provided with an index.

- Documentation shall clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Documentation shall make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Documentation shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Documentation shall provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.

Information in the documentation shall be correlated so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

The Contractor shall show, as required, throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

Content:

The operating and maintenance manuals shall include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Full size and reduced A3 copies of all drawings together with an index.
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.

- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, engineers, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.
- The manuals must contain all commissioning datasheets and certification.
- Provide electronic copies of all Operating and Maintenance documentation in disk format, fully indexed.

6.27 LATE SUBMITTAL OF OPERATING AND MAINTENANCE MANUALS AND DRAWINGS

The Contractor shall provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the As-Built drawings and Operation and Maintenance Manuals are not available when the works would, in the opinion of the principal agent and consulting engineer, otherwise qualify for Practical Completion.

In the event of the Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

6.28 CLIENT STAFF TRAINING

The Contractor shall be responsible for the training of the Client's site staff after the commissioning has been completed. The site staff shall receive enough instructions to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training. Upon completion of training exercise the Contractor is to obtain the proprietor's representative's written acceptance of this handover tuition, thus acknowledging his complete understanding of the operation procedures for this installation. Site staff shall be instructed on:

- the general operating method of the equipment;
- starting and stopping instructions;
- stopping the equipment in an emergency and warning against restarting after an emergency;
- positions and normal settings of control equipment;
- safety measures;
- name, address and telephone number of competent person responsible for the maintenance of the plant.

6.29 IDENTIFICATION AND LABELLING OF SERVICES AND EQUIPMENT

All services shall be clearly and appropriately identified and labelled.

Equipment shall be fitted with identification labels.

Samples of identification methods that the contractor proposes, shall be submitted to the engineer for review, prior to ordering and installation.

All identification and labelling methods shall be in accordance with the relevant SANS, British Standards or better.

7. GASEOUS FIRE SUPPRESSION SYSTEM

The gas fire suppression system shall be of the FM 200 type, shall be safe for use in occupied areas, environmentally friendly and shall utilise a NFPA approved extinguishing agent. The system shall extinguish fires based on a total flooding basis.

The system shall comprise of a welded steel cylinder holding the FM 200 suppression gas. The cylinder shall be rated to withstand a pressure of 25 bar and shall include a wall mounted cylinder holding bracket and a fast acting discharge valve.

All cylinders shall be capable of configuration to operate individually or as part of a group.

An early warning smoke detection system shall be included. Upon detection of a fire, the system shall provide a primary and secondary activation trigger. There shall be a built in and adjustable time delay of 30 to 60 seconds prior to the fire suppression gas discharge. Audible and visual alarms shall be provided. The system shall include an air-conditioning shutdown interface.

The system shall include an automatic and manual state of readiness function. When the rooms are unoccupied, the system shall be set to automatic. The selected state shall be visually displayed.

The equipment shall carry the SABS mark of approval and the contractor shall be an ISO 9001:2000 registered company.

8. ELECTRICAL WORKS RELATED TO THE FIRE SUPPRESSION INSTALLATION

The services of a qualified electrician shall be employed by the contractor. The contractor shall be responsible for the design, documentation, supply, installation and commissioning of the electrical system for the fire suppression installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of premises, SANS 10142-1 latest Edition. An electrical certificate of compliance shall be issued by the contractor after completion of the installation. The electrical installation shall be in line with the main electrical specification of the project as produced by the electrical engineer.

OCCUPATIONAL HEALTH AND SAFETY SPECIFICATION

See Section 1 – Preliminaries clause A7.0 and C11 for pricing of compliance with all the requirements set out in the Construction Regulations issued under the Occupational Health and Safety Act.

public works
& infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

OCCUPATIONAL HEALTH AND SAFETY

FOR

CONSTRUCTION PROJECT:

CONSTRUCTION OF NEW MAGISTRATE OFFICE AT

KEIMOES DOJ

MANAGED ON BEHALF OF

THE DEPARTMENT OF PUBLIC WORKS

PRINCIPAL CONTRACTOR RECEIPT

Received by:

Name:

Signature: *Date:*

Capacity:

OHS MANAGEMENT: WENDY MBOLEKWA

CONTENTS

1. PREAMBLE

In terms of Construction Regulation 4(1)(a) of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and 5(1) construction regulation of 2014, the Department of Public Works, as the Client and/or its Agent on its behalf, shall be responsible to prepare Health & Safety Specifications for any intended construction project and provide any Principal Contractor who is making a bid or appointed to perform construction work for the Client and/or its Agent on its behalf with the same.

The Client's further duties are as described in The Act and the Regulations made there-under. The Principal Contractor shall be responsible for the Health & Safety Policy for the site in terms of Section 7 of the Act and in line with Construction Regulation 5 as well as the Health and Safety Plan for the project.

2. SCOPE OF HEALTH AND SAFETY SPECIFICATION DOCUMENT

These Specifications should be read in conjunction with the Act, the Construction Regulations and all other Regulations and Safety Standards which were or will be promulgated under the Act or incorporated into the Act and be in force or come into force during the effective duration of the project.
The stipulations in this specification, as well as those contained in all other documentation pertaining to the project, including contract documentation and technical specifications shall not be interpreted, in any way whatsoever, to countermand or nullify any stipulation of the Act, Regulations and Safety Standards which are promulgated under, or incorporated into the Act.

2.1 APPLICATIONS AND INTERPRETATION

This document is to be read and understood in conjunction with the following, inter- alia:

- *Occupational Health and Safety Act 85 of 1993 (OHS Act).*
- *All regulations published in terms of the OHS Act.*
- *Construction Regulations, 2014*
- *SABS codes referred to by the OHS Act.*
- *Contract Documents*
- *Basic Conditions of Employment Act (Act 75 of 1997)*
- *National Environmental Management Act 107 of 1998 and all Regulations*
- *Compensation for Occupational Injuries and Diseases (COID) Act No. 130 of 1993*

ABBREVIATIONS

- OHS : Occupational Health and Safety
- CEO : Chief Executive Officer
- CR : Construction Regulations
- HCS : Hazardous Chemical Substances
- MSDS : Material Safety Data Sheet
- AIA : Approved Inspection Authority
- HBA : Hazardous Biological Agents
- OEL : Occupational Exposure Limit

- CSIR : Council for Scientific and Industrial Research
- H&SS : Health and Safety Specification
- HS&EP : Health, Safety and Environmental Plan
- HS&EF : Health, Safety and Environmental File
- CHSO : Construction Health and Safety Officer

3. PURPOSE

The Department is obligated to implement measures to ensure the health and safety of all people and properties affected under its custodianship or contractual commitments, and is further obligated to monitor that these measures are structured and applied according to the requirements of these Health and Safety Specifications.

The purpose of this specification document is to provide the relevant Principal Contractor (and his /her contractor) with any information other than the standard conditions pertaining to construction sites which might affect the health and safety of persons at work and the health and safety of persons in connection with the use of plant and machinery; and to protect persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work during the carrying out of construction work for the Department of Public Works and Infrastructure. The Principal Contractor (and his /her contractor) is to be briefed on the significant health and safety aspects of the project and to be provided with information and requirements

4. DEFINITIONS

The following definitions from the Occupational Health and Safety Act are listed as follows:

"Chief Executive Officer"
In relation to a body corporate or an enterprise conducted by the State, means the person who is responsible for the overall management and control of the business of such body corporate or enterprise.

"Danger"
Means anything that may cause injury or damage to persons or property.

"Employee"
Means, subject to the provisions of Subsection (2), any person who is employed by or works for any employer and who receives or is entitled to receive any remuneration or who works under the direction or supervision of an employer or any other person.

"Employer"
Means, subject to the provisions of Subsection (2), any person who employs or provides work for any person or remunerates that person or expressly or tacitly undertakes to remunerate him, but excludes a labour broker as defined in Section 1(1) of the Labour Relations Act, 1953 (Act No. 28 of 1956).

"Healthy"
Means free from illness or injury attributable to occupational causes.

“Machinery”
Means any article or combination of articles assembled, arranged or connected and which is used or intended to be used for converting any form of energy to performing work, or which is used or intended to be used, whether incidental thereto or not, for developing, receiving, storing, containing, confining, transforming, transmitting, transferring or controlling any form of energy.

“Medical Surveillance”
Means a planned programme of periodic examination (which may include clinical examinations, biological monitoring or medical tests) of employees by an occupational health practitioner or, in prescribed cases, by an occupational medicine practitioner. Plant Includes fixtures, fittings, implements, equipment, tools and appliances, and anything which is used for any purpose in connection with such plant. Properly Used Means used with reasonable care, and with due regard to any information, instruction or advice supplied by the designer, manufacturer, importer, seller or supplier.

User
In relation to plant or machinery, means the person who uses plant or machinery for his own benefit or who has the right of control over the use of plant or machinery, but does not include a lessor of, or any person employed in connection with, the plant or machinery.

Reasonably Practicable
Means practicable having regards to: a) the severity and scope of the hazard or risk concerned, b) The state of knowledge reasonably available concerning that hazard or risk and of any means to remove or mitigate that hazard or risk. c) the availability and suitability of means to remove of mitigate that hazard or risk; and d) The cost of removing or mitigating that hazard or risk in relation to the benefits deriving there from.

“Risk”
Means the probability that injury or damage will occur.

“Safe”
Means free from any hazard.

“Standard”
Means any provision occurring: a) in a specification, compulsory specification, code of practice or standard method as defined in Section 1 of the Standards Act, 1993 (Act No. 29 of 1993); OR b) in any specification, code or any other directive having standardization as its aim and issued by an institution or organization inside or outside the Republic which, whether generally or with respect to any particular article or matter and whether internationally or in any particular country or territory, seeks to promote standardisation.

The following definitions from the Construction Regulations are listed as follows:

“**Agen**t” – means any person who acts as a representative for a Client;

“**Client**” – means any person for whom construction work is performed;

‘‘**Construction Work’’** is defined as any work in connection with –

(a) the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;

(b) the installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling;
(c) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
(d) the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work;

"**Health and Safety File**" – means a file, or other record in permanent form, containing the information required a contemplated in the regulations;

"**Health and Safety Plan**" – means a site, activity or project specific documented plan in accordance with the client's health and safety specification;

"**Health and Safety Specification**" – means a site, activity or project specific document prepared by the client pertaining to all health and safety requirements related to construction work;

"Electrical installation" means any electrical installation as defined in regulation 1 of the Electrical Installation Regulations, published under Government Notice R.2270 of 11 October 1985;

"**Method Statement**" – means a document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment;

"**Principal Contractor**" – means an employer, as defined in section 1 of the Act who performs construction work and is appointed by the Client to be in overall control and management of a part of or the whole of a construction site;

"**Risk Assessment**" – means a program to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard.

"**Competent person**" – means any person having the knowledge, training, experience and qualifications specific to the work or task being performed: Provided that where appropriate qualifications and training are registered in terms of the provisions of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995), these qualifications and training shall be deemed to be the required qualifications and training.

5. OCCUPATIONAL HEALTH & SAFETY MANAGEMENT

5.1. Overall Supervision and Responsibility for OH&S

The Client and/or its Agent shall ensure that the Principal Contractor implements and maintains the agreed and approved H&S Plan. Failure on the part of the Client or Agent to comply with this requirement will not relieve the Principal Contractor from any one or more of his/her duties under the Act and Regulations.

5.2. Further (Specific) Supervision Responsibilities for OH&S

Several appointments or designations of responsible and /or competent people in specific areas of construction work are required by the Act and Regulations. The following competent appointments, where applicable, in terms of the Construction Regulations and other Regulations shall be made to ensure compliance to the Act, Regulations and SANS Standards.

LEGAL DOCUMENTATION/APPOINTMENTS

The following documents must be provided in the Health and Safety Plan (H&SP):

- Health and Safety Policy signed by CEO or statement of commitment to SHE
- Letter of good standing with the Compensation Commissioner, Federated Employers or similar insurer.
- HSE Organogram (or table), outlining the HSE Team, as well as the appointment(s) they have under the Act and Regulations (reference to specific section/regulation applicable to appointment)
- The competency of each member of the HSE Team must be provided and should include knowledge, training, experience & qualifications specific to the appointment.

Signed copies of the following legal appointments must be provided in the Health, Safety and Environmental Plan:

APPOINTMENT	OHS-ACT / REGULATION REFERENCE
Section 16.2 appointment	Section 16.2
HSE Representative (if necessary)	Section 17(1)
Incident Investigator	GAR 9(2)
First Aiders	GSR 3(4)
Fire Fighters	ER 9 & CR 29
Risk Assessor	HCS Reg (Incl. Asbestos & Lead); CR 9

The following information must be provided in the H&SP:

- Indicate the estimated number of employees to be working on site.
- Indicate the expected number of sub-contractors to be appointed by the Principal Contractor.

The following competent persons, where applicable, shall be appointed in writing by the Principal Contractor, prior to any work being carried out, and shall adhere to the requirements of the specific sub-regulations.

The competency of each of these appointed competent persons must be provided and should include knowledge, training, experience & qualifications specific to the appointment.

APPOINTMENT	OHS-ACT / REGULATION REFERENCE
Construction Manager	CR 8 (1)
Assistant Construction Manager	CR 8 (2)
Construction H&S Officer where applicable	CR 8 (5)
Construction Supervisor	CR 8 (7)
Construction Assistant Supervisor	CR 8(8)
Risk assessor	CR 9(1)
Fall Protection Competent Person	CR 10 (1)
Temporary works competent person	CR12 (2)
Excavation Work Supervisor	CR 13 (1)(a)
Demolition Work	CR 14 (1)
Competent Person (Use of Explosives for Demolition Work)	CR14(11
Scaffolding Erector/ Team Leader/ Inspector	CR 16 (1)
Suspended platform Competent Person	CR 17(1)
Rope Access Work Competent Person	CR 18 (1) (a)
Material Hoist Competent Person	CR 19(8)(a)
Bulk Mixing Plant Competent Person	CR 20 (1)
Explosive Powered Tools Competent Person	CR 21(2)(b)
Construction Vehicle and Mobile Plant Competent Person	CR23 (1)(d)
Electrical Machinery Competent Person	CR 24 (c)
Stacking and Storage Supervisor	CR 28 (a)
Fire Equipment Inspector	CR 29(h)

Indicate in the H&SP, which of these listed appointments are applicable to the construction work in question (project specific).

No work involving any of the listed appointments may be performed without the knowledge and approval of an appointed competent person.

5.3 Communication & Liaison

5.2.1 The Principal Contractor will communicate all health and safety concerns with the DPW Health and Safety Officer.

6. RESPONSIBILITIES

6.1 Client/Agent

6.1.2 The Client/Agent shall discuss and negotiate with the Principal Contractor the contents of the health and safety plan and when compliant, approve the plan.

6.2 Principal Contractor

6.2.1 The Principal Contractor shall accept the appointment under the terms and Conditions of Contract. The Principal Contractor shall sign and agree to those terms and conditions and shall, before commencing work, notify the Department of Labour of the intended construction. Annexure 2 of this construction regulation contains a "Notification of Construction Work" form. The Principal Contractor shall submit the notification in writing prior to commencement of work and inform the Client or his Agent accordingly.

6.2.2 The Principal Contractor shall ensure that he is fully conversant with the requirements of this Specification and all relevant health and safety legislation.

6.2.3 The Principal Contractor will in no manner or means be absolved from the responsibility to comply with all applicable sections of the Act, the Construction Regulations or any Regulations proclaimed under the Act or which may perceivable be applicable to this contract.

6.2.4 The Principal Contractor shall provide and demonstrate to the Client a suitable and sufficiently documented health and safety plan based on this Specification, the Act and the Construction Regulations, which shall be applied from the date of commencement of and for the duration of execution of the works. This plan shall, as appendices, include the health and safety plans of all Sub-contractors for which he has to take responsibility in terms of this contract.

6.2.5 The Principal Contractor shall provide proof of his registration and good standing with the Compensation Fund or with a licensed compensation insurer prior to commencement with the works.

6.2.6 The Potential Principal Contractor shall, in submitting his tender, demonstrate that he has made provision for the cost of compliance with the specified health and safety requirements, the Act and Construction Regulations. (Note: This shall have to be contained in the conditions of tender upon which a tenderer's offer is based.)

6.2.7 The Principal Contractor shall consistently demonstrate his competence and the adequacy of his resources to perform the duties imposed on the Principal Contractor in terms of this Specification, the Act and the Construction Regulations.

6.2.8 The Principal Contractor shall ensure that a copy of his health and safety plan is available on site and is presented upon request to the Client, an Inspector, Employee or Sub-contractor.

6.2.9 The Principal Contractor shall ensure that a health and safety file, which shall include all documentation required in terms of the provisions of this Specification, the Act and the Construction Regulations, is opened and kept on site and made available to the Client or Inspector upon request. Upon completion of the works, the Principal Contractor shall hand over a consolidated health and safety file to the Client.

6.2.10 The Principal Contractor shall, throughout execution of the contract, ensure that all conditions imposed on his Sub-contractors in terms of the Act and the Construction Regulations are complied with as if they were the Principal Contractor.

6.2.11 The Principal Contractor shall from time to time evaluate the relevance of the Health and Safety Plan and revise the same as required, following which revised plan shall be submitted to the Client and/or his/her Agent for approval.

6.2.12 A letter of good standing in terms of COIDA (Compensation Commissioner) must be submitted to DPW.

7. SCOPE OF WORK

Construction of the new magistrate office. These specifications are applicable to the specific scope of work pertaining to the above-mentioned project as detailed in the tender documents.

8. HEALTH AND SAFETY FILE

a) The Principal Contractor must, in terms of Construction Regulation 7(7), keep a Health & Safety File on site at all times that must include all documentation required in terms of the Act and Regulations and must also include a list of all Contractors on site that are accountable to the Principal Contractor and the agreements between the parties and details of work being done. A more detailed list of documents and other legal requirements that must be kept in the Health and

b) The Health and Safety File will remain the property of the Client and/or its Agent on its behalf throughout the period of the project and shall be consolidated and handed over to the Client and/or its Agent on its behalf at the time of completion of the project

9. RISK ASSESSMENTS

In terms of Construction Regulations 5 the Client will prepare a baseline risk assessment for the construction work project. The Principal Contractor shall, before commencement of any construction work and during the construction work, have risk assessments performed by a competent person appointed in writing, which risk assessments form part of the health and safety plan to be applied on site, and must include –

(a) the identification of the risks and hazards to which persons may be exposed to;
(b) the analysis and evaluation of the risks and hazards identified;

(c) a documented plan of safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;
(b) a monitoring plan; and
(e) a review plan.

The following hazards are identified:

- Drilling (Breaking of walls)
- Formwork and support work
- Scaffolding
- Construction vehicles and mobile equipment
- Electrical installations and electrical machinery
- Housekeeping
- Stacking and storage practices
- Fire risks and fire precautions
- Use of jackhammers
- Hot work (steel cutting and welding)
- Portable electrical tools
- Intoxicated persons on site
- Use of ladders
- Impact of construction work upon occupants of buildings not evacuated for the duration of the work
- Working at height (fall protection)
- Noise
- Potential presence of asbestos that forms part of the structure (cement fibre)
- Dust

Site Specific risk assessment of the above must be submitted to DPW before commencement of work.

10. HEALTH AND SAFETY POLICY

Each contractor to submit a suitable documented Health and Safety Policy as required by Section 7 of the OHS Act.

11. IDENTIFICATION OF HAZARDS AND DEVELOPMENT OF RISK ASSESSMENTS, STANDARD WORKING PROCEDURES (SWP) AND METHOD STATEMENTS

The Principal Contractor is required to develop Risk Assessments, Standard Working Procedures (SWP) and Method Statements for each activity executed in the contract or project.

The identification of hazards is over and above the hazards identification programme and those hazards identified during the drafting of the Health and Safety Plan.

12. ARRANGEMENTS FOR MONITORING AND REVIEW

12.1 Monthly Audit by Client and/or its Agent on its behalf

The Client and/or its Agent on its behalf will be conducting Periodic Audits at times agreed with the Principal Contractor Audit to comply with Construction Regulation 4(1)(d) to ensure that the principal Contractor has implemented, is adhering to and is maintaining the agreed and approved OH&S Plan.

12.3 Reports

a) The Principal Contractor shall report all incidents where an employee is injured on duty to the extent that he/she:

   i. dies
   ii. becomes unconscious
   iii. loses a limb or part of a limb
   iv. is injured or becomes ill to such a degree that he/she is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he/she was usually employed

OR where:

   i. a major incident occurred
   ii. the health or safety of any person was endangered
   iii. where a dangerous substance was spilled
   iv. the uncontrolled release of any substance under pressure took place
   v. machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects
   vi. machinery ran out of control, to the Provincial Director of the Department of Labour within seven days and at the same time to the Client and/or its Agent on its behalf.

b) The Principal Contractor is required to provide the Client and/or its Agent on its behalf with copies of all statutory reports required in terms of the Act and the Regulations.

c) The Principal Contractor is required to provide the Client and/or its Agent on its behalf with a monthly “SHE Risk Management Report”.

d) The Principal Contractor is required to provide a.s.a.p. the Client and/or its Agent on its behalf with copies of all internal and external accident/incident investigation reports.

12.4 Review

The Principal Contractor is to review the Hazard Identification, Risk Assessments and Standard Work Processes at each Production Planning and Progress Report meeting as the construction work develops and progresses and each time changes are made to the designs, plans and construction methods and processes.

The Principal Contractor must provide the Client and/or its Agent on its behalf, other Contractors and all other concerned parties with copies of any changes, alterations or amendments as contemplated in the above paragraph.

12.5 Site Rules and other Restrictions

a) *Site OH&S Rules*

The Principal Contractor must develop a set of site-specific OH&S rules that will be applied to regulate the Health and Safety Plan and associated aspects of the construction. When required for a site by law, visitors and non-employees upon entering the site shall be issued with the proper Personal Protective Equipment (PPE) as and when necessary.

b) Security Arrangements

The Principal Contractor must establish site access rules and implement and maintain these throughout the construction period.

12.6 Training

a) *General Induction Training*

All employees of the Principal and other Contractors must be in possession of proof of General Induction training

b) Other Training

All operators, drivers and users of construction vehicles, mobile plant and other equipment must be in possession of valid proof of training.

12.7 Accident and Incident Investigation

The Principal Contractor is responsible to oversee the investigation of all accidents/incidents where employees and non-employees were injured to the extent that he/she/they had to receive first aid or be referred for medical treatment by a doctor, hospital or clinic. (General Administrative Regulation 9)

The Principal Contractor is responsible for the investigation of all non-injury incidents as described in Section 24 (1) (b) & (c) of the Act and keeping a record of the results of such investigations including the steps taken to prevent similar incidents in future.

Notwithstanding the requirements of Section 24 of the Act, ALL incidents shall be investigated and reported on in writing, irrespective of whether such incident gave rise to injury or damage.

13 OUTLINED DATA, REFERENCES AND INFORMATION ON CERTAIN AND/OR SPECIFIC OBLIGATORY REQUIREMENTS TO ENSURE COMPLIANCE

OHS Act Section/ Regulation	Subject	Requirements
Construction. Regulation	**Notice of carrying out Construction work**	• Department of Labour notified • Copy of Notice available on Site
General Admin. Regulation 4	**Copy of OH&S Act (Act 85 of 1993)**	• Updated copy of Act & Regulations on site. • Readily available for perusal by employees.
COID Act Section 80	**Registration with Compens. Insurer**	• Written proof of registration/Letter of good standing available on Site
Construction. Regulation 4 & 5(1)	**H&S Specification & Programme**	• H&S Spec received from Client and/or its Agent on its behalf • OH&S programme developed & Updated regularly
Section 8(2)(d) Construction. Regulation	**Hazard Identification & Risk Assessment**	• Hazard Identification carried out/Recorded • Risk Assessment and – Plan drawn up/Updated • RA Plan available on Site • Employees/Sub-Contractors informed/trained
Section 16(2)	**Assigned duties (Managers)**	• Responsibility of complying with the OH&S Act assigned to other person/s by CEO.
Section 37(1) & (2)	**Agreement with Mandatories/ (Sub-)Contractors**	• Written agreement with (Sub-)Contractors • List of Subcontractors displayed. • Proof of Registration with Compensation Insurer/Letter of Good Standing
Section 24 & General Admin. Regulation 8 COID Act Sect.38, 39 & 41	**Reporting of Incidents (Dept. of Labour)**	• Incident Reporting Procedure displayed. • All incidents in terms of Sect. 24 reported to the Provincial Director, Department of Labour, within 3 days. (Annexure 1)(WCL 1 or 2) and to the Client and/or its Agent on its behalf • Cases of Occupational Disease Reported • Copies of Reports available on Site • Record of First Aid injuries kept

General Admin. Regulation 9	**Investigation and Recording of Incidents**	• All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. • Copies of Reports (Annexure 1) available on Site • Tabled at H&S Committee meeting • Action taken by Site Management.
Construction. Regulation Driven Machinery Regulations 18 & 19	**Cranes & Lifting Machines Equipment**	• Competent person appointed in writing to inspect Cranes, Lifting Machines & Equipment • Written Proof of Competence of above appointee available on Site. • Cranes & Lifting tackle identified/numbered • Register kept for Lifting Tackle • Log Book kept for each individual Crane • Inspection: - All cranes - **daily by operator** - Tower Crane/s - **after erection/6monthly** - Other cranes - **annually by comp. person** • - Lifting tackle(slings/ropes/chain slings etc.) - daily or before every new application
General Safety Regulation 3	**First Aid**	• Every workplace provided with sufficient number of First Aid boxes. (Required where 5 persons or more are employed) • First Aid freely available • Equipment as per the list in the OH&S Act. • One qualified First Aider appointed for every 50 employees. (Required where more than 10 persons are employed) • List of First Aid Officials and Certificates • Name of person/s in charge of First Aid box/es displayed. • Location of First Aid box/es clearly indicated. • Signs instructing employees to report all • Injuries/illness including first aid injuries
General Safety Regulation 2	**Personal Safety Equipment (PSE)**	• PSE Risk Assessment carried out • Items of PSE prescribed/use enforced

		• Records of Issue kept • Undertaking by Employee to use/wear PSE • PSE remain property of Employer, not to be removed from premises GSR 2(4)
General Safety Regulation 13A	**Inspection of Ladders**	• Competent person appointed in writing to inspect Ladders • Ladders inspected at arrival on site and weekly there after. Inspections register kept • Application of the types of ladders (wooden, aluminium etc.) regulated by training and inspections and noted in register
Asbestos Regulations 5	**Information and training**	• Ensure that employees are adequately informed and trained on both practical aspects and theoretical knowledge.
Asbestos Regulations 17	**Personal Protective equipment (PPE)**	• Ensuring suitable PPE, storing of PPE, disposal of such PPE and that persons exposure is adequately controlled.
Asbestos Regulations 20	**Disposal of asbestos**	• Safe disposal and handling of asbestos or asbestos containing material.

14. LOCKOUT PROCEDURE

Contractors undertaking maintenance and repair work must submit a suitably documented lockout/tag-out procedure to be approved before work commences.

15. HOUSEKEEPING

Good housekeeping will be maintained at all times as per Construction Regulation No. 25. Poor housekeeping contributes to three major problems, namely, costly or increased accidents, fire or fire hazards and reduction in production. Good housekeeping will enhance production time.

In promotion of environmental control all waste, rubble, scrap etc, will be disposed of at a registered dump site and records will be maintained. Where it is found to be impractical to use a registered dump site or it is not available, the Principal Contractor will ensure that the matter is brought to record with the client or his representative, after which suitable, acceptable alternatives will be sought and applied.

Dross and refuse from metals, and waste matters or by-products whose nature is such that they are poisonous or capable of fermentation, putrefaction or constituting a nuisance shall be treated or disposed of by methods approved of by an inspector.

NOTE: No employer (Principal Contractor) shall require or permit any person to work at night or after hours unless there is adequate, suitable artificial lighting including support services in respect of Health and Safety.

16. ELECTRICAL EMERGENCY RESPONSE PROCEDURE

Contractors undertaking electrical maintenance and repair work must submit a suitably documented Electrical Emergency Response Procedure to be approved before work commences.

17. Compliance to COVID Directives

The contractor should comply with Directives of Dept. of Health and Dept. Of Labour and Employment.

10.1 Induction wrt COVID-19 is mandatory.
10.2 Specific COVID-19 PPE is mandatory

PW 1544

DEPARTMENT OF PUBLIC WORKS

HIV/AIDS

SPECIFICATION

OCTOBER 2004

SECTION

HIV/AIDS SPECIFICATION

HIV/AIDS REQUIREMENTS

1 SCOPE

This specification contains all requirements applicable to the Contractor for creating HIV/AIDS awareness amongst all of the Workers involved in this project for the duration of the construction period, through the following strategies:

- Raising awareness about HIV/AIDS through education and information on the nature of the disease, how it is transmitted, safe sexual behaviour, attitudes towards people affected and people living with HIV/AIDS, how to live a healthy lifestyle with HIV/AIDS, the importance of voluntary testing and counselling, the diagnosis and treatment of Sexually Transmitted Infections and the closest health Service Providers;

- Informing Workers of their rights with regard to HIV/AIDS in the workplace;

- Providing Workers with access to condoms and other awareness material that will enable them to make informed decisions about sexual practices.

2 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Service Provider: The natural or juristic person recognised and approved by the Department of Public Works as a specialist in conducting HIV/AIDS awareness programmes.

Service Provider Workshop Plan: A plan outlining the content, process and schedule of the training and education workshops, presented by a Service Provider which has been approved by the Representative/Agent.

Worker: Person in the employ of the Contractor or under the direction or supervision of the Contractor or any of his Sub-contractors, who is on site for a minimum period of 30 days in all.

2.2 Abbreviations

HIV : Human Immunodeficiency Virus.

AIDS : Acquired Immune Deficiency Syndrome.

STI : Sexually Transmitted Infection.

3 BASIC METHOD REQUIREMENT

3.1 The Contractor shall, through a Service Provider, conduct onsite workshops with the Workers.

The Service Provider shall develop and compile a Service Provider Workshop Plan to be presented at the workshops and which will be best suited for this project to achieve the specified objectives with regard to HIV/AIDS awareness.

The Service Provider Workshop Plan shall be based on the following information provided by the Contractor:

- Number of Workers and Sub-contractors on site;
- When new Workers or Sub-contractors will join the construction project;
- Duration of Workers and Sub-contractors on site;
- How the maximum number of Workers can be targeted with workshops;
- How the Contractor prefers workshops to be scheduled, e.g. three hourly sessions per Worker, or one 2.5 hour workshop per Worker;
- Profile of Workers, including educational level, age and gender (if available);
- Preferred time of day or month to conduct workshops;
- A Gantt chart reflecting the construction programme, for scheduling of workshops;
- Suitable venues for workshops.

The Contractor shall submit the Service Provider Workshop Plan for approval within 21 days after the tender acceptance date. After approval by the Representative/Agent, the Contractor shall make available a suitable venue that will be conducive to education and training.

3.2 The Service Provider Workshop Plan shall address, but will not be limited to the following:

3.2.1 The nature of the disease;
3.2.2 How it is transmitted;
3.2.3 Safe sexual behaviour;
3.2.4 Post exposure services such as voluntary counselling and testing (VCT) and nutritional plans for people living with HIV/AIDS;
3.2.5 Attitudes towards other people with HIV/AIDS;
3.2.6 Rights of the Worker in the workplace;
3.2.7 How the Awareness Champion will be equipped prior to commencement of the HIV/AIDS awareness programme with basic HIV/AIDS information and the necessary skills to handle questions regarding the HIV/AIDS awareness programme on site sensitively and confidentially;
3.2.8 How the Service Provider will support the Awareness Champion;
3.2.9 Location and contact numbers of the closest clinics, VCT facilities, counselling services and referral systems;
3.2.10 How the workshops will be presented, including frequency and duration;
3.2.11 How the workshops will fit in with the construction programme;
3.2.12 How the Service Provider will assess the knowledge and attitude levels of attendees to structure workshops accordingly;
3.2.13 How the video will be used;
3.2.14 How the Service Provider will elicit maximum participation from the Workers;
3.2.15 A questions and answers slot (interactive session).

The Service Provider Workshop Plan shall encompass the Specific Learning Outcomes (SLO) as stipulated.

4 HIV/ AIDS AWARENESS EDUCATION AND TRAINING

4.1 Workshops

The Contractor shall ensure that all Workers attend the workshops.

The workshops shall adequately deal with all the aspects contained in the Service Provider Workshop Plan. A video of HIV/AIDS in the construction industry, which can be obtained from all Regional Offices of the Department of Public Works, is to be screened to Workers at workshops. In order to enhance the

learning experience, groups of not exceeding 25 people shall attend the interactive sessions of the workshops.

4.2 Recommended practice

4.2.1 Workshop Schedule

Presenting information contained in the Service Provider Workshop Plan can be divided in as many workshop sessions as deemed practicable by the Contractor, provided that all Workers are exposed to all aspects of the workshops as outlined in the Service Provider Workshop Plan.

Breaking down the content of information to be presented to Workers into more than one workshop session however, has the added advantage that messages are reinforced over time while providing opportunity between workshop sessions for Workers to reflect and test information. Workers will also have an opportunity to ask questions at a following session.

4.2.2 Service Providers

A database of recommended Service Providers is available from all Regional Offices of the Department of Public Works.

4.2.3 HIV/AIDS Specific Learning Outcomes and Assessment Criteria

Workers shall be exposed to workshops for a minimum duration of two-and-a-half hours. In order to set a minimum standard requirement, the following specific learning outcomes and assessment criteria shall be met.

4.2.3.1 UNIT 1: The nature of HIV/AIDS

After studying and understanding this unit, the Worker will be able to differentiate between HIV and AIDS and comprehend whether or not it is curable. The Worker will also be able to explain how the HI virus operates once a person is infected and identify the symptoms associated with the progression of HIV/AIDS.

Assessment Criteria:
1. Define and describe HIV and AIDS;
2. List and describe the progression of HIV/AIDS.

4.2.3.2 UNIT 2: Transmission of the HI virus

After studying and understanding this unit, the Worker will be able to identify bodily fluids that carry the HI virus. The Worker will be able to recognise how HIV/AIDS is transmitted and how it is not transmitted.

Assessment Criteria:
1. Record in what bodily fluids the HI virus can be found;
2. Describe how HIV/AIDS can be transmitted;
3. Demonstrate the ability to distinguish between how HIV/AIDS is transmitted and misconceptions around transmittance of HIV/AIDS.

4.2.3.3 UNIT 3: HIV/AIDS preventative measures

After studying and understanding this unit, the Worker will comprehend how to act in a way that would minimise the risk of HIV/AIDS infection and to use measures to prevent the HI virus from entering the bloodstream.

Assessment Criteria:
1. Report on how to minimise the risk of HIV/AIDS infection;
2. Report on precautions that can be taken to prevent HIV/AIDS infection;
3. Explain or demonstrate how to use a male and female condom;
4. List the factors that could jeopardize the safety of condoms provided against HIV/AIDS Transmission.

4.2.3.4 UNIT 4: Voluntary HIV/AIDS counselling and testing

After studying and understanding this unit, the Worker will be able to recognise methods of testing for HIV/AIDS infection. The Worker will be able to understand the purpose of voluntary HIV/AIDS testing and pre- and post-test counseling.

Assessment Criteria:
1. Describe methods of testing for HIV/AIDS infection;
2. Report on why voluntary testing is important;
3. Report on why pre- and post-test counselling is important.

4.2.3.5 UNIT 5: Living with HIV/AIDS

After studying and understanding this unit, the Worker will be able to recognise the importance of caring for people living with HIV/AIDS and be able to manage HIV/AIDS.

Assessment Criteria:
1. List and describe ways to manage HIV/AIDS;
2. Describe nutritional needs of people living with HIV/AIDS;
3. Describe ways to embrace a healthy lifestyle as a person living with HIV/AIDS;
4. Explain the need for counselling and support to people living with HIV/AIDS.

4.2.3.6 UNIT 6: Treatment options for people with HIV/AIDS

After studying and understanding this unit, the Worker will be familiar with the various treatments available to HIV/AIDS infected or potentially HIV/AIDS infected people.

Assessment Criteria:
1. Discuss anti-retroviral therapy;
2. List methods of treatment to prevent HIV/AIDS transmission from mother-to-child;
3. Describe the need for treatment of opportunistic diseases for people living with HIV/AIDS;
4. Describe post exposure prophylactics.

4.2.3.7 UNIT 7: The rights and responsibilities of Workers in the workplace with regard to HIV/AIDS

After studying and understanding this unit, the Worker will be able to identify the rights and responsibilities of the Worker living with HIV/AIDS in the workplace. The Worker will recognise the importance of accepting colleagues living with HIV/AIDS and treating them in a non-discriminative way.

Assessment Criteria:
1. Discuss the rights of a person living with HIV/AIDS in the workplace;
2. Discuss the responsibilities of a person living with HIV/AIDS in the workplace;
3. Report on why acceptance and non-discrimination of colleagues living with HIV/AIDS is important.

4.3 Displaying of plastic laminated posters and distribution of information booklets

The Contractor shall obtain a set of four laminated posters conveying different key messages and information booklets. The contractor should include the costs of posters and information booklets in his/her tender price.

The above-mentioned posters and information booklets have been prepared to raise awareness and to share information about HIV/AIDS and STI's.

Posters or display stands shall be displayed on site as soon as possible, but not later than 14 days after the date of site handover.

Posters shall be displayed in areas highly trafficked by Workers, including toilets, rest areas, the site office and compounds.

The posters on display must always be intact, clear and readable.

Information booklets must be distributed to all Workers as soon as possible, but not later than 14 days after site handover, or as soon as the Worker joins the site.

5 PROVIDING WORKERS WITH ACCESS TO CONDOMS

The Contractor shall provide and maintain condom dispensers and make both male and female condoms, complying with the requirements of SABS ISO 4074, available at all times to all Workers at readily accessible points on site, for the duration of the contract. The Contractor may obtain condom dispensers from the Department of Health and condoms may be obtained from the Local Clinic or the Department of Health.

At least one male and one female condom dispenser and a sufficient supply of condoms, all to the approval of the Representative/Agent, shall be made available on site within 14 days of site hand over. Contractors should note that arrangements to obtain condoms from the Department of Health Clinics prior to site hand over may be necessary, to ensure that condoms are available within 14 days of site handover.

Condoms shall be made available in areas highly trafficked by Workers, including toilets, the site office and compounds.

6 ENSURING ACCESS TO HIV/AIDS TESTING AND COUNSELLING FACILITIES AND TREATMENT OF SEXUALLY TRANSMITTED INFECTIONS (STI)

The Contractor shall provide Workers with the names of the closest Service Providers that provide HIV/AIDS testing and counselling and Clinics providing Sexually Transmitted Infection (STI) diagnosis and treatment. Information on these Service Providers and Clinics must be displayed on a poster of a size not smaller than A1 in an area highly trafficked by Workers.

7 APPOINTMENT OF AN HIV/AIDS AWARENESS CHAMPION

7.1 Within 14 days of site handover the Contractor shall appoint an Awareness Champion from amongst the Workers, who speaks, reads and writes English, who speaks and understands all the local languages spoken by the Workers and who shall be on site during all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available and the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner.

7.2 The Awareness Champion shall be responsible for:

7.2.1 Liasing with the Service Provider on organising awareness workshops;
7.2.2 Filling condom dispensers and monitoring condom distribution;
7.2.3 Handing out information booklets;
7.2.4 Placing and maintaining posters.

8 MONITORING

The Contractor shall grant to the Representative/Agent reasonable access to the construction site, in order to establish that the Contractor complies with his obligations regarding HIV/AIDS awareness under this contract.

The Contractor must report problems experienced in implementing the HIV/AIDS requirements to the Representative/Agent.

The attached SITE CHECKLIST (SCHEDULE A) shall be completed and submitted at every construction progress inspection to the Representative/Agent.

The attached SERVICE PROVIDER REPORT (SCHEDULE B) shall be completed and submitted on a monthly basis to the Department's Project Manager, through the Representative/Agent.

The attached CONTRACTOR HIV/AIDS PROGRAMME REPORT (SCHEDULE C), a close out programme report, shall be completed by the Contractor at the end of the contract.

SCHEDULE A

HIV/AIDS PROGRAMME: SITE CHECKLIST

When did construction commence: _____

Name of Departmental Project Manager: _____

Please refer to HIV/AIDS Programme activities during the reporting period

Tick the block if Contractor satisfactorily complied with specifications																												
DATE	**PI**				**PI**				**PI**				**PI**				**PI**				**PI**				**PI**			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Programme implemented within 14 days of site handover																												
Awareness champion on site																												
HIV/AIDS awareness service provider report																												
Male condom dispenser																												
Sufficient male condoms available																												
Male condom dispenser in a highly trafficked area																												
Female condom dispenser																												
Sufficient female condoms available																												
Female condom dispenser in a highly trafficked area																												
All four types of posters displayed																												
Posters in a good condition																												
Posters in a highly trafficked area																												
Posters displayed on local support services: clinic & VCT centre																												
Support service poster/s in highly trafficked area																												
Support service poster/s in a good condition																												

Please indicate the applicable number for the reporting period							
Workers on payroll (at PI)							
Sub-Contractors who will be on site for longer than 30 days (at PI)							
Workshop attendees							
Number of workshops held							
Scheduled workshops according to approved workshop plan							
Booklets distributed							
Male condoms distributed							
Female condoms distributed							

Representative/Agent

Date

Contractor

Date

Date of progress inspection: (ccyy/mm/dd)

Reporting period: (ccyy/mm/dd) _____ to (ccyy/mm/dd) _____

Deviations from HIV/AIDS awareness programme plan:

Corrective actions:

Representative/Agent	Departmental Project Manager
Date	Date

SCHEDULE B

HIV/AIDS AWARENESS PROGRAMME: SERVICE PROVIDER REPORT

Reporting period: (ccyy/mm/dd) _____ to (ccyy/mm/dd) _____

Number of workshops conducted in reporting period: _____

Number of scheduled workshops according to approved workshop plan: _____

Deviations from workshop plan:

State reasons for deviating from workshop plan:

Corrective actions:

_____ _____

Service Provider

_____ _____

Date Date

HIV/AIDS AWARENESS PROGRAMME : WORKSHOP CONTENT ADDRESSED

Fill in the applicable information with regard to each workshop conducted																									
DATE	**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Content of workshop: (Mark the content included)																												
SLO1																												
SLO2																												
SLO3																												
SLO4																												
SLO5																												
SLO6																												
SLO7																												
HIV/AIDS in construction video																												
Indicate the duration of the workshop in hours																												
Total number of Workers																												
Indicate workshop venue																												

HIV/AIDS AWARENESS PROGRAMME: ATTENDANCE REGISTER

Fill in your name and indicate attendance by ticking the appropriate date																											
DATE		**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**			
		D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
No	**NAMES**																												

SCHEDULE C

CONTRACTOR HIV/AIDS PROGRAMME REPORT

Project name: _____

Project Location: _____

Contract value of project: R_____

Department of Public Works Project Manager: _____

HIV/AIDS Programme duration: (ccyy/mm/dd) _____ to (ccyy/mm/dd) _____

AWARENESS MATERIAL

Describe location of posters displayed during the programme: _____

_____

Comments on posters: _____

Indicate total number of booklets distributed: _____

Comments on booklets: _____

_____

CONDOMS

Indicate total number of male condoms distributed: _____

Indicate total number of female condoms distributed: _____

Describe where male condom dispenser was placed: _____

Describe where female condom dispenser was placed: _____

HIV/AIDS WORKSHOPS

Indicate the total number of HIV/AIDS workshops conducted: _____

Indicate the duration of workshops: _____

Indicate the total number of Workers that participated in the HIV/AIDS workshops: _____

Indicate the total number of Workers that were exposed to the video on HIV/AIDS in the Construction Industry:

_____

Comments on HIV/AIDS workshops on site: _____

_____

GENERAL

Briefly describe programme activities and satisfaction with outcome: _____

_____

_____

Additional comments, suggestions or needs with regard to the HIV/AIDS awareness programmes on site:

_____

_____

_____

Please indicate if your company has a formal HIV/AIDS policy focussing on HIV/AIDS awareness raising and care and support of HIV/AIDS Workers:	Yes	No	Currently developing one

Please indicate if, to your knowledge, you have lost any workers during the duration of the project to HIV/AIDS related sicknesses. One or more of the following might indicate an HIV/AIDS related death:

Excessive weight loss	Coughing or chest pain	Vomiting
Reactive TB	Pain when swallowing	Meningitis
Hair loss	Persistent fever	Memory loss
Severe tiredness	Diarrhoea	Pneumonia

Number of HIV/AIDS-related deaths: _____

_____ _____

Contractor **Date**

_____ _____

Departmental Project Manager **Date**

SABS 1200
SPECIFICATIONS

C3.4 : CONSTRUCTION

C3.4.1 WORKS SPECIFICATION

C3.4.1.1 Applicable SANS standards

Not applicable

C3.4.1.2 Applicable national and international standards

a) For the purpose of this Contract the latest issues of the following Standard Specifications for Civil Engineering Construction, applicable at the date of tender advertisement, shall apply -

SANS (*previously SABS*) 1200 C	:	Site Clearance (Amendment 1, 1982)
SANS (*previously SABS*) 1200 D	:	Earthworks (Amendment 1, 1990)
SANS (*previously SABS*) 1200 DB	:	Earthworks (Pipe Trenches)
SANS (*previously SABS*) 1200 DM	:	Earthworks (Roads, Subgrade)
SANS (*previously SABS*) 1200 G	:	Concrete (Structural)
SANS (*previously SABS*) 1200 L	:	Medium-Pressure Pipelines
SANS (*previously SABS*) 1200 LB	:	Bedding (Pipes)
SANS (*previously SABS*) 1200 LD	:	Sewers
SANS (*previously SABS*) 1200 LE	:	Stormwater Drainage
SANS (*previously SABS*) 1200 M	:	Roads (General)
SABS (*previously SABS*) 1200 ME	:	1981 Subbase
SABS (*previously SABS*) 1200 MF	:	1981 Base
SABS (*previously SABS*) 1200 MJ	:	1984 Segmented Paving
SABS (*previously SABS*) 1200 MK	:	1983 Kerbing and Channelling

b) The term “project specifications” appearing in any of the SANS (*previously SABS*) 1200 standardised specifications must be replaced with the term “scope of work”.

PS C : SITE CLEARANCE

PS C 3 **MATERIAL**

PS C 3.1 **DISPOSAL OF MATERIAL**

Substitute the first sentence of C 3.1 with the following:

An area for the disposal of material obtained from clearing and grubbing, demolition of structures and dismantling and removal of pipes shall be disposed of at an approved site as identified by the local authority.

PS C 5 **CONSTRUCTION**

PS C 5.1 **AREAS TO BE CLEARED AND GRUBBED**

Substitute the first sentence of C 5.1 with the following:

Clearing and grubbing shall only be done in areas as instructed in writing by the Engineer. Clearing and grubbing of pipe and cable routes, shall be limited to a 3 m wide strip.

The Contractor may proceed with clearing and grubbing after hand-over of the site.

Measurement and payment for clearing and grubbing shall occur for areas as required by the Engineer.

Substitute the last paragraph with the following:

The Contractor shall program his work in such a manner that re-clearing will not be necessary. The cost of reclearing shall be borne by the Contractor.

PS C 5.2 **CUTTING OF TREES**

Trees outside the area to be excavated for the new structures must be left standing and undamaged, except when otherwise ordered, in writing, by the Engineer.

A penalty of R5000-00 per tree for trees damaged and/or removed will be charged.

PS C 5.9 **EXISTING FENCING**

The fences around the site shall be repaired immediately after any damage to them has occurred.

The Contractor is strongly advised to make sketches and, where applicable, take photographs of existing fences before they are removed so as to avoid, as far as possible, arguments that may arise between himself and the property owner as to the quality of the re-erected fences.

PS C 8 **MEASUREMENT AND PAYMENT**

PS C 8.2 **SCHEDULED ITEMS**

PS C 8.2.3 **Remove and Grub All Trees and Tree Stumps Regardless of Girth ..... Unit : ha**

Add the following to C 8.2.3:

The number of trees and/or stumps in the areas indicated on the drawings, is such that individual measurement is impractical. Individual trees that fall outside the indicated area, will be measured and paid for under C 8.2.2.

PS C 8.2.7 **Dismantle and Remove Pipelines**

Add the following to C 8.2.7:

Existing pipelines, cables, etc shall only be dismantled subject to written instruction by the Engineer. Excavation and backfilling shall be measured in the appropriate items of SABS 1200 DB : Earthworks (pipe trenches).

PS C 8.2.11 **Removal of existing walls, kerbs, etc ..... Unit : m**

Separate items will be listed for each type. The rate shall cover the cost of excavation, removal, backfill and shaping of the site, loading, transport, spoil levelling and shaping thereof on the spoil site.

PS C 8.2.12 **Temporary Piping ..... Unit : Sum**

The rate shall cover the costs of providing, placing, operating, maintaining and the removal on completion of all piping and other equipment of suitable type and size for the draining of water from the specified existing structures.

PS C 8.2.14 **Removal of rubble from site ..... Unit : m³**

The rate shall cover the cost of demolishing existing structures/foundations as ordered by the Employer's Agent and the removal of all rubble from site, in order for construction work to continue on site. The rate shall include all machinery and labour to dispose of the rubble at the dumping site, all levies payable at the registered landfill site, as well as levelling and shaping of the site.

The volume of rubble must be agreed upon prior to demolishing and removal.

PS D : EARTHWORKS

PS D 2 **INTERPRETATIONS**

PS D 2.3 **DEFINITIONS**

Add the following to D 2.3:

Sand (cohesionless and non-cohesive)

For the purpose of the compaction requirements, a non-plastic material of which not less than 95 % by mass passes a sieve of nominal aperture size 4,75 mm, and not more than 10 % passes a sieve of nominal aperture size 0,075 mm.

Topsoil: The top layer of soil to a depth of 100 mm including the vegetal matter in the soil and above the ground.

PS D 3 **MATERIALS**

PS D 3.1.1 Method of classifying

After the first paragraph add:

Inspection of the material for any classification other than soft excavation shall be undertaken by the Employer's Agent's Representative prior to any excavation. Levels of the occurrence of intermediate and hard rock excavation shall be measured and agreed, recorded and signed by both the Employer's Agent's Representative and the Contractor before commencement of intermediate or hard rock excavation.

PS D 3.1.2 **Classes of excavation**

Add the following:

Notwithstanding the provisions of this sub-clause of anything to the contrary in these Specifications or the Schedule of Quantities, Boulder Excavation Class A and Class B shall be classified as Intermediate Material, with the proviso that boulders requiring drilling and blasting in order to be removed or loaded as specified in Sub-Clauses 3.1.2(a)(1) and (2) will be measured separately as Hard Rock Excavation.

PS D 3.3 **SELECTION**

PS D 3.3.1 **General**

Substitute the second paragraph of D 3.3.1 with the following:

The Contractor shall deal selectively with material from general excavation. Any imported material in road reserves that do not comply with the minimum requirements for the respective layers, shall be removed and replaced with suitable material, all at the Contractor's expense.

The Contractor shall deal in such a way with materials from all excavations for structures and pipe trenches to ensure that usable material is not contaminated with unsuitable material. If usable material is contaminated, such contaminated material shall be removed and replaced with material of standard at least equal to the in situ usable material, all at the Contractor's expense. No additional payment shall be made in respect of this and all relevant costs shall be deemed to be included in the tendered rates.

All unsuitable material shall be removed prior to importing fill material to such areas.

PS D 3.3.2 **Backfilling and embankments**

Delete this sub-clause and replace with the following:

"Sufficient material arising from excavations for soil improvement, ponds, structures, terraces, foundations etc. and which is suitable for backfilling round and beneath structures, footings etc, in embankments, terraces and the like, shall be stockpiled in the vicinity of its final destination or point of use. The Contractor shall ensure that the site(s) selected for such stockpiling are well clear of all works to be constructed and that such siting will not hamper construction activities.

All surplus material suitable for backfilling and embankments and all material which the Employer's Agent's Representative considers to be unsuitable for backfilling, embankments and terraces shall be disposed of as directed by the Employer's Agent's Representative. For this particular Contract, unsuitable material arising from the site shall be disposed of to registered landfills identified by the Contractor. Tenderers shall therefore allow in their prices for all temporary stockpiling and double handling arising from this requirement.

The Contractor shall be entirely responsible for deciding whether or not excavated material suitable for backfilling is surplus to that required for the full construction and reinstatement of the Works. Should it become necessary to reclaim material previously disposed of or to import additional material from spoil dumps as a result of the Contractor's failure to comply with the above requirement for any reason whatever, then the Contractor shall bear all additional costs connected with such reclamation and/or importation.

PS D 3.4.1 **Material for Subsoil Drainage**

PS D 3.4.1.1 **Pipes**

Pipes for subsoil drainage shall be uPVC pipes complying with the requirements of SABS 791, but shall be perforated or slotted.

The size of perforations in perforated pipes shall in all cases be 8 mm in diameter ± 1,5 mm and the number of perforations per metre shall be not less than 26 for 110 mm pipes and 52 for 160 mm pipes. Perforations shall be spaced in two rows for 110 mm pipes and in three rows for 160 mm pipes.

Slotted pipes shall have a slot width of 8 mm ± 1,5 mm. The arrangement of slots shall be subject to the Engineer's approval, but the total slot area shall be not less than that presented for perforations.

Pipes without slots or perforations required for conveying ground water from the subsoil drainage proper to the point of discharge, shall be uPVC pipes as specified above.

PS D 3.4.2 **Crushed Stone**

Crushed stone in subsoil drains shall be 19 mm single-sized stone complying with the grading requirements of stone for concrete in SABS 1083.

PS D 3.4.3 **Geotextile Blanket**

The geotextile blanket around subsoil drains shall be a woven polypropylene tape similar to Kaytech Bidim A2.

PS D 3.4.4 **Sand**

Sand in subsoil drains shall comply with the requirements of PS D 2.3.

PS D 4 **PLANT**

Add the following to D 4:

PS D 4.5 **AVOIDING QUAGMIRE CONDITIONS**

In order to prevent quagmire conditions occurring in the excavations, relatively static plant such as back-actors shall be used combined with hand trimming to complete the excavation to final level. Should the Contractor allow quagmire conditions to develop, he shall, at his own expense, take such steps to rectify the conditions as the Engineer may order.

PS D 5 **CONSTRUCTION**

PS D 5.1 **PRECAUTIONS**

PS D 5.1.1.2 Safeguarding of Excavations

Delete the first three lines and substitute the following:

The Contractor or his agent or representative appointed in writing shall be deemed to be and shall be both the "employer" and "a person who is competent to pronounce on the safety" of all bracing and shoring as set out in Regulation 13 (Demolition and Excavation) of the General Safety Regulations of the Occupational Health and Safety Act, No 85 of 1993.

PS D 5.1.2 **Existing Services**

PS D 5.1.2.2 **Detection, location and exposure**

Add the following to D 5.1.2.2:

The requirements of PS A 5.4 shall apply mutatis mutandis.

If existing services are not shown on the drawings but the existence thereof can be reasonably expected, the Contractor shall, in conjunction with all relevant authorities, determine the exact depth and location of such services before the commencement of construction.

After locating the exact position of services, whether indicated on the drawings or not, such services shall be deemed to be known services and the Contractor shall be liable for all costs and subsequent costs arising from the damage thereof as a result of the Contractor's activities. These services must also be indicated on the "As Built" drawings.

The information provided in the drawings regarding the location, level and sizing of existing services has been obtained from municipal service records and on-site investigations. However, there may be inaccuracies in the information provided on buried services, which have been overlooked. The Contractor shall proceed as follows:

During the period of time allowed for the commencement of work in terms of Clause 5.2 & 5.3 of the General Conditions of Contract and before commencing work on site the Contractor shall confer with the authorities and departments concerned regarding all services both overhead and underground affected by the Works. At such conferences, which will be convened by the Contractor, the Contractor shall satisfy himself that he has obtained all the information regarding existing services that he needs to complete the contract. The Contractor will also be informed which existing services, if any, will be altered in any way and whether it is proposed to lay any new services during the period of the contract, and a schedule of operations, insofar as the services are concerned, shall be drawn up and agreed upon. No work shall be started until such schedule of operations has been agreed upon. The Employer's Agent's Representative is to be informed and invited to all such conferences.

Thereafter the Contractor shall carry out the works with the minimum interference to existing services. He shall co-operate with all authorities and departments concerned and he shall be solely responsible for carrying out the following operations and checks:

Identify all existing sewer and stormwater manholes in the vicinity of the works and confirm their routing and invert levels.

Confirm the routing of all other services in the area including water, electricity, Neotel and Telkom. Where necessary he shall locate services by careful hand excavation of cross-trenches under supervision of the relevant service authority where required.

Inform all authorities and departments in good time before the stage of the construction is reached for the laying and/or alteration of any particular service in accordance with the schedule of operations.

Set out the lines and levels of kerbs and any other necessary features of the contract in order that authorities and departments are able to lay and/or alter services to correct line and level.

Ensure that the authorities and departments lay and/or alter services correctly with regard to their position, length and reduced levels.

It shall be clearly understood that any extra work such as the removal of any portion of the works already executed either by the Contractor or other authority or department and its subsequent re-execution, which is caused by the Contractor's failure to observe and carry out his responsibilities as specified above will be for the Contractor's account.

After locating the exact position of services, whether indicated on the drawings or not, such services shall be deemed to be known services and the Contractor shall be liable for all costs and subsequent costs arising from the damage thereof as a result of the Contractor's activities. These services must also be indicated on the "As Built" drawings.

Unless the contrary is clearly specified or ordered, the Contractor shall not carry out any alterations to existing services. Where this may be necessary, the Contractor shall inform the Employer's Agent's Representative, who will either make arrangements for such work to be executed by the owner of the service or instruct the Contractor to make such arrangements himself.

Where existing services are damaged by the Contractor, he shall immediately inform the Employer's Agent's Representative, or when this is not possible, the relevant authority, and shall obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take all necessary steps to minimize damage to and the interruption of the service. No repairs shall be attempted to telecommunication cables, or electric power lines and cables.

No liability for damages arising from any delay in having such alterations or repairs effected will be accepted by the Employer. The Contractor shall provide all reasonable opportunity, access and assistance to persons doing alterations or repairs to existing services.

Add the following clause to DB 5.1.2:

PS DB 5.1.2.5 **Access to Services**

The Contractor shall allow all reasonable access to any Authority for the purpose of maintaining, laying and/or relaying any service, cables or mains during the period of this Contract.

The Contractor shall co-operate with other Contractors or Authorities responsible for the installation of water reticulation, electricity cables and telephone cables and shall arrange his programme accordingly.

PS D 5.1.2.3 **Protection of cables**

Substitute "estimated position" in the second sentence of D 5.1.2.3 with "actual or exposed position".

PS D 5.1.4 **Nuisance**

PS D 5.1.4.1 **Dust Nuisance**

Add the following to D 5.1.4.1:

The Contractor is responsible for dust control and is liable for all claims that may result from dust nuisance on all parts of the site and at all times from the date of handing over of the site to the completion date of the contract. No payment regarding the above-mentioned will be made and all costs shall be deemed to be covered by the tendered rates.

PS D 5.1.6 **Road Traffic Control**

Add the following to D 5.1.6:

a) Sufficient road signs must be erected in such a way that motorists will be warned in time of works, e.g. at the closing of a street sufficient signs to direct traffic must be erected at the preceding intersection.

b) Bypasses and/or road signs shall be provided and/or erected at all locations where the free flow of traffic is obstructed and shall be approved by the Engineer before the commencement of construction. Where main roads are crossed, detours and temporary traffic signs must be provided as shown on the attached drawings.

c) Where a trench crosses a street or any place where a trench crosses the direction of traffic flow, drums must be placed in the street and not just along the sides of the street with danger tape in between.

d) Danger tape must be put up between drums and tied around the drums.

e) Drums may not be filled with stones. The spacing of drums must be in such a way (maximum 5 m) that they are visible from all directions.

f) Sufficient safety measures must be utilised for pedestrians.

PS D 5.2 **METHODS AND PROCEDURES**

D 5.2.1 **Site Preparation**

PS D 5.2.1.2 **Conservation of topsoil**

Add the following to D 5.2.1.2:

Removal of topsoil shall only occur in areas as approved by the Engineer. The topsoil shall be conserved for use elsewhere.

PS D 5.2.2 **Excavation: Add or Amend the Following Sub-Clauses**

PS D 5.2.2.1 **Excavations for general earthworks and for structures**

Add the following to D 5.2.2.1:

Strip foundations and encasement of pipes shall be cast directly against excavated surfaces.

Materials under foundations and floors of structures, which are regarded by the Engineer as unsuitable for the bearing of such structures shall be removed to the depths and widths, ordered. The excavated voids shall then be filled with sand compacted to 100 % of MAASHTO density, to the underside of such foundation or floors, unless a soil cement mixture in terms of PS D 5.2.3.2 is ordered by the Employer's Agent

PS D 5.2.2.3 **Disposal**

Substitute the second sentence of D 5.2.2.3 with the following:

All surplus material which is suitable for fill shall be transported to an open site or be used for terracing works around structures on site, to be designated by the Engineer, spread and compacted as fill.

All material unsuitable for fill shall be disposed of at a facility as indicated by the local authority.

PS D 5.2.2.4 **Excavation limits for payment purposes**

Where formwork has to be provided to the outside face of a concrete member, the limits of excavation for measurement and payment purposes shall be the vertical planes 0,5m outside the perimeter of the concrete member for which the formwork is to be provided at the founding level as shown on the Drawings.

PS D 5.2.2.5 **Utilisation of excavated material**

Excavated material and material recovered from temporary work shall, in so far as it is suitable, be utilised for backfill. Material unsuitable for use as backfill or in excess of the quantity required to be completed the backfill shall be spoiled or utilised as directed by the Engineer.

Excavated material not used for backfill or not taken to spoil but used in the contraction of embankments or other parts of the work, as directed by the Engineer, shall be paid for under the relevant item for the purpose for which it is used.

PS D 5.2.3.1 **Embankments**

Add the following to D 5.2.3.1:

Embankments of ponds and terraces shall be constructed of approved material from excavations and shall be compacted to 95 % (100 % for sand) of MAASHTO density, in layers not exceeding 150 mm in depth.

PS D 5.2.3.2 **Backfilling of trenches and backfilling against structures**

Add the following to D 5.2.3.2:

Backfilling around structures shall be compacted to 95 % (100 % for sand) of MAASHTO density.

When specified or ordered by the Engineer the backfilling against structures shall be done using a mixture of soil cement. The mixture shall contain 5 % cement and just sufficient water

for it to be placed and compacted like ordinary backfilling material.

Add the following to D5.2.3:

PS D 5.2.3.3 **Filling under floors**

Filling under the floors of buildings shall be done with sand from commercial sources, compacted to 100 % of MAASHTO density.

PSD 5.2.3.4 **Foundation fill**

Due to the poor founding conditions encountered during the geotechnical investigations, an engineered soil raft should be provided. The existing in-situ material should be removed from the structural footprint, which must then be over-excavated and the in-situ material suitably compacted. The over-excavated material should then be replaced with foundation fill consisting of approved granular material (G7 or better), constructed in layers not exceeding 150 mm in thickness after compaction. Each layer shall be moistened or dried to optimum moisture content for the material and be compacted to a density of not less than 95% of Mod. AASHTO density.

A concrete blinding, 75 mm thick and of class 15/19 concrete, shall be placed underneath all footings, except where mass concrete fill is used or where the Engineer authorises that it need not be done.

PS D 5.2.4 **Finishing**

PS D 5.2.4.1 **Final grading**

Add the following to D 5.2.4.1:

Embankments and terraces shall be trimmed to an even grade of 1 in 3 or as shown on the drawings.

PS D 5.2.4.2 **Top soiling**

Add the following to D 5.2.4.2:

Topsoil shall be placed on the sides and on the tops of embankments and other terraces where no paving is specified, or in areas where directed by the Engineer.

PS D 5.2.4.3 Grass or other vegetation

Add the following D 5.2.4.3:

Planting shall be carried out at the earliest convenient stage of the construction and shall be arranged to suit the seasonal weather conditions. Undue humps and hollows shall be smoothed out before planting is commenced.

a) **Grassing**

Stools or runners of "Kikuyu" or other grass approved by the Engineer shall be planted by forming trenches 75 mm deep at 300 mm intervals along lines at right angles to the direction of maximum slope, laying the stools or runners at intervals not exceeding 150 mm along the trenches and closing the trenches in such a way to cover the grass entirely. After planting the surface shall be lightly rolled with a hand roller with a maximum mass of 150 kg.

D 5.2.5 **Transport for Earthworks**

PS D 5.2.5.1 **Freehaul**

Substitute the clause with the following:

All haul of material will be regarded as freehaul, and no overhaul will be paid, including haul of spoil to the registered landfill site to be located by the Contractor.

PS D 5.2.6 **Dewatering Of Foundation Excavations**

Over and above his general obligations in regard to dealing with water as specified in SABS 1200 A, the Contractor shall be responsible for preventing the ingress of water into the foundation excavations. The preventative measures shall include the construction of proper drainage channels, diversion channels, berms, sumps, and the supply, operation and maintenance of the necessary bailing and pumping equipment.

The dewatering measures, with the exception of pumping, shall be maintained until the backfilling has been completed, after which all settled silt, mud, etc. shall be removed from the exposed surfaces where necessary. Between the various construction stages, pumping may be interrupted as may be decided by the Engineer. The draining or pumping of water from foundation excavations shall be so done that no concrete materials will be carried away.

PS D 8 **MEASUREMENT AND PAYMENT**

PS D 8.1 **BASIC PRINCIPLES**

Add the following to D 8.1:

The rates for excavation shall also cover the cost of dealing with any stormwater or subsurface water, which may appear in the excavations.

PS D 8.3 **SCHEDULED ITEMS**

PS D 8.3.2 **Bulk Excavation**

Add the following sub items to D 8.3.2:

a) Excavate in all materials and use for embankment
or backfill or dispose, as ordered ..... Unit : m^3

Add the following to D 8.3.2(a):

There will also be distinguished between the different types of fill and backfill as well as the different densities to which each will be compacted.

c) Extra-over 8.3.2(a) for soil cement backfilling where specifically required
by the Engineer (percentage of cement indicated) ..... Unit : m^3

The tendered rate for sub item PS D 8.3.2(c) shall be additional to the rates tendered for D 8.3.2(a) and shall cover the cost of all incidentals required for the complete backfilling with soil cement as specified. The rate shall also include for the trimming and compacting of the excavation before placement of soilcrete.

d) Excavate and dispose of unsuitable material from excavation bottom ..... Unit : m^3

The rate shall cover the cost of complying with all the precautions required in terms of D 5.1 in addition to the cost of excavation of the additional depth in any material and the disposal of the unsuitable material as specified in PS D 5.2.2.3.

e) Extra-over 8.3.2(a) for trimming and compacting terraces ..... Unit : m^2

The rate includes for the trimming and compacting of horizontal and sloping sides of the terraces before top soil and grass is placed, including for the removal of large stones and rubble to form a uniform surface.

PS D 8.3.3 **Restricted Excavation**

Add the following sub items to D8.3.3

Restricted excavation shall be limited to those excavations detailed on the drawings or as agreed to by the Engineer as being restricted.

Refer to sub clause PSD 5.2.2.4:

c) Extra-over 8.3.3(a) for soil cement backfilling (percentage of cement indicated) ..... Unit : m^3

The tendered rate for sub-item PS D 8.3.3(c) shall be additional to the rates tendered for D 8.3.3(a) and shall cover the cost of all incidentals required for the complete backfilling with soil cement as specified. The rate shall also include for the trimming and compacting of the excavation before placement of soilcrete.

d) Excavate and dispose of unsuitable material from excavation bottom ..... Unit : m^3

The rate shall cover the cost of complying with all the precautions required in terms of D 5.1 in addition to the cost of excavation of the additional depth in any material and the disposal of the unsuitable material as specified in PS D 5.2.2.3.

e) Extra-over 8.3.3(a) for trimming and compacting terraces ..... Unit : m^2

The rate includes for the trimming and compacting of horizontal and sloping sides of the terraces before topsoil and grass is placed, including for the removal of large stones and building rubble to form a uniform surface.

PS D 8.3.5 **Extra Excavation in All Materials to Provide Working Space around Structures**

Delete this sub clause and refer to sub clause PSD 5.2.2.4

PS D 8.3.8.1 **c) Excavate by hand in soft material to expose existing services ..... Unit : m^3**

Add the following to D 8.3.8.1(c):

Excavation by hand to expose existing services shall only be measured and paid for if so ordered in writing by the Engineer. After the excavation of trial holes to determine the exact position and depth of existing services, at intervals as required by the Engineer, the excavation to a level of 300 mm above such services shall be measured and paid for as normal excavation, independent of the depth of such excavation. Only excavation within 300 mm of the existing services will be measured and paid for as excavation by hand and then only if ordered in writing by the Engineer. The rate shall also include the backfilling of the excavations and compaction thereof.

PS D 8.3.15 **Geotextile Blanket beneath Structures ..... Unit : m^2**

The rate shall cover the cost of supplying the geotextile blanket and of placing it as indicated on the drawings.

PS D 8.3.19 **Shaping on Terraces ..... Unit : m^2**

The rate shall cover the cost of the finishing off of terraces after mass earthworks have been completed and includes all labour and plant necessary to shape the surface to the ensure stormwater can drain freely.

PS DB : EARTHWORKS (PIPE TRENCHES)

PS DB 1 **SCOPE**

Add the following to DB 1.1:

This specification also covers the excavation for cable trenches.

PS DB 2.2 **APPLICATION**

Substitute "pipe trenches" with "pipe and cable trenches" in DB 2.2.

PS DB 3 **MATERIALS**

PS DB 3.5 **BACKFILL MATERIALS**

a) Substitute "from trenches" in DB 3.5(a) with "from trenches or excavations for structures".

Add the following to DB 3.5(b):

c) All pipe trenches in street reserves shall be classified as areas subject to loads from road traffic.

d) All pipe trenches underlying or adjacent to the carriageway shall be backfilled with sand complying with the requirements for A3 materials.

DB 3.6 **MATERIALS FOR REINSTATEMENT OF ROADS AND PAVED AREAS**

PS DB 3.6.1 **Subbase and Base**

Substitute DB 3.6.1 with the following:

Where trenches cross or run adjacent to surfaced roads and paved areas of which the surfaces are scheduled to be reinstated, the material excavated from the existing base and/or subbase pavement layer(s) shall be set aside and used in the reconstruction of the subbase layer. Where, applicable new material complying with the requirements of SANS 1200 MF shall be used in the reconstruction of the base layer. Any shortfall in material for the reconstruction of the subbase layer shall be made up by the use of material complying with the requirements of SANS 1200 ME.

PS DB 4 **PLANT**

PS DB 4.1 **EXCAVATION EQUIPMENT**

Add the following to DB 4.1:

All excavations exceeding the specified widths, shall be backfilled with approved selected material. No payment shall be made for this and all relevant costs shall be deemed to be included in the tendered rates.

PS DB 4.4 **DEWATERING EQUIPMENT**

One set of dewatering equipment shall consist of pumps, pipes, well points and other equipment necessary for keeping the trenches sufficiently free from water for dewatering of excavations up to 4 m depth and a trench length of 45 m for both sides and 70 m on one side.

PS DB 5 **CONSTRUCTION**

PS DB 5.1 **PRECAUTIONS**

PS DB 5.1.1 **Water in Trenches**

Water in pipe trenches may cause movement of the pipe due to flotation and backfilling must be completed as soon as possible. If there was any movement, the Contractor must remove and relay the pipes at his own cost and to the satisfaction of the Engineer.

PS DB 5.1.2 **Stormwater, Seepage and Dewatering of Excavations**

Substitute DB 5.1.2 with the following:

The costs of dealing with water shall be deemed to be included in the tendered rates for excavation and no additional payment shall be made in this respect.

PS DB 5.1.3 **Accommodation of Traffic and Access to Properties**

Add the following to DB 5.1.3:

Detour and road traffic signs must be in accordance with “CSRA-CUTA: Road Traffic Signs Sub-Committee; Road Signs Note No. 13” and the “Suid-Afrikaanse Handleiding vir Padverkeerstekens” or any amendments thereof and must be approved by the Employer’s Agent’s Representative before commencement of construction.

Where steel drums are being used as barricades, they must be filled with sand or soil. Rocks may not be used for this purpose or be stacked on top of drums. Drums must be whitewashed with danger tape put up between and tied around the drums.

Add the following to DB 5.1:

PS DB 5.1.4 **Existing services that intersect or adjoin trenches**

Add the following to DB 5.1.4

The conditions of PS A5.4 shall apply mutatis mutandis.

PS DB 5.1.5 **Hand Excavation**

Certain trenches will have to be excavated by hand, because of limited access and space. The Contractor is to ensure that all excavation done by hand is in strict accordance with the requirements of the Occupational Health and Safety Act.

PS DB 5.2 **MINIMUM BASE WIDTHS SPECIFIED**

Substitute DB 5.2(a) with the following:

The base widths for combined pipe trenches are as shown on the drawings and the excavation depth is determined by the deepest pipe in the trench. The depth increment of a combined trench will be determined by the sewer or alternatively by the water pipe. The electrical ducts will determine the depth increment where they are laid together with house water connections. The total excavation, backfilling, bedding, etc form a specific trench and is measured in the bill of quantities under the service that determines the depth.

Substitute paragraph (b) of DB 5.2 with the following:

The minimum base width for all pipes with a diameter less than 125 mm shall be 600 mm plus the outside diameter of the pipes, irrespective of the depth at which they are laid, except for

subsurface drains where the width shall be 400 mm and for house water connections where the width shall be 300 mm.

Bedding is required for all pipes with a diameter less than 125 mm, except for subsurface drains.

The minimum base width for electric cable trenches shall be 500 mm. Where more than one cable is installed in the same trench, the base width shall become 300 mm plus the distances specified between the centre lines of the cables (50 mm minimum).

PS DB 5.4 **EXCAVATION**

Add the following to DB 5.4:

Excavation and backfilling of pipe trenches on sidewalks in the residential area shall be done in such a way as to ensure the least possible disruption to the public and entrances to properties. No additional payment shall be made for this and all relevant costs shall be deemed to be included in the tendered rates.

The provisions of PS D 5.2.2.4 shall apply mutatis mutandis for hand excavation.

The maximum continuous length of open trench may not exceed 100 metres. The total length of open trenches on site at any stage may not exceed 200 metres. The pipeline must be installed from one end, (preferably in an upstream direction) and be completed before moving on. No additional payment shall be made for this and all relevant costs shall be deemed to be included in the tendered rates.

PS DB 5.5 **TRENCH BOTTOM**

Substitute "90 %" in the second paragraph of DB 5.5 with "93 % (100 % for sand)".

PS DB 5.5.1 **Trench Bottom**

Material that Engineer considers unsuitable as the bottom of the trench shall be excavated to the depths and disposed of in the manner directed. The resulting space shall be refilled, as order, with approved material and compacted as directed.

Should bedding of the pipeline in accordance with SABS 1200 LB form part of the contract, the depth of the trench shall be such that the specified depth of the cradle can be placed under the pipeline, and the trimming and grading of the trench shall be such that the barrel of each length of pipe can be uniformly supported over its full length, free at the joints, and at the correct grades and levels. Except where the trench excavation is in rock, hard objects and boulders that may adversely affect the uniformity of the foundation shall be removed to a depth of 100 mm below the specified trench bottom. Where the bottom of the trench has been loosened during excavation, it shall be compacted at OMC to 90 % of the modified AASHTO maximum density prior to bedding and pipe laying.

The bottom of trenches shall be sufficiently straight (or true to alignment in the case of curved pipelines) to enable the pipes to be laid without reduction of the side allowances given in 5.2 and in conformity with the applicable tolerance specified in any standardised specification covering pipe work that forms part of the contract.

PS DB 5.6 **BACKFILLING**

PS DB 5.6.2 **Material for Backfilling**

Substitute "from trench excavations" in the first paragraph of DB 5.6.2 with "from excavations for trenches and structures.

Add the following to DB 5.6.2:

Where pipe trenches cross a road the selected fill blanket specified in PS LB 3.2 shall be brought up to the bottom of the sub base.

PS DB 5.6.3 **Disposal of Soft Excavation Material**

Add the following to DB 5.6.3:

The provisions of PS D 5.2.2.3 shall apply mutatis mutandis.

PS DB 5.7 **COMPACTION**

PS DB 5.7.2 **Areas Subject To Traffic Loads**

Substitute "98 %" in DB 5.7.2 with "100 %".

Add the following to DB 5.7.2:

Sand backfilling shall be compared to 100 % of MAASHTO density.

DB 5.9 **REINSTATEMENT OF SURFACE**

PS DB 5.9.2 **Private Property and Commonage**

Add the following to DB 5.9.2:

Gardens and lawns shall be repaired to the original standard where they were crossed. Grass and plants shall be taken out of the ground, temporarily planted, watered during construction and replanted after backfilling.

PS DB 5.9.4 **Bitumen Roads : Subbase and Base**

Add the following to DB 5.9.4:

Any additional imported material required for the reinstatement of selected layers, subbase or base shall comply with the requirements of the relevant standardised and/or project specifications.

PS DB 5.9.5 **REINSTATEMENT OF BITUMEN SURFACE**

Add the following to DB 5.9.5.1:

Trench excavations crossing existing roads must be completed, reinstated and reopened to traffic outside of peak-hours.

The thickness of the asphalt shall be 30 mm for all streets except if specified otherwise.

PS DB 7 TESTS

Substitute DB 7.1 with the following:

Density tests on backfilling compaction will be for the Contractor’s own cost and must be as follows:

Trench

Depth: 1 m increments

Intervals: Every 50 m maximum for main pipeline excavations

Road crossings

At least four on each road crossing.

Depth: 0,5m increments

The choice of positioning of density test will be at the Employer's Agent's Representative's discretion. If the backfilling does not conform to the specified minimum densities, the Contractor must at his own cost prove to the Employer's Agent's Representative that the rest of the backfilling complies with the specified minimum densities.

PS DB 8 MEASUREMENT AND PAYMENT

PS DB 8.1 BASIC PRINCIPLES

Delete "along the route of the pipeline" in DB 8.1.1.

Add the following to DB 8.1.2(b):

The depth of electric cable trenches is as indicated on the relevant drawings.

PS DB 8.2 COMPUTATION OF QUANTITIES

PS DB 8.2.4 **Shoring**

Add the following to DB 8.2.4:

Shoring will only be measured and paid for if written approval is given by the Engineer before it is installed.

PS DB 8.3 SCHEDULED ITEMS

PS DB 8.3.2 **Excavation ..... Unit : m**

Add the following to DB 8.3.2:

The rate shall also cover the cost of dealing with any stormwater or subsurface water, which may appear in the trenches.

PS DB 8.3.2 **a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material ..... Unit : m**

Add the following to D 8.3.2(a):

In cases where services lay parallel to steep slopes, the depth of the excavation will be measured along the centre of the trench (on the route of the service).

The rate shall also provide for the fact that the excavation width in sand will be wider than normal and that fast excavation and backfill will reduce ground water seepage.

i) Electric cable trenches

Excavation for electric cables not laid with other services will be measured and paid for separately under the relevant depth increments. The rate shall provide for excavation, preparing trench lengths as requested by the electrical subcontractor, backfilling and compaction thereof.

The rate shall also make provision for the possibility that long trenches need to be prepared for the electrical Contractor to lay full cable lengths (up to 300 m) and immediate backfilling after the installation of the cable (same day) to prevent theft.

ii) Combined trenches

The rate for excavation and backfilling of trenches with more than one service, shall allow for trench widths as set out in PS DB 5.2 and the bill of quantities. Extra bedding and fill blanket will be measured as in the case of normal pipe trenches.

The depth increment for combined trenches is determined by the deepest pipe in the trench.

PS DB 8.3.2 **c) Excavate unsuitable material from trench bottom ..... Unit : m^3**

Delete "and the disposal" in the heading of DB 8.3.2(c) and in the last paragraph.

PS DB 8.3.2 **d) Hand excavation and backfill ..... Unit : m³**

The provisions of PS DB 8.3.2(a), DB 8.3.2(b) and PS DB 8.3.2(c) shall apply mutatis mutandis for hand excavation.

Payment shall only be made if so ordered by the Engineer.

PS DB 8.3.2 **e) Extra-over PS DB 8.3.2(a) for temporary stockpiling of material ……Unit : m^3**

Temporary stockpiling of material will only be measured and paid for if ordered so in writing by the Engineer and if it is not contaminated with unsuitable material.

The rate shall provide for the handling and stockpiling of the material within the free-haul distance.

Add the following sub item:

e) Excavate by hand in soft material to expose existing services ..... Unit : m³

The rate shall apply for pipe lines and cables.

The provisions of sub clause PS D 8.3.8.1(c) shall apply mutatis mutandis.

DB 8.3.3 **Excavation Ancillaries**

PS DB 8.3.3.1 **Make up deficiency in backfill material (provisional) ..... Unit : m^3**

Add the following to DB 8.3.3.1:

a) From other necessary excavations on site .....Unit : m^3

c) From commercial sources.....…….Unit : m^3

d) Stockpile ..... Unit : m^3

Add the following to the last paragraph of DB 8.3.3.1:

No payment will be made for the transport of material from commercial sources or sources outside the site that the Contractor has selected.

PS DB 8.3.3.3 **Compaction in road reserves ..... Unit : m^3**

Add the following to DB 8.3.3.3:

This item is only applicable to the backfill above the bedding and fill blanket.

PS DB 8.3.5 **Existing Services That Intersect or Adjoin A Pipe Trench**

PS DB 8.3.5 **a) Existing services that intersect a trench .....Unit : No**

Add the following to DB 8.3.5(a):

Existing services with a depth of cover exceeding 300 mm, measured from the bottom of excavation to the top of the existing service shall not be measured and paid for.

The rate shall also cover the cost of the following:

i) Sufficient photo's being taken of existing services and submitted to the Engineer before they are being crossed, if there is a possibility of a difference of opinion over the condition of these services.

ii) Repair of damaged services to its original condition.

iii) If such a service is removed, replacement thereof.

PS DB 8.3.5 **b) Existing services that adjoin a trench Unit : No or m**

Add the following to DB 8.3.5 (b):

The unit "number" will only be used for services such as poles and trees.

No payment will be made for overhead services that do not rest directly on the ground except where allowance is made for this in the schedule of quantities.

Existing services that rest directly on the ground e.g. poles, trees, walls and structures are handled in the same way as underground services, but the axis of the service will be determined as follows:

The vertical axis is defined as the nearest side or corner of the existing structure to the excavation, measured at the point where the structure and natural ground level intersect.

The horizontal axis will be at the point where the structure and the natural ground level intersect. In this instance, where the excavation falls above the 45° line but within 1,0 meter horizontally from the structure, the service will also be measured as adjoining.

If the structure, according to the above-mentioned, does not qualify as an adjoining service but the foundation of the structure is such that if a 45° line drawn from the nearest bottom corner thereof cuts through the excavation, the structure will be measured as an adjoining service **if approved by the Engineer**.

PS DB 8.3.5.1 **Removal and relaying of existing brick paving, concrete paving or tile paving... Unit: m^2**

The rate shall include the cost of the removal of the existing paving, stacking on site and the relaying thereof, after completion of the services, on a 25 mm layer of sand from commercial sources placed on a 300 µm (0,3 mm) polyethylene sheet. No payment will be made for the buying of additional brick paving due to damage, and it will be deemed as covered in the relevant items. The rate must also include the removal of any mortar from the existing paving bricks before it is placed back. Payment for excavation and backfilling up to the level of the polyethylene sheet will be made under the relevant items in the schedule of quantities.

PS DB 8.3.5.2 **Removal and replacement of concrete paving…….. ……Unit: m^2**

The rate shall include the cost of cutting the concrete, breaking, loading, transport and spoiling thereof on the municipal dumping site, preparation of the backfill directly beneath the concrete, placement of a 100 mm thick class 20/19 concrete in panels of maximum 2 m x 2 m including

the necessary shuttering, expansion joints and wood-floated finish to match the level of the existing surfaces.

A maximum of 10 % of the tendered amount will be payable after completion of the breaking up and removal of the concrete.

Existing services that rest directly on the ground e.g. poles, trees, walls and structures are handled in the same way as underground services, but the axis of the service will be determined as follows:

The vertical axis is defined as the nearest side or corner of the existing structure to the excavation, measured at the point where the structure and natural ground level intersect.

The horizontal axis will be at the point where the structure and the natural ground level intersects. In this instance, where the excavation falls above the 45° line but within 1,0 meter horizontally from the structure, the service will also be measured as adjoining.

If the structure, according to the above-mentioned, does not qualify as an adjoining service but the foundation of the structure is such that if a 45° line drawn from the nearest bottom corner thereof cuts through the excavation, the structure will be measured as an adjoining service **if approved by the Employer's Agent**.

There will be distinguished between existing trunk services and existing erf connection.

DB 8.3.6 **Finishing**

PS DB 8.3.6.1 **Re-instatement of road layers**

Add the following to DB 8.3.6.1:

The rate shall include for the selective excavation of existing subbase and base material where this material is going to be re-used.

No additional payment for a G7 selected layer or any work relating to a G7 selected layer will be considered as the backfill material in road reserves and must be an A3 (AASHTO Soil classification system) sand compacted to 100% of modified AASTHO maximum density. If level control of the backfill material is required, it must be included in the rate for a sub-base layer.

AASHTO Soil Classification System Chart

General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	...	...	...	...	...	...	...	...	...	...
0.425 (No. 40)	30 max	50 max	51 min	...	...	...	...	...	...	...	...
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	...		...	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

Note: Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30

The rate for the reinstatement of all road layers shall also provide for the fact that the excavation width in sand and wet conditions will be wider than normal. Therefore, the rate must allow for reinstating the actual width of road layers damaged. The rate shall also include material, labour and equipment for cutting back the damaged premix layer to form a neat straight line parallel to the kerb line with no steps for at least 20m per section, removing the old premix by hand and replacing it with new premix.

Where actual reinstatement is specified in the schedule of quantities however, no additional allowances need to be considered, as the actual reinstated dimensions will be measured for payment.

PS DB 8.3.6.2 **Extra-over DB 8.3.6.1 for imported material ..... Unit : m^3**

The quantity will be calculated according to the actual volume of material placed in the final position according to the specified dimensions.

The rate is an “extra-over” Item DB 8.3.6.1 and includes all costs of supplying and placing of imported material in the final position with material from commercial sources.

PS DB 8.3.8 **Placing of topsoil.....Unit: m^2**

The provisions of D 8.3.10 shall apply mutatis mutandis

PS DM : EARTHWORKS (ROADS, SUBGRADE)

PS DM 3 **MATERIALS**

PS DM 3.1 **CLASSIFICATION FOR EXCAVATION PURPOSES**

Add the following to DM 3.1:

The requirements of PS D 3.1.2 shall apply mutatis mutandis.

All in situ pavement material shall be classified as soft material for excavation purposes.

PS DM 3.2 **CLASSIFICATION FOR PLACING PURPOSES**

PS DM 3.2.1 **General**

The type of material prescribed and used for the construction of each pavement layer shall comply with the requirements set out in the relevant section of SANS 1200. Refer to SANS DM (selected subgrade), SANS ME (sub-base) and SANS MF (base).

PS DM 3.2.3 **Selected Layers**

Substitute DM 3.2.3 with the following:

All imported material underlying the sub base or base of the final road prism, whichever may be applicable, that does not comply with the requirements for lower selected layer or upper selected layer in the respective depth categories, shall be removed and replaced with material complying with the requirements of selected layers, all at the Contractor's expense.

DM 4 PLANT

PS DM 4.2 **PLANT FOR TREATMENT BELOW SELECTED LAYER**

PS DM 4.2.1 **Pneumatic-Tyred Roller**

Pneumatic-tyred rollers shall be of the self-propelled type that is equipped with smooth pneumatic-tyred wheels of the same diameter. The mass of the roller shall be at least 10 tons. All wheels must bear the same mass.

The rollers must be equipped with devices that will be able to keep the wheels wet and clean during operation.

The wheels of the roller shall be arranged in such a way that one pass with the roller will cover the whole width of the machine. The roller must be able to take a tyre pressure of 600 kPa and the minimum allowed working tyre pressure shall be 450 kPa. The maximum difference in pressure between any two wheels shall not be greater than 35 kPa.

PS DM 5 **CONSTRUCTION**

PS DM 5.1 **PRECAUTIONS**

PS DM 5.1.1 **Safety, Existing Services, Stormwater, Etc. And Nuisance**

Add the following to DM 5.1.1:

The requirements of PS A 5.4 shall apply mutatis mutandis.

PS DM 5.1.2 **Accommodation of Traffic**

Add the following to DM 5.1.2:

Bypasses shall be constructed, and road signs erected where the free flow of public traffic is restricted. Such bypasses and road signs shall be in accordance with the "CSRA-CUTA : Road Traffic Signs Sub-committee; Road Signs Note no 13, the SA Road Traffic Signs Manual" and shall be approved by the Employer's Agent before the commencement of construction.

PS DM 5.2 **METHODS AND PROCEDURES**

DM 5.2.2 **Cut and Borrow**

PS DM 5.2.2.2 **Dimensions of cuts**

Substitute "subbase" in the second paragraph of DM 5.2.2.2 with "subbase or selected layer, whichever may be applicable", and

Substitute "CBR of at least 7" with "CBR as applicable according to the provisions of PS DM 3.2.3".

PS DM 5.2 .2 **Dimension and Level Control and Process Control**

The contractor shall submit records of dimension and level control and/or process control to the Employer's Agent's Representative, at least 24 hours in advance of requesting the Employer's Agent's Representative to carry out any routine tests and/or inspections.

PS DM 5.2.2.3 **b) Cut to spoil**

Substitute DM 5.2.2.3(b) with the following:

The requirements of PS D 5.2.2.3 shall apply mutatis mutandis.

PS DM 5.2.2.4 **Temporary stockpiling of materials**

Add the following to DM 5.2.2.4:

The Contractor shall program the works in such a manner that suitable excavated material shall, if practically possible, be placed directly in the appropriate position to ensure that temporary stockpiling is limited to an absolute minimum. No payment shall be made for the temporary stockpiling of material where such material is to be used for backfilling of pipe trenches, except when so ordered in writing by the Engineer.

PS DM 5.2.3 **Treatment of Road bed**

PS DM 5.2.3.3 **Treatment of road bed**

a) Preparation and compaction of road bed

Substitute the first paragraph of DM 5.2.3.3(a) with the following:

The road bed shall be scarified to a depth of 150 mm, watered, shaped and compacted to 90 % of MAASHTO density (100 % for sand), except where otherwise ordered by the Engineer.

In clay areas only excavation and shaping to the correct level will be necessary.

The road bed shall be prepared with a ionic stabiliser at a rate of 0,03 ℓ/m^2 in layers of 150 mm and 0,02 ℓ/m^2 in layers of 100 mm before compaction if ordered by the Engineer.

The stabiliser must be thoroughly mixed with water.

Measurement and payment shall be made under item PS ME 8.3.8(g).

Add the following subclause:

c) In situ preparation of roadbed with eight roller passes

Any part of the roadbed that lies within the selected layer and which, regardless of its density, is suitable according to the Employer's Agents opinion, can be used in situ if so, instructed by the Employer's Agent.

If due to the nature of material, the degree of compaction cannot be controlled by means of in situ density tests, the Employer's Agent may instruct compaction to be done by eight roller passes as specified in PS DM 4.2. The Employer's Agent may further request that the compaction effort be altered by increasing or reducing the number of passes and that payment be amended accordingly.

The surface of the roadbed shall be shaped true in respect of line and level within the tolerances as specified in clause 6. During the shaping of the roadbed, all material that has to be removed and cannot be re-used, shall be disposed of and will be paid for under item PS DM 8.3.7. If necessary, additional material that has been approved by the Employer's Agent shall be imported to meet the required levels.

No strict measurements in connection with soil moisture content will be applied by the Employer's Agent during compaction. The Contractor must however convince the Employer's Agent that all possible efforts have been made to utilise favourable soil moisture conditions. Compaction must be done during periods when the roadbed is not to wet or to dry. The Employer's Agent has full authority to decide whenever conditions are favourable for compaction and may at any stage instruct the Contractor to water the roadbed at the Contractors expense if he, in the Employer's Agent's opinion, neglected to satisfy the above-mentioned requirements.

PS DM 5.2.5 **Selected Layer**

Add the following to DM 5.2.5:

The Employer's Agent may, depending on the quality of the in-situ material, order the omission of one or both of the selected layers. To determine the amount of selected layers, if any, the Employer's Agent may order the Contractor to dig test holes with maximum dimensions of 1,5 m x 1,5 m and 1,0 m deep at positions indicated by the Employer's Agent, before construction commences.

The Contractor shall backfill all test holes with selected material and compact it to 95 % of Modified AASHTO maximum density, after the Employer's Agent has taken samples and profiled the holes.

PS DM 5.2.9 **Shaping and Compacting Below Selected Layer**

Each portion of the road bed below the selected layer which, by virtue of its inadequate natural density, is directed by the Employer's Agent to be compacted by means of a pneumatic-tyred roller, shall be prepared by shaping where necessary, and each such portion shall be compacted by means of at least eight complete passes by a pneumatic-tyred roller. One pass shall consist of the complete area being systematically passed in the longitudinal direction so that each pass overlaps the previous by half.

PS DM 6 **TOLERANCES**

PS DM 6.5 **DIMENSIONS AND LEVEL CONTROL**

The Contractor shall submit to the Engineer, in a form acceptable to the Engineer, records of dimension and level control, prior to requesting the Engineer to carry out any routine inspections.

PS DM 7 **TESTING**

PS DM 7.2 **PROCESS CONTROL**

Amend table 1 of DM 7.2 as follows:

Substitute "2 000 m^2" with "1 500 m^2", "1 500 m^2" with "1 200 m^2 and "5 000 m^2" with "3 000 m^2".

PS DM 7.3 **ROUTINE INSPECTION AND TESTING**

Substitute DM 7.3.2 with the following:

No density shall be less than the specified minimum density for the relevant layer.

The cost of all routine testing done by the Engineer, and of which the results do not comply with the specified minimum requirement for the material, shall be borne by the Contractor and will be subtracted from the monthly payment certificates.

DM 8 **MEASUREMENT AND PAYMENT**

DM 8.3 **SCHEDULED ITEMS**

PS DM 8.3.3 **Preparation of Road Bed**

Substitute DM 8.3.3(b)(1) and (2) with the following:

b) Preparation of in situ road bed in:

1) Intermediate material ..... Unit : m^3

Add the following subclauses:

(c) In situ preparation of road bed with eight roller passes (pneumatic roller) ..... Unit : m^2

The unit of measurement is in square metres of road bed which has been treated with eight roller passes.

The rate shall cover the costs of shaping, watering and compacting all as specified in PS DM 5.2.3.3(c). The removal, disposal, transport and replacing of materials will be paid under the appropriate items.

(d) Variations in compaction effort (pneumatic roller) ..... Unit : m^2.pass

The unit of measurement is the surface on which the variation is applicable multiplied by the amount with which the compaction effort was reduced or increased as instructed by the Employer's Agent.

If there is a change in compaction effort, as instructed by the Employer's Agent, the Contractor will be paid as for the standard effort, except that the amount as calculated above will be subtracted or added in the appropriate item.

This rate shall include full compensation for supervision, labour, machines, construction equipment, fuel, material and additional costs necessary for the completion of the process.

e) Treatment of existing road layers (roadbed, sub-base and base) Unit: m^3

The rate shall cover the cost of testing the in-situ compaction of the exposed surfaces, ripping, shaping, scarifying, sizing, knapping, mixing of in-place and imported material if required, trimming, levelling and compaction as specified at optimum moisture content of the material and the determination of the optimum moisture content, as well as removal of excavated and loose material and disposal thereof.

The unit of measure shall be the cubic meter of road surface treated.

Additional imported or stockpiled material shall be measured under the relevant items in Civil Works Schedule while the compaction of the complete layer shall be measured under the relevant sub-items.

PS DM 8.3.3 **Treatment of Road Bed**

Add the following:

c) Treatment of existing road layers (roadbed, sub-base and base) Unit: m^3

The rate shall cover the cost of testing the in-situ compaction of the exposed surfaces, ripping, shaping, scarifying, sizing, knapping, mixing of in-place and imported material if required, trimming, levelling and compaction as specified at optimum moisture content of the material and the determination of the optimum moisture content, as well as removal of excavated and loose material and disposal thereof.

The unit of measure shall be the cubic meter of road surface treated.

Additional imported or stockpiled material shall be measured under the relevant items in Civil Works Schedule while the compaction of the complete layer shall be measured under the relevant sub-items.

PS DM 8.3.4 **Cut To Fill, Borrow To Fill ..... Unit : m^3**

Substitute "90 %" in DB 8.3.4 with "90 % (100 % for sand)" and "road prism" with "road prism and borrow pits".

Add the following:

Separate items will be scheduled for fill in the road prism, fill on spoil areas and fill on erven (where a minimum density for such spoil material is required by the Engineer) and fill from the road prism, fill from the site and fill from commercial sources.

The rate for fill from commercial sources shall, in addition to the requirements of DM 8.3.4, cover the cost of the location of the source, complying with all the applicable precaution as set out in DM 5.1, obtaining the material, selection and transport from the source to the point on the road where it is to be used.

PS DM 8.3.5 **Selected Layer Compacted To 93 % Of MAASHTO Density ..... Unit : m^3**

Substitute "93 % of MAASHTO density" in the heading of DM 8.3.5 with "93 % (100 % for sand) of MAASHTO density".

Add the following to DM 8.3.5:

Separate items will be scheduled for lower and upper selected layers as well as for material from the site of works and from commercial sources. The rate for selected layers from commercial sources shall, in addition to the provisions of DM 8.3.5, allow for locating the source, complying with all the applicable precautions as set out in DM 5.1, obtaining the material, selection and transport from the source to the point on the road where it is going to be used. No payment shall be made for the removal and replacement of unsuitable imported material.

PS DM 8.3.7 **Cut To Spoil Or Stockpile From ..... Unit : m^3**

Add the following to DM 8.3.7:

Payment for temporary stockpiling shall be made under DM 8.3.11, only if so instructed in writing by the Engineer.

(*For hand excavation see SABS 1200 D*.)

PS DM 8.3.12 **Overhaul ..... Unit : m^3 or m^3.km**

Substitute DM 8.3.12 with the following:

The provisions of clause D 8.3.6 shall apply mutatis mutandis.

PS DM 8.3.17 **Trim, Shape And Compact Sidewalks Unit : m^2**

The area to be trimmed is the unsurfaced area from the back side of the kerbs to the boundary of the road reserve, or such wider area necessitated by the road prism.

Measurement and payment for the above shall be restricted to areas ordered in writing by the Engineer.

The rate shall cover the cost of trimming and shaping the sidewalks to the lines, levels and dimensions as shown on the drawings, of acquiring additional material to compensate for any material lost due to weather or other reasons, and of the compaction of any loose or disturbed material to 90 % of MAASHTO density (100 % for sand).

PS DM 8.3.19 **Removal Of Unsuitable Material ..... Unit : m^3**

The volume measured for payment is the volume of unsuitable material, removed on written instruction of the Engineer in accordance with clause DM 5.2.3.2, below the level of the initial road bed.

The rate is extra-over Item PS DM 8.3.7 and covers all additional costs in respect of the removal and spoil of unsuitable material, as well as all additional costs in respect of the backfilling thereof. Payment for backfilling shall be made either under PS DM 8.3.4 or PS DM 8.3.5, whichever may be applicable.

Payment shall differentiate between the areas of the unsuitable material, as measured on the initial road bed, in increments as scheduled.

PS DM 8.3.21 **Existing Services That Adjoin Excavation for Streets ..... Unit : m**

The provision of items DB 8.3.5(a) and DB 8.3.5(b) shall apply mutatis mutandis.

PS DM 8.3.22 **Existing Services Intersecting Excavation for Streets ..... Unit : No**

The quantity is the number of each service, as indicated in the schedule of quantities, that intersect the excavation for streets.

Separate items will be provided for the depth increments as scheduled.

The rate for the crossing of services below the level of the road bed, measured to the top of the service, covers all additional costs in respect of excavation, irrespective of the method, the protection and ensuring of the continuous functioning thereof and the costs of all repair work and/or subsequent costs arising from damage to the service.

Services with a depth of cover of more than 500 mm shall not be measured and paid for.

PS DM 8.3.23 **Cutting Back of Existing Pavement Layers** Unit: m

The rate shall cover the cost of saw-cutting the existing asphalt/bituminous surface, cutting back the layer works and disposing of the material to fill, or to spoil off site, and all tools, equipment, plant, labour and supervision to provide a stepped joint.

The tendered rate shall also include full compensation for any handwork that might be necessary to form a neat joint such that the face of the joint in each layer is in vertical plane and for the protection of the trimmed joint during construction. The unit of measurement shall be the length of joint constructed.

PS G : CONCRETE (STRUCTURAL)

PS G 3 **MATERIAL**

PS G 3.2 **CEMENT**

PS G 3.2.1 **Applicable Specifications**

Substitute G 3.2.1 with the following:

All cement types shall comply with the requirements of SANS 50197-1:2013.

PS G 3.2.2 Alternative Types of Cement

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

All cement shall have a guaranteed alkali content (Na_2O equivalent) of less than 0,6% by mass of cement. For each consignment, the Contractor shall furnish a certificate stating that the cement has been tested and analysed by the manufacturer and complies with this requirement.

Alternatively, Portland Cement extenders, complying to SANS 50197 may be used, subject to approval by the Employer's Agent's Representative, to reduce the potential for alkali-aggregate reactivity and to enhance concrete durability.

Add to the Sub-Clause:

Portland cement (PC) and ground granulated blast furnace slag to SANS 50197 (slagment) shall be blended in a 50% PC and 50% slagment mix by mass for use under this contract.

PS G 3.2.3 **Storage of Cement**

Add the following to G 3.2.3:

Separate storage facilities shall be provided for the various types of cement specified.

Consignments of cement shall be used in the same sequence as that in which they are delivered to site. No cement shall be used which has been stored on site for a longer period than 6 (six) weeks. All cement so stored for a longer period than 6 (six) weeks, all cement damaged in any way, and all cement which does not comply with the specification, shall be removed immediately and permanently from the site.

PS G 3.5.2 **Air-entraining Agents**

Substitute G 3.5.2 with the following:

Air-entraining agents shall not be used in concrete.

PS G 4 **PLANT**

PS G 4.5.3 **Ties**

Add the following to G 4.5.3:

Permanent metal ties shall have a minimum concrete cover of 50 mm after formwork has been removed.

Tie holes shall be filled with an approved expansive cementitious grout similar to "Durarep" of ABE. The product shall be prepared to a non-slump consistency, but where no cracking

occurs when pressed into a firm ball. Trial mixes shall be made to arrive at the required working consistency.

PS G 5 **CONSTRUCTION**

PS G 5.1 **REINFORCEMENT**

PS G 5.1.2 Fixing

Add to the Sub-Clause:

Reinforcement shall not be welded.

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance of the member) is not, in the opinion of the Employer's Agent's Representative, impaired thereby.

Where mortar blocks are used they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed and they shall be cured in water for at least 7 days. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m³ and which are free from honeycombing. Mortar blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Employer's Agent's Representative, shall be rejected and shall be removed from the Site.

PS G 5.1.3 **Cover**

Add the following to G 5.1.3:

Unless otherwise shown on the drawings, exposure conditions shall be classified as "severe", and minimum cover to reinforcement shall be designated accordingly.

PS G 5.2.1 **Classification of Finishes**

Add the following to G 5.2.1:

The following surface conditions are required on the various portions of the finished concrete:

(a) **Rough**

Concealed surfaces and surfaces more than 150 mm below final ground level.

(b) **Smooth**

All surface finishes not classified as "rough" in paragraph (a) shall be classified as "smooth". All exposed arrises (i.e. where the angle between adjacent sides is 110° or less) unless otherwise indicated on the drawings, shall be chamfered 25 mm x 25 mm by means of triangular fillets fixed to the formwork.

(c) **Repair of concrete**

Immediately after the removal of the formwork, the Engineer shall inspect the concrete for defects. Skilled workmen only shall perform all repairs of such defects, by approved methods and to the satisfaction of the Engineer and at the expense of the Contractor.

PS G 5.2.5 **Removal of formwork**

In Table 2 of G 5.2.5.2, substitute "Portland cement and Portland cement 15" in columns 2, 3 and 4 with "CEM I Portland cement", delete columns 5, 6 and 7 and substitute "Portland blast-

furnace cement" in columns 8, 9 and 10 with "CEM III blast-furnace cement or blends of CEM I Portland cement with milled granulated blast-furnace slag".

PS G 5.4 **PIPES AND CONDUITS**

Add the following to G 5.4:

All pipes and specials, which must be installed in the floors and walls of structures, shall be embedded in the concrete during the casting of such concrete. No holes shall be left for the later installation of pipes and specials, without the written approval of the Engineer.

Where such holes have been approved by the Engineer, the Contractor shall be responsible for the grouting-in of such pipes or specials with an approved expansive cementitious grout as specified in PS G 4.5.3, regardless of whether or not these have been supplied by himself. The Contractor shall provide a smooth, dense and waterproof finish around the pipes or specials.

The clear space between pipes of any kind embedded in reinforced concrete and the clear space between such pipes and reinforcement shall at any point be not less than -

(a) 50 mm, or

(b) 5 mm plus the maximum size of coarse aggregate,

whichever is the greater.

PS G 5.5 **CONCRETE**

PS G 5.5.1.1 Quality: General

Add to the Sub-Clause:

All concrete other than above ground concrete in non-water retaining structures shall be regarded as watertight, i.e. water retaining concrete, notwithstanding that a test for water tightness may not be called for.

PSG 5.5.1.2 **Consistency**

Add the following under subclause G 5.5.1.2(a):

The slump for concrete to be used in water retaining structures shall not be less than 30 mm and not more than 60 mm.

PSG 5.5.1.3 **Workability**

Add the following to this subclause:

The concrete mix to be used in water retaining structures shall have a water/cement ratio not exceeding 0,55.

PS G 5.5.1.5 **Durability**

Add the following to G 5.5.1.4:

All concrete structures shall be deemed to be exposed to severe conditions.

PS G 5.5.1.7 **Strength concrete**

Add to the Sub-Clause:

The concrete mixes for the various grades of strength concrete shall be designed by a laboratory, approved by the Employer's Agent's Representative.

At least six weeks before placing any concrete on the Works the Contractor shall supply and deliver to the approved laboratory, at his own cost, samples of the aggregates he proposes to use in the concrete mixes. The approved laboratory shall prepare a batch of each grade of the designed mix and manufacture six cubes for compression testing in accordance with SABS Method 863, three of which will be crushed at 7 days and three at 28 days.

A provisional sum has been included in the Schedule of Quantities to cover the fees and charges levied to the Contractor by the approved laboratory in designing and testing the laboratory cubes of this concrete mix.

Add the following to G 5.5.1.7:

The grade of strength concrete and the maximum nominal size of coarse aggregate for each portion of the works, unless otherwise indicated on the drawings, shall be as follows:

(a) Blinding layers ..... 20 MPa/19 mm

(b) Encasing of pipes ..... 20 MPa/19 mm

(c) Benching and screeds ..... 20 MPa/10 mm

(d) All Reinforced concrete ..... 40 MPa/19 mm

(e) All water retaining concrete ..... 40 MPa/19 mm

(f) Mass concrete and unreinforced strip foundations ..... 25 MPa/19 mm

The Contractor shall be responsible for the following:

- Mix design for the applicable exposure and durability for the project;
- Preparation and implementation of a concrete Quality Assurance Management Plan.
- Site concrete monitoring reports (to be signed off by the Mix Designer) to be submitted for acceptance by the Engineer on a monthly bases.
- A maintenance procedure and plan (for client implementation).

PS G 5.5.2.3 **Aggregates**

Add to the Sub-Clause:

Batching for strength concrete is to be by mass using an approved type of weigh-batching plant.

PS G 5.5.3.2 **Ready-Mixed Concrete**

Delete the first sentence and substitute the following:

Ready mixed concrete is permitted provided the concrete is placed within 1 hour from the time it is discharged from the mixer at the central concrete production facility. The results of quality control tests from such a production facility will not be acceptable for evaluation in terms of Clause 7.3 of SANS 1200 G.

The method of controlling deliveries shall be subject to the approval of the Employer's Agent's Representative.

PS G 5.5.7 **Construction Joints**

Add the following to G 5.5.7.1:

Construction joints shall be limited to the minimum and shall only be made in positions as shown on the drawings or in positions as specifically approved by the Engineer.

PS G 5.5.7.4 **Expansion joints**

Expansion joints shall be formed in positions and in accordance with details as shown on the drawings. All expansion joints shall be formed with an approved closed cell polyethylene fill material with a density of not less than 100 kg/m^3. Joint sealers shall consist of a two-component polyurethane sealing compound complying with SANS 1077 (2009).

All sealants, fill material and waterstops shall be installed strictly in accordance with the specification of the manufacturers and to the satisfaction of the Engineer. The sealant shall be installed in one operation and jointing to already hardened sealant will not be permitted.

PS G 5.5.8 **Curing and Protection**

Add to the Sub-Clause:

Any face of freshly placed concrete shall not be exposed to the sun or wind for more than 0,5 hours after being placed, until it is fully cured.

Curing Compounds

The use of membrane curing compounds will be subject to the approval of the Employer's Agent's Representative.

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Employer's Agent's Representative, shall be rejected. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Employer's Agent's Representative will, at his discretion, require the Contractor to immediately adopt an effective alternative means of curing of any area of the structure to which a membrane has been applied, which, in the opinion of the Employer's Agent's Representative, is unsatisfactory.

PS G 5.5.9 **Adverse Weather Conditions**

Add the following to G 5.5.9.1:

No material having a temperature of below 5 °C shall be used for concrete, and no concrete shall be deposited when the ground or air temperature is below 2 °C. Furthermore, if the air or ground temperature is likely to fall below 2 °C within 12 (twelve) hours after depositing of concrete, no concreting shall be done without the written consent of the Engineer. If such consent is given, the Contractor shall heat the aggregate stockpiles and mixing water, and defrost the formwork and reinforcement.

PS G 5.5.10 **Concrete Surfaces**

Add the following to G 5.5.10.1:

Concrete surfaces under screeds, granolithic floor finishes or benching, and surfaces of strip foundations and footings shall be brought up to a plane, uniform surface with a suitable screed board.

Add the following to G 5.5.10:

PS G 5.5.10.4 **Wood-floated finish**

Where wood floating is specified or scheduled, the surface shall first be given a finish as specified in G 5.5.10.1 and after the concrete has hardened sufficiently, it shall be floated to a uniform surface free from trowel marks. The screeded surface shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screed marks.

PS G 5.5.10.5 **Steel-floated finish**

Where steel floating is specified or scheduled, the surface shall be treated as specified in PS G 5.5.10.4 except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

PS G 5.5.11 **Watertight Concrete**

Substitute G 5.5.11 with the following:

PS G 5.5.11.1 **General**

All structures that are designed to retain or keep out liquids shall be regarded as watertight structures.

PS G 5.5.11.1 **Requirements and tests for watertightness of structures**

The completed structure shall be watertight, and the quality and finish of the work shall be such that no after-treatment of the work such as plastering or cement wash is necessary to ensure compliance with this requirement.

Before the contractor is released from his obligations on site, he will ensure that watertightness testing is complete to the satisfaction of the Engineer. The works will not be certified complete until the structures enumerated in PS G 5.5.11 have been proved by testing to be watertight.

Upon completion of construction and when so agreed by the Engineer, the structure shall be filled by the gradual admission of water until the water level reaches the designed maximum level. The water level shall then be carefully noted and recorded by the Engineer in relation to a fixed bench mark, and the structure shall be allowed to remain filled for a period of 2 (two) weeks or such longer time as may be required to permit complete saturation of the concrete. During this period, readings will be taken by the Engineer and the results so obtained will be available for the information of the Contractor.

At the end of this period more water shall be added, if necessary, to bring the water level back to the designed maximum level and the water shall be left undisturbed for a period of at least 4 (four) days during which time the level shall again be recorded by the Engineer at regular intervals. The structure shall be considered to be watertight if the drop in water level does not exceed 6 mm in 96 (ninety-six) hours in the case of a roofed structure and if no leakage is apparent.

The acceptable drop in level in the case of an unroofed structure shall be such that it allows for normal evaporation during the time of the test.

If appreciable leakage is evident at any stage of the filling or testing or if, in the opinion of the Engineer, the degree of watertightness is unsatisfactory, the Contractor shall, when so ordered by the Engineer, discontinue the test immediately and at his own expense take approved steps to rectify the work. The work of rectification shall be continued assiduously until, on repetition of the test procedure, a satisfactory test result is obtained and the degree of watertightness is acceptable.

Backfilling around structures shall not commence until a satisfactory test result has been obtained.

The Engineer shall have the right to retest the structure before the expiry of the defects liability period and the results of these tests will be made available to the Contractor. If these tests indicate to the Engineer that the degree of watertightness is unsatisfactory, the Engineer (before issuing the final certificate) will be entitled to order the Contractor to rectify the work at his own expense in such a manner as will cause least interruption to the Employer and will ensure that the degree of watertightness of the structure is satisfactory.

PS G 5.6 NO-FINES CONCRETE

PS G 5.6.1 Materials

Cement shall be CEM II.

Water and aggregate shall comply with the requirements of G 3.3 and G 3.4.

Each size of aggregate shall be a single size aggregate graded in accordance with SABS 1083.

PS G 5.6.2 Classes Of No-fines Concrete

No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used. Class NF 19 means a no-fines concrete with a 19 mm nominal size aggregate.

The volume of aggregate per 50 kg of cement for each class of concrete shall be as follows:

CLASS	**AGGREGATE PER 50 kg CEMENT**
NF 38	0,33 m^3
NF 19	0,30 m^3
NF 13	0,27 m^3

PS G 5.6.3 Batching and Mixing

Cement shall be measured by mass or in full pockets of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The aggregate shall be moist or wetted before the cement is added. Where drum mixers are used, about 20 % of the water shall be poured into the drum before the aggregate and cement are loaded. The mixing time in the drum shall be about 45 to 50 seconds.

The quantity of water added shall be just sufficient to form a smooth grout which will adhere to and completely coat each and every particle of aggregate, and which is just wet enough to ensure that, at points of contact of aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water for every 50 kg of cement.

Mixing shall be done in an approved batch-type mechanical mixer, but small quantities may be hand mixed.

PS G 5.6.4 Placing

No-fines concrete shall be placed in accordance with the procedure approved by the Engineer. It shall be placed in its final position within 15 minutes of having been mixed.

The concrete shall be worked sufficiently to ensure that it will completely fill the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping shall be avoided and the concrete shall not in any circumstances be vibrated.

PS G 5.6.5 **Protection**

All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods:

a) Retaining formwork in place;

b) Covering exposed surfaces with sacking or other approved material kept continuously wet;

c) Covering exposed surfaces with plastic sheeting.

No-fines concrete placed during cold weather shall be adequately protected against frost for at least three (3) days.

PS G 6 **TOLERANCES**

PSG 6.1 **BASIS OF MEASUREMENT**

PSG 6.1.1 **General**

Unless otherwise specified on the drawings, Degree of Accuracy II shall apply.

PS G 7 **TESTS**

PSG 7.1 **FACILITIES AND FREQUENCY OF SAMPLING**

PSG 7.1.2 **Frequency of Sampling**

Notwithstanding the requirements of this subclause a sample shall consist of six (6) standard 150mm cubes. Each sample shall be tested on the basis of three (3) cubes being crushed when 7 days old and three (3) when 28 days old.

One set of samples shall be taken from each day's casting and/or each 50m³ of concrete poured.

The Contractor shall keep the following minimum records of all cubes taken and tested:

Date cast; Section of work from which samples were taken; results of 7 and 28 day tests.

The results of all tests shall be submitted to the Engineer within 2 days of the test having been carried out.

PSG 7.2.3 Laboratory Testing

Add the following to Subclause G 7.2.3:

The Contractor will be liable for all costs incurred in making structural concrete cubes and having these tested at an approved laboratory.

PS G 7.3 **ACCEPTANCE CRITERIA FOR STRENGTH CONCRETE**

PS G 7.3.6 **Submittals**

The Contractor shall submit the following documentation for acceptance by the Engineer:

- Details and experience of Mix Designer, including PREng registration number.
- Copy of valid Professional Indemnity cover Certificate of Designer (Minimum value to be twice the value of the concrete works for each and every claim).
- List concrete requirement (to include, but not limited to):
  - Exposure conditions: severe
  - Water tight structures, designed with a maximum crack width of 0.1mm and a minimum cover of 50mm
  - Design life: 50 years
  - Grade of concrete for all structures and structural elements
  - Shutters as proposed by contractor (Steel, timber, etc.)
  - Curing and shutter stripping as proposed by contractor
  - Maximum heat of hydration
- Mix design (to include):
  - Materials, material origins, mix proportions and associated testing
  - Cube test results for 3, 7 and 28 days (56 day test results can follow)
- Quality Assurance Management Plan (including post concreting inspections and sign offs).
- Remedial Maintenance Procedures and Suggested Remedial Maintenance Program

PS G 7.3.7 **Suppliers Warranty**

The contractor shall submit a written guarantee accompanied by substantiating data, stating that the products used are in accordance with or exceed these specifications.

In addition to the above, upon completion of works the Mix Designer shall submit all documentation to confirm constructed concrete works meet his design specifications and were correctly implemented on site.

PS G 8 **MEASUREMENT AND PAYMENT**

PS G 8.1 **MEASUREMENT AND RATES**

PS G 8.1.1 **Formwork**

Delete the following in G 8.1.1.3 (c):

"and for different prop heights for beams and slabs".

PS G 8.1.2 **Reinforcement**

Substitute G 8.1.2 with the following:

PSG 8.1.2.1 **Steel reinforcing bars**

The unit of measurement for steel reinforcing bars shall be the tonne of reinforcement in place in accordance with the drawings or as authorised by the Engineer.

Clips, ties, separators, stools and other steel used for positioning reinforcement shall not be measured unless detailed on the bending schedules.

The rate tendered shall cover the cost of the supply, delivery, cutting, bending, placing and fixing of the steel reinforcement irrespective of bar diameter, including all tying wire, stools, supports and waste.

PSG 8.1.2.2 **Welded mesh reinforcing**

The welded mesh reinforcement shall be measured as the nett plan area of the element being reinforced. It shall not include for wastage or laps which shall be allowed for in the tendered rate.

The rate tendered shall include for supply, delivery to site, cutting as necessary, placing and maintaining in the specified position, waste and laps based on a minimum of 300 mm side laps in all positions.

PS G 8.1.3 **Concrete**

Delete “or the plan size of the excavation where additional excavation is provided to facilitate erection of forms“ in the first sentence of PS G 8.1.3.1 (c).

Add the following to PS G 8.1.3.1 (d):

Strip foundations and encasement of pipes shall be cast directly against the sides and bottoms of excavations. No payment shall be made for additional concrete in over-break.

Delete the full stop at the end of G 8.1.3.3 (a) and add the following:

"and special steps necessary before depositing concrete during cold weather, as prescribed in PS G 5.5.9".

PS G 8.2 **SCHEDULED FORMWORK ITEMS**

PS G 8.2.5 **Narrow Widths**

Replace G 8.2.5 with the following:

Narrow widths formwork will not be measured separately, but shall be included in G 8.2.1 and G 8.2.2, where applicable.

PS G 8.2.7 **Chamfers Exceeding 25 mm x 25 mm, Grooves And Rebates ..... Unit : m**

The size of chamfers, or the width and depth in the case of grooves and rebates, is stated.

PS G 8.3.2 **High-Tensile Welded Mesh..... Unit : m^2**

Add the following to G 8.3.2:

The rate shall include for overlaps and wastage.

PS G 8.4 **SCHEDULED CONCRETE ITEMS**

PS G 8.4.4 **Unformed Surface Finishes ..... Unit : m^2**

Add the following to G 8.4.4:

The concrete surface finishes under screeds, granolithic finishes or benching as prescribed in PS G 5.5.10 shall not be measured separately. The rates for the related concrete items shall also cover the cost of these surface finishes.

PS G 8.4.7 **Concrete Complete with Formwork And / Or Trowel Finish ..... Sum or m^3**

The rate shall cover the cost of the provision of concrete (made from ordinary Portland cement, unless otherwise scheduled), mixing, testing, placing, compaction, the forming of stop-ends and unforeseen construction joints, striking-off or levelling as applicable, trowelling and curing and repairing where necessary, together with the cost of all parts of formwork in contact with the concrete and the necessary bearers, struts, and other supports, plus the layout and plant necessary to erect and strike such formwork.

PS G 8.5 **JOINTS ..... Unit : m**

Add the following to G 8.5:

The cost of all other construction joints shall be deemed to be included in the rates for the relevant concrete items.

The cost of all construction and expansion joints shall include formwork, joint filler and sealer as well as waterstops where applicable (see PS G.5.5.7 and PS G 5.5.7.4).

PS G 8.7 **GROUTING ..... Unit : m**

Add the following pay items:

c) Grouting in of equipment supplied and installed by the Plant Supplier

(i) using non-shrink grout (state type) ..... **Unit : cubic metre (m^3)**

(ii) using dry-packed grout ..... **Unit : cubic metre (m^3)**

The unit of measurement shall be the cubic metre of completed grouting.

The tendered rate shall include full compensation for supplying of all materials, mixing, applying and finishing to a steel-float surface after installation of the Plant.

PS G 8.9 **TEST STRUCTURE FOR WATERTIGHTNESS ..... Unit : Sum**

The rate shall cover the cost of all equipment and labour necessary to test the structure for watertightness as described in PS G 5.5.11.1, including the supply of water, filling and emptying such structure.

No additional payment will be made for re-testing the structure for watertightness after the repair of leaks.

PS L : MEDIUM PRESSURE PIPELINES

PS L 3 **MATERIALS**

PS L 3.1 **GENERAL**

Substitute the first sentence of L 3.1 with the following:

Types and classes of materials shall be as scheduled.

PS L 3.3 **CI PIPES, FITTINGS AND SPECIALS**

Add the following:

Ductile Iron Saddles

The saddles shall be manufactured in ductile iron in accordance with SANS 509 (as amended) and shall conform to the dimensions shown on the attached drawing no. W4-G-004.

1. The saddles shall be machinable and free from blowholes, pitting, sand and any other injurious defects. The malleability of the complete fitting (bolted together) shall be tested in accordance with SANS 509 – 7.4.

2. The saddles shall be suitable for use on constant outside diameter asbestos cement pipe manufactured in accordance with SABS 1223 or uPVC Class 12 pipe manufactured in accordance with SABS 966 and shall be designed so as to permit taping of the water main under pressure with a Talbot or similar tapping machine.

3. The bolts and nuts shall be electro-galvanized mild steel having an ultimate tensile strength size from 15mm to 40mm (½ B.S.P. to 1½" B.S.P.).

4. The saddle pieces shall be supplied complete with the base sealing gaskets as detailed and in accordance with SABS 564 (as amended). Where required in the Schedule, the saddles shall be drilled to any size from 15mm to 40mm (½ B.S.P. to 1½" B.S.P.).

PS L 3.4 **STEEL PIPES, FITTINGS AND SPECIALS**

PS L 3.4.2 **Pipes Of Nominal Bore Up To 150 mm**

Substitute "screwed in L 3.4.2 with "flanged".

PS L 3.4.3 **Pipes of Nominal Bore Over 150 mm**

Add the following:

All mild steel pipes must be manufactured from Grade B steel with minimum plate thickness of 6,0 mm except where specified otherwise.

PS L 3.7.1 **uPVC Pipes**

Add the following to L 3.7.1:

Pipes used for main pipes in this contract will be Class 12. All uPVC pipes must comply to SANS 966 using spigot and socket rubber ring joints.

All T's, reducers etc to PVC pipes shall be Ductile Iron to EN 12842, fusion bonded thermoplastic coated internally and externally, to minimum 0.25 mm coating DFT with EPDM rubber insert seal.

All mild steel specials shall after manufacture be hot dip galvanized and coated internally and externally with fusion bonded thermoplastic, to minimum 0.25mm coating DFT.

Only stainless-steel bolts and nuts shall be used on all fittings such as saddles, flanges, Ranger couplings, etc.

PS L 3.7.2 **Polyethylene Pipes**

Add the following to L 3.7.2:

High-density polyethylene (HDPE) pipes shall comply with SANS ISO 4427 PE100 PN16 joined with mechanical compression fittings.

PS L 3.8 **JOINTING MATERIALS**

PS L 3.8.4 **Loose Flanges**

Substitute the first sentence of the last paragraph of L 3.8.4 with the following:

Bolts and nuts shall comply with the requirements of SABS 135.

PS L 3.9 **CORROSION PROTECTION**

PS L 3.9.2.1 **Steel pipes of nominal bore up to 150 mm**

Add the following to L 3.9.2.1:

The requirements of PS L 3.9.2.2 shall apply mutatis mutandis.

PS L 3.9.2.2 **Steel pipes of nominal bore over 150 mm**

Add the following to L 3.9.2.2:

All mild steel pipes and fittings shall be cleaned and treated with a polymide-cured epoxy system similar and equal to COPON EP2300 or AMERCOAT 385, coating, externally and internally as specified in Clause 3.9.2.2 of SABS 1200L, to a dry-film thickness of at least 300 micrometres..

Substitute "250 μm" in L 3.9.2.2(b)(2) with "350 μm".

PS L 3.9.5 **Joints, Bolts, Nuts and Washers**

Substitute L 3.9.5 with the following:

All joints, bolts, nuts and washers shall be of grade 304 stainless steel, where installed above ground level or below water level. For underground installations, hot dipped galvanised bolts, nuts and washers shall be used. Nickel anti-seize compound shall be applied between dissimilar materials to prevent corrosion.

PS L 3.9.6 **Corrosive Soil**

Substitute L 3.9.6 with the following:

All steel, cast iron and ductile iron pipes, accessories, fittings and joints together with the bolts and nuts which are in direct contact with the ground must be treated as follows with a corrosion protection system, approved by the Employer's Agent's Representative:

Apply petrolatum primer to entire outside surface of the pipes, accessories, fittings and joints, followed by petrolatum mastic to fill all voids and to provide a smooth surface, wrap the outside surface with petrolatum tape afterwards. The tape must not span over the concave surface since it can cause voids under the wrapping. An outside wrapping of plastic film must then be applied to the entire outside surface afterwards.

PS L 3.10 VALVES

PS L 3.10.1 Gate Valves

All gate valves shall comply with the requirements of SABS 664 and shall be suitable for a working pressure of 1,6 MPa. All gate valves must be supplied with a square spindle nut, suitable to be used with a valve key.

Gate valves shall have spigot ends unless shown differently on the drawings and shall open clockwise. The direction for opening and closing shall be permanently displayed on the valves. Valves shall have non-rising spindles.

Compression shut-off valves with rubber protected gate and smooth finish without recess inside, may be used.

All flanged gate valves shall be drilled according to SABS 1123 Table 1600/3. Pipes shall not be tested against a closed valve. Thrust blocks for test sections shall be approved by the Engineer prior to testing of pipes.

All internal surfaces shall be grit blasted to SA 2½ standard and then coated with Copon EP 2300 epoxy paint to a minimum thickness of 225 micron.

PS L 3.10.2 Butterfly Valves

Butterfly valves shall be of the wafer pattern to be installed between two flanges in the water main with either short collar repair couplings or Viking Johnson couplings.

The valves shall be fitted with a gearbox with a stainless steel shaft. The body shall be clad with rubber.

Valves shall be similar to the "Compact" type with a working pressure of 1,6 MPa. Pipes shall not be tested against closed butterfly valves.

All internal surfaces shall be grit blasted to SA 2½ standard and then coated with Copon EP 2300 epoxy paint to a minimum thickness of 350 micron.

PS L 3.10.3 Fire Hydrants

Fire hydrants shall be of the screw-down underground type and shall be suitable for a working pressure of 1,6 MPa with a 65 mm inlet. The outlet shall be 63 mm dia gun-metal with London Vee screw thread with cap top and chain. It shall open clockwise with a square spindle nut of the same size that is specified for the gate valves.

The fire hydrant shall be bolted to the flanged branch of a cast iron hydrant tee.

PS L 3.10.4 Air Valves

Air valves for potable water shall be suitable for a working pressure of 1,6 MPa. All air valves shall be double action air valves of Vent-o-mat series RBX (for water pipelines) and RGX (for sewer pipelines).

The branch of the tee on the main pipe shall be the same as diameter of the main pipe.

All air valve installations shall be supplied with an isolating valve and distance piece between the air valve and the branch of the tee, and other fittings shown on the drawings.

Double-acting air valves shall have large as well as small orifices. The large orifice shall have a rubber bed, and the small orifice a brass bed on which the balls can shut. Double-acting air valves shall be flanged and supplied with flanged isolating valves. Air valves shall be designed to remain open until all the air has escaped and shall not close due to the speed of the escaping air.

PS L 3.10.5 **Scour valves**

Scour valves shall be suitable for a working pressure of 1,6 MPa.

Scour valves shall consist of a flanged gate valve of 100 mm dia coupled horizontally to a flanged cast iron scour valve tee. The outlet pipe shall be a 100 mm nominal diameter steel pipe with 4 mm wall thickness and Copon coated. The outlet shall discharge above ground level in the direction of the fall of the natural ground surface, perpendicular to the main pipe. The outlet end of the pipe shall be cut diagonally and supplied with a cover that is hinged and that will remain closed unless it is forced open by the water. The hinge shall be non-removable.

Scour valves on 75 mm dia pipes shall be the same as above except that a 75 x 75 mm dia fire hydrant tee shall be used and that the gate valve and outlet pipe shall both be 75 mm diameter.

PS L 3.11 **MANHOLES AND SURFACE BOXES**

PS L 3.11.1 **Bricks**

Add the following to L 3.11.1:

Bricks shall be from commercial sources and shall comply with the requirements of SANS 1215.

PS L 3.11.4 **Step Irons**

Substitute L 3.11.4 with the following:

Step irons shall consist of polypropylene coated 12 mm high tensile steel such as Calcamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer.

PS L 4 **PLANT**

PS L 4.2.6 **Fittings and Specials**

- All bends, tee's reducers etc. to PVC pipes shall be Ductile Iron to EN 12842, fusion bonded thermoplastic coated internally and externally, to minimum 0.25 mm coating thickness with EPDM rubber insert seal.

- All mild steel specials shall after manufacture be hot dip galvanized and coated internally and externally, to minimum 0.25mm coating thickness or Carboline 891 (3 coats, minimum 125 microns/coat) to the manufacturers specification.

- Only stainless steel bolts and nuts shall be used on all fittings such as saddles, flanges, short collar couplings, etc.

- All brass fittings shall be SABS approved.

- All compression fittings to be done according to PS L 4.2.7.

PS L 4.2.7 **Compression fittings for HDPE Pipes**

- All compression fittings included in this specification shall be designed and be suitable for use with potable water distribution systems and be supplied from manufacturer complying with the requirements of ISO 9002. Fittings bodies may be of various configurations and include male adaptors, female adaptors, couplings, reduced couplings, elbows 90°, elbows 90° with male off take, elbows 90° with female off takes, elbows 45°, elbows 45° with male off take, Tee 90°, Tee 90° reduced / increased, Tee 90° with male off take, Tee 90° with female off take, Flanged joints, end caps and wall plate-elbows. The main size range is from 16 mm diameter up to 110 mm diameter. The fittings must be able to operate at a constant working pressure of 16 bar at an ambient temperature of 20 degree centigrade.

- Suppliers must provide approvals of minimum three internationally recognised authorities, such as DVGW, DS, SVGW etc. for their products.

- All bodies shall be injection moulded from recognised top quality polypropylene (PP) and be coloured black. The bodies must have moulded-in manufacturer identification, material and series information and show the dimensions of the pipe outside diameter and if necessary of the threads. All male and female threads of the bodies shall be injection moulded according to the ISO 7/1 standard.

- All compression fitting nuts shall be injection moulded from recognised top quality polypropylene (PP) and be coloured blue. The nuts must have an UV resistance of grade 8 according to ASTM D2565 and shall have moulded-in manufacturer identification and show the KIWA and Australian standard approval. The outer circumference must be provided with ribs to enhance handgrip or the tightening of the nut with adequate tools.

- All clamp rings shall be injection moulded from recognised top quality Polyacetalic Resin (POM) and be coloured white. Clamp rings shall not be connected to the thrust rings but be able to move freely on them. Thrust rings and clamp rings must be two (2) different components.

- All thrust rings shall be injection moulded from recognised top quality polypropylene (PP) and be coloured black. Thrust rings up to 50 mm diameter shall be secured in the body so that they cannot fall if the fittings are disassembled. Thrust rings must not be connected to the clamp rings. Thrust rings must apply pressure on the gaskets if the nut is tightened.

- All gaskets shall be made of a recognised top quality Nitrile Rubber (NBR) and not contain a plasticiser that when in direct contact, has a harmful effect to either plastic pipes or fittings. Each gasket must have a smooth finish and be free from moulding flashes or similar. Gaskets up to 63 mm diameter must have an average Shore hardness of 70 ± 5 degrees. Gaskets greater than 63 mm diameter must have an average Shore hardness of 60 ± 5 degrees.

- All gaskets shall be coloured black. All gaskets must have a conical shape on the inside of the gasket for an easy insertion of the pipe without disassembling of the fitting. All gaskets are to have a wide flat sealing contact function with the pipe in question. All gaskets must have a cylindrical shape on the outside of the gasket. Gaskets must have two (2) lips on the bottom of the gaskets to guarantee a good sealing in cases of suction and vacuum. Gaskets must be pre – lubricated to facilitate easy installation. The use of O-rings as a pipe to fitting seal is not permitted.

- The compression fittings must conform to the relevant internationally recognised performance requirements:

  - Type test Standard Dimensions of the threads - ISO 7/1
  - Tightness of the joints - ISO 3458
  - Tightness of the joints when subjected to bending - ISO 3503

- Resistance to pull-out	-	ISO 3501
- Internal under-pressure test	-	ISO 3459
- Long term pressure test	-	ISO/DIS 14236

- Samples to be submitted to the Project Manager of the relevant Administration for approval.

PS L 4.3 **TESTING**

Add the following to L 4.3:

The Contractor must ensure that the test equipment is in good working order and that it is calibrated.

L 5 **CONSTRUCTION**

L 5.1 **LAYING**

PS L 5.1.1 **General**

Add the following L 5.1.1:

Where fibre cement pipes are built into structures as indicated on the drawings, the length of pipe that is built in, must not exceed 600 mm.

In order to accommodate differential movement, a length of pipe no less than 500 mm and no longer than 8 diameters must be coupled to the built-in length.

L 5.1.4 **Depths and Cover**

PS L 5.1.4.1 **Cover**

Add the following to L 5.1.4.1:

The minimum cover over uPVC pipes must be at least 700 mm.

The minimum cover of main water pipelines in road reserves and under streets must be 1 100 mm and carried out according to L 5.1.4.2.

PS L 5.1.4.2 **Deflection**

Substitute “1,5° per joint in the case of FC pipes” in L 5.1.4.2 with “3° per joint in the short case of FC pipes with FC couplings and 4° in the case of FC pipes with cast-iron short collar repair couplings”. The maximum deflection for uPVC pipes with uPVC couplings is 3°.

L 5.5 **ANCHOR BLOCKS**

Measurement for anchor blocks will be determined on site by the Engineer after each position has been inspected.

L 5.6 **VALVE AND HYDRANT CHAMBERS**

PS L 5.6.1 **General**

Substitute the first sentence of L 5.6.1 with the following:

The drawings of valve and hydrant chambers which are bound into the document shall supersede the corresponding drawings in the standard specification.

PS L 5.6.2 **Construction of Chambers**

Add the following to L 5.6.2:

The depth from the cover of the surface box at final level to the top of a valve spindle shall be not less than 75mm nor more than 600mm. Hydrant outlets shall be not more than 400mm below the level of the hydrant cover.

To achieve the above cover requirements, in the case of hydrants, double-flanged distance pieces shall be provided when necessary.

Where for practical purposes it is not possible to provide the required cover for gate valves, an extension spindle may, subject to approval of the Employer's Agent's Representative, be provided.

PS L 5.9 **LIFTING AND RELAYING OF EXISTING PIPES**

Add the following to L 5.9:

Existing water pipes at certain points shall be lifted and relayed deeper in the same position. The Contractor must make timeous arrangements with the local authority.

Add the following:

PS L 5.11 **CONNECTING TO EXISTING MAINS**

The work involving the connection to, or cutting into existing pipes, will be executed by the City of Cape Town. A Prime Cost Sum has been allowed in the Schedule of Quantities for this work.

PS L 5.12 **LOCATION OF VALVES AND HYDRANTS**

Valve covers shall be painted blue. The position of the valve shall be marked on the kerb by cutting a "V" on the kerb face (75mm x 75mm).

Hydrant chambers to be constructed in accordance with the drawings and hydrant covers shall be painted yellow. The position of the hydrant shall be marked on the kerb by painting a 1000 mm wide strip of the kerb length yellow opposite the hydrant position.

PS L 7 **TESTING**

PS L 7.3 **STANDARD HYDRAULIC PIPE TEST**

PS L 7.3.1.2 **Test pressure**

Add the following to L 7.3.1.1:

Pipes shall not be tested against isolating valves. Special blank flanges or end caps, fully anchored, shall be provided for testing.

Substitute L.3.1.2 with the following:

The test pressure for field testing shall be 1,2 times the rated maximum working pressure of the pipe e.g. class 9 uPVC pipe (0,9 MPa rated working pressure) shall be tested to 1,08 MPa and class 12 uPVC pipe (1,2 MPa rated working pressure) to 1,44 MPa.

Substitute L 7.3.1.3 with the following:

The test pressure applied according to L 7.3.1.2, must, with allowance for any level differences along the pipeline, be such that the pressure at any point in the pipeline will be at least the rated pressure and not more than 1,2 times the rated working pressure of the pipe.

PS L 8 MEASUREMENT AND PAYMENT

PS L 8.1 GENERAL

No extra payment will be made for any cutting, etc. required for permanent closure pipes (L 8.2.1).

No extra payment will be made for testing, nor for temporary water supply connections for testing, which will be held to be included in the price for laying of pipes, valves and specials.

Notwithstanding instructions for backfilling, the Contractor shall bear the cost of finding and repairing leaks on new pipe work.

PS L 8.2 SCHEDULED ITEMS

PS L 8.2.1 Supply, Lay and Bed Pipes Complete with Couplings ..... …Unit: m

Add the following to L 8.2.1:

The rates for pipes, couplings, accessories, fittings, saddles and joints shall cover the cost for the treating as specified in PS L 3.9.6.

The rate for the connection of saddles on existing pipes will include the cost of labour and equipment to open the existing pipe and the handling of water in the existing pipe.

PS L 8.2.3 **Extra-over 8.2.1 For The Supplying, Fixing And Bedding Of Valves ..... Unit : No**

Add the following to L 8.2.3:

Valves (air valves) are measured and paid for per item, complete with the inclusion of the cutting of pipes, couplings, extra excavation and all extra material and labour that is required, excluding tees, fittings, isolating valves (e.g. under air valves), complete as shown on the drawings. Flanged distance pieces shall be included in the rate for fire hydrants.

PS L 8.2.5 **Supply and Place Pipes, Valves and Specials.....Unit: No**

Add the following to L 8.2.5:

The tendered rate for the supply and installation of pipes, valves and specials listed in the schedule “x” and in the Bill of Quantities shall cover the cost of the provision of each item, complete with couplings, bolts, nuts and gaskets where applicable and the cost of the handling, fixing, bedding and testing of the special or valve as applicable. The rate for all pipes, valves and specials will include the protected against corrosion as specified, see PS L 3.9.6. The rate for all steel pipes, specials, flanges, bolts and nuts will include the hot dipped galvanizing after manufacturing, see PS L 3.9.2.1. and PS L 3.9.2.2.

PS L 8.2.10 **Temporary Valves, Etc. ..... Unit : Sum or No**

Substitute L 8.2.10 with the following:

Temporary valves, end caps or blank flanges for testing shall be included in the rate for the laying of pipes except where separate items are included in the schedule of quantities.

PS L 8.2.11 **Anchor/Thrust Blocks ..... Unit : m^3**

Anchor and thrust blocks shall be measured per cubic metre concrete and the tendered rate shall include for all formwork and reinforcement (where specified) for the required dimensions.

PS L 8.2.13 **Valve And Hydrant Chambers, Etc ..... Unit : No**

Add the following to L 8.2.13:

The rate for scour-valve chambers must also cover the cost of the supply and installation of the scour outlet as described in PS L 3.10.5 and indicated on the drawings.

PS L 8.2.15 **Pipeline Markers ..... Unit : No**

The rate shall include the costs of all labour, material and equipment necessary to install the pipeline markers to the following specification:

A 100 mm dia AC pipe filled with concrete. The pipe shall have a total length of 1,5 m with height 1,0 m above ground level and painted respectively in yellow and blue in 500 mm intervals.

PS L 8.2.16 **Cut Into And Connect To Existing Mains ..... Unit : No**

The cutting into existing mains shall be measured by the number of each type and diameter of pipe cut into.

The tendered rate shall include full compensation for all arrangements with the relevant authorities, isolating the main, cutting into the main to accommodate the connecting fitting, dewatering, excavating, removing of excess material, taking steps to prevent the ingress of soil, stones and other material into the main as well as all material and labour to connect the pipe.

PS LB : BEDDING (PIPES)

PS LB **BEDDING (PIPES)**

PS LB 1 **SCOPE**

Add the following to LB 1.1:

This specification also covers the bedding required for electric cables.

PS LB 3 **MATERIALS**

PS LB 3.1 **SELECTED GRANULAR MATERIAL**

Substitute LB 3.1 with the following:

Selected granular material shall be an aggregate, sand or granular material, all of a non-cohesive nature and free from any organic material, of which the grading analysis shows 100 % passing a 13,2 mm sieve and not more than 5 % passing a 0,075 mm sieve.

In very wet conditions and if so ordered by the Engineer, a non plastic crushed material with the specification as stated underneath should be used for bedding cradle.

a) **Grading**

Sieve size (mm)	**% going through**
19,0	100
13,2	84 - 100
9,5	70 - 84
4,75	45 - 65
2,36	29 - 47
1,18	19 - 33
0,600	13 - 25
0,300	10 - 18
0,150	6 - 13
0,075	4 - 10

b) **Crusher value**

The aggregate crushing value, calculated at minus 13,2 mm plus 0,5 mm fraction, may not exceed 29.

PS LB 3.2 **SELECTED FILL MATERIAL**

Substitute LB 3.2 with the following:

The requirements of PS LB 3.1 shall apply mutatis mutandis.

PS LB 3.3 **BEDDING**

Add the following to LB 3.3:

All pipes shall be classified as rigid pipes and shall be laid on a Class C bedding except water connections, which shall be classified as flexible pipes.

PS LB 3.4.1 **Suitable Material Available From Trench Excavations**

Substitute LB 3.4.1 with the following:

The provisos of PS D 3.3.1 shall apply mutatis mutandis.

PS LB 5 **CONSTRUCTION**

PS LB 5.1 **GENERAL**

PS LB 5.1.4 **Compacting**

Substitute "90 %" of MOD AASHTO" in LB 5.1.4 with "93 % of MOD AASHTO (100 % for sand)".

PS LB 8 **MEASUREMENT AND PAYMENT**

PS LB 8.1 **PRINCIPLES**

PS LB 8.1.1 **Supply of Bedding Materials Measured Separately**

Add the following to LB 8.1.1:

Payment for bedding material and selected fill material is only made if the selected trench-excavation material cannot be used in the same position as bedding material but has to be obtained from another part of the site of works or from commercial sources.

PS LB 8.1.4 **Separate Items for Cradle and Blanket**

Substitute LB 8.1.4 with the following:

No distinction shall be made as regards material for the bedding cradle and selected fill blanket, and the material shall comply with the requirements for material for bedding cradle.

PS LB 8.1.5 **Disposal of Displaced Material**

Add the following to LB 8.1.5:

Surplus displaced material shall be dumped and levelled at the adjacent Vissershok municipal dumping site.

PS LB 8.2 **SCHEDULED ITEMS**

Add the following to LB 8.2:

LB 8.2.1 **Supply of Bedding Material from Trench Excavation**

Add the following to LB 8.2.1:

Where bedding material is available direct from the trench excavation, it will not be paid for.

LB 8.2.2 **Supply Only of Bedding by Importation**

PS LB 8.2.2.3 **From commercial sources**

Add the following to LB 8.2.2.3:

c) Bedding for wet conditions ..... Unit : m^3

The requirements of PS LB 3.1 for bedding in wet conditions must be noted. Payment will only be applicable if ordered by the Engineer.

PS LB 8.2.2.4 **From stockpile (Provisional)**

a) Selected granular material ..... Unit : m^3

b) Selected fill material ..... Unit : m^3

The rate shall cover the cost of obtaining, handling and transport regardless the distance, of the required bedding material from the stockpile, the delivery thereof at positions that are spaced along the trench in such a way as suits the working method of the Contractor, as well as the removal of material displaced by this importation within a free-haul distance of 0,5 km.

PS LB 8.2.5 **Overhaul Of Material For Bedding Cradle And Selected Fill Blanket ..... Unit : m^3.km**

Substitute LB 8.2.5 with the following:

a) Limited overhaul ..... Unit : m^3

b) Long overhaul ..... Unit : m^3km

Except that the volume is calculated according to LB 8.1.3, the requirements of D 8.3.6 or DA 8.3.3, as applicable, shall apply for overhaul.

PS LB 8.2.6 **Building Pipes Into Brick Work**

Pipes supplied and installed by the Contractor (irrespective of type)

i) (110mm diameter of pipe and 220mmwall thickness) ..... Unit : No

ii) (75mm diameter and 220mm wall thickness) ..... Unit : No

The unit of measurement shall be the number of pipes built into the brick work as shown on the drawing.

The tendered rate shall include full compensation for supplying all materials (wet to dry epoxy in the case of casting new concrete against the faces of old concrete) concreting in the pipes, cutting and placing formwork to fit around pipes and neatly finishing to conform to a smooth surface finish.

In the case of the Contractor building in his own pipes the rate shall also include for holding the pipe in position and aligning the pipes to the correct levels as indicated on the drawing or as ordered by the Engineer.

PS LD: SEWERS

LD 2 **INTERPRETATION**

PS LD 2.4 **ADDITIONAL ABBREVIATION**

Add the following to LD 2.4:

GRP : Glass reinforced polyester.

PS LD 3 **MATERIALS**

PS LD 3.1 **PIPES, FITTINGS, AND PIPE JOINTS**

PS LD 3.1.5 **uPVC-pipes**

Substitute "approved flexible joints" in LD 3.1.5 with "spigot and socket rubber ring joints".

PS LD 3.1.8 **GRP Pipes**

Add the following to LD 3.1.5:

GRP pipes must comply with the applicable stipulations in ANSI / AWWA C950 – 88 and must have a suitable flexible joint.

PS LD 3.5 **MANHOLES, CHAMBERS, ETC.**

PS LD 3.5.1 **Bricks**

Bricks shall be obtained from an approved manufacturer and shall be special grade Class NFX (Non-facing extra) clay bricks to SANS 227 with a nominal compressive strength of 21 MPa and a water absorption of not more than 10 %.

PS LD 3.5.2 **Precast Concrete Sections**

Add the following to LD 3.5.2:

Precast concrete sections with an inside diameter of at least 1 000 mm shall be used for manholes. Sectional spun concrete cylinders shall have been manufactured from dolomitic aggregate.

The joint between the manhole and the concrete roof slab shall be sealed effectively with a sealant, to the prescriptions of the manufacturers and approval of the Engineer, to prevent the infiltration of subsurface water or stormwater. Lifting holes shall be sealed off effectively, with an epoxy, after installation and before backfilling.

In the case of only one inlet pipe with the same diameter as the outlet pipe and with a deviation of less than 45° from the straight, the invert level of the outlet pipe shall be 10 mm lower than that of the inlet pipe.

Where the angle between the inlet and outlet of the manhole deviates by more than 45 ° from the straight or where more than one inlet enter a manhole, the invert level of the outlet shall be 30 mm lower than the lowest inlet invert level.

The soffits of all inlet pipes in a manhole shall be on the same level. If the outlet pipe is bigger than all the inlet pipes, it shall have the same soffit level as the inlet pipes.

To prevent buoyancy of manholes, all manholes deeper than 1,5 m shall be bedded in grade 20 MPa/19 mm concrete to dimensions as specified on drawing STE/R-11. The concrete bases may be partly precast, subject to approval by the Engineer.

All manholes complete with bottom, shall be able to accommodate a water pressure of the full manhole depth, as specified on the drawings, with an additional 50 % safety factor.

Benching must be formed with 20MPa /10mm concrete using dolomitic aggregate.

PS LD 3.5.7 **Step Irons**

Substitute LD 3.5.7 with the following:

Step irons shall be installed in all manholes deeper than 1,2 m. Step irons shall consist of polypropylene coated 12 mm high tensile steel, such as Calcamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer.

PS LD 3.5.8 **Manhole Covers and Frames**

Add the following:

Covers and frames of manholes in roadways and paved sidewalks shall be finished flush with the final road level. Where manholes are not in the roadway, the final cover level shall be constructed to 150 mm above the natural ground level.

Manhole covers shall be Ductile Iron, non-removable, hinged, heavy duty Type 2A complying with EN 124 D400.

Concrete used in foul sewer manholes shall be at least 30 MPa. The minimum cover to reinforcing shall be 50 mm.

PS LD 3.5.9 **Locking Devices for Manhole Covers**

Two 6 mm x 40 mm long stainless-steel grub screws shall be installed in the cover as follows:

i) Two holes must be drilled through the cover on opposite sides to host the screws.

ii) Two threaded holes must be provided in the frame to suit the screws and must be at least 20 mm deeper than required for the screws to accommodate dirt etc. These holes must be drilled through the holes in the cover to ensure accurate alignment.

iii) Incisions must be made in the frame to indicate the positions of the holes after the cover is in place.

PS LD 5 **CONSTRUCTION**

PS LD 5.6 **MANHOLES, INSPECTION CHAMBERS, ETC**

LD 5.4 **CONNECTIONS TO MANHOLES**

Add the following to LD 5.4:

If the gradient of a pipe is more than 1:10, a vertical bend shall be used to connect up to the manhole. The Contractor shall take care that no low point is formed in the pipe as a result of the bend. If a pipe lies at a gradient of 1:10 (5,71°), a 11,25° bend cannot be used since a bend with an angle larger than the grade of the pipe will result in a low point. It is the responsibility of the Contractor to shorten the bend in order to create the required angle.

For pipes with a gradient of up to 1:10, the angle can be taken up by a joint in the manhole and if required, also by the joint between the short-length and first full pipe.

PS LD 5.6.1 **General**

Substitute LD 5.6.1(a) with the following:

Manholes shall be brick or precast concrete for uPVC sewer pipes and GRP for GRP pipes and shall be constructed as shown on drawings or as per manufacturer's specifications.

1. Final cover levels of manholes in streets and paved areas shall be to the same level as the street or paved area.

2. On sidewalks, lawns and garden areas the cover level shall be 20 mm above the final ground level.

3. In midblock sewers it shall be 50 mm above ground level.

4. In the veld 100 mm above natural ground level or shown otherwise.

If a manhole is positioned at a low point or in a hollow where stormwater infiltration may occur, the manhole cover level must be raised to a level to avoid the danger of infiltration, or to a level as agreed with the Engineer.

PS LD 5.6.2 **Benching**

Add the following to LD 5.6.2.3:

Benching for all manholes except those with sand traps shall be in accordance with the drawings bound into the document.

PS LD 5.6.3 **Step Irons**

Add the following to LD 5.6.3:

Step irons shall only be installed in manholes deeper than 1,2 m.

PS LD 5.6.4 **Brick Manholes**

Add the following to LD 5.6.4.3:

Walls of brick manholes, as well as the extension of precast manholes above the concrete roof slab, shall be plastered internally. External plasterwork shall extend to at least 150 mm below ground level. Manholes shall not be extended above the concrete roof slab by more than 300 mm with brickwork.

If manhole covers are raised with bricks, a half-brick recess, as a foothold, shall be left directly below the concrete slab above the step irons.

LD 5.9 **CONNECTING SEWERS**

PS LD 5.9.1 **Location and Details**

Add the following to LD 5.9.1:

Erf connections shall be installed on the exact positions as indicated on the drawings and shall extend 1 m into the erf where it shall be blanked of with an end cap.

All connecting sewers shall be laid at a gradient of 1:60, except where otherwise ordered by the Employer's Agent.

This excludes midblock sewers where connections on the topographical high side can be laid at steeper gradients to end at a minimum depth of 1,2 m or at such greater depth that any point on the erf is able to be connected.

Single and double erf connections for sewers shall be in according with drawing S4.

Add new clauses:

PS LD 5.11 Connections to Existing System

Connection to the existing system will be at an existing manhole.

The benching and channels of the existing manhole shall be adapted to accommodate the new pipe connection. The Contractor shall exercise extreme care when connecting into the existing sewer to prevent the ingress of water and sand into the system. The Contractor shall make good any damage and clean the pipeline should this be necessary. The benching and manhole walls shall be reinstated after completing the channel connection.

Work must be planned and executed in such a manner so as to avoid interruption of the existing service if at all possible.

PS LD 7 TESTS

PS LD 7.1 GENERAL

Add the following to LD 7.1.5:

All tests shall be repeated after the completion of backfilling of pipe trenches.

PS LD 7.2 Tests and Acceptance/Rejection Criteria

PS LD 7.2.6 Watertightness of Manholes

A watertightness test will be called for by the Employer’s Agent’s Representative at the Contractor's expense on every fifth manhole as follows:

The manhole shall be tested by filling internally to cover level with water. After allowing sufficient time for absorption, the loss of water over a one hour period shall be equivalent to the volume of water which has to be added to return the water level to its original position. The manhole will have passed the test provided the volume measured is less than the equivalent of 0,40 litres per millimetre of nominal diameter of manhole per metre depth from cover level to invert per one hour period. Rectification, if necessary, is to be carried out by the Contractor at his own expense.

All of the manholes so tested shall pass the test. If they do not pass, then all the manholes shall be tested at the Contractor's expense.

The test pressures on manholes which have been backfilled shall be increased by the equivalent of the exterior hydrostatic pressure caused by surrounding ground conditions.

The Contractor shall provide all the necessary testing apparatus and materials and shall carry out the tests. The Contractor shall request the Employer’s Agent’s Representative to observe only when he himself is satisfied that the manhole will pass the test.

All manholes that have not been subjected to the watertightness test, shall be visually inspected internally, for ingress of water. All manholes shall be watertight. Manholes that are visibly not watertight shall be repaired at the Contractor’s expense and then subjected to the watertightness test.

PS LD 8 **MEASUREMENT AND PAYMENT**

PS LD 8.2 **SCHEDULED ITEMS**

PS LD 8.2.1 **Supply, Lay, Joint, Bed And Test Pipeline ..... Unit : m**

Add the following to LD 8.2.1:

The internal length of manhole is considered as the nominal internal diameter or size of the manhole shaft at the height where the pipeline connects to the manhole. Short lengths of pipe and additional couplings necessary to connect to manholes and structures are measured under this item.

PS LD 8.2.3 **Manholes**

Add the following to LD 8.2.3:

PS LD 8.2.3.1 **Brick manholes ..... Unit : No**

Brick manholes shall be measured complete as indicated on the drawings and the rate shall be all inclusive for benching, step irons, cover and frame, and it shall make provision for all additional excavation and backfilling.

Manholes deeper than 1,5 m shall be provided with an additional concrete base, if specified by the Engineer. All costs involved for additional excavation, backfilling, material and labour shall be included in the rate for the additional base. These bases will be measured as an extra-over item and shall not be included with manholes.

The depth of manholes as mentioned in the schedule of quantities, shall be measured from the final cover level to the outlet invert level (flow level).

PS LD 8.2.11 **Connection To Existing Sewers ..... Unit : No**

Add the following to LD 8.2.11:

Separate items will be scheduled for each diameter of connecting pipe.

The tendered rate shall include full compensation for connecting the proposed pipe, any additional channelling and benching associated with the connection, cutting the pipe to suit the connection, supplying and building in the short junction pipe, extra couplings, dealing with existing flow, preventing foreign material from entering the sewer and making the connection.

The excavation for pipelines, pipes, backfilling and manholes shall be measured separately.

PS LD 8.2.12 **Connection to existing pipes ..... Unit : No**

Separate items will be schedules for each diameter pipe.

The tendered rate shall include full compensation for connecting the proposed pipe, any additional fittings associated with the connection, cutting the pipe to suit the connection dealing with existing flow preventing foreign material from entering the sewer and making the connection.

PS LE : STORMWATER DRAINAGE

LE 3 **MATERIALS**

LE 3.1 **CULVERT UNITS AND PIPES**

PS LE 3.1 a) Pipes for underground stormwater reticulation shall be spigot and socket type concrete pipes in the sizes and classes indicated on the drawings.

d) **Skewed Ends**

Substitute LE 3.1(d) with the following:

Where pipe culverts are to be constructed with a skew angle of more than 20°, the skew ends shall be cut on site.

PS LE 3.1 f) **Materials for Subsurface Drains**

i) Pipes: uPVC

E 3.4 **MANHOLES, CATCHPITS AND ACCESSORIES**

PS LE 3.4.3 **Manhole Covers, Grid Inlets, Etc.**

Substitute the last sentence in LE 3.4.3 with the following:

Covers and frames for manholes and grid inlets shall comply with the requirements of SABS 558 for Type 2A and Type 9D, and 8-ton gully grids respectively.

LE 5 **CONSTRUCTION**

LE 5.1 **TRENCH BOTTOM**

PS LE 5.1.3 **Unsuitable Founding Conditions**

Substitute "90 % of MAASHTO maximum density" in LE 5.1.3 with "90 % of MAASHTO maximum density (100 % for sand)".

LE 5.2 **BEDDING AND LAYING**

PS LE 5.2.2 **Pipe Culverts**

Add the following to LE 5.2.2:

All pipes shall be laid on a Class C bedding, as specified in SABS 1200 LB.

PS LE 5.4 **BACKFILLING OF PREFABRICATED CULVERT UNITS**

PS LE 5.4.2 **Portal and Rectangular Sections**

Add the following to LE 5.4.2:

Backfilling on the sides of portal and rectangular sections can, if indicated on the drawings and requested in writing by the Engineer, be done with a 1:3:6/38 mix concrete.

LE 5.5 **CATCHPITS, MANHOLES, INLETS, AND OUTLET STRUCTURES**

PS LE 5.5.3 **Plaster**

Add the following to LE 5.5.3:

No plaster is required for manholes or inlets, except where otherwise shown on the drawings or ordered in writing by the Engineer.

PS LE 5.5.5 **Precast Manholes And PS LE 5.5.7 : Precast Inlet And Outlet Structures**

Substitute LE 5.5.5 and LE 5.5.7 with the following:

Manholes and inlet and outlet structures shall be constructed in accordance with the details as shown on the drawings.

LE 8 **MEASUREMENT AND PAYMENT**

LE 8.2 **SCHEDULED ITEMS**

PS LE 8.2.4 **Extra-over Items LE 8.2.1 and LE 8.2.2 for Cutting End Units For Culverts On Site ..... Unit : No**

Add the following to LE 8.2.4:

Payment shall be made only for skew cuts greater than 20° at manholes, kerb inlets and inlet and outlet structures.

PS LE 8.2.8 **Supply And Install Manholes, Catch pits, And The Like ..... Unit : No**

Substitute LE 8.2.8 with the following:

The unit of measurement shall be the number of each, in the depth increments as scheduled, fully installed in accordance with the details shown on the drawings.

The rate shall cover the cost of excavating and backfilling with approved selected material from site borrow pits, stockpile or commercial sources, compacted to 93 % of MAASHTO density (100 % for sand), supplying and installing of all material and accessories, the inlet kerbs and the channel adjacent thereto as well as for the removal and spoil of all surplus material. The rate shall also include the connection of pipes to manholes, catch pits, etc. and of building pipes into the walls of such structures, but not for the cutting of skewed ends.

PS LE 8.2.14 **Supply and Install Subsurface Drains According to Drawings ..... Unit : m**

a) Supply and Install Subsurface Drains Unit: m

The length shall be measured on the centreline of the completed subsurface drain, where indicate on the drawings or instructed by the Employer's Agent's Representative. The rate shall cover the cost of excavation, backfilling, supplying, transporting, off-loading and installing all materials required as well as cutting, wasting, overlapping, overhaul and installation of the materials in accordance to the detail drawing.

The rate shall be inclusive of the slotted drainage pipes of specified diameter, free draining sand and stone, filter fabric and connecting into existing manholes or kerb inlets, all in accordance with the detail drawing.

b) Sub-surface drain rodding eye Unit: No.

The unit of measurement is the number of rodding eyes supplied and installed. The rate shall include full compensation for all costs, overheads and profits associated with the works.

PS LE 8.2.15 **Connecting Subsurface Drains to Manholes, Kerb Inlets, Etc ..... Unit : No**

The number is the number of subsurface drainpipes built in at manholes or kerb inlets.

The rate shall cover the cost of all labour, plant and materials necessary to connect the sub-surface drain to manholes and/or kerb inlets, and making the structure watertight, all as shown on the drawings.

PS LE 8.2.16 **In Situ Concrete Invert Slabs for Portal Culverts ..... Unit : m**

The rate covers the supply, delivery and placement of all material as indicated on the drawing, including all required formwork, as well as the wood-floated finishing thereof.

PS LE 8.2.17 **Concrete Lined Channels ..... Unit : m**

Channels of different shapes and sizes will be scheduled separately.

The rate shall cover the cost of the supply, delivery and placing of all materials as specified on the drawings, including formwork, wood-floated finishing, steel reinforcement, weep-holes and filter materials wrapped in geotextile below and alongside the channels and compaction and preparation of the channel bed to 93 % of modified AASHTO maximum density, all as specified on the drawings.

PS LE 8.2.18 **Expansion Joints ..... Unit : m**

Expansion joints for the different channels will be scheduled separately. The length shall be measured on the surface of the completed expansion joints.

The item shall be extra-over PS LE 8.2.17 and the rate shall cover all costs of the construction of the joint, complete as specified on the drawings.

PS ME : SUBBASE

ME 3 **MATERIALS**

ME 3.2 **PHYSICAL PROPERTIES**

PS ME 3.2.1 **Subbase Material**

Substitute ME 3.2.1 with the following:

a) Materials of G5 quality for use in the unstabilised subbase shall comply with the requirements of SABS 1200 M 3.3.3.

b) Materials of G7 quality for use in the unstabilised subbase shall comply with the requirements as specified in SABS 1200 M 3.3.3, except that the maximum aggregate size after compaction shall not exceed 63 mm.

ME 3.3 **STABILISING AGENT**

PS ME 3.3.1 **General**

Substitute ME 3.3.1 with the following:

Where ionic stabilisation is required, the stabilising agent shall be approved by the Engineer, and the rate of application shall be 0,03 ℓ/m^2 for layer thickness of 150 mm and 0,02 ℓ/m^2 for layer thicknesses of 100 mm.

ME 5 **CONSTRUCTION**

ME 5.4 **PLACING AND COMPACTION**

PS ME 5.4.1 **Placing**

Substitute "the project specification" in the second paragraph of ME 5.4.1 with "ME 6.1.4".

PS ME 5.4.5 **Work In Restricted Areas**

No additional payment shall be made for work in restricted areas and any relevant costs shall be deemed to be included in the tendered rates.

PS ME 5.5.6 **Curing**

Substitute ME 5.5.6 with the following:

Stabilised layers will be protected against desiccation during the first 7 days after construction, by lightly watering the layer to ensure the surface is always damp. Only light water sprinklers must be used seeing that heavy sprinklers will damage the layer. Any negligence to ensure above mentioned is implemented, may result into the disapproval of the layer. In that case, the Contractor will on his own costs, break up the layer, re-stabilise and compact. Compaction and indicator tests will be done on the first day after completion of construction. No other traffic, except the vehicles that water the layer, will be allowed on the layer within 7 days after stabilising have been completed.

ME 5.7 **TRANSPORT**

PS ME 5.7.1 **Free-haul**

Substitute ME 5.7.1 with the following:

An unlimited free-haul distance shall apply to subbase material.

ME 7 **TESTING**

ME 7.2 **PROCESS CONTROL AND ROUTINE INSPECTION AND TESTING**

PS ME 7.2.1 **Process Control**

Substitute "1 500 m^2" with "1 200 m^2" and "5 000 m^2" with "3 000 m^2" in Table 2 of ME 7.2.1.

PS ME 7.2.2 **Routine Inspection and Testing**

Substitute the second sentence of ME 7.2.2 with the following:

No density shall be less than the specified minimum density for the relevant layer.

ME 8 **MEASUREMENT AND PAYMENT**

PS ME 8.2 **COMPUTATION OF QUANTITIES**

Substitute ME 8.2 with the following:

Measurement and payment shall be to the exact dimensions as shown on the drawings.

ME 8.3 **SCHEDULED ITEMS**

PS ME 8.3.3 **Gravel Wearing Course from Commercial Sources ..... Unit : m^3**

Add the following to ME 8.3.3:

Material imported from commercial sources shall comply with the requirements as specified in PS ME 3.2.2.

PS ME 8.3.8 **Stabilising Agent**

Add the following sub item to ME 8.3.8:

No additional payment will be made for Stabilising Agent within small areas. The rate per ton will be applicable for any size of area that must be stabilised.

g) Ionic stabilising agent ..... Unit : ℓ

The rate shall also cover the cost of application and mixing in of the stabilising agent.

PS ME 8.3.11 **Preparation of Road bed to a depth of 150 mm as subbase compacted to 95 % of MAASHTO density (100 % for sand) ..... Unit : m^3**

The rate covers the cost of crust breaking up to a minimum depth of 150 mm, watering, shaping, building and compaction of subbase, final scraping, compliance with the tolerances and testing.

PS MF : BASE

MF 3 **MATERIALS**

MF 3.3 **PHYSICAL AND CHEMICAL PROPERTIES**

PS MF 3.3.1 **Natural Gravel (Unstabilised or Stabilised)**

Substitute the requirements of MF 3.3.1 for unstabilised natural gravel with the following:

1) Natural gravel, of G4 quality which is placed in the base shall, after compaction, comply with the requirements of SABS 1200 M 3.3.3.

2) Natural gravel, of G5 quality which is placed in the base shall, after compaction, comply with the requirements of SABS 1200 M 3.3.3.

PS MF 3.3.2 **Graded Crushed Stone**

Substitute the requirements of MF 3.3.2 with the following:

Graded crushed stone placed in the base shall, after compaction, comply with the requirements for type G1 as specified in 3.3.3 in SABS 1200 M.

PS MF 3.3.3 **Graded Crushed Stone And Soil Fines**

Substitute the requirements of MF 3.3.3 with the following:

Graded crushed stone that is admixed with soil fines, placed in the base shall comply with the requirements for type G2 or G3 as specified in 3.3.3 in SABS 1200 M.

MF 5.4 **PLACING AND COMPACTION OF A BASE OTHER THAN A WATER BOUND MACADAM BASE**

PS MF 5.4.6 **Work In Restricted Areas**

No additional payment shall be made for work in restricted areas and any relevant costs shall be deemed to be included in the tendered rates.

MF 5.9 **TRANSPORT**

PS MF 5.9.1 **Free-haul**

Substitute M 5.9.1 with the following:

An unlimited free-haul distance shall apply to basecourse material.

MF 6 **TOLERANCES**

MF 6.1 **DIMENSIONS, LEVELS, ETC**

PS MF 6.1.2 **Grade**

Add the following to MF 6.1.2:

In addition to the above-mentioned requirements the surface shall be of such a grade that all surface water shall drain freely to the adjacent kerbs and/or channels, and all subsequent costs to rectify the surface to comply hereto shall be borne by the Contractor.

MF 7 **TESTING**

PS MF 7.2 **PROCESS CONTROL**

Substitute "1 500 m^2" with "1 200 m^2", "1 500 m^3" with "1 200 m^3" and "5 000 m^2" with "3 000 m^2" in Table 3 of MF 7.2.

MF 7.3 **ROUTINE INSPECTION AND TESTING**

Substitute MF 7.3.2 with the following:

No density shall be less than the specified minimum density for the relevant layer.

MF 8 **MEASUREMENT AND PAYMENT**

PS MF 8.2 **COMPUTATION OF QUANTITIES**

Substitute MF 8.2 with the following:

PS ME 8.2 shall apply mutatis mutandis.

PS MJ: SEGMENTED PAVING

MJ 3 **MATERIALS**

MJ 3.1 **UNITS**

PS MJ 3.1.2 **Class, Strength And Type**

Add the following to MJ 3.1.2:

Areas as indicated on the drawings shall be paved with 80 mm thick Type S-A Class 35 precast concrete blocks (interlocking type).

MJ 5 **CONSTRUCTION**

PS MJ 5.7 **JOINT FILLING**

Joint filling shall be done with sand (A3 specification).

MJ 6 **TOLERANCES**

PS MJ 6.2 **PERMISSIBLE DEVIATIONS**

Add the following to MJ 6.2:

The degree of accuracy shall be degree I.

MJ 8 **MEASUREMENT AND PAYMENT**

MJ 8.2 **SCHEDULED ITEMS**

PS MJ 8.2.2 **Construction Of Paving Complete ..... Unit : m^2**

Add the following to MJ 8.2.2:

The rate shall also cover the cost of the joint filling and 25mm thick sand layer beneath paving as specified in PS MJ 5.7.

PS MK: KERBING AND CHANNELLING

MK 3 **MATERIALS**

MK 3.2 **PRECAST KERBING AND CHANNELLING**

PS MK 3.2.3 **Strength**

Substitute MK 3.2.3 with the following:

Precast kerbs, edging and channels shall be of grade 20 MPa/19 mm concrete.

PS MK 3.9 **BEDDING MATERIAL**

Substitute MK 3.9 with the following:

The material on which concrete kerbs, channels and edging are bedded, shall be in accordance with the dimensions shown on the drawings and shall consist of a 1:3:6 concrete mix with a 6,7 mm single size coarse aggregate.

MK 5 **CONSTRUCTION**

PS MK 5.1 **EXCAVATION AND BEDDING**

Substitute "90 %" in MK 5.1 with "93 % (100 % for sand)".

PS MK 5.2 **PRECAST CONCRETE KERBING AND CHANNELLING**

Substitute the first sentence of MK 5.2 with the following:

Precast concrete kerbing and channelling shall be laid and bedded on concrete bedding complying with the requirements of PS MK 3.9 and to the dimensions shown on the drawings.

PS MK 5.11 **TRANSITION SECTIONS AND INLET AND OUTLET STRUCTURES**

Substitute the first sentence of the second paragraph of MK 5.11 with the following:

Inlet and outlet structures shall be in accordance with the details shown on the drawings.

MK 8 **MEASUREMENT AND PAYMENT**

PS MK 8.1 **BASIC PRINCIPLES**

Substitute the second sentence of MK 8.1.1 with the following:

Deductions will be made for catch pits, etc.

Add the following to MK 8.1.1:

Payment shall include the provision of expansion joints as specified.

PS MK 8.2.15 **Transition Kerbs (In situ) ..... Unit : No**

The tendered rate shall cover all costs for material and labour to construct in situ transition kerbs and/or channels with a length of 1,0 m to fit the profiles of the different types of kerbs and channels.

PART C4 :
SITE INFORMATION

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

PG-03.2 (EC) SITE INFORMATION – JBCC 2000 PRINCIPAL BUILDING AGREEMENT (EDITION 6.2 OF MAY 2018)

Project title:	**CONSTRUCTION OF NEW KEIMOES MAGISTRATE'S OFFICE**				
Tender no:	KIM03/2023	**WCS no:**	*046641*	**Reference no**:	*19/2/4/2/2/2324/7*

C4 Site Information

1. **GENERAL**

The site for the Construction of the New Keimoes Magistrate Office is located on the remainder of erf 2867 in Lang Street, Keimoes in the Northern Cape. It is situated next to the existing Keimoes SAPS station.

Upington is the closest major town to Keimoes and is situated approximately 40km north-east of Keimoes.

See the attached Location map on Drawing 25716-A1000-00.

2. **COMPULSORY SITE INSPECTION**

A compulsory pre-tender site inspection will be held at the site at Lang street, Keimoes street on 26 October at 11:00.

The principal agent will meet prospected tenderers at the site. The site inspection certificate (DPW-16) as included in this document must be submitted on the site to the Principal Agent for confirmation in attending the non-compulsory site inspection.

Tenderer must acquaint themselves with the nature of the works, the site conditions, access to the work, defined works areas, etc. at this meeting.

3. **ADJACENT PREMISES OCCUPIED**

The existing SAPS complex premises adjacent to the site will be in use and occupied during the execution of the works.

The contractor shall execute the works with the least interfere with the general routine of the occupants of the buildings and the operation of the Police station and cell block and minimise any nuisance from dust, noise or other causes. (see clause B3.3 of Preliminaries for pricing purposes)

4. **ACCESS**

The site is accessible via existing tarred roads from National Route N14 (main road) via Jooste Street and right into Lang Street.

Security clearance and access permits need to be arranged for all personnel that will be working on the premises.

5. DAMAGE TO EXISTING SERVICES

The Contractor shall be solely responsible for ensuring that every necessary precaution is taken to protect all existing services on site from any damage. Damage to existing services by the contractor must be repaired without delay and with no expenses to the employer. The contractor shall make any necessary allowances in his pricing for the disruptions and costs that will be required to comply with any such restrictions

6. GENERAL SITE ESTABLISHMENT

Approval for the establishment of a construction camp must be obtained from the SAPS and the neighbours. The Contractor is responsible for all arrangements for obtaining approval, establishment and subsequent removal and reinstatement of his construction camp.

The contractor must at all time limit his personnel, plant, equipment and materials to the Contractor's site or the working areas as approved by the Principal Agent.

No personnel shall be accommodated on the grounds. Only guards approved by the Employer and on duty may be on site at all times.

The contractor shall make his own arrangements for the supply of electrical power, water telecommunication services, ablution facilities, sewer services, first aid facilities and other services, the payment thereof and all reinstatements required upon completion.

The site has very limited availability area for storage, plant and material.

7. ENCLOSURE OF THE WORKS

The contractor shall erect, maintain and remove at completion barriers necessary for the enclosure of the works and the protection of the public, staff and others.

8. GEOTECHNICAL INVESTIGATION

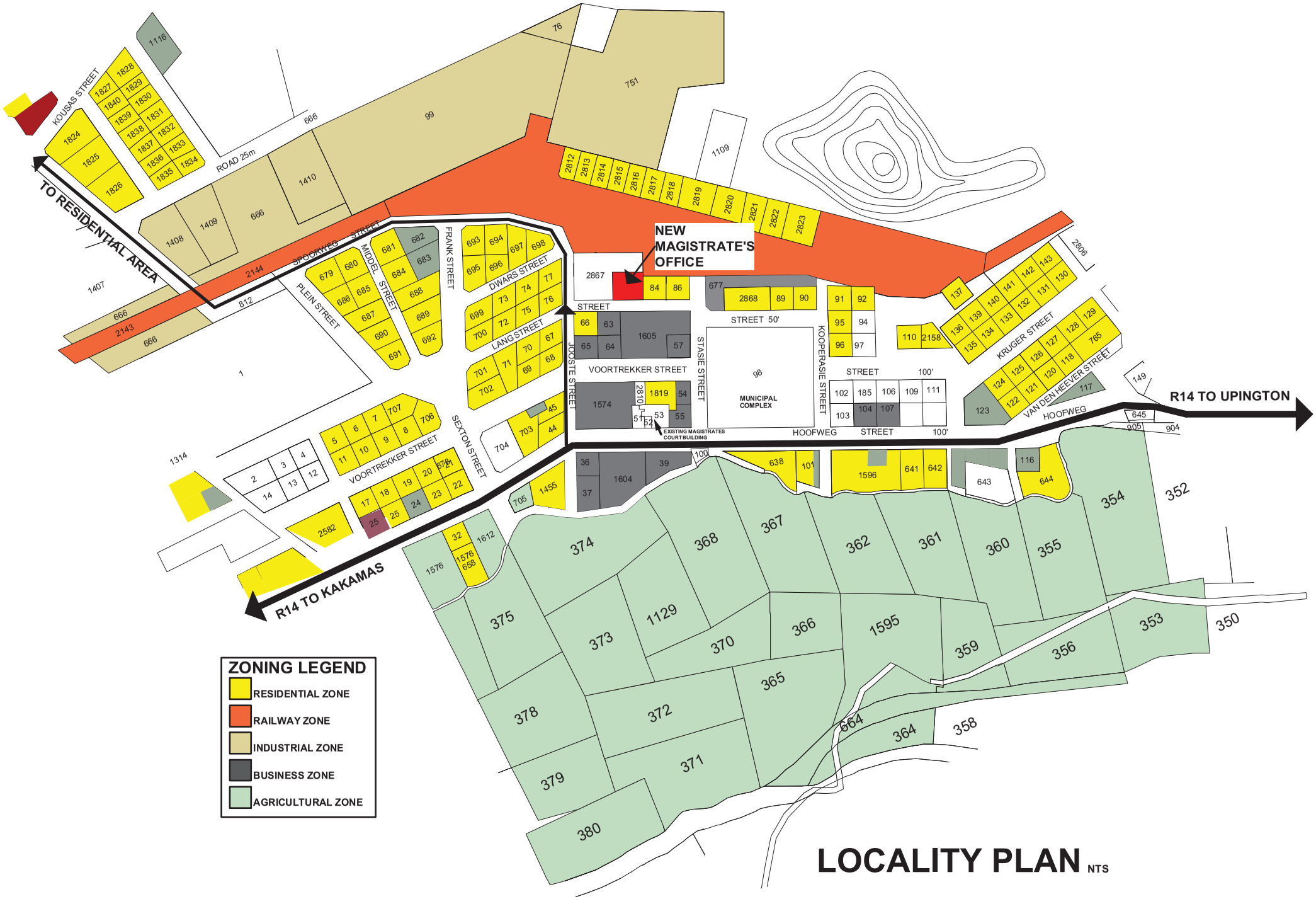
The Geotechnical report is attached to this document.

9. DISTURBANCE

The contractor shall keep the site, structures, etc, well-watered during operations to prevent dust.

10. CLEANING

The contractor shall be responsible for the removal of any waste, rubbish and superfluous material that may accumulate on the site. The removal of the waste and the proper disposal thereof elsewhere, will be at his own cost. No indiscriminate spoiling of material will be allowed and unsuitable surplus material shall be removed from the site to a suitable and approved spoil site.



LOCALITY PLAN NTS

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GEOTECHNICAL CONDITIONS ON THE REMAINDER OF ERF 2867 KEIMOES : A PHASE 3 REPORT FOR THE PROPOSED CONSTRUCTION OF THE PROPOSED MAGISTRATE'S OFFICE

1 INTRODUCTION

1.1 Appointment

It is envisaged to construct a new office for the magistrate on the remainder of Erf 2867, Keimoes, in the Northern Cape. For this purpose Soilkraft was appointed by Mr Herman Schmidt of WorleyParsons RSA (Pty) Ltd to conduct a geotechnical investigation on the property. The investigation undertaken is deemed to comply with the requirements of a Phase 3 detail investigation as proposed by the Council for Geoscience[Reference 9.1].

1.2 Reporting

Three printed and bound copies of the report are supplied to the client. An electronic copy of the report is also supplied to enable the client to adjust the site plans to a scale convenient to him and to provide additional copies of the report, should it be required. All printed drawings in the hard copies are in A4 format, and serve for illustrative purposes only.

1.3 Scope of the Report

The report is compiled to determine geotechnical conditions on the property as detailed indications of what may be expected. Information obtained can not be extrapolated to adjacent properties. For purpose of this investigation the focus was on the following conditions :

- Founding Conditions.
- Conditions of Excavation.
- Soil Chemistry.
- Materials Utilization.

2 INVESTIGATION CONSTRAINTS

It was originally proposed to excavate some six test pits in a representative pattern across the property. However, at the time of investigation it was found that virtually the entire area of the stand was used for stocking building material for the construction of the new police station on the adjacent property. Three test pits were thus excavated in areas that could be reached. Discussing the soil profile encountered during the survey with the resident engineer for the construction of the police station, it appears as if virtually the same materials profiles are encountered on both properties.

3 SITE DESCRIPTION

3.1 Site Location

Access to the property from National Route N14 is via Jooste Street and right into Lang Street. The area of investigation is located on the left of Lang Street, second stand from the corner opposite the Agrimark. The total area of the property is 1590m^2.

Refer to the attached Figure 1 : Locality Plan.

3.2 Topography and Drainage

The land investigated is located between 732 mamsl and 735 mamsl. The site is located within an existing residential area with level landscape. Slope across the site is less than 2% towards the south. Drainage takes place by means of sheetwash and infiltration. Surface run off is contained in the street and disposed of by means of an engineered stormwater system.

3.3 Vegetation and Landscape

Based on the work done by Mucina[Reference 9.2] the area of investigation is referred to as Bushmanland Arid Grassland. The landscape features are described as consisting of extensive to irregular plains on a slightly sloping plateau, vegetated sparsely by grassland dominated by various species of white grasses. The vegetation type gives the land the character of semi-desert steppe. In years of abundant rainfall displays of annual herbs can be

Figure 1 : Locality Plan

expected.

On site it was found that the land surface was covered by bricks and all sorts of builder's requirements. A single, very large Acacia erioloba tree is present on the stand. Conditions on the site are illustrated on Photo 1.

3.4 Climate and Weather Conditions

The site is located in an area with a Weinert N-value between 30 and 35 and a Thornthwaite Moisture Index less than -40. Climatically the area may thus be described as arid. The importance of this is that mechanical breakdown of rock material will take place, rather than chemical decomposition there of that may result in the formation of expansive clay even if the suitable parent material is available. Especially minerals like amphiboles, pyroxenes and olivine are susceptible to such weathering.

Rainfall occurs in late summer and early autumn and may vary considerably from year to year. The occurrence of whirlwinds is common on hot, summer days. The mean annual rainfall varies between 70mm to 200mm. The mean maximum monthly temperature of 41°C occurs in January ; and the mean minimum monthly temperature of -3,7°c occurs in July.

3.5 Existing Facilities

Municipal services are supplied to the site. All normal services usually associated with residential development are thus available.

4 NATURE OF INVESTIGATION

4.1 Soil Profiling

Three test pits were excavated with a Caterpillar 428 TLB provided by Mr Rosco Spangenberg. The test pits were excavated on 23 April 2013. The test pits were profiled by a professionally registered geotechnical engineer according to the guidelines of SAICE and SAIEG[Reference 9.3]. For the benefit of the non-geotechnical reader of this document, these guidelines are summarized in the attached Table 1 : Soil Profiling Parameters. The profiles of the test pits may be found in Addendum A to this report. The profile descriptions reflect the impressions created by the pedological conditions and may sometimes be in slight variance with the results of the soil testing.

Photo 1 : Site Conditions.

TABLE 1 : SOIL PROFILING PARAMETERS

CONSISTENCY : GRANULAR SOILS

SPT N	GRAVELS & SANDS Generally free draining soils		DRY DENSITY (kg/m^3)
<4	Very loose	Crumbles very easily when scraped with geological pick. Requires power tools for	<1450
4-10	Loose	Small resistance to penetration by sharp pick point. requires many blows by pick point	1450-1600
10-30	Medium dense	Considerable resistance to penetration by sharp pick point.	1600-1750
30-50	Dense	Very high resistance to penetration by sharp pick point. Requires many blows by pick point for excavation.	1750-1925
>50	Very dense	High resistance to repeated blows of geological pick. Requires power tools for excavation.	>1925

CONSISTENCY : COHESIVE SOILS

SPT N	SILTS & CLAYS and combinations with SANDS. Generally slow draining soils		UCS (kPa)
<2	Very soft	Pick point easlily pushed in 100mm. Easily moulded by fingers.	<50
2-4	Soft	Pick point easlily pushed in 30mm to 40mm. Moulded by fingers with some pressure.	50-125
4-8	Firm	Pick point penetrates to 10mm. Very difficult to mould with fingers.	125-250
8-15	Stiff	Slight indentation by pick point. Cannot be moulded by fingers. Penetrated by thumb nail.	250-500
15-30	Very stiff	Slight indentation by blow of pick point. Requires power tools for excavation.	500-1000

SOIL TYPE

SOIL TYPE	PARTICLE SIZE(mm)
Clay	<0,002
Silt	0,002-0,06
Sand	0,06-2,0
Gravel	2,0-60,0
Cobbles	60,0-200,0
Boulders	>200,0

MOISTURE CONDITION

Dry	No water detectable
Slightly moist	Water just discernable
Moist	Water easily discernable
Very moist	Water can be squeezed out
Wet	Generally below water table

COLOUR

Speckled	Very small patches of colour <2mm
Mottled	Irregular patches of colour 2-6mm
Blotched	Large irregular patches 6-20mm
Banded	Approximately parallel bands of varying colours
Streaked	Randomly orientated streaks of colour
Stained	Local colour variations : Associated with discontinuity surfaces

SOIL STRUCTURE

Intact	No structure present.
Fissured	Presence of discontinuities, possibly cemented.
Slickensided	Very smooth, glossy, often striated discontinuity planes.
Shattered	Presence of open fissures. Soil break into gravel size blocks.
Micro shattered	Small scale shattering, very closely spaced open fissures. Soil breaks into sand size crumbs.
Residual structures	Residual bedding, laminations, foliations etc.

ORIGIN

Transported	Alluvium, hillwash, talus etc.
Residual	Weathered from parent rock, eg residual granite
Pedocretes	Ferricrete, silcrete, calcrete etc.

DEGREE OF CEMENTATION OF PEDOCRETES

TERM	DESCRIPTION	UCS (MPa)
Very weakly cemented	Some material can be crumbled between finger and thumb. Disintegrates under knife blade to a friable state.	0,1-0,5
Weakly cemented	Cannot be crumbled between strong fingers. Some material can be crumbled by strong pressure between thumb and hard surface. Under light hammer blows disintegrate to a friable state.	0,5-2,0
Cemented	Material crumbles under firm blows of sharp pick point. Grains can be dislodged with some difficulty by a knife blade.	2,0-5,0
Strongly cemented	Firm blows of sharp pick point on hand-held specimen show 1-3mm indentations. Grains cannot be dislodged by knife blade.	5,0-10,0
Very strongly cemented	Hand-held specimen can be broken by single firm blow of hammer head. Similar appearance to concrete.	10,0-25

4.2 Materials Testing

Soil testing was done at the laboratory facilities of Roadlab/Prehab JV in Upington. The soils testing schedule for a Phase 2 investigation as per the GFSH 2 document was used as a guideline towards the extent of the testing. Although the GFSH 2 document requires the

retrieval of undisturbed soil samples for consolidation testing, it was not possible to do so in this case. The dense and granular consistency of the residual soils resulted in the disintegration of soil samples, even in the process of sample cutting.

Soil testing consisted of the following :

- Conductivity and pH determinations on samples of the in-situ soils to determine the corrossivity there of.
- Foundation indicator testing on samples of the in-situ soils to determine possible conditions of heave.
- CBR and road indicator testing to determine the suitability of the alluvium to be utilized as road layerworks.

The results of the soil testing may be found in Addendum B. However, for easy reference, these results are summarized in the attached Table 2 : Summary of Soil Testing.

5 SITE GEOLOGY AND GROUNDWATER CONDITIONS

5.1 Geology

Two geological units can be identified on site as follows :

5.1.1 Mokalanen Formation

The Mokalanen Formation consists of calcrete straddling the boundary between the Pliocene and the Quaternary eras, between 2,6 million and 2,8 million years ago. Pedogenic deposits of the Mokalanen Formation occur as hardpan or nodular calcrete in the area. On site the Mokalanen Formation was encountered as fine grained, dirty white, nodular calcrete of in conjunction with residual soils in all the test pits.

5.1.2 Vaalputs Granite

Bedrock in the area under investigation occurs as igneous rock of the Keimoes Suite, consisting of the so-called Vaalputs granite. There is some disagreement among stratigraphic geologists whether the rock material should be classified as gneiss or granite. For purposes of this report and based on the information as per the official geology map, it is regarded as being of granitic origin. The granite is described as medium coarse grained, non-foliated and grey in colour. The mineral assemblage is adamelitic, consisting of quartz-feldspate-biotite with inclusions of older quartzite, presumably originating from the older Formation Goede Hoop.

Table 2 : Results of Soil Testing

Fault zones, shear zones or intrusive dykes or sills were not encountered during the investigation.

The regional geology of the area is indicated on the attached Figure 2 : Regional Geology.

5.2 Soil Profiles

Three distinct horizons of soil were encountered on site, as follows :

5.2.1 Alluvium

Alluvium occurs as a surface horizon on site and was encountered in the three test pits, extending to a depth between 600mm and 900mm. The deposits of alluvium most probably originate from shifting of the course of the Orange River, or paleo-flooding that may have taken place. The alluvium is described as light brown, loose, intact, fine sand with matrix supported, fine subrounded gravels of quartz. The results of soil testing on two samples of alluvium indicate the plasticity index of the alluvium to vary between three and four ; and the grading modulus between 1,18 and 1,30. The clay content of the samples tested varied from 5,3% to 5,8%. The PRA soils classification of the alluvium is A-2-4(0) and the Unified classification is SM.

5.2.2 Nodular Calcrete

Nodular calcrete of the Mokalanen Formation was encountered in all the test pits underlying the alluvium. It occurs in close conjunction with the residual granite and in most cases as one horizon. It forms an irregular horizon of material, extending to deeper than 2000mm in TP 1, but only to 800mm deep in TP 3. It is described as abundant clast supported, coarse angular gravels of calcrete, quartz and granite in a matrix of light brown, fine sand of dense consistency. The results of soil testing on a sample of the nodular calcrete indicate a plasticity index of four and a grading modulus of 2,16. The clay content of the sample tested is 2,5%. The PRA soils classification of the nodular calcrete is A-1-a(0) and the Unified classification is SP.

5.2.3 Residual Granite

Residual granite was encountered in all the test pits in close conjunction with the nodular calcrete, but as pure material only in TP 3 underlying the nodular calcrete from a depth of 800mm. It is described as dirty white speckled black, coarse sand with lenses of light brown, fine sand. The overall consistency is dense and the material quality tended to very soft rock. The results of soil testing on a sample of the residual granite indicate a plasticity index of

Figure 2 : Regional Geology

three and a grading modulus of 1,96. The clay content of the sample tested is 2,1%. The PRA soils classification of the residual granite is A-1-b(0) and the Unified classification is SP.

5.3 Groundwater

- *Perched Water* : No perched water was encountered during the survey in any of the test pits. Considering the climate of the area and the nature of in situ materials, it is anticipated that perched water will not prove problematic on the site. Even if it did occur, the grading of in situ materials is such that draining will take place fairly rapidly. Furthermore, it is expected that perched water and/or surface seepage may occur shortly after precipitation events and in years of excessive rain.
- *Permanent Water* : Vegter[Reference 9.4] indicates the probability for drilling successfully for water in the area to be between 40% and 60%, and the probability that such a borehole will yield more than 2l/s is less than 10%. Groundwater is expected to occur at depths between 20 and 30 meters in fractures restricted to a zone directly below the water table.

6 GEOTECHNICAL EVALUATION

6.1 Engineering and Material Characteristics

Based on studies done by the US Army Corps of Engineers, Brink[Reference 9.5] reports the compressibility of materials of SP and SM classifications in the Unified system as present in the test pits to be low once compacted, but both materials may be subject to erosion.

Other considerations are :

6.1.1 Properties of Heave

The results of the materials tests indicate the in-situ soils are not expansive. The building site is thus not subject to heave.

6.1.2 Properties of Settlement

- *Alluvium* : The surface horizon is of loose consistency and subject to settlement if any structures are founded on them. Partridge[Reference 9.6] indicates that foundation precautionary measures may potentially be required if the vertical extent of such a horizon of compressible material exceeds 700mm.
- *Residual Granite* : The residual granite that occurs in conjunction with the nodular calcrete is in principle of medium dense to dense consistency, but may contain pockets of loose material as encountered in TP 2. In principle any structure founded on this horizon

will be less subjected to settlement than one founded on the overlying alluvium, but some differential settlement may occur due to the presence of the pockets of loose material.

6.1.3 Geotechnical Zoning

Based on the above discussion, the entire land parcel can be regarded as being of a single geotechnical classification. Considering the guidelines posted by IStructE[Reference 9.7], settlement between 10mm and 20mm may take place if single storey structures of masonry construction are founded at a depth of approximately 500mm. At this depth the founding horizon will consist of alluvium overlying residual granite and nodular calcrete. The stand is thus zoned as “S1”.

The above information is indicated on the attached Figure 3 : Geotechnical Zoning.

6.2 Soil Corrossivity

When discussing soil corrossivity, it is applicable to consider the guidelines as proposed by Evans[Reference 9.8]. The corrossivity of a soil towards buried, exposed, metallic surfaces is dependent on the following properties of the soil :

- Electrical conductivity.
- Chemical properties of the soil.
- Ability of the soil to support sulphate reducing bacteria.
- Heterogeneity of the soil.

The tests carried out for the compilation of this report must be considered as indicative of the corrossivity of the soils only. The pH of a soil gives an indication of potential acid related problems. Should the soil pH be less than 6,0, corrosion may take place ; and should the pH be less than 4,50, the problem of corrosion may be serious. If the conductivity of the soil is less than 0,1mScm^{-1}, corrosiveness is generally not a problem. However, the potential of the soil increases with an increase in conductivity. Should the conductivity of the soil exceed 0,5mScm^{-1}, the soil can be regarded as very corrosive. Should exposed metal pipes pass from argillaceous soils to arenaceous soils or vice versa, electrochemical cells are set up due to the different rates of oxygen diffusion of the soils. Sulphate reducing bacteria is usually present under anaerobic conditions, that is, typically saturated or waterlogged clays.

The results of the chemical testing carried out for this report indicate the following :

- *Soil Acidity* : The pH of the soil samples of soil tested varied between 8,08 and 8,64. The soils are thus regarded as non-corrosive due to the acidity there of.

Figure 3 : Geotechnical Zoning.

- *Water Soluble Salts Content* : The conductivity of the samples of soil varied between 0,55mScm^{-1} to 1,19mScm^{-1}. The soils can thus be regarded as highly corrosive due to the presence of water soluble salts.

Other considerations are :

- *Heterogeneity of the Soil* : Conditions of corrosive soils due to a heterogeneous soil profile do not occur on the property.
- *Water Logged Soils* : Conditions of water logged soils do not occur on site.

6.3 Materials Utilization

As far as the suitability of the in-situ materials for utilisation in the construction of earthworks is concerned, the results of the soil testing indicate materials of suitable quality for earthworks to be present on site. Based on the results of compaction and indicator testing, the quality of the alluvium is G6 in the TRH 14 classification. The material is thus suitable to be used for layerworks up to selected layer in lightly trafficked roads and also as surface bed layer underneath floor slabs.

6.4 Excavation Classification

Materials of consistency less than very dense can normally be excavated manually or with a TLB ; very dense material may be excavated with considerable effort with a TLB (not economically) but usually with an excavator or explosives and may be classified as hard excavation. One can thus see that it will be possible to excavate generally to a depth of approximately 1500mm to 2000mm on site with a TLB, after which it will be more economical to use alternative methods.

One can thus summarise by stating :

- All soils can be regarded as soft excavation.
- Pedocretes can be regarded as soft excavation.
- Bedrock of unweathered granite can be regarded as hard excavation.
- Conditions of wet or clayey excavation are not expected.
- The side walls of trenches excavated to a maximum depth of 1500mm are expected to be stable.

6.5 Seismicity

The closest source of seismic measurements to Upington under control of the Council for

Geoscience is Tontelbos. Kijko[Reference 9.9] indicates the annual probability for an earthquake with intensity of 4,2 on the Modified Mercalli Scale to occur in the area to be less than 10^{0} ; and with an intensity of 8,5 to occur the probability to be less than 10^{-4}. A 10% probability exists that an earthquake with Peak Ground Acceleration of 0,09g may take place once in 50 years at Keimoes. A 10% probability of an event with magnitude less than 100cms^{-2} to take place once in 50 years is regarded as most favourable ; natural seismic activity with magnitude exceeding 100cms^{-2} is regarded as unfavourable.

To put the above information into perspective, Table 3 : Earthquake and Magnitude and Intensity, is attached to this report.

6.6 Other Considerations

Apart from the individual conditions as discussed, the following is applicable :

- *Undermined Ground* : Undermining has not taken place in the area.
- *Dolomite and Limestone Stability* : The area is not subject to the presence of dolomite and limestone related instabilities.

7 CONCLUSIONS

It is concluded that the site can be regarded as suitable with constraints for the construction of the new office for the magistrate. The following conditions prevail :

- *Geology* : The area under investigation is located on Vaalputs granite of the Keimoes Granite Suite.
- *Soil Profiles* : The surface soil cover consists of a surface horizon of alluvium overlying residual granite sand including coarse gravels of Mokalanen calcrete.
- *Hydrology* : In general terms, it is expected that seasonal perched water will be absent from site. Surface drainage takes place by means of sheetwash and is disposed of in an engineered stormwater system.
- *Founding Conditions* : Based on the distribution of the soil profiles on the property, the area is regarded as S1. Structures founded in the alluvium may be subject to unwanted settlement and differential settlement due to the properties of the material. Settlement of the future structure will be decreased if it is founded within the horizon of residual granite/calcrete gravels.
- *Materials Utilization* : The alluvium is of G6 quality and suitable for the construction of road layerworks up to subbase level for lightly trafficked roads and also as surface beds.

TABLE 3 : EARTHQUAKE MAGNITUDE AND INTENSITY

MODIFIED MERCALLI INTENSITY SCALE	INTENSITY	DESCRIPTION	RICHTER SCALE MAGNITUDE	RADIUS OF PERCEPTIBILITY (km)
I	Instrumental	Detected only by seismography		
II	Feeble	Noted only by sensitive people	3.5 to 4.2	3 to 24
III	Slight	Like the vibrations due to a passing lorry. Felt by people at rest, especially on upper floors		
IV	Moderate	Felt by people while walking. Rocking of loose objects, including vehicles	4.3 to 4.8	24 to 48
V	Rather strong	Felt generally ; most sleepers are awakened and bells ring		
VI	Strong	Trees sway and suspended objects swing ; damage by overturning and flling of loose objects	4.9 to 5.4	48 to 112
VII	Very strong	General public alarm ; walls crack ; plaster falls	5.5 to 6.1	110 to 200
VIII	Destructive	Car drivers seriously disturbed; masonry fissured ; buildings damaged	6.2 to 6.9	200 to 400
IX	Ruinous	Houses collapse ; pipes break		
X	Disasterous	Ground cracks badly ; buildings destroyed ; railway lines bent ; landslides on steep slopes	7.0 to 7.3	400 to 700
XI	Very disasterous	Few buildings remain standing; bridges destroyed ; all services out of action ; great landslides and floods	7.4 to 8.1	400 to 700
XII	Catastrophic	Total destruction ; objects thrown into the air; ground rises and falls in waves	>8.1	400 to 700

- *Excavation Potential* : It is expected that conditions of hard rock excavation prevail at depths deeper than 2000mm. The overburden can be regarded as soft excavation.
- *Land Slope* : Slope across the land is less than 2,0%.
- *Soil Corrossivity* : All soils can be regarded as corrosive due to the presence of excessive water soluble salts.

- *Historic Monuments* : There are no historic monuments on the site.
- *Dolomite Stability* : The property is not subject to instabilities due to the presence of dolomite.
- *Undermining* : The area is not subject to undermining.
- *Seismicity* : The annual probability for an earthquake with intensity of 4,2 on the Modified Mercalli Scale to occur in the area is less than 10^{0} ; and with an intensity of 8,5 to occur the probability is less than 10^{-4}. A 10% probability exists that an earthquake with Peak Ground Acceleration of 0,09g may take place once in 50 years at Keimoes.

8 RECOMMENDATIONS

8.1 Foundation Design

It is recommended that structures be founded by means of ordinary strip foundations. Such foundations shall be placed at a depth of 1000mm, in other words below the horizon of alluvium and in the horizon of residual granite and calcrete gravel to avoid excessive settlement due to the properties of the alluvium. The surface of the excavated trench shall be compacted to ensure a stable and homogenous working platform. This is also the method of founding used for the new police complex on the adjacent property. The superstructure shall be lightly reinforced and the consulting engineer may consider the provision of a ring beam of Y8 steel reinforcement in all the brickwork at the level of the plinths above the doors.

The anticipated soil movements, soil zoning and foundation alternatives are summarized in the attached Table 4 : Foundation Design, Building Procedures and Precautionary Measures.

8.2 Conditions of Excavation

All soil materials can be regarded as soft excavation. Very dense material requiring the use of an excavator and eventually blasting for removal is present at variable depths, but from a minimum of 2000mm only.

8.3 Soil Corrossivity

The results of the soil conductivity tests indicate all soils to be moderately corrosive. Exposed underground metal objects will thus be subject to corrosion. Such objects therefore need to be protected by an anti-corrosion coating, or some measures provided to protect it against corrosion.

Table 4 : Foundation Design, Building Procedures and Precautionary Measures.

8.4 Materials Utilization

The design of the pavement around the future office is still unsure and is presumed to consist of interlocking brick pavement. Should this be the case, the allivium can be regarded as an in-situ selected layer and compacted to a density of 93% Modified AASHTO, and a subbase layer imported on top of it.

8.5 Other Considerations

Although the presence of the large tree on the stand is not a geotechnical issue, the decision to remove or retain it may have consequences as far as the future integrity of the structure is concerned. If the tree is retained on site, it must be recognised that future root growth may damage the foundations of the structure. If the tree is removed, the crater left behind must be backfilled in layers of maximum 200mm thick and compacted to a density of 90% Modified AASHTO. Preferably a material of G7 quality (TRH 14) shall be used for such purpose.

9 SOURCES OF REFERENCE

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9.6 Partridge TC et al : *Table 1 : Geotechnical Classification for Township Development*, published in the South African Geographical Journal, 1992.

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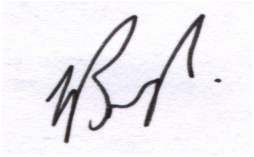
9.9 Kijko A et al : *Probabilistic Peak Ground Acceleration and Spectral Seismic Hazard Maps for South Africa*, Report 2003-0053 by the Council for Geoscience.



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