



KNYSNA
Municipality
Munisipaliteit
uMasipala

TENDER DOCUMENT

TENDER NO.		T 17-2021/22	
TENDER DESCRIPTION		Repair and delivery of pumps, motors, generators, including maintenance and repair for various water and sewer pump stations and facilities for the Knysna Municipality	
CLOSING TIME	12H00	CLOSING DATE	11 October 2021
Tender Box: SUPPLY CHAIN MANAGEMENT UNIT FINANCE BUILDING CLYDE STREET KNYSNA 6570		NB: 1. All bids must be submitted on the official forms (not to be re-typed) 2. Bids must be completed in black ink in writing 3. No bids will be considered from persons in the service of the state	
Name of Bidder:			
Tender Price:			
B-BBEE Status Level of Contributor			
Preference Points Claimed:			
CSD Supplier number			
CIDB Grading			
B-BBEE certificates submitted with the bid document MUST be VALID ORIGINAL BBBEE CERTIFICATES or VALID CERTIFIED COPIES OF THE B-BBEE CERTIFICATES			
Prepared by: Manager: Water and Sewer Knysna Municipality PO Box 21 KNYSNA 6570		For technical enquiries, contact: Rhoydon Parry at: e-mail rparry@knysna.gov.za or Kim Sampson at: ksampson@knysna.gov.za Supply Chain queries may be addressed to Mzwanele Mato at: mmato@knysna.gov.za	

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KNYSNA MUNICIPALITY

**TENDER NO: T 17/202122: REPAIR AND DELIVERY OF PUMPS, MOTORS AND GENERATORS,
INCLUDING MAINTENANCE AND REPAIR FOR VARIOUS WATER AND SEWER PUMP STATIONS
AND FACILITIES FOR A PERIOD OF THREE (3) YEARS**

Knysna Municipality hereby invites tenders from suitable tenderers for Repair and Delivery of Pumps, Motors and Generators, including Maintenance and Repair for various Water and Sewer Pump Stations and Facilities for a period of three (3) years.

A receipt for a non-refundable deposit of R633.32 payable by EFT (Knysna Municipality, Current Account – 1626561826, Nedbank, Knysna, Branch Code – 198765, EFT Reference number: 349750848228) made out in favour of Knysna Municipality is required on collection of the tender documents. Tenderers must use the tender number as a reference. Tender documents can be downloaded from the Knysna Municipality website: www.knysna.gov.za at no cost. Website navigation is as follow: Do Business – Bidding Opportunities - Tenders – Current Tenders.

Tenderers must have a minimum CIDB contractor grading designation of **6 ME or 6 EP** or higher.

Engineering queries relating to these documents may be addressed to: Rhydon Parry, e-mail: rparry@knysna.gov.za or Kim Sampson, e-mail: ksampson@knysna.gov.za and Supply Chain queries may be addressed to: Mzwanele Mato, e-mail: mmato@knysna.gov.za.

A compulsory virtual tender clarification meeting will be held on **Tuesday, 21 September 2021, @ 10:00**. To attend the meeting, tenderers are to email Mzwanele Mato at mmato@knysna.gov.za in order to register for the meeting. Closing time for registration will be 30 minutes prior to the meeting and no contact meeting will take place.

No person/s will be allowed to join the clarification meeting or to submit a bid if such a person/s is more than fifteen (15) minutes late.

Bids will be opened on the same day at the Supply Chain Management Offices at 12h00. Late or unmarked bids will not be considered.

The closing time for submission of bids is **12h00 on Monday, 11 October 2021**. Bids must be sealed in an envelope clearly marked with the bid number and title given above, and placed in the bid box at the Supply Chain Management Unit, Finance Building, Queen Street, Knysna, on or before the mentioned time and latest date. Telephonic, facsimile, e-mail and late bids will not be accepted. Bids must remain valid for a period of ninety (90) days after the closing date of the bid. Knysna Municipality reserves its right to extend the validity period, should you not be willing to hold your bid valid in all respects for further period as requested, it will lapse on expiry of the current validity period.

Bids may only be submitted on the bid documentation that is issued.

The bids are subject to local content and production. Minimum Stipulated Local Content Designation for Pumps and Medium Voltage Motors is **70%**, Steel Products and Components for Constructions is **100%** and Electrical and Telecom Cables is **90%**.

The evaluation of this bid will be subjected to functionality scoring. Tenderers must achieve a minimum functionality score of **70 out of 100 points** for functionality in order to be evaluated further. The functionality criteria and weighting is set out in the tender document.

Bids will be evaluated according to the **80/20** preference points system. The bids are subject to the Council Supply Chain Management Policy, Preferential Procurement Policy Framework Act, 2000, and the Preferential Procurement Regulations 2017.

The Municipality reserves the right to withdraw any invitation to bid and/or re-advertise or to reject any bid or to accept a part of it. The Municipality does not bind itself to accept the lowest bid or to award a contract to the Bidder scoring the highest number of points.

NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE AS DEFINED IN THE MUNICIPAL SUPPLY CHAIN MANAGEMENT REGULATIONS (GOVERNMENT GAZETTE NO 40553 DATED 20 JANUARY 2017).

Further requirements for sealing, addressing, delivery, opening and assessment of bids are stated in the Tender Document.

**Dawid Adonis
Acting Municipal Manager
Clyde Street
KNYSNA
6570**

T1.2 TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in Annex F of the Construction Industry Development Board (CIDB) Standard for Uniformity in Construction Procurement as published in Board Notice 136 of 2015 of July 2015. (See www.cidb.org.za).

The Standard Conditions of Tender make several references to the Tender Data for details that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the standard conditions of tender. Each item of data given below is cross-referenced to the clause in the Standard Conditions of Tender to which it mainly applies.

The following variations, amendments and additions to the Standard Conditions of Tender as set out in the Tender Data below shall apply to this tender:

Clause number	Tender Data
F.1.1	The Employer is Knysna Municipality.
F.1.2	The Tender Documents issued by the Employer comprise the following documents: THE TENDER Part T1: Tendering procedures. Part T2: Returnable documents. THE CONTRACT Part C1: Agreements and Contract data Part C2: Pricing data. Part C3: Scope of work. Part C4: Site information Annexures
F.1.4	The Employer's Agent is : N/A
F.1.6	The Competitive Negotiation Procedure will not be followed.

T1.2.2

F.2.1	Only those Tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a ME or EP class of construction work, are eligible to have their tenders evaluated. Joint ventures are eligible to submit tenders provided that: 1. every member of the joint venture is registered with the CIDB; 2. the lead partner has a contractor grading designation in the ME or EP class of construction work; and 3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a ME or EP class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.
F.2.1.1	Only Tenderers who achieve the minimum functionality score as per Clause F.3.11.9 below are eligible to have their tenders further evaluated.
F.2.7	The arrangements for a compulsory clarification meeting are as stated in the Tender Notice and Invitation to Tender. Tenderers should be represented at the meeting by a person who is suitably qualified and experienced to comprehend the implications of the work involved. Tenderers must sign the attendance list in the name of the tendering entity. Addenda will be issued to and tenders will be considered only from those tendering entities appearing on the attendance list and who has purchased tender documents.
F.2.12	If a tenderer wishes to submit an alternative tender offer he shall do so as a separate complete offer on a separate complete set of tender documents clearly marked as an “Alternative Tender” in order to distinguish it from the unqualified tender. The Tenderer must purchase an additional document and set out the alternative therein, including a schedule comparing the requirements of the tender documents with the alternative requirements that are proposed. Calculations, drawings and all other pertinent technical information and characteristics as well as modified or proposed Pricing Data must be submitted with the alternative tender offer to enable the Employer to evaluate the efficacy of the alternative and its principal elements, to take a view on the degree to which the alternative complies with the Employer’s standards and requirements and to evaluate the acceptability of the pricing proposals. Calculations must be set out in a clear and logical sequence and must clearly reflect all design assumptions. Pricing Data must reflect all assumptions in the development of the pricing proposal. Acceptance of an alternative tender offer will mean acceptance in principle of the offer. It will be an obligation of the contract for the Tenderer, in the event that the alternative is accepted, to accept full responsibility and liability that the alternative offer complies in all respects with the Employer’s standards and requirements. The modified Pricing Data must include an amount equal to 5% of the amount tendered for the alternative offer to cover the Employer’s costs in confirming the acceptability of the detailed design.
F.2.13.3	The complete Tender Document shall be returned with the tender, including all Parts as listed in F.1.2 above. Parts of each tender offer communicated on paper shall be submitted as an original, plus one complete copy. The duplicate copy of the tender document shall be clearly marked as “DUPLICATE”

T1.2.3

F.2.13.5 F.2.15.1	The employer's details and address for delivery of tender offers and identification details that are to be shown on each tender offer package are: Location of tender box: The Tender Box, Knysna Municipality, Supply Chain Management Unit, Clyde Street, KNYSNA, 6570 Physical address: Clyde Street, Knysna, 6570 Identification details: Bid reference number, title and the closing date and time.
F.2.13.9	Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.
F.2.15	The closing time for submission of tender offers is as stated in the Tender Notice and Invitation to Tender.
F.2.16	The tender offer validity period is 120 days.
F.2.20	The Tenderer is required to submit with his tender a letter of intent from an approved insurer undertaking to provide the Performance Bond to the format included in Part C1.3 of this procurement document. The form as per Part T2.2.9 can be used for this purpose.
F.2.22	Return all retained parts of tender documents within 28 days after expiry of the validity period.

F.2.23	The Tenderer is required to submit with his tender: 1) Tax Compliance Status Certificate issued by the South African Revenue Services. 2) Documents as listed in the List of Returnable Documents in Part T2.1.
F.3.4	Tenders will be opened immediately after the closing time for receipt of tenders as stated in the Tender Notice and Invitation to Tender.
F.3.5	A two-envelope system will not be followed.
F.3.11	The procedure for the evaluation of responsive tenders is Method 2, i.e. Functionality, Price and Preference.
F.3.11.7	The financial offer will be scored using Formula 2 where the value of W1 is 80 points.
F.3.11.8	Points will be awarded to Tenderers who are eligible for preferences in terms of the Preference Points Claim Form in terms of the Preferential Procurement Regulations, 2017, which is included in Part T2.2. The terms and conditions of the Preference Points Claim Form shall apply in all respects to the tender evaluation process and any subsequent contract.
F.3.11.9	The qualifying criteria and the score in respect of each criteria is as follows: A minimum of 70 points out of 100 total points is required for the tender to be evaluated further. Should the Tenderer not complete the following column, no points will be awarded. The Tenderer must provide sufficient proof, i.e. documentation, contact persons & contact numbers, etc. under Parts T2.2.3, T2.2.6, T2.2.7, and T2.2.8 in this document for each of the following items stipulated. Unclear or incomplete information provided will result in no points being awarded.

T1.2.4

Item	Description	Column to be completed by Tenderer	Points awarded by Employer
a)	Tenderer's relevant experience (track record) on previous contracts of a similar nature (i.e. pump stations, control panels, generators, etc.), in excess of R 2 000 000-00, excl. VAT previously successfully completed by the Tenderer. (Letters from Client/Employer will suffice) 0 projects = 0 points 1 to 4 projects = 2 points 5 to 9 projects = 10 points 10 to 16 projects = 20 points [20]	.....	.....
b)	Number of years' experience pertaining to pump stations, control panels, generators, etc. of the Tenderer's site supervisor to be employed on the project. (Detailed CV with relevant qualifications and contactable references) 0 to 1 years = 0 points 2 to 4 years = 2 points 5 to 9 years = 10 points 10 or more years = 20 points [20]	.....	.....
c)	Number of years' experience of the Tenderer's proposed Mechanical Fitter to be employed on the project. (Detailed CV with relevant qualifications and contactable references) 0 to 5 years = 5 points 6 to 9 years = 10 points 10 or more years = 20 points [20]	.....	.....
d)	Number of years' experience of the Tenderer's proposed Electrician to be employed on the project. (Detailed CV with relevant qualifications and contactable references) 0 to 5 years = 5 points 6 to 9 years = 10 points 10 or more years = 20 points [20]	.....	.....
e)	Vehicles, Plant and Equipment (e-Natis documents or proof of ownership must accompany the bid) No Hiring of vehicles will be allowed. 2 LDV's (10 points) Crane truck (10 points) Mobile Aerators (5 points) High volume sewage pumps (5 points)		
	Total points awarded out of 100	.....	.....

	Should the Tenderer not complete the above column, no points will be awarded. The Tenderer must provide sufficient proof, i.e. documentation, contact persons and contact numbers, etc. under Parts T2.2.3, T2.2.6, T2.2.7 and T2.2.8 in this document for each of the above-mentioned items stipulated. Unclear or incomplete information provided will result in no points being awarded.
F.3.13	Tender offers will only be accepted if: a) the Tenderer submits an original valid Tax Compliance Status Certificate issued by the South African Revenue Services or has made arrangements to meet outstanding tax obligations; b) the tenderer submits a letter of intent from an approved insurer undertaking to provide the Performance Bond to the format included in Part T2.2 of this procurement document c) the Tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation; d) the Tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector; e) the Tenderer has not: i) abused the Employer's Supply Chain Management System; or ii) failed to perform on any previous contract and has been given a written notice to this effect; f) the Tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the Tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process and persons in the employ of the state are permitted to submit tenders or participate in the contract; g) the Tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer; h) the employer is reasonably satisfied that the Tenderer has in terms of the Construction Regulations, 2014, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.
F.3.17	The number of paper copies of the signed contract to be provided by the employer is one.

	The additional conditions of tender are:
	The additional conditions of Tender are: 1. Bidder MUST have in his full time employ a <u>registered Installation Electrician</u> with valid wireman's licence for signing off on all electrical installations and providing the necessary Certificate of Compliance on completion. Documentary evidence in this respect, i.e. copy of registration certificate, CV, qualifications must be provided. 2. Bidder MUST have in his full time employ a <u>qualified Fitter and Turner</u> with relevant trade test certificate issued by an accredited organisation or the Dept. of Labour, with minimum 5 years' experience in pumping installations. Documentary evidence in this respect, i.e. copy of qualifications, trade test certification, CV, must be provided.

T2.1 LIST OF RETURNABLE DOCUMENTS

Part No.	The tenderer must ensure that the following documents are completed and included with his tender. The tender may be regarded as non-responsive, should these documents be in-complete or not be submitted.	Tenderer to confirm in this column that document has been completed and returned.
T2.2.1	1. Returnable Schedules required for tender evaluation purposes:	
T2.2.2	Record of Addenda to Tender Documents	
T2.2.3	Schedule of Amendments and Qualifications by Tenderer	
T2.2.4	Schedule of Particulars / Information	
T2.2.5	Compulsory Enterprise Questionnaire	
T2.2.6	Certificate of Authority for Joint Ventures	
T2.2.7	Schedule of Tenderer's Experience	
T2.2.8	Schedule of Subcontractors	
T2.2.9	Schedule of Plant and Equipment	
T2.2.10	Undertaking to Provide Performance Bond	
T2.2.11	Authority for Signatory	
	Municipal Bidding Documents (MBD):	
	MBD 2 – Tax Clearance Certificate	
	MBD 4 – Declaration of Interest	
	MBD 5 – Declaration For Procurement above R10 MILLION	
	MBD 6.1 – Preference Points Claim Form	
	MBD 8 – Declaration of Bidders Past Supply Chain Management Practices.	
	MBD 9 – Certificate of Independent Bid Determination	
	Certificate for Municipal Services Financial	
	References	
	2. Other documents required for tender evaluation purposes:	

-	If the Tenderer rents premises, proof that the rental includes Municipal rates and taxes and municipal charges, and that rent is not in arrears by more than 3 months.	
-	Proof of registration on the Central Supplier Database (CSD).	
-	CV of the Tenderer's intended Site Supervisor / s for the project, which must clearly state their name, surname, ID, qualifications and experience. CV of the Tenderer's intended Mechanical Fitter for the project, which must clearly state their name, surname, ID, qualifications and experience. CV of the Tenderer's intended Electrician for the project, which must clearly state their name, surname, ID, qualifications and experience.	
-	Company profile indicating the location of various Tenderer's offices / branches, as well as a detailed reference list providing the names and contact details of previous Clients.	

T2.1.2

Part No.	The tenderer must ensure that the following documents are completed and included with his tender. The tender may be regarded as non-responsive, should these documents be in-complete or not be submitted.	Tenderer to confirm in this column that document has been completed and returned.
3.	Returnable Schedules that will be incorporated into the Contract: All schedules as per Item 1 above.	
4.	Other documents that will be incorporated into the Contract:	
C1.1	Form of Offer and Acceptance	
C1.2	Contract Data	
C1.3	Performance Guarantee	
C1.4	Occupational Health and Safety Agreement	
C1.5	Certificate of Ownership of Plant / Materials	
C2.1	Pricing Instructions	
C2.2	Bill of quantities	
C3	Scope of Work	
C4	Site information	
-	Annexures	

T2.2 RETURABLE SCHEDULES

T2.2.1 RECORD OF ADDENDA TO TENDER DOCUMENTS

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:		
	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Attach additional pages if more space is required.

Signed

Date

.....

.....

Name

Position

.....

.....

Tenderer

.....

T2.2.2 SCHEDULE OF AMENDMENTS AND QUALIFICATIONS BY TENDERER

The Tenderer is required to give full details of any departure from the Specification and shall then sign this page officially. If there are no departures, the Tenderer must state NIL on this page and sign it. The Tender shall then be held to comply in all respect with the Specification. If the Tenderer does not indicate anything on this page, the Tenderer will also be held to comply in all respects with the Specification.

Should there be insufficient space, the Tenderer may include separate sheets arranged in the same manner as above. Mere reference to a covering letter will not be regarded as compliance with this requirement. Any amendments and / or qualifications stated in a covering letter will be regarded as null and void.

The Tenderer's attention is drawn to clause F.3.8 of the Standard Conditions of Tender referenced in the Tender Data regarding the Employer's handling of material deviations and qualifications.

Page	Clause or item	Proposal

Signed

Date

.....

.....

Name

Position

.....

.....

Tenderer

.....

T2.2.3 SCHEDULE OF PARTICULARS / INFORMATION

Note: 1. This schedule must be completed for all items offered, stating where appropriate, the size or capacity of equipment, type or catalogue no, country of origin and any other detail considered necessary. Failure to comply with this requirement may render the tender invalid.

2. Information in amplification of that given below may be submitted in the form of a covering letter, published literature, etc.
3. Acceptance of a Tender, with this Schedule complete, does not relieve the Tenderer of the responsibility of complying with the Specification for the items listed.

1. LV CABLING AND ACCESSORIES

- (a) LV cabling manufacturer:
.....
- (b) Instrumentation cabling manufacturer:
.....
- (c) Make and type of cable tray and fittings:
.....
- (d) Make of compression type termination kit:
.....
- (e) Type of through-joint kit:
.....
- (f) Delivery period:
.....

2. MOTOR CONTROL CENTRE (MCC) LV SWITCHGEAR AND CONTROL EQUIPMENT

- (a) Make of MCB's:
.....
- (b) Make and type of HMI controller:
.....
- (c) PLC:
 - (i) Make and type of CPU:
.....
 - (ii) I/O Module types:
.....
 - (iii) Comms Protocol to HMI:
.....
- (d) Make and type of power analyzer:
.....

3. VARIABLE SPEED DRIVES (VSD's)

- (a) Manufacturer:
.....

- (b) Type:
.....
.....
- (c) Comms protocol to PLC / HMI / telemetry:
.....

4. **SOFT STARTERS**

- (a) Manufacturer:
.....
- (b) Type:
.....
.....
- (c) Comms protocol to PLC / HMI / telemetry:
.....

5. **TRANSDUCERS**

- (a) Make and Type of Ultrasonic Sensor:
.....
- (b) Make and Type of Submersible Pressure Sensors:
.....
- (c) Make and Type of Float Switches:
.....

6. **GENERATOR EQUIPMENT**

- (a) Make and Type of Engine:
- (i) 50 kVA (40 kWe):
.....
 - (ii) 100 kVA (80 kWe):
.....
 - (iii) 150 kVA (120 kWe):
.....
 - (iv) 200 kVA (160 kWe):
.....
 - (v) 300 kVA (240 kWe):
.....
 - (vi) 400 kVA (320 kWe):
.....

T2.2.9.1

(b) Make and Type of Alternator:

(i) 50 kVA (40 kWe):

.....

(ii) 100 kVA (80 kWe):

.....

(iii) 150 kVA (120 kWe):

.....

(iv) 200 kVA (160 kWe):

.....

(v) 300 kVA (240 kWe):

.....

(vi) 400 kVA (320 kWe):

.....

(c) Battery:

(i) Manufacturer:

.....

(ii) Capacity and Voltage:

.....

(d) Control / Change Over Panel

(i) Manufacturer:

.....

(ii) Make and type of Genset Controller:

.....

(iii) Make and type of change-over switch:

.....

7. **PUMPS**

(a) Make and Type of Self-Priming Pumps (All sizes):

.....

.....

(b) Make and Type of Centrifugal Pumps (All sizes):

.....

.....

(c) Make and Type of Sewage Submersible Pumps (All sizes):

.....
.....

(d) Make and Type of Borehole Submersible Pumps (All sizes):

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

(e) Make and Type of Lime Dosing Pump:

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

8. ELECTRIC MOTORS

(a) Make and Type of 4-pole Electric Motor (All sizes):

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

(b) Make and Type of 4-pole Electric Motor (All sizes):

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

(c) Make and Type of 6-pole Electric Motor (All sizes):

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

9. MAINTENANCE AND REPAIR

(a) Location of Nearest Permanent Office:

.....

(b) Guaranteed Maximum Response Time to:

(i) Normal Work Instruction:

.....

(ii) Emergency Work Instruction:

.....

(c) * Name and Experience of Maintenance Team Supervisor:
.....

(d) * Name and Experience of proposed Mechanical Fitter on maintenance team:
.....
.....

(e) * Name and Experience of proposed Electrician on maintenance team:
.....
.....

* Tenderer to attach list of all the above-mentioned proposed technical employees the Tenderer intends using on the project. The list must clearly state for each staff member, their name, surname, ID, qualifications and relevant trade test / registration certificates, experience, level of training and the number of years employed by the Tenderer.

10. GENERAL

The following information must be submitted by the Tenderer:

(a) Name of MCC Panel Manufacturer:
.....
.....
.....

(b) Name of Sub-Contractor to undertake generator installation:
.....
.....
.....

(c) Name of and experience of Supervisor in Item (b) above:
.....
.....
.....

Name of Tenderer:
.....
(Print or Rubber stamp)

Signed on behalf of tenderer:

Date:

T.2.2.4 COMPULSORY ENTERPRISE QUESTIONNAIRE

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

Section 1: Name of enterprise:

Section 2: VAT registration number, if any:

Section 3: CIDB registration number, if any:

Section 4: Particulars of sole proprietors, partners in partnerships, closed corporation members and company directors.

Name*	Identity number*	Personal income tax number*

* Attach separate page if more than 3 partners, etc

Section 5: Particulars of companies and close corporations

Company registration number
 Close corporation number Tax
 reference number

Section 6: The MBD 4 form attached under Part T2.2.11 must be completed and be attached as a tender requirement.

Section 7: The MBD 5 form attached under Part T2.2.11 must be completed and be attached as a tender requirement.

Section 8: The MBD 6.1 form attached under Part T2.2.11 must be completed and be attached as a tender requirement.

T2.2.13.1

Section 9: The MBD 8 form attached under Part T2.2.11 must be completed and be attached as a tender requirement.

Section 10: The MBD 9 form attached under Part T2.2.11 must be completed and be attached as a tender requirement.

T2.2.4.2

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

- i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
- ii) confirms that neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;
- iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;
- iv) confirms that I / we are not associated, linked or involved with any other Bidding entities submitting Bid offers and have no other relationship with any of the Bidders or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
- v) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise, have:
 - i) abused the Employer's Supply Chain Management System; or
 - ii) failed to perform on any previous contract and has been given a written notice to this effect;
- vi) confirms that the enterprise is registered and in good standing with the compensation fund or with a licensed compensation insurer;
- vii) confirms that the enterprise has the necessary competencies and resources to carry out the work safely in terms of the Construction Regulations, 2014, issued in terms of the Occupational Health and Safety Act, 1993; viii) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed

Date

Name

Position

Enterprise name

T2.2.5 CERTIFICATE OF AUTHORITY FOR JOINT VENTURES

This Returnable Schedule is to be completed by joint ventures.

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

NAME OF FIRM	ADDRESS	DULY AUTHORISED SIGNATORY
Lead partner CIDB registration no		Signature:..... Name:..... Designation:.....
CIDB registration no		Signature:..... Name:..... Designation:.....
CIDB registration no		Signature:..... Name:..... Designation:.....
CIDB registration no		Signature:..... Name:..... Designation:.....

T2.2.6 SCHEDULE OF TENDERER'S EXPERIENCE (Letters from Client/Employer **MUST** accompany the bid)

The following is a statement of similar work successfully executed by myself / ourselves:

Employer, contact person and telephone number.	Description of contract	Value of work inclusive of VAT (Rand)	Date completed

Signed

Date

Name

Position

Tenderer

T2.2.7 SCHEDULE for CIRRICULUM VITAES (Detailed CV's and qualifications must accompany the bid)

Employer, contact person and telephone number.	Description of qualification(s)

T2.2.8 SCHEDULE OF SUB-CONTRACTORS

We notify you that it is our intention to employ the following Sub-contractors for work in this contract.
 If we are awarded a contract we agree that this notification does not change the requirement for us to submit the names of Sub-contractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.
 A CV of each of the proposed Sub-contractors must be submitted with the Tender.

	Name and address of Subcontractor	B-BBEE / EME Status	Nature and extent of work	Previous experience with Sub-contractor.
1.				
2.				
3.				
4.				

Signed

Date

Name

Position

Tenderer

T2.2.9 SCHEDULE OF PLANT AND EQUIPMENT (e-Natis documents or proof of ownership MUST accompany the bid)

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

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

Quantity	Description, size, capacity, etc.
	Attach additional pages to this page if more space is required.

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

Quantity	Description, size, capacity, etc.
	Attach additional pages to this page if more space is required.

Signed

Date

.....

.....

Name

Position

.....

.....

Tenderer

T2.2.9 UNDERTAKING TO PROVIDE PERFORMANCE BOND

A performance bond will not initially be required for this contract.

The Municipality does, however, reserve the right to request a performance bond from the Contractor for any or all work instruction / s issued during the contract period.

For this purposes, the Tenderer is requested to complete the details of their nominated Insurance company / bank below, who would be able to provide a Guarantee in the exact terms of the Pro Forma Guarantee provided in Part C1.3 hereof should it be required. It is anticipated that the total value of such Performance Bond will not exceed an amount of R 100 000-00.

We hereby declare that the insurance company / bank named below is aware of our financial position and commitments in terms of this tender and any other tender offers made and is prepared to issue the Guarantee unconditionally, within the period called for in these tender documents, and until the issue of the Certificate of Completion.

Name of proposed Guarantee provider:
(Insurance Company/Bank)

Date: Signed on behalf
Of the Tenderer:

Date: Signed on behalf
Of the insurance
company/bank:

In their capacity as

T2.2.10 AUTHORITY FOR SIGNATORY

Details of person responsible for Tender process
Name

Contact number ()

Address of office submitting the Tender

T2.2.11.3

Telephone no ()

Fax no ()

E-mail address

Signatories for close corporations and companies shall confirm their authority by attaching to this form a **duly signed and dated original or certified copy** of the relevant resolution of their members or their board of directors, as the case may be.

"By resolution of the board of directors passed on (date)

Mr.

has been duly authorized to sign all documents in connection with the Tender for Contract
Numberand any Contract which may arise there from
on behalf of

(BLOCK CAPITALS)

SIGNED ON BEHALF OF THE COMPANY

IN HIS CAPACITY AS

DATE :

FULL NAMES OF SIGNATORY

AS WITNESSES 1.

2.

T2.2.11 MUNICIPAL BIDDING DOCUMENTS (MBD)

BID FOR THE REQUIREMENTS OF KNYSNA MUNICIPALITY

BID NO: T 17 2021/22	
CLOSING DATE: 11 October 2021	CLOSING TIME: 12:00

DESCRIPTION:
**REPAIR AND DELIVERY OF PUMPS, MOTORS AND GENERATORS, INCLUDING
MAINTENANCE AND REPAIR FOR VARIOUS WATER AND SEWER PUMP STATIONS AND
FACILITIES FOR A PERIOD OF THREE YEARS**

Bid documents, placed in a sealed envelope and clearly marked with the bid number on the outside, may be deposited in:

The Tender Box
Knysna Municipality
Supply Chain Management Unit
Queen Street
KNYSNA
6570

Please note:

- **Bidders must ensure that bids are delivered timeously to the correct address. If the bid is late, it will not be accepted for consideration.**
- All bids must be submitted on the official forms. Forms may not be retyped.
- This bid is subject to the General Conditions of Contract (GCC) and, if applicable, any other special conditions of contract included in this tender document.

THE FOLLOWING PARTICULARS MUST BE FURNISHED. FAILURE TO DO SO MAY RESULT IN YOUR BID BEING NOT BEING ACCEPTED.

NAME OF BIDDER

.....

POSTAL

ADDRESS.....

STREET

ADDRESS.....

TELEPHONE NUMBER:

.....

CELLPHONE

NUMBER.....

.....

FACSIMILE NUMBER

.....

E-MAIL

ADDRESS.....

VAT REGISTRATION NUMBER

.....

HAS AN ORIGINAL AND VALID TAX CLEARANCE CERTIFICATE BEEN ATTACHED?

YES/NO

HAS A VALID ORIGINAL OR A VALID CERTIFIED COPY OF A B-BBEE STATUS LEVEL
VERIFICATION CERTIFICATE BEEN SUBMITTED? (MBD 6.1)

YES/NO

IF YES, WHO WAS THE CERTIFICATE ISSUED BY?

AN ACCOUNTING OFFICER AS CONTEMPLATED IN THE CLOSE CORPORATION ACT

(CCA)

☐

A VERIFICATION AGENCY ACCREDITED BY THE SOUTH AFRICAN NATIONAL

ACCREDITATION SYSTEM (SANAS)

☐

A REGISTERED AUDITOR

☐

(Tick applicable box)

T2.2.11.6

(A VALID ORIGINAL OR VALID CERTIFIED COPY B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE)

ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS/SERVICES/WORKS OFFERED? **YES/NO**

(IF YES ENCLOSE PROOF)

SIGNATURE OF BIDDER

DATE.....

CAPACITY UNDER WHICH THIS BID IS SIGNED.....

TOTAL BID PRICE: **Refer to Part C2.2.**

TOTAL NUMBER OF ITEMS OFFERED: **Refer to Part C2.2**

DELIVERY BASIS:

Is the delivery period firm?	YES / NO
Period required for delivery after receipt of order (days)	
Is the price (inclusive of VAT) firm?	YES / NO
Discount offered:	Conditional/Unconditional
If conditional, state condition:	
Is offer strictly to specification/terms of reference	YES / NO
If not to specification/terms of reference. Please state deviation(s) if any:	

BANK DETAILS (IF APPLICABLE):

T2.2.11.7

BANK NAME:	
BRANCH:	BRANCH CODE:
ACCOUNT HOLDER:	
ACCOUNT NUMBER:	ACCOUNT TYPE:

OFFICAL STAMP FROM BANK

..... AUTHORISED BANK OFFICIAL

AUTHORISED

SIGNATURE:

.....

NAME:

.....
.....

CAPACITY:

.....
.....

DATE:

.....
.....

MBD4: DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state*.
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority and/or take an oath declaring his/her interest.

3. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

3.1 Full Name of bidder:

3.2 Identity
Number:.....

3.3 Registration number of company, enterprise, close corporation, partnership
agreement or trust:

.....

3.4 Tax Reference Number:

3.5 VAT Registration Number:

3.6 Are you presently in the service of the state* **YES / NO**

3.6.1 If so, furnish particulars.

.....

.....

3.7 Have you been in the service of the state for the past **YES / NO**
twelve months?

3.7.1 If so, furnish particulars.

.....

.....

* "in the service of the state" means to be – (a) a member of –

- (i) any municipal council;
- (ii) any provincial legislature; or
- (iii) the national Assembly or the national Council of provinces;

(b) a member of the board of directors of any municipal entity;

(c) an official of any municipality or municipal entity;

(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);

(e) a member of the accounting authority of any national or provincial public entity; or (f) an employee of Parliament or a provincial legislature.

3.8 Do you, have any relationship (family, friend, other) with |
state and who may be involved with the evaluation and or ad

YES / NO

3.8.1 If so, furnish the following particulars:

.....
.....

3.9 Are you, aware of any relationship (family, friend, other)
between a bidder and any persons in the service of the state
who may be
involved with the evaluation and or adjudication of this bid?

3.9.1 If so, furnish particulars

.....
.....

3.10 Are any of the company's directors, managers, principal
shareholders or stakeholders in service of the
state? **YES / NO**

3.10.1 If so, furnish particulars.

.....
.....

T2.2.11.10

3.11 Are any spouse, child or parent of the company's directors, managers, principal shareholders or stakeholders in service of the state?

YES / NO

3.11.1 If so, furnish particulars.

.....
.....

DECLARATION

I, THE UNDERSIGNED (NAME)

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....
Signature

.....
Date

.....
Position

.....
Name of bidder

DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (ALL APPLICABLE TAXES INCLUDED)

For all procurement expected to exceed R10 million (all applicable taxes included), bidders must complete the following questionnaire:

- 1 Are you by law required to prepare annual financial statements for auditing?
 - 1.1 If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.
.....
.....
- 2 Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?
 - 2.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days.
 - 2.2 If yes, provide particulars.
.....
.....
.....
.....

* Delete if not applicable

***YES / NO**

***YES / NO**

3 Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?

3.1 If yes, furnish particulars

.....
.....

***YES / NO**

4. Will any portion of goods or services be sourced from outside
NO
the Republic, and, if so, what portion and whether any portion
of payment from the municipality / municipal entity is expected to be
transferred out of the Republic?

***YES /**

4.1 If yes, furnish particulars

.....
.....

CERTIFICATION

I, THE UNDERSIGNED (NAME)

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

T2.2.11.13

**I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO
BE**

FALSE.

.....

Signature

.....

Date

.....

Position

.....

Name of Bidder

MBD 6.1**PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2017**

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for Broad-Based Black Economic Empowerment (BBBEE) Status Level of Contribution

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017.

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2

a) The value of this bid is estimated to not exceed R50 000 000 (all applicable taxes included) and therefore the 80/20 preference point system shall be applicable; or

1.3 Points for this bid shall be awarded for:

- (a) Price; and
- (b) B-BBEE Status Level of Contributor.

1.4 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	80
B-BBEE STATUS LEVEL OF CONTRIBUTOR	20
Total points for Price and B-BBEE must not exceed	100

1.5 Failure on the part of a bidder to submit proof of B-BBEE Status level of contributor together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.6 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

2. DEFINITIONS

- (a) **“B-BBEE”** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;
- (b) **“B-BBEE status level of contributor”** means the B-BBEE status of an entity in terms of a code of good practice on black economic empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;
- (c) **“bid”** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of goods or services, through price quotations, advertised competitive bidding processes or proposals;
- (d) **“Broad-Based Black Economic Empowerment Act”** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- (e) **“EME”** means an Exempted Micro Enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;
- (f) **“functionality”** means the ability of a tenderer to provide goods or services in accordance with specifications as set out in the tender documents. (g) **“prices”** includes all applicable taxes less all unconditional discounts;
- (h) **“proof of B-BBEE status level of contributor”** means:
 - 1) B-BBEE Status level certificate issued by an authorized body or person;
 - 2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;
 - 3) Any other requirement prescribed in terms of the B-BBEE Act;
- (i) **“QSE”** means a qualifying small business enterprise in terms of a code of good practice on black economic empowerment issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act;
- (j) **“rand value”** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;

3. POINTS AWARDED FOR PRICE

3.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20	or	90/10
$P_s = 80 \frac{P_t - P_{min}}{P_{min}}$	or	$P_s = 90 \frac{P_t - P_{min}}{P_{min}}$

Where

P_s = Points scored for price of bid under consideration

P_t = Price of bid under consideration

P_{min} = Price of lowest acceptable bid

4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTOR

- 4.1 In terms of Regulation 6 (2) and 7 (2) of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	6	14
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

5. BID DECLARATION

5.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

6. B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 4.1

6.1 B-BBEE Status Level of Contributor: = (maximum of 10 or 20 points)

(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

7. SUB-CONTRACTING

7.1 Will any portion of the contract be sub-contracted? (*Tick applicable box*)

YES	☐	NO	☐
-----	--------------------------	----	--------------------------

7.1.1 If yes, indicate:

i) What percentage of the contract will be subcontracted% ii)

The name of the sub-contractor..... iii)

The B-BBEE status level of the sub-contractor.....

iv) Whether the sub-contractor is an EME or QSE

(*Tick applicable box*)

YES	☐	NO	☐
-----	--------------------------	----	--------------------------

v) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations, 2017:

Designated Group: An EME or QSE which is at least 51% owned by:	EME	QSE
Black people		
Black people who are youth		
Black people who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

8. DECLARATION WITH REGARD TO COMPANY/FIRM

8.1 Name of company
/firm:.....

8.2 VAT registration
number:.....

8.3 Company registration
number:.....

8.4 TYPE OF COMPANY/ FIRM
Partnership/Joint Venture / Consortium
One-person business/sole propriety
Close corporation
Company
(Pty) Limited

[TICK APPLICABLE BOX]

8.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

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

8.6 COMPANY CLASSIFICATION

Manufacturer
Supplier
Professional service provider
Other service providers, e.g. transporter, etc.

[TICK APPLICABLE BOX]

8.7 MUNICIPAL INFORMATION

Municipality where business is situated:

Registered Account Number:

Stand Number:.....

8.8 Total number of years the company/firm has been in business:.....

8.9 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contributor indicated in paragraphs 1.4 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

- i) The information furnished is true and correct;
- ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;
- iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
- iv) If the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –
 - (a) disqualify the person from the bidding process;
 - (b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
 - (c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
 - (d) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and
 - (e) forward the matter for criminal prosecution.

WITNESSES

- 1.
- 2.

MB Copyright

.....
SIGNATURE(S) OF BIDDERS(S)

DATE:

ADDRESS

.....
.....

MBD 6.2

DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT FOR DESIGNATED SECTORS

This Municipal Bidding Document (MBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2017, the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 (Edition 1) and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)].

1. General Conditions

- 1.1. Preferential Procurement Regulations, 2017 (Regulation 8) make provision for the promotion of local production and content.
- 1.2. Regulation 8.(2) prescribes that in the case of designated sectors, organs of state must advertise such tenders with the specific bidding condition that only locally produced or manufactured goods, with a stipulated minimum threshold for local production and content will be considered.
- 1.3. Where necessary, for tenders referred to in paragraph 1.2 above, a two stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.
- 1.4. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.
- 1.5. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 2011 as follows:

$$LC = [1 - x / y] * 100$$

Where x is the imported content in Rand y
is the bid price in Rand excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by South African Reserve Bank (SARB) at 12:00 on the date of advertisement of the bid as indicated in paragraph 4.1 below.

The SABS approved technical specification number SATS 1286:2011 is accessible on [http://www.thedti.gov.za/industrial development/ip.jsp](http://www.thedti.gov.za/industrial%20development/ip.jsp) at no cost.

- 1.6. A bid may be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation;

2. The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:

<u>Description of services, works or goods</u>	<u>Stipulated minimum threshold</u>
<i>Electrical and telecom cables</i>	90 %
<i>Pumps and Medium Voltage Motors</i>	70 %
<i>Steel Products and Components for Constructions</i>	100 %

3. Does any portion of the goods or services offered?
have any imported content?

(Tick applicable box)

YES		NO	
-----	--	----	--

- 3.1 If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by SARB for the specific currency at 12:00 on the date of advertisement of the bid.

The relevant rates of exchange information are accessible on www.reservebank.co.za

Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

4. Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the AO/AA provide directives in this regard.

LOCAL CONTENT DECLARATION
(REFER TO ANNEX B OF SATS 1286:2011)

LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)

IN RESPECT OF BID NO.

ISSUED BY: (Procurement Authority / Name of Institution):

.....

NB

- 1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.
- 2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on <http://www.thdti.gov.za/industrialdevelopment/ip.jsp>. Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. **Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below.** Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

I, the undersigned, (full names), do hereby declare, in my capacity as of (name of bidder entity), the following:

- (a) The facts contained herein are within my own personal knowledge.
- (b) I have satisfied myself that:
 - (i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286:2011; and
- (c) The local content percentage (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E which has been consolidated in Declaration C:

Bid price, excluding VAT (y)	R
Imported content (x), as calculated in terms of SATS 1286:2011	R
Stipulated minimum threshold for local content (paragraph 3 above)	
Local content %, as calculated in terms of SATS 1286:2011	

If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above.

The local content percentages for each product has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E.

- (d) I accept that the Procurement Authority / Institution has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.
- (e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286:2011, may result in the Procurement Authority / Institution imposing any or all of the remedies as provided for in Regulation 14 of the Preferential Procurement Regulations, 2017 promulgated under the Preferential Policy Framework Act (PPFA), 2000 (Act No. 5 of 2000).

SIGNATURE: _____

DATE: _____

WITNESS No. 1 _____

DATE: _____

WITNESS No. 2 _____

DATE: _____

Local Content Declaration - Summary Schedule

Note: VAT to be excluded from all calculations

[illegible]

Signature of tenderer from Annex B

Date: _____

MBD8: DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

- 1 This Municipal Bidding Document must form part of all bids invited.
- 2 It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
- 3 The bid of any bidder may be rejected if that bidder, or any of its directors have:
 - a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;
 - b. been convicted for fraud or corruption during the past five years;
 - c. willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
 - d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).
- 4 **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

Item	Question	Yes	No
4.1	Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the <i>audialterampartem</i> rule was applied). The Database of Restricted Suppliers now resides on the National Treasury's website(www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.	Yes ☐	No ☐
4.1.1	If so, furnish particulars:		
4.2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.	Yes ☐	No ☐
4.2.1	If so, furnish particulars:		

Item	Question	Yes	No
4.3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐
4.3.1	If so, furnish particulars:		
4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes ☐	No ☐
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.7.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME)CERTIFY THAT THE

INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

MBD 9: CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids¹ invited.
2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).² Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.
3. Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
 - a. take all reasonable steps to prevent such abuse;
 - b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
 - c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
5. In order to give effect to the above, the attached Certificate of Bid Determination (MBD9) must be completed and submitted with the bid:

¹ Includes price quotations, advertised competitive bids, limited bids and proposals.

² Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

(Bid Number and Description)

in response to the invitation for the bid made by:

(Name of Municipality / Municipal Entity)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of:

that: (Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
 - (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - (a) prices;
 - (b) geographical area where product or service will be rendered (
 - (c)

- (d)
- (e) market allocation)
- (f) methods, factors or formulas used to calculate prices;
- (g) the intention or decision to submit or not to submit, a bid;
- (h) the submission of a bid which does not meet the specifications and conditions of the bid;
- or (f) bidding with the intention not to win the bid.

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No. 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No. 12 of 2004 or any other applicable legislation.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

³ Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

MBD 15 – CERTIFICATE FOR PAYMENT OF MUNICIPAL SERVICES

NAME OF THE BIDDER:

FURTHER DETAILS OF THE BIDDER'S; Director / Shareholder / Partners, etc:

Director / Shareholder / partner	Physical address of the Business	Municipal Account number(s)	Physical residential address of the Director / shareholder / partner	Municipal Account number(s)

NB: Please attach a copy of your latest municipal account.

I, _____

(full name in block letters) the undersigned, certify that the information furnished on this declaration form is correct and that I / we have no undisputed commitments for municipal services towards a municipality in respect of which payment is overdue for more than 90 days.

If the value of the transaction is expected to exceed R10 million (VAT included) I certify that the bidder has no undisputed commitments for municipal services towards **a Municipality** in respect of which payment is overdue for more than 30 days;

THUS DONE AND SIGNED for and on behalf of the Bidder, at _____

_____, on the _____
_____ day of _____ 20_____.

Number of sheets appended by the tenderer to this schedule (If nil, enter NIL)	
--	--

SIGNATURE:		NAME (PRINT):	
CAPACITY:		NAME OF FIRM:	

For office use (comments):

DECLARATION

1. I hereby declare that I have read, understood, agree and comply with all of the sections below, if included, that it shall be deemed to form and be construed as part of this agreement:

- (i) Bidding documents, viz
 - Invitation to bid;
 - Tax clearance certificate;
 - Pricing schedule(s);
 - Technical Specification(s);
 - Preference claims for Broad Based Black Economic Empowerment Status
 - Level of contribution in terms of the Preferential Procurement Regulations, 2017;
 - Declaration of interest;
 - Declaration of bidder's past SCM practices;
 - Certificate of Independent Bid Determination
 - Special Conditions of Contract;
- (ii) General Conditions of Contract; and
- (iii) Other (specify)

2. I confirm that I am duly authorised to sign this document.

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES

1.

2.

DATE:

THE CONTRACT**PART C1 – AGREEMENTS AND CONTRACT DATA****C1.1 FORM OF OFFER AND ACCEPTANCE (Agreement)****OFFER**

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

T 17 OF 2021/22: REPAIR AND DELIVERY OF PUMPS, MOTORS AND GENERATORS, INCLUDING MAINTENANCE AND REPAIR FOR VARIOUS WATER AND SEWER PUMP STATIONS AND FACILITIES FOR A PERIOD OF THREE YEARS .

The Tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS:

.....

.....Rand (in words) R.....(in figures).

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

For the Tenderer:

Signature

Name

Capacity

Name and address of organisation:

.....

.....

Signature and name of witness:

Signature Name

.....

Date:

ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the Tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the Conditions of Contract identified in the Contract Data. Acceptance of the Tenderer's Offer shall form an Agreement between the Employer and the Tenderer upon the terms and conditions contained in this Agreement and in the Contract that is the subject of this Agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Agreement)
Part C2	Pricing Data
Part C3	Scope of Work
Part C4	Site Information

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representative(s) of both parties.

The Tenderer shall within two weeks of receiving a completed copy of this Agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after, the date this Agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now Contractor) within five days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties.

For the Employer:

Signature

Name

Capacity

Name and address of organisation:

.....

.....

Signature and name of witness:

Signature

Name

Date:

SCHEDULE OF DEVIATIONS

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
2. A Tenderer's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid, become the subject of Agreements reached during the process of offer and acceptance, the outcome of such Agreement shall be recorded here.
3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here.
4. Any change or addition to the tender documents arising from the above Agreements and recorded here, shall also be incorporated into the final draft of the Contract.

(i) Subject

 Details

(ii) Subject

 Details

(iii) Subject

 Details

C1.1.4

(iv)	Subject	.....
	Details	.....
		
		
(v)	Subject	.....
	Details	.....
		
		
(vi)	Subject	.....
	Details	.....
		
		

By the duly authorised representatives signing this Schedule of Deviations, the Employer and the Tenderer agree to and accept the foregoing Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the Tenderer:

..... Signature

..... Name

..... Capacity

Name and address of organisation:

.....

.....

.....

..... Witness Signature

..... Witness Name

..... Date

For the Employer:

.....

.....

.....

Name and address of organisation:

.....

.....

.....

.....

.....

.....

CONFIRMATION OF RECEIPT

The Tenderer, (now Contractor), identified in the Offer part of this Agreement hereby confirms receipt from the Employer, identified in the acceptance part of this Agreement, of one fully completed original copy of this agreement, including the Schedule of Deviations (if any) today:

the (day)

of (month)

20 (year)

at (place)

For the Contractor:

Signature

Name

Capacity

Signature and name of witness:

Signature

Name

C.1.2 CONTRACT DATA

The General Conditions of Contract for Construction Works, Third Edition (2015) published by the South African Institution of Civil Engineering, Private Bag X200, Halfway House, 1685, is applicable to this Contract and is obtainable from www.saice.org.za

The following contract specific data, referring to the General Conditions of Contract for Construction Works, Third Edition, 2015, are applicable to this Contract. Tenderers must read the abovementioned General Conditions of Contract in order to understand the implications of the Data provided by the Employer, as well as the Data which has to be completed by the Tenderer.

PART 1: DATA PROVIDED BY THE EMPLOYER

Clause	Data
1.1.1.13	The Defects Liability Period is 12 months measured from the date of the Certificate of Completion of a work instruction.
1.1.1.14	The time for achieving Practical Completion includes the days referred to under Clause 5.3.2 and the non-working days, but excludes the special non-working days (Clauses 5.1.1 and 5.8.1).
1.1.1.15	The name of the Employer is Knysna Municipality.
1.1.1.16	There will be no Employer's Agent
1.1.1.26	The Pricing Strategy is a Re-Measurement Contract.
1.2.1.2	The address of the Employer is: Address (physical): Clyde Street, Knysna, 6570 Address (postal): PO Box 21, Knysna, 6570 Telephone: 044-302 6300 Facsimile: 044-384 1816 e-mail: e-mail: rparry@knysna.gov.za
1.2.1.2	The address of the Employer's Agent is: N/A
3.2.3	The Employer shall obtain the specific approval of the Employer before carrying out any of his functions or duties according to the following Clauses of the General Conditions of Contract: None.

C1.2.2

5.1.1 and 5.8.1	The non-working days are Sundays, with the exception of work which must be undertaken during scheduled outages planned for Sundays. The special non-working days are: The public holidays.
5.3.1	The documentation required before commencing with the Works are: Health and Safety Plan (refer to Clause 4.3). Initial programme (refer to Clause 5.6). Security (refer to Clause 6.2). Insurance (refer to Clause 8.6). Occupational Health and Safety Agreement (refer to Part C1.4). Letter of Good Standing from the Compensation Commissioner.
5.3.2	The time to submit the documentation required before commencement of the Works is 21 days.
5.12.2.2	A delay caused by inclement weather conditions will be regarded as a delay only if, in the opinion of the Employer's Agent, all progress on an item or items of work on the critical path of the working programme of the Contractor has been brought to a halt. Delays on working days only (based on a five-day working week) will be taken into account for the extension of time, but the Contractor shall make provision in his programme of work for an expected delay of 2 (Two) working days per month caused by normal rainy weather, for which he will not receive any extension of time. Extension of time during working days will be granted to the degree to which actual delays, as defined above, exceed the number of 2 (Two) working days. It shall be further noted that where the critical path is not affected, no extension of time for abnormal climatic conditions or for any other reason will be entertained. Abnormal climatic conditions are conditions that occur less frequently than once in ten years.
5.13.1	Penalties will be applied as follows: - 0,5% reduction in monthly payment if the complaints or work instructions given by the Municipality, or their designated representative have not been attended to within the agreed time period or within two weeks, whichever is quicker. - 2% reduction in monthly payment if the work performed is not to specification or of an unacceptable standard. - 5% reduction in monthly payment for failure to submit the required monthly maintenance reports and on work executed. - A call-out penalty of R 1 500-00 per call-out event may be levied from the Contractor should it be proven that Municipal personnel need to attend to problems on site that are the direct cause of lack of response or negligence to such problems by the Contractor. - A Non-Compliance penalty of R 1 500-00 per event may be levied from the Contractor should it be proven that the Contractor has failed to comply with, or ignored an official work instruction given by the Municipality, or their designated representative.
5.14.1	The requirements for achieving Practical Completion are that the Works must be in a state of readiness, fit for the intended purpose and occupation without danger or undue inconvenience to the Employer.
5.16.3	The latent defects period is 3 years.
5.4.2	The access and possession of the Site shall not be exclusive to the Contractor but as set out in the Site Information.

C1.2.3

6.8.2	This will be a fix term contract with no contract price adjustment Fixed annual percentage increases are built in the document
6.8.3	Price adjustments for variations in the costs of special materials are not allowed.
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80%. The percentage advance on Plant not yet supplied to Site is 80%. Documentary evidence of ownership and an indemnity against claims in respect of the plant and or materials shall be provided, and items shall be clearly marked and identified as being the property of the Employer. A Certificate of Ownership of Plant / Materials as per Part C1.5 shall be submitted to the Employer's Agent together with the claim for payment.
6.10.3	No Retention will be deducted.
8.6.1.1.2	The value of Plant and material supplied by the Employer to be included in the insurance sum is R Nil.
8.6.1.3	The limit of indemnity for liability insurance is R10 million.
10.3.2	Amicable settlement in terms of Clause 10.4 shall be contemplated for all disputes prior to referring any dispute to adjudication or arbitration.
10.5.3	The number of Adjudication Board Members to be appointed is one.
10.7.1	The determination of disputes which are unresolved in terms of Clause 10.4.2 shall be by arbitration.

C.1.2 CONTRACT DATA**PART 2: DATA PROVIDED BY THE CONTRACTOR**

The Tenderer shall provide the following information

Clause	Data						
1.1.1.9	The name of the Contractor is						
1.2.1.2	The address of the Contractor is:						
	Address(physical): Address (postal): Telephone: Facsimile: E-mail:						
1.1.1.14	The available time frame for achieving Practical Completion is as stipulated under Part C3.1, Clause 7. I / we hereby confirm that I / we will comply with this programme..... Yes / No						
6.2.1	The Client reserves the right to request Security from the Contractor for due performance of any or all work instruction / s issued during the contract period. It is anticipated that the total value of such Security will not exceed an amount of R 1 000 000-00. The security to be provided by the Contractor shall be one of the following:						
	<table border="1"> <thead> <tr> <th>Type of security (Value Added Tax is excluded from the Contract Sum and the value of the Works for calculating the percentages)</th><th>Contractor's Choice (Indicate "Yes" or "No")</th></tr> </thead> <tbody> <tr> <td>Cash deposit of 10% of the Contract Sum plus retention of 5% of the value of the Works</td><td>.....</td></tr> <tr> <td>Performance guarantee of 10% of the Contract Sum plus retention of 5% of the value of the Works.</td><td>.....</td></tr> </tbody> </table>	Type of security (Value Added Tax is excluded from the Contract Sum and the value of the Works for calculating the percentages)	Contractor's Choice (Indicate "Yes" or "No")	Cash deposit of 10% of the Contract Sum plus retention of 5% of the value of the Works		Performance guarantee of 10% of the Contract Sum plus retention of 5% of the value of the Works.	
Type of security (Value Added Tax is excluded from the Contract Sum and the value of the Works for calculating the percentages)	Contractor's Choice (Indicate "Yes" or "No")						
Cash deposit of 10% of the Contract Sum plus retention of 5% of the value of the Works							
Performance guarantee of 10% of the Contract Sum plus retention of 5% of the value of the Works.							

C1.3 PRO FORMA PERFORMANCE GUARANTEE

The Performance Guarantee is to contain the wording of the pro-forma document hereafter

GUARANTOR DETAILS AND DEFINITIONS

“Guarantor” means:

Physical Address:

“Employer” means:

“Contractor” means:

“Engineer” means:

“Works” means:

“Site” means:

“Contract” means: The Agreement made in terms of the Form of Offer and Acceptance and such amendments or additions to the Contract as may be agreed in writing between the parties.

“Contract Sum” means: The accepted amount inclusive of tax of R

Amount in words:

“Guaranteed Sum” means: The maximum aggregate amount of R

Amount in words:

“Expiry Date” means:

CONTRACT DETAILS

Engineer issues: Interim Payment Certificates, Final Payment Certificate and the Certificate of Completion of the Works as defined in the Contract.

PERFORMANCE GUARANTEE

1. The Guarantor’s liability shall be limited to the amount of the Guaranteed Sum.
2. The Guarantor’s period of liability shall be from and including the date of issue of this Performance Guarantee and up to and including the Expiry Date or the date of issue by the Engineer of the Certificate of Completion of the Works or the date of payment in full of the Guaranteed Sum, whichever occurs first. The Engineer and/or the Employer shall advise the Guarantor in writing of the date on which the Certificate of Completion of the Works has been issued.
3. The Guarantor hereby acknowledges that:

C.1.3.2

any reference in this Performance Guarantee to the Contract is made for the purpose of convenience and shall not be construed as any intention whatsoever to create an accessory obligation or any intention whatsoever to create a suretyship; its obligation under this Performance Guarantee is restricted to the payment of money.

4. Subject to the Guarantor's maximum liability referred to in 1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 4.1 to 4.3:
 - 4.1 A copy of a first written demand issued by the Employer to the Contractor stating that payment of a sum certified by the Engineer in an Interim of Final Payment Certificate has not been made in terms of the Contract and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 4.2;
 - 4.2 A first written demand issued by the Employer to the Guarantor at the Guarantor's physical address with a copy to the Contractor stating that a period of seven (7) days has elapsed since the first written demand in terms of 4.1 and the sum certified has still not been paid;
 - 4.3 A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 4.
5. Subject to the Guarantor's maximum liability referred to in 1, the Guarantor undertakes to pay to the Employer the Guaranteed Sum or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor at the Guarantor's physical address calling up this Performance Guarantee, such demand stating that:
 - 5.1 the Contract has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 5; or
 - 5.2 a provisional or final sequestration or liquidation court order has been granted against the Contractor and that the Performance Guarantee is called up in terms of 5; and
 - 5.3 the aforesaid written demand is accompanied by a copy of the notice of termination and/or the provisional/final sequestration and/or the provisional liquidation court order.
6. It is recorded that the aggregate amount of payments required to be made by the Guarantor in terms of 4 and 5 shall not exceed the Guarantor's maximum liability in terms of 1.
7. Where the Guarantor has made payment in terms of 5, the Employer shall upon the date of issue of the Final Payment Certificate submit an expense account to the Guarantor showing how all monies received in terms of this Performance Guarantee have been expended and shall refund to the Guarantor any resulting surplus. All monies refunded to the Guarantor in terms of this Performance Guarantee shall bear interest at the prime overdraft rate of the Employer's bank compounded monthly and calculated from the date payment was made by the Guarantor to the Employer until the date of refund.
8. Payment by the Guarantor in terms of 4 or 5 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.
9. Payment by the Guarantor in terms of 5 will only be made against the return of the original Performance Guarantee by the Employer.
10. The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may deem fit and the Guarantor shall not have the right to claim his release from this Performance Guarantee on account of any conduct alleged to be prejudicial to the Guarantor.
11. The Guarantor chooses the physical address as stated above for the service of all notices for all purposes in connection herewith.

C.1.3.3

12. This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 2, where after no claims will be considered by the Guarantor. The original of this Guarantee shall be returned to the Guarantor after it has expired.
13. This Performance Guarantee, with the required demand notices in terms of 4 or 5, shall be regarded as a liquid document for the purposes of obtaining a court order.
14. Where the Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrate's Courts Act No 32 of 1944, as amended, to the jurisdiction of the Magistrate's Court of any district having jurisdiction in terms of Section 28 of the said Act, notwithstanding that the amount of the claim may exceed the jurisdiction of the Magistrate's Court.

Signed at

Date

Guarantor's signatory (1)

Capacity

Guarantor's signatory (2)

Capacity

Witness signatory (1)

Witness signatory (2)

C1.5 CERTIFICATE OF OWNERSHIP OF PLANT / MATERIALS**NAME OF CONTRACTOR:****ADDRESS:**

.....

NAME OF EMPLOYER:**ADDRESS:**

.....

CONTRACT DESCRIPTION:**CONTRACT NO:**

The undersigned Contractor (duly authorised hereto by virtue of a resolution of the Board of Directors / Members on) hereby certifies the following in accordance with the terms of Clause 6.10.1.5 of the General Conditions of Contract:

- (i) The plant and or materials listed hereunder, which are the Contractor's sole and exclusive property and to which no third party has any rights will upon payment be lawfully acquired by the Employer.
- (ii) The Employer is indemnified against any claim to or in respect of the plant and or materials by reason of the Contractor's sequestration or liquidation, or of any defect in the Contractor's title to the plant and or materials.
- (iii) Upon payment, effective delivery of the plant and or materials to the Employer will take place.
- (iv) Ownership of the plant and or materials will then vest in the Employer.
- (v) The plant and or materials are insured in accordance with the requirements of the Conditions of Contract.
- (vi) The Contractor shall be responsible for the care of the plant and or materials and clearly mark and identify same as being the property of the Employer.
- (vii) The plant and or materials are held by the Contractor in storage for and on behalf of the Employer at address: (the premises).
- (viii) The premises is:
 - *a) the property of the Contractor; or
 - *b) the property of of (address)

..... and are let to the Contractor by

..... of (address)

.....

* (delete whichever is not applicable)

SIGNATURE OF CONTRACTOR:**WITNESS:**

PART C2 – PRICING DATA

C2.1 PRICING INSTRUCTIONS

- 1.0 The Bills of Quantities form part of and must be read in conjunction with the Specification. The Price Summary is to reflect the total price carried forward from the Bills of Quantities which need to be submitted with the tender documents.
- 2.0 The tender price must be based on the Bills of Quantities. The priced Bills of Quantities shall be submitted with the tender documents.

It is important to note that the items and quantities included in the Bill of Quantities are provisional only with the intention in this regard to obtain a schedule of rates for tender and comparative purposes. These provisional quantities are therefore subject to adjustments and / or omissions, partly or in their entirety, depending on the availability of sufficient funding.

- 3.0 The completed Bills of Quantities shall detail the unit rate and total amount for material and labour respectively for each Item. Tenderers are advised to check their Item extensions and total additions since no claim for arithmetical errors will be considered.

“Material Rate” shall include the supply and delivery of all items of material and equipment (plant) to the site including all incidentals necessary for the completion of each Item, plus the profit thereon. Rates shall be exclusive of VAT.

“Labour Rate” shall include the cost of all labour, both skilled and unskilled, including supervision and profit required to complete the installation of all material covered by each Item. Rates shall be exclusive of VAT.

- 4.0 No alteration, erasure or addition is to be made in the text of the Bills of Quantities. Should any erasure or addition be made it will not be recognised but the original wording of the Bills of Quantities will be adhered to.
- 5.0 The quantities in the Bills are not to be considered as limiting or extending the amount of work to be done and materials to be supplied.
- 6.0 The Engineer will check the completed Bills of Quantities for arithmetical errors, omissions and discrepancies in accordance with the Standard Conditions of Tender.
- 7.0 Only major Items have been scheduled but the Tenderer shall nevertheless include for all things he considers necessary whether specified in detail or not to complete the work to specification and in a satisfactory and workmanlike manner, in order to provide a complete and working system. No extra price will be considered for the provision of materials which should have been allowed in order to provide the completed works unless detailed by the Contractor in the space provided elsewhere in the Specification.
- 8.0 Where alternative prices for equipment of different manufacture are offered, the lowest alternative price for equipment to specification must be included, against the relevant Item in the Bills of Quantities. The remaining alternative prices must be furnished separately.

Where such equipment is found not to comply with the Specification, the Contractor will be required to provide equipment which does comply, without adjustment to the price in the Bills of Quantities.

- 9.0 All items in the Bills of Quantities are deemed to include supply, delivery, installation and commissioning where appropriate, unless specifically stated otherwise. The unit rate must include for all things necessary, whether specified in detail or not, including all components, small installation

materials, allowance for off-cuts, wastage etc., erection and fixings to complete the item to Specification in a satisfactory and workmanlike manner, in order to provide a complete and working system.

C2.1.2

- 10.0 In certain instances prices are requested for Items which may be required during the progress of the work, but which are not included in the known quantities of material / labour required. These Items are indicated by the designation "R/O" (rate only) in the "Quantity" column and the price is to be noted in the "Rate" columns only and must not be carried forward.
- 11.0 Where no rates are filled-in by the Tenderer, or the rate is indicated as Nil, it will be assumed that there is no charge for the particular item and that the cost thereof has been included in the other rates provided.
- 12.0 The Bills of Quantities shall not be used for ordering purposes. The Contractor shall check and measure the lengths of cables / conductors on site before ordering any of these materials.
- 13.0 The quantities and rates included for Daywork shall form part of the tender price, but Tenderers shall note that this item must be regarded as provisional and will only be payable to the Contractor if and when a written instruction to this effect has been issued.
- 14.0 Expenditure in connection with Provisional and Prime Cost Sums and under the Contingency Allowance (if any) shall be solely at the discretion and on the written instruction of the Engineer.
- 15.0 An Excel spreadsheet version of the Bill can be made available to Tenderers on request. The spreadsheet may be used for calculation purposes only. The Engineer or the Employer does not take responsibility for any arithmetical or other errors that may occur due to the use of the spreadsheet. The original wording and quantities of the Bills included in the tender document will be adhered to and this Bill must be completed by hand in black ink and submitted with the tender.

C2.2 BILLS OF QUANTITIES

INDEX TO BILLS OF QUANTITIES

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BILL A: PRELIMINARY AND GENERAL ITEMS

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
(i)	<u>NOTES:</u> All rates must be exclusive of VAT.						
(ii)	All quantities are provisional and are for comparative purposes only and do not describe the extent of the work.						
A1.0	<u>GENERAL</u>						
A1.1	Provision of Performance Bond to the value of:						
A1.1.1	R 50 000-00	Sum	R / O		Nil		Nil
A1.1.2	R 100 000-00	Sum	1				
A1.2	Allow for <u>annual</u> premium costs incurred for insurances as required in terms of the contract.	Sum	1				
A1.3	Allow for <u>annual</u> cost incurred for compliance with the requirements of the OHS Act construction regulations.	Sum	1				
A1.4	Monthly standby fee.	Sum	12				
A1.5	Monthly cost of liaison, co-ordination and attendance on Municipality, Eskom, other Contractors, etc.	Sum	12				
A1.6	Allow for attendance on monthly maintenance meetings with the Municipality of minimum 2 hours each.	Sum	12				
A1.7	Allow for monthly liaison with Municipality's appointed Maintenance Supervisor. Item to include for daily feedback / progress / co-ordination meetings and sessions held in Knysna of approx. 1 hour each.	Sum	12				
A1.8	Competent Health and Safety Official (including safety file)	Sum	12				
A2.0	<u>LABOUR AND TRANSPORT RATES</u>						
A2.1	Labour, Normal Time:						
A2.1.1	Engineer	Hour	20				
A2.1.2	Supervisor	Hour	600				
A2.1.3	Installation Technician	Hour	600				
A2.1.4	Labourer	Hour	600				
A2.2	Labour, Normal Overtime:						
A2.2.1	Engineer	Hour	10				
A2.2.2	Supervisor	Hour	120				
A2.2.3	Installation Technician	Hour	120				
A2.2.4	Labourer	Hour	120				
A2.3	Labour, Sundays and Public Holidays:						
A2.3.1	Engineer	Hour	5				
A2.3.2	Supervisor	Hour	50				
A2.3.3	Installation Technician	Hour	50				
A2.3.4	Labourer	Hour	50				
A2.4	Travel:						

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
A2.4.1	Private Car or Light Delivery Vehicle.	km	180000				
A2.4.2	1 Ton 4 x 4 Bakkie	km	5000				
A2.4.3	10 Ton Crane Truck	Hr	200				
A2.4.4	JCB type Backhoe Loader	Hr	200				
A2.5	Accommodation and Subsistence per Person.	day	60				
A3.0	MATERIAL AND LABOUR						
A3.1	Percentage mark-up on the nett cost of unscheduled items of material and labour from external specialist supplier / firm.	%	.....				
A4.0	MISCELLANEOUS						
A4.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawings. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE A TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL B: GENERATOR INSTALLATION

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>NOTES:</u>						
(i)	All rates must be exclusive of VAT.						
(ii)	All rates to include for supply, delivery and installation thereof unless specified otherwise.						
(iii)	All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work.						
B1.0	<u>EQUIPMENT</u>						
B1.1	Generating set with residential type exhaust silencing system complete as specified, including delivery to site and rigging into position inside roofed building:						
B1.1.1	50 kVA (40 kWe)	Item	2				
B1.1.2	100 kVA (80 kWe)	Item	2				
B1.1.3	150 kVA (120 kWe)	Item	R / O		R nil	R	nil
B1.1.4	200 kVA (160 kWe)	Item	R / O		R nil	R	nil
B1.1.5	300 kVA (240 kWe)	Item	R / O		R nil	R	nil
B1.1.6	400 kVA (320 kWe)	Item	R / O		R nil	R	nil
B1.1.7	550 kVA (440 kWe)	Item	R / O		R nil	R	nil
B1.2	Weatherproof, 3CR12, canopy type enclosure for generating set mentioned in Item B1.1 above with sound output level of 80 dB @ 7m, including all sound attenuating louvres, padding, etc required.						
B1.2.1	50 kVA (40 kWe)	Item	R / O		R nil	R	nil
B1.2.2	100 kVA (80 kWe)	Item	R / O		R nil	R	nil
B1.2.3	160 kVA (128 kWe)	Item	R / O		R nil	R	nil
B1.2.4	200 kVA (160 kWe)	Item	1		R nil	R	nil
B1.2.5	300 kVA (240 kWe)	Item	R / O		R nil	R	nil
B1.2.6	400 kVA (320 kWe)	Item	R / O		R nil	R	nil
B1.2.7	550 kVA (440 kWe)	Item	R / O		R nil	R	nil
B1.3	Generator control / change-over panel complete as specified, excluding kVA / kWh consumption meter measured elsewhere for:						
B1.3.1	50 kVA (40 kWe)	Item	2				
B1.3.2	100 kVA (80 kWe)	Item	2				
B1.3.3	150 kVA (120 kWe)	Item	R / O		R nil	R	nil
B1.3.4	200 kVA (160 kWe)	Item	R / O		R nil	R	nil
B1.3.5	300 kVA (240 kWe)	Item	R / O		R nil	R	nil
B1.3.6	400 kVA (320 kWe)	Item	R / O		R nil	R	nil
B1.3.7	550 kVA (440 kWe)	Item	R / O		R nil	R	nil
B1.4	Day tank with 12 hour diesel storage capacity including drip tray and interconnecting pipework, etc for:						
B1.4.1	50 kVA (40 kWe)	Item	2				
B1.4.2	100 kVA (80 kWe)	Item	2				
B1.4.3	150 kVA (120 kWe)	Item	R / O		R nil	R	nil
B1.4.4	200 kVA (160 kWe)	Item	R / O		R nil	R	nil
B1.4.5	300 kVA (240 kWe)	Item	R / O		R nil	R	nil
B1.4.6	400 kVA (320 kWe)	Item	R / O		R nil	R	nil
B1.4.7	550 kVA (440 kWe)	Item	R / O		R nil	R	nil
B1.5	Self priming electrically operated pump for automatically filling of indoor day tank.	Sum	4				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
B1.6	Supply, install and connect Wica diesel type, 0 to 1m, pressure transmitter complete with 15 m of instrumentation cable, including isolating ball valve, etc on day tank inside generator room.	Sum	4				
B1.7	Earthing of new generator equipment, including 2 x 4,5m earth spikes and ± 30 metres of 70 mm² Cu bare conductor, lugs, etc.	Sum	4				
B1.8	Interconnecting and interfacing of generator controls, diesel level sensor, etc to telemetry equipment supplied by others, including liaison with Telemetry Contractor to ensure correct operation of remote monitoring of the generator set .	Sum	4				
B2.0	<u>MISCELLANEOUS</u>						
B2.1	Supply and install replacement generator starter battery:						
B2.1.1	12V, 102Ah	Sum	4				
B2.2	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawings. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE B TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL C: CONTROL PANEL EQUIPMENT

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>NOTES:</u>						
(i)	All rates must be exclusive of VAT.						
(ii)	All rates to include for supply, delivery and installation thereof unless specified otherwise.						
(iii)	All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work.						
C1.0	<u>CONTROL CUBICLES</u>						
	Tenders to price each control / equipment cubicle separately in accordance with the typical items of equipment to be installed inside same as indicated in the Specification. Allowance shall be made for all busbars, wiring, cut-outs, etc required, as well as for the necessary 304 stainless steel cladding / enclosure.						
C1.1	Supply and install typical incomer compartment cubicle, excl kWh meter but complete with power analyser, surge arrestors, busbars, etc. with both main incoming and generator MCB's rated at:						
C1.1.1	60A @ 10 kA	Sum	1				
C1.1.2	100A @ 15 kA	Sum	1				
C1.1.3	150A @ 15 kA	Sum	1				
C1.1.4	250A @ 25 kA	Sum	1				
C1.1.5	300A @ 25 kA	Sum	1				
C1.1.6	300 to 630A @ 50 kA (adjustable type)	Sum	1				
C1.2	Single pump control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl pump motor drive (i.e. VSD / Soft Starter) measured elsewhere for:						
C1.2.1	3 kW pump	Sum	1				
C1.2.2	7,5 kW pump	Sum	1				
C1.2.3	15 kW pump	Sum	1				
C1.2.4	30 kW pump	Sum	1				
C1.2.5	55 kW pump	Sum	1				
C1.2.6	90 kW pump	Sum	1				
C1.2.7	132 kW pump	Sum	1				
C1.2.8	315 kW pump	Sum	1				
C1.3	Single mixer control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl pump motor drive (i.e. VSD / Soft Starter) measured elsewhere for:						
C1.3.1	1.1 kW mixer	Sum	1				
C1.3.2	3 kW mixer	Sum	1				
C1.4	Single mixer control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl mixer motor drive (i.e. VSD / soft starters) measured elsewhere for:						
C1.4.1	1.1 kW mixer	Sum	1				
C1.4.2	3 kW mixer	Sum	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
C1.5	Single mechanical screen control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl screen motor drive (i.e. VSD / soft starters) measured elsewhere for:						
C1.5.1	1.1 kW screen	Sum	1				
C1.5.2	3 kW screen	Sum	1				
C1.6	Single screw conveyor screen control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl motor drive (i.e. VSD / soft starters) measured elsewhere for:						
C1.6.1	1.1 kW screw conveyor	Sum	1				
C1.6.2	3 kW screw conveyor	Sum	1				
C1.7	Single lime dosing control compartment complete with typical control gear, alarm / status indicator lamps, telemetry I/O, etc as specified, but excl motor drive (i.e. VSD / soft starters) measured elsewhere for:						
C1.7.1	0,75 kW lime dosing unit	Sum	1				
C1.8	Single PLC / HMI control compartment complete with Delta type PLC and HMI equipment, I/O and communication cards, etc as specified with sufficient I/O modules to cater for:						
C1.8.1	50 x DIN, 10 x DOT, 5 x AIN	Sum	1				
C1.8.2	100 x DIN, 10 x DOT, 5 x AIN	Sum	1				
C1.8.3	150 x DIN, 20 x DOT, 10 x AIN	Sum	1				
C1.9	Single spare compartment with backplate for mounting of telemetry / future equipment.	Sum	1				
C1.10	HMI / PLC software programming including implementation of Client / Engineer specific requirements regarding HMI security and control setup, as well as checking and verifying all other control functions for implementing typical control philosophy described in specification for:						
C1.10.1	Pump	Sum	1				
C1.10.2	Mixer	Sum	1				
C1.10.3	Mechanical screen	Sum	1				
C1.10.4	Screw Conveyor	Sum	1				
C1.10.5	Lime dosing	Sum	1				
C1.11	Supply and install VSD similar or approved equal to Weg CFW11 type inside new Motor Control Panel cubicles for:						
C1.11.1	0,75 kW motor	Item	1				
C1.11.2	1,1 kW motor	Item	1				
C1.11.3	3 kW motor	Item	1				
C1.11.4	7,5 kW motor	Item	1				
C1.11.5	15 kW motor	Item	1				
C1.11.6	30 kW motor	Item	1				
C1.11.7	55 kW motor	Item	1				
C1.11.8	90 kW motor	Item	1				
C1.11.9	132 kW motor	Item	1				
C1.11.10	315 kW motor	Item	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
C1.12	Supply and install soft starter equipment similar or approved equal to Weg type inside new Motor Control Panel cubicles for:						
C1.12.1	0,75 kW motor	Item	1				
C1.12.2	1,1 kW motor	Item	1				
C1.12.3	3 kW motor	Item	1				
C1.12.4	7,5 kW motor	Item	1				
C1.12.5	15 kW motor	Item	1				
C1.12.6	30 kW motor	Item	1				
C1.12.7	55 kW motor	Item	1				
C1.12.8	90 kW motor	Item	1				
C1.12.9	132 kW motor	Item	1				
C1.12.10	260 kW motor	Item	1				
C1.13	Spare set of three ultra-rapid fuses for all VSD / Soft Starter equipment installed in MCC panel measured elsewhere.						
C1.13.1	0,75 kW motor	Item	1				
C1.13.2	1,1 kW motor	Item	1				
C1.13.3	3 kW motor	Item	1				
C1.13.4	7,5 kW motor	Item	1				
C1.13.5	15 kW motor	Item	1				
C1.13.6	30 kW motor	Item	1				
C1.13.7	55 kW motor	Item	1				
C1.13.8	90 kW motor	Item	1				
C1.13.9	132 kW motor	Item	1				
C1.13.10	260 kW motor	Item	1				
C1.14	Supply and install kWh meter inside incomer compartment cubicle of MCC control panel for incoming three phase supplies:						
C1.14.1	<u>Less than 100A</u> - Direct connect Landis & Gyr 3219 (Ampy) type kWh meter	Item	1				
C1.14.2	<u>Above 100A</u> - Landis & Gyr type ZMD 405 C7 kWh meter, including CT's LED indicator fuses, test block and cell phone modem for remote metering. Item to include testing, commissioning and programming of meter by Specialist Contractor to municipal requirements, including test reports, etc.	Item	1				
C1.15	Moulded case circuit breaker complete with interconnecting tails, etc. installed inside MCC Panel, kiosk, etc:						
C1.15.1	300 to 630A @ 50 kA (TP, adjustable type)	No.	1				
C1.15.2	300A @ 25 kA (TP)	No.	1				
C1.15.3	250A @ 25 kA (TP)	No.	1				
C1.15.4	150A @ 15 kA (TP)	No.	1				
C1.15.5	100A @ 10 kA (TP)	No.	1				
C1.15.6	80A @ 10 kA (TP)	No.	1				
C1.15.7	63A @ 10 kA (TP)	No.	1				
C1.15.8	40A @ 10 kA (TP)	No.	1				
C1.15.9	20A @ 10 kA (TP)	No.	1				
C1.15.10	80A @ 10 kA (SP)	No.	1				
C1.15.11	63A @ 10 kA (SP)	No.	1				
C1.15.12	40A @ 10 kA (SP)	No.	1				
C1.15.13	20A @ 10 kA (SP)	No.	1				
C1.15.14	63A E/L Unit (3P + N)	No.	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
C1.15.15	63A E/L Unit (1P + N)						
C2.0	<u>MISCELLANEOUS</u>						
C2.1	Liasion with Municipality's Telemetry Contractor for the interfacing and enabling of the new / upgraded MCC panel and equipment onto the telemetry system.	Sum	1				
C2.2	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawings. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE C TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL D: ELECTRICAL INSTALLATION

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>NOTES:</u>						
(i)	All rates must be exclusive of VAT.						
(ii)	All rates to include for supply, delivery and installation thereof unless specified otherwise.						
(iii)	All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work.						
D1.0	<u>ELECTRICAL INSTALLATION</u>						
D1.1	Arrange power shut-down with Municipality / Eskom. Item to include Attendance Fee to be paid to Municipality / Eskom.	Sum	1				
D1.2	Trenching by hand for LV cable / sleeve, 400 mm wide x 700 mm deep, including backfilling and compaction:						
D1.2.1	Soft pickable soil	m	250				
D1.2.2	Soft Rock	m	100				
D1.2.3	Hard rock	m	50				
D1.3	400 mm wide x 100 micron PVC Marker tape over cable in trench measured elsewhere.	m	400				
D1.4	Concrete cable markers indicating cable direction, size etc.	No.	8				
D1.5	450mm Deep imported bedding / cover material in 400mm wide trench measured elsewhere. Backfill material to be recovered from trenches	m	400				
D1.6	Extra over cost for Items D1.2 and D1.5 above:						
D1.6.1	Imported backfill material from off-site source.	m³	6				
D1.6.2	Disposal of surplus or unsuitable material including haulage up to 10 km from site.	m³	6				
D1.7	Break-up and re-instate paving along cable route after installation of sleeve.	m	40				
D1.8	uPVC sleeve installed in floor slab / trench measured elsewhere:						
D1.8.1	110mm Ø sleeve.	m	40				
D1.9	Seal sleeve ends after installation of cable using Sista foam.						
D1.9.1	110mm Ø sleeve.	No.	4				
D1.9.2	75mm Ø conduit.	No.	4				
D1.9.3	50mm Ø conduit.	No.	4				
D1.10	Supply and install overall screened, steel wire armoured, twisted pair type instrumentation cables in sleeve / conduit / cable tray measured elsewhere.						
D1.10.1	1,5 mm² x 1 Pair	m	100				
D1.10.2	1,5 mm² x 8 Pair	m	100				
D1.10.3	1,5 mm² x 8 Pair	m	100				
D1.11	Supply and install LV, PVCAS cable in trench / sleeve / cable tray measured elsewhere:						
D1.11.1	630 mm² Cu x 1 Core (Unarmoured)	m	5				
D1.11.2	300 mm² Cu x 1 Core (Unarmoured)	m	5				
D1.11.3	185 mm² Cu x 4 Core	m	5				
D1.11.4	150 mm² Cu x 4 Core	m	5				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
D1.11.5	120 mm ² Cu x 4 Core	m	5				
D1.11.6	95 mm ² Cu x 4 Core	m	50				
D1.11.7	70 mm ² Cu x 4 Core	m	50				
D1.11.8	50 mm ² Cu x 4 Core	m	50				
D1.11.9	35 mm ² Cu x 4 Core	m	50				
D1.11.10	25 mm ² Cu x 4 Core	m	50				
D1.11.11	16 mm ² Cu x 4 Core	m	50				
D1.11.12	10 mm ² Cu x 4 Core	m	50				
D1.11.13	6 mm ² Cu x 4 Core	m	50				
D1.11.14	4 mm ² Cu x 4 Core	m	50				
D1.11.15	2,5 mm ² Cu x 4 Core	m	50				
D1.11.16	1,5 mm ² Cu x 4 Core	m	50				
D1.12	Duracast resin through joint in LV, PVCAS cable measured elsewhere:						
D1.12.1	630 mm ² Cu x 1 Core (Unarmoured)	No.	1				
D1.12.2	300 mm ² Cu x 1 Core (Unarmoured)	No.	1				
D1.12.3	185 mm ² Cu x 4 Core	No.	1				
D1.12.4	150 mm ² Cu x 4 Core	No.	1				
D1.12.5	120 mm ² Cu x 4 Core	No.	1				
D1.12.6	95 mm ² Cu x 4 Core	No.	1				
D1.12.7	70 mm ² Cu x 4 Core	No.	1				
D1.12.8	50 mm ² Cu x 4 Core	No.	1				
D1.12.9	35 mm ² Cu x 4 Core	No.	1				
D1.12.10	25 mm ² Cu x 4 Core	No.	1				
D1.12.11	16 mm ² Cu x 4 Core	No.	1				
D1.12.12	10 mm ² Cu x 4 Core	No.	1				
D1.12.13	6 mm ² Cu x 4 Core	No.	1				
D1.12.14	4 mm ² Cu x 4 Core	No.	1				
D1.12.15	2,5 mm ² Cu x 4 Core	No.	1				
D1.12.16	1,5 mm ² Cu x 4 Core	No.	1				
D1.13	Terminate and connect LV, PVCAS cables at kiosk / MCC panel / motors / equipment using brass cable gland, brass locknut, neoprene rubber shroud and crimp lugs:						
D1.13.1	630 mm ² Cu x 1 Core (Unarmoured)	No.	2				
D1.13.2	300 mm ² Cu x 1 Core (Unarmoured)	No.	2				
D1.13.3	185 mm ² Cu x 4 Core	No.	2				
D1.13.4	150 mm ² Cu x 4 Core	No.	2				
D1.13.5	120 mm ² Cu x 4 Core	No.	2				
D1.13.6	95 mm ² Cu x 4 Core	No.	2				
D1.13.7	70 mm ² Cu x 4 Core	No.	2				
D1.13.8	50 mm ² Cu x 4 Core	No.	2				
D1.13.9	35 mm ² Cu x 4 Core	No.	2				
D1.13.10	25 mm ² Cu x 4 Core	No.	2				
D1.13.11	16 mm ² Cu x 4 Core	No.	2				
D1.13.12	10 mm ² Cu x 4 Core	No.	2				
D1.13.13	6 mm ² Cu x 4 Core	No.	2				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
D1.13.14	4 mm ² Cu x 4 Core	No.	2				
D1.13.15	2,5 mm ² Cu x 4 Core	No.	2				
D1.13.16	1,5 mm ² Cu x 4 Core	No.	2				
D1.14	Terminate and connect overall screened, steel wire armoured, twisted pair type instrumentation cables at MCC panel / equipment / remote E-stop stations / pratley or termination box using brass cable gland, brass locknut, neoprene rubber shroud and crimp lugs:						
D1.14.1	1,5 mm ² x 1 Pair	No.	2				
D1.14.2	1,5 mm ² x 4 Pair	No.	2				
D1.14.3	1,5 mm ² x 8 Pair	No.	2				
D1.15	Terminate and connect instrumentation cables supplied with pressure / flow sensors, no flow / float switches, PT 100 sensors, etc at MCC panel / junction box using compression type glands and crimp lugs.	Sum	10				
D1.16	HD bare copper earth wire laid in trench / sleeve / cable tray:						
D1.16.1	50mm ²	m	30				
D1.16.2	35mm ²	m	30				
D1.16.3	25mm ²	m	30				
D1.16.4	16mm ²	m	30				
D1.16.5	6mm ²	m	30				
D1.16.6	4mm ²	m	30				
D1.17	Hard drawn bare copper earth wire terminated at kiosk / MCC panel / pump motor / pratley or termination box.						
D1.17.1	50mm ²	No.	4				
D1.17.2	35mm ²	No.	4				
D1.17.3	25mm ²	No.	4				
D1.17.4	16mm ²	No.	4				
D1.17.5	6mm ²	No.	4				
D1.17.6	4mm ²	No.	4				
D1.18	Main AMF / MCC earth consisting of approx 30 metre length of 70mm ² PVC bare copper conductor installed in trench, 2 x 4,5 metre long earth spikes and 2 x earth spike markers.	Sum	4				
D1.19	Galvanised steel conduit saddled to pumpstation ceiling / wall / roof purlins, etc. Item to include for all saddles, adapters etc required.						
D1.19.1	40 mm Ø	m	40				
D1.19.2	32 mm Ø	m	40				
D1.19.3	25 mm Ø	m	50				
D1.19.4	20 mm Ø	m	60				
D1.20	PVC conduit saddled to pumpstation ceiling / wall / roof purlins, etc. Item to include for all saddles, adapters etc required.						

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
D1.20.1	75 mm Ø	m	20				
D1.20.2	50 mm Ø	m	40				
D1.20.3	40 mm Ø	m	40				
D1.20.4	32 mm Ø	m	40				
D1.20.5	25 mm Ø	m	60				
D1.20.6	20 mm Ø	m	60				
D1.21	Surface mounted conduit boxes complete with covers and including fixing screws, etc:						
D1.21.1	100 x 50 mm PVC boxes	No.	10				
D1.21.2	65mm Diameter PVC round box	No.	10				
D1.21.3	100 x 50 mm galvanised steel boxes	No.	10				
D1.22	Surface mounted, weather and vandalproof instrumentation junction boxes rated IP 65 minimum, complete with all terminals, connectors, etc for all cable / conduit terminations as required for connection of:						
D1.22.1	Typical pump (i.e. flow switch, PT 100's, Klixons, etc)	No.	4				
D1.22.2	Typical Mixer (seal fail, Klixons, etc)	No.	4				
D1.22.3	Typical Screen (over torque, etc)	No.	4				
D1.22.4	Sump (ultrasonic sensor, float switches, etc)	No.	1				
D1.23	Three way, IP 68 EZEE-FIT Ex n Pratley No. 0 Instrumentation cable box, complete with Kwikblok mountings, Kwikblocks, etc.	Item	4				
D1.24	600 / 1000 V PVC insulated copper conductors wiring drawn into conduit / cable tray, including terminations, etc. (Conduit / cable tray measured elsewhere):						
D1.24.1	4 mm ²	m	60				
D1.24.2	2,5 mm ²	m	60				
D1.25	Supply and install Matelec type rotatable weatherproof switches in flush mounted boxes:						
D1.25.1	One way	No.	8				
D1.25.2	Two way	No.	4				
D1.26	Light fittings surface mounted to wall / ceiling, etc including all galvanised steel screws, grommets, lamps, tubes, etc.:						
D1.26	IP 65, enclosed fluorescent type luminaire similar or approved equal to the Lascon Corolite 10N type with 2 x 58W lamps.	No.	6				
D1.26.2	150 W HPS luminaires with internal eyelids, glass diffusers and decorative skirt similar or approved equal to Bkanova type.	No.	R / O		Nil		Nil
D1.27	Surface mounted 16 Amp 3-pin weatherproof switch socket outlet:						
D1.27.1	Double socket outlet	No.	5				
D1.28	Hot dipped galvanised steel <u>mesh</u> cable tray installed against wall / floor. Item to include all brackets, stainless steel mounting screws / bolts required:						
D1.28.1	400mm wide	m	10				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
D1.28.2	200mm wide	m	10				
D1.28.3	100mm wide	m	10				
D1.28.4	50mm wide	m	10				
D1.29	Labelling of all cables.	Sum	1				
D2.0	<u>MISCELLANEOUS</u>						
D2.1	Provide Certificate of Compliance for upgraded / modified / new electrical installation as required in terms of the regulations.	Item	5				
D2.2	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE C TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL E: MISCELLANEOUS EQUIPMENT AND MATERIAL ITEMS

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>NOTES:</u> (i) All rates must be exclusive of VAT. (ii) All rates to include for supply, delivery and installation thereof unless specified otherwise. (iii) All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work.						
E1.0	<u>LEVEL SENSORS</u>						
E1.1	Supply, install and connect high / low level float switches, similar or equal to Flygt ENM-6 type inside pump chamber complete with 15m of trailing cable.	Sum	10				
E1.2	Supply, install and connect Wica type or similar, submersible pressure transducer (0 to 5 m) complete with 10 m of instrumentation cable inside sewage sump / reservoir. Item to include for 3 off stainless steel unistrut type mounting brackets with K-type clamps and +- 50 mm diameter protective PVC pipe.	Sum	2				
E1.3	Supply, install and connect Wica type or similar, submersible pressure transducer (0 - 150m) complete with 1500m of instrumentation cable inside borehole. Item to include for ± 1500m of ± 50 mm diameter protective HDPE Pipe, including all mounting brackets, etc required.	Sum	2				
E1.4	Supply, install and connect Wica type or similar, 0 to 15 bar, pressure transmitter complete with 10 m of instrumentation cable, including isolating ball valve, etc on pipeline inside pumpstation.	Sum	2				
E1.5	Supply, install and connect Mobrey type or similar, 0 to 5m, ultrasonic level / flow monitoring transducer complete with 10 m of instrumentation cable, including stainless steel mounting brackets assemblies and sensor head inside sump / reservoir.	Sum	4				
E1.6	Supply and install Mobrey MCU901WX-A type controller or similar inside MCC panel, etc.	Sum	1				
E2.0	<u>FLOW METERS</u>						
E2.1	Supply and install new <u>24 / 220 V AC</u> , PN10 rated in-line, full bore, double flanged electromagnetic type flow meter and display similar or equal to Siemens Magflow type, complete as specified including all setting up, calibration, etc of nominal internal diam size:						
E2.1.1	DN80	Item	R / O		Nil		Nil
E2.1.2	DN100	Item	R / O		Nil		Nil
E2.1.3	DN125	Item	R / O		Nil		Nil
E2.1.4	DN150	Item	R / O		Nil		Nil
E2.1.5	DN200	Item	R / O		Nil		Nil
E2.1.6	DN250	Item	R / O		Nil		Nil

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
E2.1.6	DN300	Item	R / O		Nil		Nil
E2.2	Supply and install new battery powered, PN10 rated in-line, full bore, double flanged electromagnetic type flow meter and display similar or equal to Flowmetrix Batmag type, complete as specified including all setting up, calibration, etc of nominal internal diam size:						
E2.2.1	DN80	Item	R / O		Nil		Nil
E2.2.2	DN100	Item	R / O		Nil		Nil
E2.2.3	DN125	Item	R / O		Nil		Nil
E2.2.4	DN150	Item	R / O		Nil		Nil
E2.2.5	DN200	Item	R / O		Nil		Nil
E2.2.6	DN250	Item	R / O		Nil		Nil
E2.2.7	DN300	Item	R / O		Nil		Nil
E2.3	Supply and install new IP67 rated ultrasonic clamp on type flow meter and display similar or equal to the Siemens Sitrans type, complete as specified including all setting up, calibration, etc.	Item	R / O		Nil		Nil
E2.4	Liasion with Municipality's Telemetry Contractor for the interfacing and enabling of the new flowmeter onto the telemetry system.	Sum	1				
E3.0	<u>MISCELLANEOUS</u>						
E3.1	Supply, install and connect IP 65 microswitch limit type flow monitoring switches on counterweights on non-return valve arm attachments, including stainless steel mounting brackets, etc.	Sum	8				
E3.2	Start / Stop / Emergency Stop push button station, hot dipped galvanised 1 200 mm x 100 mm x 50 mm channel iron and base plate support assembly, etc	Item	8				
E3.3	Supply and install 9 kg dry powder Fire Extinguisher.	Item	5				
E3.4	Safety sign and notices complete as specified.	Sum	5				
E3.5	Supply and install municipal type padlocks on building / equipment.	Item	5				
E3.6	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE E TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL F: PUMPS, MOTORS AND ACCESSORIES

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>Notes:</u> (i) All rates must be exclusive of VAT. (ii) All rates to include for supply, delivery and installation thereof unless specified otherwise. (iii) All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work. <u>RAW WATER PUMPS</u> <u>Self- Priming Pumps</u> The specified raw water self-priming pump sizes listed below shall each include for the following items: - Priming air valve to suit application and duty. - Low NPSHreq. - Cast iron impeller and mechanical seals. - Baseplate and coupling or V-belt with pulleys for both pump and motor. F1.1 Supply and install <u>self-priming pump</u> with an approximate Flow Rate (l/s) and Head (m) as follows: F1.1.1 15l/s Flow and 15m Head F1.1.2 20l/s Flow and 35m Head F1.1.3 30l/s Flow and 6m Head F1.1.4 35l/s Flow and 20m Head F1.1.5 40l/s Flow and 30m Head F1.1.6 45l/s Flow and 15m Head F1.1.7 50l/s Flow and 40m Head F1.1.8 50l/s Flow and 80m Head F1.1.9 60l/s Flow and 4m Head F1.1.10 110l/s Flow and 45m Head F1.1.11 150l/s Flow and 50m Head F1.1.12 150l/s Flow and 60m Head F2.0 <u>Centrifugal Pumps</u> The specified raw water centrifugal pump sizes listed below shall each include for the following items: - Bronze impeller, diffuser and wear rings. - EN57 shafts and mechanical seals. - Baseplate and coupling for both pump and motor. - Suitable for raw water. F2.1 Supply and install <u>4-pole centrifugal pump</u> with an approximate Flow Rate (l/s) and Head (m) as follows: F2.1.1 5l/s Flow and 25m Head F2.1.2 7,5l/s Flow and 100m Head F2.1.3 10l/s Flow and 175m Head F2.1.4 15l/s Flow and 15m Head						

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
F2.1.5	15l/s Flow and 45m Head	No	1				
F2.1.6	20l/s Flow and 35m Head	No	1				
F2.1.7	20l/s Flow and 150m Head	No	1				
F2.1.8	30l/s Flow and 6m Head	No	1				
F2.1.9	35l/s Flow and 20m Head	No	1				
F2.1.10	40l/s Flow and 30m Head	No	1				
F2.1.11	45l/s Flow and 15m Head	No	1				
F2.1.12	50l/s Flow and 40m Head	No	1				
F2.1.13	50l/s Flow and 80m Head	No	1				
F2.1.14	50l/s Flow and 120m Head	No	1				
F2.1.15	60l/s Flow and 4m Head	No	1				
F2.1.16	110l/s Flow and 45m Head	No	1				
F2.1.17	150l/s Flow and 50m Head	No	1				
F2.1.18	150l/s Flow and 60m Head	No	1				
F3.0	<u>Borehole Pumps</u> The specified raw water borehole pump sizes listed below shall each include for the following items: - Stainless steel or non-ferrous pump / motor casing and impeller. - Mechanical seals. - Motor drop cable to be of suitable length to suit depth of borehole, i.e. no cable joints allowed in drop cable. - Suitable for raw water with a high iron and manganese concentration.						
F3.1	Supply and install <u>4-pole borehole pump</u> with an approximate Flow Rate (l/s) and Head (m) as follows:						
F3.1.1	2,5l/s Flow and 50m Head	No	1				
F3.1.2	2,5l/s Flow and 100m Head	No	1				
F3.1.3	5l/s Flow and 50m Head	No	1				
F3.1.4	5l/s Flow and 100m Head	No	1				
F3.1.5	7,5l/s Flow and 50m Head	No	1				
F3.1.6	7,5l/s Flow and 100m Head	No	1				
F3.1.7	10l/s Flow and 50m Head	No	1				
F3.1.8	10l/s Flow and 100m Head	No	1				
F3.1.9	7,5l/s Flow and 125m Head	No	1				
	<u>SEWAGE PUMPS</u>						
F4.0	<u>Self- Priming Pumps</u> The specified self-priming pumps of sizes and duty listed below shall each include for the following items: - Priming air valve to suit application and duty. - Low NPSHreq. - Cast iron semi open type impeller and mechanical seals. - Replaceable wear plate. - Baseplate and coupling or V-belt with pulleys for both pump and motor. - Suitable for raw unscreened sewage of minimum 76mm solids capacity.						

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
F4.1	Supply and install self-priming pump of size and Max Head (m) and Flow Rate (l/s) as follows:						
F4.1.1	Size: 152 x 152mm Max Head: 32m Max Flow Rate: 24 l/s	No	1				
F4.1.2	Size: 254 x 254mm Max Head: 40m Max Flow Rate: 214 l/s	No	1				
F4.1.3	Size: 102 x 76 mm Max Head: 51m Max Flow Rate: 121 l/s	No	1				
F5.0	<u>Submersible Pumps</u> The specified sewage submersible pump sizes listed below shall each include for the following items:						
-	Cast iron and non-clog impeller.						
-	10m Power and control cable.						
-	Mechanical seals.						
-	Motor fitted with Klixon type winding over temperature sensors and mechanical seal failure sensor.						
-	Duckfoot bend kit complete.						
-	Suitable for raw unscreened sewage.						
F5.1	Supply and install submersible pump set similar or approved equal to existing make and model listed below:						
F5.1.1	Robot type RW 2120 BE-V (2.6 kW)	No	1				
F5.1.2	Robot type RW 2130 DG-V (2.9 kW)	No	1				
F5.1.3	Robot type RW 2130 DG-V (3.5 kW)	No	1				
F5.1.4	Robot type RW 2120 BH-V (4 kW)	No	1				
F5.1.5	Robot type RW 4030 DJ-V (5 kW)	No	1				
F5.1.6	Robot type RW 4040/5.5 4 (5.5 kW)	No	1				
F5.1.7	Robot type RW 4030 DL-V (6 kW)	No	1				
F5.1.8	Robot type RW 4041/7.5 (7.5 kW)	No	1				
F5.1.9	Robot type RW 4032 BR-V (9 kW)	No	1				
F5.1.10	Robot type RW 6130 JE-V (13 kW)	No	1				
F5.1.11	Robot type RW 6130 JE-V (20 kW)	No	1				
F5.1.12	EPS type 8.200 22 kW	No	1				
F5.1.13	Robot type RW 6130 JG-V (29 kW)	No	1				
F5.1.14	EPS type 150.32 30 kW	No	1				
F5.1.15	Robot type RW 6141 LI-V (34 kW)	No	1				
F5.1.16	Robot type RW 6130 JL-V (48 kW)	No	1				
	<u>LIME DOSING PUMP</u>						
F6.0	<u>Lime Dosing Pump</u>						
F6.1	Supply and install <u>dry lime feeder</u> with stainless steel worm and stainless steel hopper (0,3m ³ capacity), dosage rate of 5kg/hour, suitable for VSD application, complete with a 400V, 3-phase motor and mounting frame.						
	<u>ELECTRIC MOTORS</u> The specified pump motor sizes listed below shall each include for the following items:						
-	<u>All motors from 30kW to 150kW:</u> Fitted with thermistor winding protection.	No	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
-	<u>All motors from 185kW to 315kW:</u> Fitted with PT100 temperature sensors on windings and bearings, fitted in separate terminal enclosure.						
-	All motors to be suitable for operation at 400V, 50Hz operation.						
F7.0	<u>2-Pole Electric Motor</u>						
F7.1	Supply and install <u>4-pole electric motor</u> with a standard kW power rating as follows:						
F7.1.1	5,5kW	No	1				
F7.1.2	7,5kW	No	1				
F7.1.3	11kW	No	1				
F7.1.4	15kW	No	1				
F7.1.5	18,5kW	No	1				
F7.1.6	22kW	No	1				
F7.1.7	30kW	No	1				
F7.1.8	37kW	No	1				
F7.1.9	45kW	No	1				
F7.1.10	55kW	No	1				
F7.1.11	75kW	No	1				
F7.1.12	90kW	No	1				
F7.1.13	110kW	No	1				
F8.0	<u>4-Pole Electric Motor</u>						
F8.1	Supply and install <u>4-pole electric motor</u> with a standard kW power rating as follows:						
F8.1.1	5,5kW	No	1				
F8.1.2	7,5kW	No	1				
F8.1.3	11kW	No	1				
F8.1.4	15kW	No	1				
F8.1.5	18,5kW	No	1				
F8.1.6	22kW	No	1				
F8.1.7	30kW	No	1				
F8.1.8	37kW	No	1				
F8.1.9	45kW	No	1				
F8.1.10	55kW	No	1				
F8.1.11	75kW	No	1				
F8.1.12	90kW	No	1				
F8.1.13	110kW	No	1				
F8.1.14	132kW	No	1				
F8.1.15	150kW	No	1				
F8.1.16	185kW	No	1				
F8.1.17	225kW	No	1				
F8.1.18	260kW	No	1				
F9.0	<u>6-Pole Electric Motor</u>						
F9.1	Supply and install <u>6-pole electric motor</u> with a standard kW power rating as follows:						
F9.1.1	5,5kW	No	R/O				
F9.1.2	7,5kW	No	R/O				
F9.1.3	11kW	No	R/O				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
F9.1.4	15kW	No	R/O				
F9.1.5	18,5kW	No	R/O				
F9.1.6	22kW	No	R/O				
F9.1.7	30kW	No	R/O				
F9.1.8	37kW	No	R/O				
F9.1.9	45kW	No	R/O				
F9.1.10	55kW	No	R/O				
F9.1.11	75kW	No	R/O				
F9.1.12	90kW	No	R/O				
F9.1.13	110kW	No	R/O				
F9.1.14	132kW	No	R/O				
F9.1.15	150kW	No	R/O				
F9.1.16	185kW	No	R/O				
F9.1.17	225kW	No	R/O				
F9.1.18	260kW	No	R/O				
	<u>MISCELLANEOUS</u>						
F10.0	<u>Compressors</u>						
F10.1	Supply and install industrial rated, electrically driven piston type air compressor of standard ratings as follows:						
F10.1.1	Working Pressure: 12 Bar Displacement: 5 cfm Approx Power: ± 1,1 kW	No	1				
F10.1.2	Working Pressure: 12 Bar Displacement: 18 cfm Approx Power: ± 4 kW	No	1				
F10.1.3	Working Pressure: 12 Bar Displacement: 25 cfm Approx Power: ± 5,5 kW	No	1				
F10.1.4	Working Pressure: 12 Bar Displacement: 32 cfm Approx Power: ± 7,0 kW	No	1				
F11	<u>Cabling</u>						
F11.1	Supply and fit 600 / 1000V rated submersible type trailing cables to submersible pumps, etc.						
F11.1.1	16 mm ² Cu x 4 Core	m	10				
F11.1.2	10 mm ² Cu x 4 Core	m	10				
F11.1.3	6 mm ² Cu x 4 Core	m	10				
F11.1.4	4 mm ² Cu x 4 Core	m	10				
F11.1.5	2,5 mm ² Cu x 4 Core	m	10				
F11.1.6	1,5 mm ² Cu x 4 Core	m	10				
F11.1.7	4 mm ² Cu x 7 Core	m	10				
F11.1.8	2,5 mm ² Cu x 7 Core	m	10				
F11.1.9	1,5 mm ² Cu x 7 Core	m	10				
F12.0	<u>Guide Bars</u>						
F12.1	Supply and fit approx 6m long stainless steel guide rail inside sump:						
F12.1.1	DN65	Item	1				
F12.1.2	DN80	Item	1				
F12.1.3	DN100	Item	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
F12.2	Supply and fit new stainless steel top guide rail bracket inside sump:						
F12.2.1	DN65	Item	1				
F12.2.2	DN80	Item	1				
F12.2.3	DN100	Item	1				
F12.3	Supply and fit new stainless steel bottom guide rail bracket inside sump:						
F12.3.1	DN65	Item	1				
F12.3.2	DN80	Item	1				
F12.3.3	DN100	Item	1				
F13.0	Valves						
F13.1	Supply and install flange mounted, PN16 rated, two pack epoxy powder coated cast iron gate valve designed for sewage applications, complete with stainless steel non-rising spindle and handwheel, and EPDM coated gate:						
F13.1.1	75mm	Item	1				
F13.1.2	90mm	Item	1				
F13.1.3	110mm	Item	1				
F13.1.4	160mm	Item	1				
F13.1.5	200mm	Item	1				
F13.2	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications:						
F13.2.1	75mm	Item	1				
F13.2.2	90mm	Item	1				
F13.2.3	110mm	Item	1				
F13.2.4	160mm	Item	1				
F13.2.5	200mm	Item	1				
F13.3	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications complete with cantilever arm and weight:						
F13.3.1	160mm	Item	1				
F13.3.2	200mm	Item	1				
F13.3.3	250mm	Item	1				
F14.0	<u>Gearboxes</u>						
F14.1	Helical parallel shaft type vertically mounted gearbox						
F14.1.1	Type: Hellical parallel shaft Mounting: Vertical Power: 35kW Axial Load: 5 500N	Item	1				
F14.1.2	Type: Vertical spindle Power: 5,5kW Axial Load: 2 500N	Item	1				
F15.0	<u>Other</u>						
F15.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing.	Sum	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	Brief description of such items to be entered hereunder. TOTAL SCHEDULE F TO BE CARRIED FORWARD TO PRICE SUMMARY						
F13.0	Valves						
F13.1	Supply and install flange mounted, PN16 rated, two pack epoxy powder coated cast iron gate valve designed for sewage applications, complete with stainless steel non-rising spindle and handwheel, and EPDM coated gate:						
F13.1.1	75mm	Item	1				
F13.1.2	90mm	Item	1				
F13.1.3	110mm	Item	1				
F13.1.4	160mm	Item	1				
F13.1.5	200mm	Item	1				
F13.2	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications:						
F13.2.1	75mm	Item	1				
F13.2.2	90mm	Item	1				
F13.2.3	110mm	Item	1				
F13.2.4	160mm	Item	1				
F13.2.5	200mm	Item	1				
F13.3	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications complete with cantilever arm and weight:						
F13.3.1	160mm	Item	1				
F13.3.2	200mm	Item	1				
F13.3.3	250mm	Item	1				
F14.0	<u>Gearboxes</u>						
F14.1	Helical parallel shaft type vertically mounted gearbox						
F14.1.1	Type: Helical parallel shaft Mounting: Vertical Power: 35kW Axial Load: 5 500N	Item	1				
F14.1.2	Type: Vertical spindle Power: 5,5kW Axial Load: 2 500N	Item	1				
F15.0	<u>Other</u>						
F15.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder. TOTAL SCHEDULE F TO BE CARRIED FORWARD TO PRICE SUMMARY	Sum	1				
F13.0	Valves						
F13.1	Supply and install flange mounted, PN16 rated, two pack epoxy powder coated cast iron gate valve designed for sewage applications, complete with						

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	stainless steel non-rising spindle and handwheel, and EPDM coated gate:						
F13.1.1	75mm	Item	1				
F13.1.2	90mm	Item	1				
F13.1.3	110mm	Item	1				
F13.1.4	160mm	Item	1				
F13.1.5	200mm	Item	1				
F13.2	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications:						
F13.2.1	75mm	Item	1				
F13.2.2	90mm	Item	1				
F13.2.3	110mm	Item	1				
F13.2.4	160mm	Item	1				
F13.2.5	200mm	Item	1				
F13.3	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications complete with cantilever arm and weight:						
F13.3.1	160mm	Item	1				
F13.3.2	200mm	Item	1				
F13.3.3	250mm	Item	1				
F14.0	<u>Gearboxes</u>						
F14.1	Helical parallel shaft type vertically mounted gearbox						
F14.1.1	Type: Helical parallel shaft Mounting: Vertical Power: 35kW Axial Load: 5 500N	Item	1				
F14.1.2	Type: Vertical spindle Power: 5,5kW Axial Load: 2 500N	Item	1				
F15.0	<u>Other</u>						
F15.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder. TOTAL SCHEDULE F TO BE CARRIED FORWARD TO PRICE SUMMARY	Sum	1				
F13.0	Valves						
F13.1	Supply and install flange mounted, PN16 rated, two pack epoxy powder coated cast iron gate valve designed for sewage applications, complete with stainless steel non-rising spindle and handwheel, and EPDM coated gate:						
F13.1.1	75mm	Item	1				
F13.1.2	90mm	Item	1				
F13.1.3	110mm	Item	1				
F13.1.4	160mm	Item	1				
F13.1.5	200mm	Item	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
F13.2	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications:						
F13.2.1	75mm	Item	1				
F13.2.2	90mm	Item	1				
F13.2.3	110mm	Item	1				
F13.2.4	160mm	Item	1				
F13.2.5	200mm	Item	1				
F13.3	Supply and install free acting, flanged mounted, two pack epoxy powder coated cast iron non-return flap / check valve designed for sewage applications complete with cantilever arm and weight:						
F13.3.1	160mm	Item	1				
F13.3.2	200mm	Item	1				
F13.3.3	250mm	Item	1				
F14.0	<u>Gearboxes</u>						
F14.1	Helical parallel shaft type vertically mounted gearbox						
F14.1.1	Type: Hellical parallel shaft Mounting: Vertical Power: 35kW Axial Load: 5 500N	Item	1				
F14.1.2	Type: Vertical spindle Power: 5,5kW Axial Load: 2 500N	Item	1				
F15.0	<u>Other</u>						
F15.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder.	Sum	1				
TOTAL SCHEDULE E TO BE CARRIED FORWARD TO PRICE SUMMARY							

BILL G: SERVICING OF PLANT AND EQUIPMENT

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	<u>Notes:</u>						
(i)	All rates must be exclusive of VAT.						
(ii)	All rates to include for supply, delivery and installation thereof unless specified otherwise.						
(iii)	All quantities are provisional and are for comparative purposes only and do not describe the final extent of the work.						
G1.0	<u>GENERATOR EQUIPMENT</u>						
G1.1	<u>Minor service</u> of generator equipment consisting of:						
G1.1.1	Conduct full visual inspection on existing genset equipment.	Sum	4				
G1.1.2	Check hoses, radiator and radiator core and top-up antifreeze if necessary.	Sum	4				
G1.1.3	Check and empty diesel water trap.	Sum	4				
G1.1.4	Check V-belts and charging alternator.	Sum	4				
G1.1.5	Check all electrical connections / voltages and test battery charger circuit.	Sum	4				
G1.1.6	Test control system and safety device.	Sum	4				
G1.1.7	Full mains failure load test.	Sum	4				
G1.1.8	Transport costs, to and from Site.	Sum	4				
G1.1.9	Provide written report and / or quotation on findings / work required.	Sum	4				
G1.2	<u>Major service</u> of generator equipment consisting of:						
G1.2.1	Full minor service described in item G1.1 above.	Sum	2				
G1.2.2	Full lube service including oil, oil filters and fuel filters.	Sum	2				
G1.2.3	Replace air filter.	Sum	2				
G1.2.4	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. replacement seals, bearings, etc.						
		%	.....	R 5 000.00		R 5 000.00	
G2.0	<u>ELECTRIC MOTORS</u>						
G2.1	<u>Minor service</u> of electric squirrel cage induction motor equipment consisting of:						
G2.1.1	Disconnect and remove motor and conduct full visual inspection.	Sum	4				
G2.1.2	Disassemble, strip and clean motor.	Sum	4				
G2.1.3	Check continuity / insulation resistance of windings, movement and wear of shaft / bearings, vibration, excessive temperature, etc.	Sum	4				
G2.1.4	Test for shorted laminations, loose / open bars, etc.	Sum	4				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

G2.1.5	Check fan blades for damage and cracks.	Sum	4				
G2.1.6	Check air gap and ventilation passages.						
G2.1.7	Clean, lubricate and re-assemble.	Sum	4				
G2.1.8	Transport costs, to and from Site.	Sum	4				
G2.1.9	Provide written report and / or quotation on findings / work required.	Sum	4				
G2.1.10	Reinstall / reconnect motor in position following servicing / maintenance.	Sum	4				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
G2.2	<u>Major service</u> of electric squirrel cage induction motor equipment consisting of:						
G2.2.1	Full minor service described in item G2.1 above.	Sum	2				
G2.2.2	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. rewinding of coils, replacement bearing, etc.	%	.....	R 5 000.00		R 5 000.00	
G3.0	<u>SUBMERSIBLE PUMP</u>						
G3.1	<u>Minor service</u> of submersible pumpset equipment consisting of:						
G3.1.1	Pull pump from installed position and conduct full visual inspection.	Sum	4				
G3.1.2	Inspect impeller / volute for wear, rubbing, cavitation or blockages.	Sum	4				
G3.1.3	Inspect level and quality of existing oil inside oil chamber / housing and drain and replace oil.	Sum	4				
G3.1.4	Check and test condition of all electrical connections, submersible cables and insulation of stator windings, etc.	Sum	4				
G3.1.5	Check and test correct shaft rotation, vibration, etc	Sum	4				
G3.1.6	Test correct operation of all check valves, air valves, pressure gauges, etc	Sum	4				
G3.1.7	Transport costs, to and from Site.	Sum	4				
G3.1.8	Provide written report and / or quotation on findings / work required.	Sum	4				
G3.1.9	Reinstall / reconnect pump in position following servicing / maintenance.	Sum	4				
G3.1.10	Check and test correct operation of float switches, and untangle / clean as required.	Sum	12				
G3.2	<u>Major service</u> of submersible pumpset equipment consisting of:						
G3.2.1	Full minor service described in item G3.1 above.	Sum	2				
G3.2.2	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. supply and fit new impeller, mechanical seal, balancing, etc.	%	.....	R 5 000.00		R 5 000.00	
G4.0	<u>CENTRIFUGAL PUMP</u>						
G4.1	<u>Minor service</u> of centrifugal pump equipment consisting of:						
G4.1.1	Disconnect pump from installed position and conduct full visual inspection.	Sum	4				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

G4.1.2	Inspect impeller / volute for wear, rubbing, cavitation or blockages.	Sum	4				
G4.1.3	Inspect and lubricate bearings.	Sum	4				
G4.1.4	Check and test correct shaft rotation, vibration, etc	Sum	4				
G4.1.5	Transport costs, to and from Site.	Sum	4				
G4.1.6	Provide written report and / or quotation on findings / work required.	Sum	4				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
G5.1.7	Reinstall / reconnect pump in position following servicing / maintenance.	Sum	4				
G4.2	<u>Major service</u> of centrifugal equipment consisting of:						
G4.2.1	Full minor service described in item G4.1 above.	Sum	2				
G4.2.2	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. supply and fit new impellor, mechanical seal, balancing, etc.	%	.....	R 5 000.00		R 5 000.00	
G5.0	<u>BOREHOLE PUMP</u>						
G5.1	<u>Minor service</u> of submersible pumpset equipment consisting of:						
G5.1.1	Pull pump from installed position (up to ± 150m deep) and conduct full visual inspection.	Sum	4				
G5.1.2	Inspect impeller / volute for wear, rubbing, cavitation or blockages.	Sum	4				
G5.1.3	Inspect level and quality of existing oil inside oil chamber / housing and drain and replace oil.	Sum	4				
G5.1.4	Check and test condition of all electrical connections, submersible cables and insulation of stator windings, etc.	Sum	4				
G5.1.5	Check and test correct shaft rotation, vibration, etc	Sum	4				
G5.1.6	Test correct operation of all check valves, air valves, pressure gauges, etc	Sum	4				
G5.1.7	Transport costs, to and from Site.	Sum	4				
G5.1.8	Provide written report and / or quotation on findings / work required.						
G5.1.9	Reinstall / reconnect pump in position (up to ± 150m deep) following servicing / maintenance.	Sum	4				
G5.2	<u>Major service</u> of submersible pumpset equipment consisting of:						
G5.2.1	Full minor service described in item G5.1 above.	Sum	2				
G5.2.2	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. supply and fit new impellor, mechanical seal, balancing, etc.	%	.....	R 5 000.00		R 5 000.00	
G6.0	<u>COMPRESSOR</u>						
G6.1	<u>Minor service</u> of compressor equipment consisting of:						
G6.1.1	Check torque on head screws and conduct full visual inspection.	Sum	4				
G6.1.2	Clean and replace air filter if required.	Sum	4				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
G6.1.3	Drain and replace oil	Sum	4				
G6.1.4	Check and tighten V-belts and pulleys.	Sum	4				
G6.1.5	Drain moisture from pressure holding tank / vessel.	Sum	4				
G6.1.6	Check correct operation of automatic discharge unit if fitted.	Sum	4				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
G6.2	<u>Major service</u> of compressor equipment consisting of:						
G6.2.1	Full minor service described in item G6.1 above.	Sum	4				
G6.2.2	Percentage mark-up (as provided under Bill A, Item A3.1) on the provisional sum shown for the nett cost of unscheduled items found to be defective / faulty and require replacement / repair, i.e. supply and fit new V-Belt, water separator, etc.	%	.....	R 5 000.00		R 5 000.00	
G7.0	<u>MISCELLANEOUS</u>						
G7.1	Lump sum allowance for any items not included in this schedule necessary to complete the installation in accordance with the specification and drawing. Brief description of such items to be entered hereunder.	Sum	1				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
H	Duckfoot bend - DN200	Each	1				
	Guide rails (SS304), pair, to suite ND50 duckfoot bend, 6m long	Each	1				
	Guide rails (SS304), pair, to suite ND65 duckfoot bend, 6m long	Each	1				
	Guide rails (SS304), pair, to suite ND80 duckfoot bend, 6m long	Each	1				
	Guide rails (SS304), pair, to suite ND100 duckfoot bend, 6m long	Each	1				
	Guide rails (SS304), pair, to suit ND150 duckfoot bend, 6m long	Each	1				
	Guide rails (SS304), pair, to suit ND200 duckfoot bend, 6m long	Each	1				
	Guide rail top bracket to suite DN50 duckfoot	Each	1				
	Guide rail top bracket to suite DN65 duckfoot	Each	1				
	Guide rail top bracket to suite DN80 duckfoot	Each	1				
	Guide rail top bracket to suite DN100 duckfoot	Each	1				
	Guide rail top bracket to suite DN150 duckfoot	Each	1				
	Guide rail top bracket to suite DN200 duckfoot	Each	1				
	Lifting chain, SS316, 6mm	Each	1				

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	Lifting chain, SS316, 8mm	m	1				
	Lifting chain, SS316, 10mm	m	1				
	Supply & installation of Pipework, 304 SS, PN16:						
	DN50 Straight pipe, flanged both ends (flange to flange):						
	500mm						
	1000mm	Each	1				
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	DN80 Straight pipe, flanged both ends (flange to flange):						
	500mm						
	1000mm	Each	1				
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	DN100 Straight pipe, flanged both ends (flange to flange):						
	500mm						
	1000mm						
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	DN150 Straight pipe, flanged both ends (flange to flange):						
	500mm	Each	1				
	1000mm	Each	1				
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	DN200 Straight pipe, flanged both ends (flange to flange):						
	500mm						
	1000mm						
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	DN250 Straight pipe, flanged both ends (flange to flange):						
	500mm						
	1000mm						
	1500mm	Each	1				
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	DN300 Straight pipe, flanged both ends (flange to flange):	Each	1				
	500mm	Each	1				
	1000mm		1				
	1500mm		1				
	2000mm	Each					
	2500mm	Each	1				
	3000mm	Each	1				
	DN350 Straight pipe, flanged both ends (flange to flange):	Each	1				
	500mm		1				
	1000mm		1				
	1500mm	Each					
	2000mm	Each					
	2500mm	Each	1				
	3000mm	Each	1				
	HDPE Fustion welded fittings c/w 304 backing rings T16 in 50mm	Each	1				
	500mm		1				
	1000mm						
	1500mm						
	2000mm	Each					
	2500mm	Each	1				
	3000mm	Each	1				
	HDPE Fustion welded fittings c/w 304 backing rings T16 in 80mm	Each	1				
	500mm		1				
	1000mm		1				
	1500mm	Each					
	2000mm	Each	1				
	2500mm	Each	1				
	3000mm	Each	1				
	HDPE Fustion welded fittings c/w 304 backing rings T16 in 100mm	Each	1				
	500mm						
	1000mm						
	1500mm						
	2000mm	Each					
	2500mm	Each	1				
	3000mm	Each	1				
	HDPE Fustion welded fittings c/w 304 backing rings T16 in 150mm	Each	1				
	500mm	Each	1				
	1000mm		1				
	1500mm						
	2000mm	Each					
	2500mm	Each	1				
	3000mm	Each	1				
	HDPE Fustion welded fittings c/w 304 backing rings T16 in 200mm	Each	1				
	500mm	Each	1				
	1000mm		1				
	1500mm						
	2000mm	Each					

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	2500mm	Each	1				
	3000mm	Each	1				
		Each	1				
	90 deg. Long radius bends, flanged both ends 304 stainless steel	Each	1				
	DN50	Each	1				
	DN80	Each	1				
	DN100						
	DN150						
	DN200	Each					
	DN250	Each	1				
	DN300	Each	1				
	DN350	Each	1				
	DN400	Each	1				
	DN450	Each	1				
	DN500	Each	1				
	DN550	Each	1				
	DN600	Each	1				
		Each	1				
	45deg. Long radius bends, flanged both ends 304 stainless steel	Each	1				
	DN50	Each	1				
	DN80	Each	1				
	DN100						
	DN150	Each	1				
	DN200	Each	1				
	DN250	Each	1				
	DN300	Each	1				
	DN350	Each	1				
	DN400	Each	1				
	DN450	Each	1				
	DN500	Each	1				
	DN550	Each	1				
	DN600	Each	1				
		Each	1				
		Each	1				
		Each	1				
	Equal, swept 90 deg. Long radius Tee, flanged all ends						
	DN50	Each	1				
	DN80	Each	1				
	DN100	Each	1				
	DN150	Each	1				
	DN200	Each	1				
	DN250						
	DN300	Each	1				
	DN350	Each	1				
	DN400	Each	1				
	DN450	Each	1				
	DN500	Each	1				
	DN550	Each	1				
	DN600	each	1				
	Unequal, swept 90 deg. Long radius Tee, flanged all ends (Main x Tee off)						
	DN80 x DN50	each	1				
	DN100 x DN80	each	1				
	DN150 x DN100	each	1				
	DN200 x DN150	each	1				
	DN250 x DN200	each	1				

BILL G: SERVICING OF PLANT AND EQUIPMENT (Contd.)

ITEM	DESCRIPTION	UNIT	QTY	MATERIAL		LABOUR	
				RATE	TOTAL	RATE	TOTAL
	DN300 x DN250	each	1				
	DN350 x DN300	each	1				
	DN400 x DN350	each	1				
	DN450 x DN400	each	1				
	DN500 x DN450	each	1				
	DN550 x DN500	each	1				
	DN600 x DN550	each	1				
	Flanged double action air-release valve suitable for raw sewage, complete with 5m uPVC drainage pipework						
	DN25	each	1				
	DN50	each	1				
	DN80	each	1				
	DN100	each	1				
	DN150	each	1				
	DN200	each	1				
	Ancillary Equipment, supply & installation						
	Nuts, Bolts, ready-bar & packings, complete set (number & size) per PN16 rated flange size A2 stainless						
	DN50	each	1				
	DN65	each	1				
	DN80	each	1				
	DN100	each	1				
	DN125	each	1				
	DN150	each	1				
	DN200	each	1				
	DN250	each	1				
	DN300	each	1				
	DN350						
	DN400						
	TOTAL SCHEDULE H TO BE CARRIED FORWARD TO PRICE SUMMARY						

PRICE SUMMARY

ITEM	DESCRIPTION	MATERIAL	LABOUR
1.0	Bill A: Preliminary And General Items		
2.0	Bill B: Generator Installation		
3.0	Bill C: Control Panel Equipment		
4.0	Bill D: Electrical Installation		
5.0	Bill E: Miscellaneous Equipment Items		
6.0	Bill F: Pumps, Motors and Accessories		
7.0	Bill G: Servicing of Plant and Equipment		
8.0	Bill H: Welding		
9.0	Sub-Totals		
10.0	Total Material and Labour		
	Escalation		
11.0	Year 2 (Escalation on Total Material and Labour)		
12.0	Year 3 (Escalation on Total Material and Labour)		
	NETT TENDER AMOUNT, EXCL. VAT		
13.0	ADD 15 % VAT		
	GROSS TENDER AMOUNT, TO BE CARRIED FORWARD TO FORM OF OFFER AND ACCEPTANCE IN PART C1.1 HEREOF		
14.0	Name of Tenderer: Signature of Tenderer: Date: Address: Tel No. Address: Fax No. Address: Email Address:		

PART C3 - SCOPE OF WORK

C3.1 GENERAL PROJECT SPECIFICATION

1.0 GENERAL

The purpose of this tender is to procure the services of a Service Provider (also referred to as Supplier or Contractor) to provide the maintenance, repair and support services for the existing water and wastewater infrastructure and reticulation network of Knysna Municipality over a three (3) year period.

This contract therefore comprises of the supply and installation of various pumping and associated electrical equipment in order to expand and upgrade the existing system, as well as to undertake the day to day maintenance / servicing and repair of the entire system as required.

Tenderers are to allow for all things, whether specified or necessary, for the manufacture, works testing, delivery, off-loading, site testing, and commissioning.

Tenderers are to take note that due to the unpredictability nature of the project a tender may be accepted in whole, or in whole with certain items being added, or in whole with the provision that certain items of work may be omitted at a later date.

2.0 EXISTING SYSTEM OVERVIEW

The positions of the majority of the water and wastewater outstations are as indicated on Annexure A of this document, which provides a rough overview of the extent of the systems at present.

3.0 SCOPE OF WORK

3.1 General

This is a three (3) year multi-year contract with the exact scope of work to be determined on an ad hoc basis, subject to the availability of funding and as directed by the Municipality.

3.2 Provisional Work

It is important to note that the items and quantities included in the Bill of Quantities, Part C2.2 hereof, are provisional only with the intention in this regard to obtain a schedule of rates for tender and comparative purposes.

These provisional quantities are therefore subject to adjustments and / or omissions, partly or in their entirety, depending on the availability of sufficient funding.

3.3 Extent of Work

This specification covers inter alia the supply, delivery, installation, testing, commissioning, maintenance, servicing, repair and support services of various material and equipment associated with the existing water and wastewater infrastructure. Such material and equipment may include, but is not limited to such things as:

- (i) Pumps
- (ii) Motors
- (iii) Control Panels and associated electrical equipment
- (iv) Standby Generators
- (v) General mechanical and electrical installations

4.0 SITE INFORMATION

Refer to Part C3.4 hereof.

Tenderers must familiarise themselves with the local conditions.

5.0 LETTING OF CONTRACT

The contract will be let as a Direct Contract with Knysna Municipality in terms of the Conditions of Contract as set out in this document.

The contract period will be for three (3) years, and will automatically cease on 30 June 2021, unless the Contractor receives official notification to extend the contract.

The contract may be cancelled at any stage should it be found that the requirements of the contract data and specifications have not been adhered to.

6.0 DRAWINGS

The afore-mentioned drawing is provided for information purposes only, and to provide the Tenderer with a better understanding of the extent of the relevant water and waste water networks.

7.0 PROGRAMME AND COMPLETION

The duration of the entire contract will be three (3) years from date of tender award.

The programme for major tasks during the contract period will be agreed with the Contractor before work commences.

The maximum response time required to a normal work instruction will be one (1) working day, i.e. within 24 hours of notification.

The maximum response time required to an emergency work instruction will be four (4) hours after notification by the Municipality.

The Municipality will in any event clearly communicate the nature of the instruction provided.

It must be noted that should the Contractor fail to respond within the time frames required above, then all associated costs with regards to any sub sequential damages occurred beyond these time frames will be for the Contractor's account.

8.0 PROJECT NOTICE BOARD

A project notice board is not required as part of the contract.

9.0 ELECTRICAL SUPPLY

The existing electrical supply to the pump stations is typically 400V three phase, and 230V single phase, 50 Hz system. Actual voltages may deviate by up to 10% from these values and all equipment, jointing materials, etc., shall be suitably rated for these conditions. The phase rotation is to be checked and maintained through-out the network.

10.0 SWITCHING OF SUPPLIES

It shall be the Contractor's responsibility to make all necessary arrangements with the Municipality's Electrical Department to de-energise the LV supplies respectively, in order that the necessary connections can be made, and to pay same for their attendance costs (if any).

The Contractor shall establish their requirements regarding advance notice, permits to work, etc., at the beginning of the contract and shall comply with these requirements.

The network downstream of these points shall be earthed at all times where work is being carried out thereon.

11.0 SITE STAFF

The Contractor shall have a competent person / supervisor on site at all times to oversee the execution of the work required under this contract. This person shall be familiar and have undergone the necessary training to meet all the health and safety requirements stipulated in the Occupational Health and Safety Act (OHS Act) and where relevant to meet environmental procedures and the requirements of the Municipality.

The person in charge will also ensure that the necessary quality control is applied.

12.0 CLEARANCE WITH OTHER SERVICES

When relevant, it shall be the responsibility of the Contractor to obtain all necessary drawings and information of the existing and planned future underground services from the Municipality and Telkom to ensure that there are no damage to those services during the installation of electrical services and that all necessary clearances with their existing and future plant are allowed. Where necessary, the Contractor shall first locate existing underground services before commencing with the trenching for cables or the excavation of holes for poles.

Where and whenever tar, paving, concrete, grass and / or other existing road and pavement surfaces need to be lifted and removed for the installation of electrical services, the Municipality should be consulted in advance to inspect same before any work commences. On completion of the work, the existing road and pavement surfaces shall be re-instated to its original state and to the satisfaction of the Municipality.

13.0 DAMAGE TO STRUCTURES

The Contractor shall be responsible for the making good of damage caused by his / her staff to any part of the structures / equipment. In the event of the occurrence of damage he / she shall arrange the repair of such damage to be carried out at his / her own expense to the satisfaction of the Engineer and Employer.

14.0 CO-ORDINATION

14.1 Maintenance Supervisor

It is the Municipality's intention to appoint a Maintenance Supervisor under a separate contract who will be responsible to oversee, instruct and at times supervise the maintenance Contractor to be appointed under this contract in terms of the work required / undertaken.

It is envisaged that the afore-mentioned Maintenance Supervisor shall largely perform the role of a "Clerk of Works" on behalf of the Municipality and will be involved in the inspection and approval of the finished quality of the work undertaken under this contract. The Municipality may also request that said Maintenance Supervisor assist with the evaluation of claims for work done by the Contractor appointed under this contract.

Allowance shall be made under the relevant item allowed for in the Bill in this regard for the liaison with the afore-mentioned Maintenance Supervisor. It is foreseen that such liaison shall also include daily feedback / co-ordination meetings and planning sessions of a minimum of one hour in duration to be held in Knysna.

14.2 General

Due allowance shall be made for liaison with the appointed Maintenance Supervisor, as well as the Municipality and any other role players or contractors as required to ensure the smooth running of the project and to ensure that the work is completed without any delays.

Where I / O are to be interfaced with equipment by others, allowance shall be made for liaison with such contractors to ensure compatibility of equipment, identification of terminals or wiring and, in the case of analogue inputs, calibration and setting up of instruments.

15.0 PAYMENT

When submitting claims for payment the Contractor must provide detailed job cards for each portion of work done listing the hours spent, travel, material required, etc as applicable.

As allowed for in the Bill of Quantities a fixed mark-up is also to be applied to the proven cost of unscheduled items of equipment and material, as well as other outside expertise required and the Contractor shall also furnish the necessary invoices with any claims in this regard.

No claims for payment for work done will be entertained should the Contractor fail to furnish the necessary supporting documentation as mentioned above.

16.0 LOCAL LABOUR

Optimum use shall be made of labour from area of proposed work and the Contractor shall as far as practically possible and economically viable make use of labour intensive methods to do the work.

The extent of local labour to be employed on a work instruction will be determined and agreed with the Municipality before any work commences.

17.0 MAINTENANCE PERFORMANCE

17.1 General

The intention of the maintenance portion of this contract is to ensure that the relevant pumping networks and infrastructure be kept in a 100% functional and reliable condition at all times.

Any replacement equipment and material offered shall be capable of seamlessly integrating with the existing system and equipment without adversely affecting any functioning of the existing system.

Whole scale replacement of existing equipment shall not be permitted where it is possible to restore the functionality of the system by the simple replacement of a faulty component thereof.

All repairs and parts supplied by the Contractor shall have a minimum 12 month warranty, and a record of all manhours, job cards, etc for each particular job / instruction must be kept for scrutiny upon request if so required.

17.2 **Program**

It is envisaged that the duration of the maintenance contract will be three (3) years from date of tender award.

Due to the unpredictable and reactionary nature of the project no formal programme of work is required in terms of maintenance, however the necessary response times indicated elsewhere in this specification shall be adhered to at all times.

Cognisance must be taken of the fact that the pump station networks are in operation full time, and it is therefore imperative that as much preparation work as possible be done before the time in order to limit the disruption of service to a minimum.

Although it is envisaged that the majority works will be performed during normal office hours, the Contractor may also be required to work on weekends, public holidays and other Off-Peak hours as required.

17.3 **Resources, Tools and Spare Parts**

The Contractor shall provide all the necessary manpower, tools and materials to perform all preventative maintenance and repair work.

It is also expected that the Contractor will be able to rely on support from his workshop / factory whenever the need arises.

The tools needed to carry out the necessary work will be provided by the Contractor, and reliance shall not be made on the Municipality to supply, or lend the necessary tools to undertake any of the work. However, should the required expertise or resources be available in house the Municipality reserves the right to assist with certain aspects of the work in order to try limit costs.

The Contractor shall purchase the necessary spare parts, equipment and material through the contract if requested, however where superior quality and / or more favourable prices are available through other suppliers the Municipality reserves the right to supply the appointed Contractor with the necessary equipment / material.

The Contractor shall work closely with the Municipality and advise its store personnel regarding the standard components of equipment / materials and other consumables that should be kept in stock to avoid future supply issues.

17.4 **Preventative Maintenance**

Where instructed the successful Contractor shall undertake the necessary preventative maintenance on the existing pumping equipment and water / waste water plants.

The Contractor shall also draw the Municipality's designated representative attention to any items identified during the course of the project that it is felt may require pro-active servicing or replacement to prevent failure. The Contractor shall timeously provide the anticipated costs in this respect for formal approval before any work in this regard is undertaken.

The Contractor shall also assist the Municipality when required with the drawing up of the various preventative maintenance schedules, and shall also attend any feedback sessions / meetings when requested by the Municipality. This work shall be measured be on a time basis with the exact number of hours in this regard agreed to with the Municipality beforehand.

17.5 **Breakdown Maintenance**

The Contractor shall ensure that key staff are contactable and on standby at all times in the event of an emergency breakdown situation.

The Contractor shall provide local (onsite) support during the entire three year course of the contract with sufficient support staff to ensure that the entire water / wastewater system is maintained and that it operates at optimum performance level.

The Tenderer must have at least one mobile team at all times and the support offered must also include the following:

- 24 hours per day 365 days a year standby technical support to respond to any reported problems and to resolve any technical / equipment failures encountered.
- Response times in the order as indicated under Clause 7.0 above.
- General assistance and training to Municipal personnel on the ground dealing with any problems relating to the operation of the system.

17.6 **Response Time**

Refer to Clause 7.0 above.

18.0 **TRAINING**

As part of the contract the Contractor shall allow for on-site training of the municipal staff / operators during the course of the contract.

Training must include operating and maintenance manuals of any equipment supplied and installed, and training of the relevant municipal staff in the operation of same. Such training shall also include first line maintenance, as well as basic trouble shooting of the system / equipment.

Where follow-up or additional training of operators is required this shall be on a time basis with the exact number of hours in this regard agreed to with the Municipality beforehand.

19.0 **COST PRICE ADJUSTMENT (CPA)**

The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule indicated under Item 6.8.2 of the Contract Data, Part C1.2 hereof.

20.0 **REGISTRATION OF CONTRACTOR**

The Contractor must be registered with the Construction Industry Development Board (CIDB) with a minimum grading as specified in the Tender Data, Part 1.2 hereof.

Should the total value of any work instruction exceeds the maximum amount covered under the specified CIDB grading, then the Municipality reserves the right to request the Contractor to apply for a higher, and suitable, CIDB grading before the work commences

21.0 REFERENCES

The Employer may wish to contact one or more of the Tenderer's reference clients during the detailed evaluation period. Contact names and details of the individuals who may be contacted must be provided.

All contacts with the Tenderer's reference clients may be arranged through the Tenderer, but The Employer reserves the right to conduct these information-sharing sessions without representatives from the Tenderer's company being present.

22.0 RATES

The Bill of Quantities, Part C2.1 hereof, shall be completed by the Tenderer. Each item is deemed to include the supply and delivery of all items of material to site, including incidentals necessary for the completion thereof, plus profit, but excluding VAT.

The Tenderer shall note that various quantities are for comparative purposes only and do not necessarily describe the extent of the work.

The Municipality reserves the right to supply certain material that is available at the stage of a work instruction, as a free issue item to the Contractor for installation only. The labour rate for the specific item / s in question shall in such instance still govern. It is therefore important to note that all labour rates provided must include handling charges for the respective material.

23.0 "AS-BUILT" DRAWINGS AND MANUALS

Before the date of the issue of the Certificate of Completion, the Contractor shall hand-over to the Engineer marked-up hard copies of the "As-Builts" of the work undertaken.

These drawings shall clearly show, with measurement relative to the various structures where applicable, all cable routes and positions of cable markers, final details of all circuits, etc. The Contract will not be considered complete until these drawings and manuals have been received.

C3.2 HEALTH AND SAFETY

1.0 GENERAL

The principal contractor and contractors are required to adhere to the provisions of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended, and including the Construction Regulations (2014), as amended, forming part thereof. For the purposes of this part of the document, the terms principal contractor and contractor, and client, shall have the meanings as defined in the abovementioned Regulations.

The principal contractor, or contractor, as the case may be, shall undertake all the duties and activities required of him in terms of the abovementioned regulations. These may include but not necessarily be limited to the following:

- Notification of construction work
- Preparation, liason with and submission to the client, and implementation and maintenance of a suitable and sufficiently documented health and safety plan which must include and involve all contractors under a principal contractor's control.
- Liason and cooperation with all other contractors
- Supervision of construction work, including appointment of a construction supervisor in terms of the Regulations.
- Risk assessment
- Fall protection
- Structures, formwork and support work, excavation work, demolition work, scaffolding and suspended platforms, hoists of any type, and explosive powered tools
- Electrical installations and machinery on construction sites.
- Use and storage of flammable liquids, water hazards, general housekeeping and stacking and storage, as well as fire precautions.

2.0 HEALTH AND SAFETY INFORMATION

The design described in this document has taken into account the hazards to persons which may occur during construction, commissioning and subsequent use and maintenance. However, the nature of the work is such that certain hazards are unavoidable and will be prevalent during the above operations and these must be taken into account by the contractor when preparing and implementing the health and safety plan.

In order to assist the Contractor, certain hazards and aspects of health and safety are identified in this document and on the drawings and a Hazard Identification List is provided below to inform the contractor of any known or anticipated dangers or hazards relating to the design or construction work. The information is provided in order to assist the Contractor to analyse and evaluate the risks and does not, in any way, relieve the Contractor of his / her responsibilities in terms of health and safety.

3.0 HEALTH AND SAFETY PLAN

The Contractor shall be deemed to have read and fully understood the requirements of the above Act and Regulations and to have allowed for all costs in compliance therewith.

The Contractor shall prepare a Health and Safety Plan in respect of the Works in accordance with the Act and Regulations, which shall cover inter-alia the following details:

- Management Structure, Site Supervision and Responsible Persons including a succession plan.
- Contractor's induction training programme for employees, sub-contractors and visitors to the Site.

C3.2.2

- Health and safety precautions and procedures to be adhered to in order to ensure compliance with the Act, Regulations and Safety Specifications.
- Regular monitoring procedures to be performed.
- Regular liaison, consultation and review meetings with all parties.
- Site security, welfare facilities and first aid.
- Site rules and fire and emergency procedures.

The Contractor is required to ensure that all sub-contractors or others engaged in the performance of the contract also comply with the above requirements.

4.0 **HEALTH AND SAFETY CONDITIONS**

The Chief Executive Officer of the Contractor shall assume the responsibility in terms of Section 16(1) of the Occupational Health and Safety Act (as amended). Should the Contractor assign any duty in terms of Section 16(2), a copy of such assignment shall immediately be provided to the representative of the Employer as defined in the Contract.

All work performed on the Employer's premises shall be performed under the supervision of the construction supervisor who understand the hazards associated with any work that the Contractor performs on the site in terms of Construction Regulations 2014.

The Contractor shall appoint a Competent Person who shall be trained on any occupational health and safety aspect pertaining to them or to the work that is to be performed.

The Contractor shall ensure that he familiarises himself with the requirements of the Occupational Health and Safety Act and that he, his employees, and any sub-contractors, comply with them.

Discipline in the interests of occupational health and safety shall be strictly enforced.

Personal protective equipment shall be issued by the Contractor as required and shall be worn at all times where necessary.

Written safe work procedures and appropriate precautionary measures shall be available and enforced, and all employees shall be made conversant with the contents of these practices.

No substandard equipment/machinery/articles or substances shall be used on the site.

All incidents referred to in terms of Section 24 of the Occupational Health and Safety Act shall be reported by the Contractor to the Department of Labour and the Employer.

The Employer hereby obtains an interest in the issue of any formal inquiry conducted in terms of Section 32 of the Occupational Health and Safety Act and into any incident involving a Contractor and/or his employees and/or his sub-contractor/s.

No use shall be made of any of the Employer's machinery / plant / equipment / substance / personal protective equipment or any other article without prior arrangement and written approval.

No alcohol or any other intoxicating substance shall be allowed on the site. Any person suspected of being under the influence of alcohol or any other intoxicating substance shall not be permitted access to, or allowed to remain on the site.

Prior to commencement of any work, verified copies of all documents mentioned in the agreement, must be presented to the Employer.

5.0 HEALTH AND SAFETY HAZARD IDENTIFICATION LIST

The following list highlights items identified as presenting a hazard or danger to persons during construction and commissioning:

Item	Hazard Description	Applicable to the Project (Yes / No / N/A)	Hazard Rating (Low, Medium, High) *	Comment / Recommendation
3.1	Are there any specific client H&S requirements for the work?	Yes	High	Personal protective equipment shall be worn on site.
3.2	Have site archaeological issues been identified and evaluated (might be of historical importance)	N/A	N/A	N/A
3.3	Has a geotechnical survey been carried out, and if so do the results indicate hazards which require control measures?	N/A	N/A	N/A
3.4	Is the site adjacent to or over public transport (railways, taxi ranks, bus stops etc.)?	Yes	Medium	Work is to be carried out in the vicinity of moving vehicles and machinery which will be in operation. Necessary barricading and road signs to be allowed for.
3.5	Is the site adjacent to or over water (eg. rivers, dams, sea, canals)?	Yes	Low	Contractor to take cognisance of danger presented and provide adequate rescue equipment as required.
3.6	Is the site adjacent to, over or under any services or drains etc. (eg. high voltage cables, municipal sewer lines)?	Yes	High	Special care must be taken not to damage existing high / low voltage cables and existing underground piped services.

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3.7	Is the site adjacent to, over or under any public buildings such as schools and hospitals?	Yes	High	Work is to be carried out in residential areas and surrounding areas.
3.8	Are there any other local hazards such as overhead power cables?	Yes	High	Existing 11kV line exists in the areas where work is to be done.
3.9	Will the ground contours present any construction problems?	Yes	Low	Sloped ground areas are present at the majority of the sites.
3.10	Is there any asbestos removal involved?	No	N/A	N/A
3.11	Will excavation be close to live electrical cables or pressure pipes?	Yes	High	Pressure pipes and electrical cables exist on sites and must be taken note of.

Item	Hazard Description	Applicable to the Project (Yes / No / N/A)	Hazard Rating (Low, Medium, High) *	Comment / Recommendation
3.12	Will any excavation works take place?	Yes	Medium	Where excavations and ground works are to be done adequate allowance shall be made for protection of excavations to prevent injury to humans or animals.
3.13	Will any work be carried out close to live electrical apparatus?	Yes	High	Due care shall be exercised to ensure safety of workers at all times. Working area shall be physically isolated and demarcated from any live equipment.
3.14	Is there confined space or tank entry work involved?	Yes	High	Possible entry into existing sewage sumps to be undertaken.
3.15	Will any steel erection works be taking place?	No	N/A	N/A
3.16	Will tower cranes be used or heavy lifting operations taking place?	No	N/A	N/A

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3.17	Will mobile work platforms, cradles or abseiling be necessary?	No	N/A	N/A
3.18	Is the access to the site adequate for vehicles and pedestrians? Are there any special arrangements and / or requirements?	Yes	Low	Some areas may only be accessible to pedestrians.
3.19	Will the public have access to the site?	Yes	High	Sites are located inside residential developments and the required signage must be erected.
3.20	Have arrangements been made or co-ordinated for temporary electric supplies?	No	N/A	Arrange with Municipality if required.
3.21	Have site lighting needs been identified for all stages of the work?	No	N/A	Work will not be undertaken in the night.
3.22	Will any accommodation/ office units be located inside an existing structure?	No	N/A	Contractor must arrange for his own office.
3.23	Have arrangements been made or co-ordinated for temporary supplies such as water and sewage disposal?	No	N/A	Contractor must arrange for his own services.
3.24	What is the type of roof construction? Evaluate fall hazards.	N/A	High	Work will be done at single story roof height and adequate fall protection must be provided.

Item	Hazard Description	Applicable to the Project (Yes / No / N/A)	Hazard Rating (Low, Medium, High) *	Comment / Recommendation
3.25	Are there any 'Hot Works' to be undertaken?	Yes	High	Work is to be carried out on electrical equipment, and due care shall be exercised to ensure isolation of the supply when necessary.

C3.2.6

3.26	Are electrical items to be installed?	Yes	High	Work is to be carried out on electrical equipment, and due care shall be exercised to ensure isolation of the supply when necessary.
3.27	Will there be any lift installation works?	No	N/A	N/A
3.28	Will there be any escalators to install?	No	N/A	N/A
3.29	Is the project a fire risk?	No	N/A	N/A
3.30	Have all environmental issues been evaluated and controlled?	Yes	Low	Contractor to take adequate steps to prevent sewage spills at pump stations during construction.
3.31	Are there any specific fall protection hazards not already assessed?	Yes	High	Work will be undertaken at raised levels, on slippery surfaces and over sumps.
3.32	Are there any additional hazards which have been identified as being site specific and which are not covered by the foregoing? If YES, note here:	Yes	High	The sites lie in semi-rural areas and there is a possibility of potentially dangerous animals such as snakes being present. Hazardous conditions exist at / in the sewage pump stations and pump sumps, namely: • Poisonous and explosive sewage gases. • Lack of oxygen • Contaminated surfaces, fluids and general area with amongst others, life threatening and disease carrying germs. The Contractor will need to allow as required: • Ventilation • Protective clothing, first aid kit and disinfectants, etc. Immunisation against sewage borne diseases required for personnel working in close contact with raw sewage and contaminated areas.

C3.2.7

3.33	Are there any specific medical requirements necessary?	Yes	High	Medical fitness to work certificates signed off by a qualified Occupational Medical Practitioner must be provided for all staff / labourers to be employed on the project. Immunisation against sewage borne diseases must be provided for personnel working in close contact with raw sewage and contaminated areas.
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* The hazard rating takes into account the likely level of consequence (injury / death) to which workers are exposed, the likely number of workers exposed to the hazard, and the probability of occurrence.

C3.3: PROJECT TECHNICAL SPECIFICATION

1.0 GENERAL

This part of the specification deals with the main items of material and equipment which it will be the Contractor's responsibility to supply, install and / or repair and maintain.

Sufficient information is provided in this document to enable the tenderer to accurately price the work. Tenderers must allow for all items, whether specified in detail or not, required to complete the installation in a neat and workmanlike manner.

2.0 RESPONSIBILITY AND DUTIES

The intention of this contract is to ensure that the municipal potable water and sewerage reticulation systems and infrastructure be kept in a 100 % functional and reliable condition at all times.

It is therefore envisaged that the successful Contractor's duties shall include for the following:

- Attend to call-outs when notified by the Municipality in order to attend to / diagnose faults on the system.

The maximum response time to a normal work instruction will be twenty four hours (i.e. within one working day) and that for an emergency work instruction will be four (4) hours after notification by the Municipality.

- Servicing and general preventative maintenance on plant and equipment as and when required.
- Breakdown maintenance and repair on plant and equipment as and when required.
- Supply and install new plant, equipment or material such as replacement pump / motors, MCC panels, generators, etc. as required by the municipality during the course of the project.
- Assisting the Municipality in drawing up a detailed annual maintenance program for all equipment and plants.

3.0 SUPPLY AUTHORITY

3.1 General

The majority of the sites are located within the Knysna Municipality supply authority area and the installation shall fully comply with their requirements.

Certain sites are however supplied directly from Eskom who will obviously become the Supply Authority in such instances and their requirements will need to be adhered to.

3.2 Switching of Supplies

The switching of the supplies shall be arranged in advance with the relevant supply authority, i.e. Eskom / Knysna Municipality. The Contractor shall establish their requirements regarding advance notice, permit to work, etc., at the beginning of the work and shall comply with these requirements.

4.0 **EQUIPMENT**

Any replacement equipment offered shall be capable of seamlessly integrating with the existing plant and equipment without adversely affecting any functioning of the existing plant / system.

Whole scale replacement of existing equipment / infrastructure shall not be permitted where it is possible to restore the functionality of the system by the simple replacement of any faulty components of said equipment, unless agreed otherwise with the Municipality.

Any equipment provided or replaced shall comply with the minimum standards as given in the relevant clauses hereunder.

5.0 **STANDBY GENERATOR EQUIPMENT**

5.1 **General**

Where new standby generating sets are required these shall usually be installed inside the existing pump houses / generator rooms in order to provide emergency standby electrical power at these plants.

Any generating equipment offered shall comprise of prime power (i.e. continuously rated) engine / alternator sets and shall be capable of delivering an output of 110% of the specified output for one hour in a period of 12 hours consecutive running. An automatic change-over panel with manual override facility shall also be supplied and installed as standard.

The details of the exact automatic operation of each generator shall be confirmed by the Municipality at a later date and may involve a generator start / stop request signal being generated from the MCC panel as further described in the mode of operation of a typical MCC panel described under Clause 6.2 hereunder.

However, for tender purposes it can be assumed that the automatic operation of the generator set during a power failure shall usually be controlled by activation of a gen-set start float installed inside a sump.

All equipment offered shall be rated and sized in accordance with the load requirements imposed by the starting and running of the pumps, motors, etc. at the pump station. In addition to the aforementioned pump loads the generating set shall also be required to feed the electrical loads of the entire pump station building consisting of inter alia, power factor correction equipment, telemetry equipment, fluorescent and area lighting, extraction fans, etc.

The Tenderer shall make due allowance for all lifting gear, equipment, etc, required for installing the generator equipment in the required position and for rigging same into and out of roofed buildings where applicable.

5.2 **Site Conditions**

The following general site conditions are applicable and any equipment offered shall be suitably rated to develop their assigned rating and duty at these conditions.

- a) Height above sea level : ± 100 m
- b) Maximum ambient temperature : 41°C
- c) Average maximum ambient temperature : $21,4^{\circ}\text{C}$
- d) Average minimum ambient temperature : $11,2^{\circ}\text{C}$

5.3 **Generator Equipment**

The generator equipment shall generally comply with the requirements of the Standard Technical Specification and as further detailed in the table below.

ITEM	DESCRIPTION	REQUIREMENT
1.0	<u>Alternator</u>	
1.1	Required net output (prime power)	As indicated in the Bill of Quantities.
1.2	At load power factor of	0,8
1.3	Output voltage	400 / 231V, 3 phase
1.4	Frequency	50 Hz
2.0	<u>Engine</u>	
2.1	Type of cooling	Engine to be either air or water cooled type. In the case of water-cooling, a built-on heavy duty, tropical type pressurised radiator must be fitted. Overheat protection via a visual and audible alarm on the generator control panel to be provided against running at excessive temperatures. 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.
2.2	Aspiration	Natural or Turbocharged. Turbocharged engines will only be accepted if the Tenderer submits a written guarantee that the engine can deliver full load within the specified starting period of 15 seconds.
2.3	Engine output (prime power):	As indicated in the Bill of Quantities.

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2.4	Derating for site conditions	Engine to be de-rated for the site conditions as indicated elsewhere in this Specification.
2.5	Load requirement / assumption	Starting period of engine for either manual or automatic switch 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.
2.6	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 generator control panel.
2.7	Speed	Engine running speed not to exceed 1500 r.p.m

ITEM	DESCRIPTION	REQUIREMENT
2.8	General	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. 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. In the case of water cooled engines, any electrical heaters shall be thermostatically controlled. The electrical circuit for such heaters shall be taken from the generator control panel, and must be protected by a suitable circuit breaker.
3.0	<u>Battery</u>	
3.1	Type	The set must be supplied a fully charged lead-acid type battery, complete with necessary electrolyte. The battery must be of the heavy duty "low maintenance" type, housed in a suitable battery box.

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3.2	Capacity	The battery must have sufficient capacity to provide the starting torque stipulated by the engine makers. 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 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 also a provided for charging the battery while the set is operational. Failure of this alternator must also activate the battery charger failure circuit.
3.3	Charger	

ITEM	DESCRIPTION	REQUIREMENT
4.0	<u>Control / Change Over Panel</u>	
4.1	Construction	Totally enclosed floor mounted unit, fabricated from 3CR12 steel incorporating both the generator controls, alarms indications and automatic changeover equipment. The by-pass switch and mains isolator shall be mounted in a separate change-over compartment with a metal separation barrier between same and all other compartments. Control panel to be rated at in accordance with the fault kA rating anticipated and have a red finish.

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4.2	Change-over switch	A three position (i.e. Normal / Off / Bypass) manually operated on-load by-pass switch to be provided similar or equal to the Socomec type, which shall either connect the incoming mains to the automatic control gear or directly to the outgoing feeder.
4.3	Controller	Lovato Controller or equivalent. Controller to be supplied with RS-485 communications module in order to communicate directly with existing / future PLC / HMI equipment inside the MCC panel.
5.0	<u>Fuel Supply</u>	
5.1	Day tank	A day fuel tank shall be installed inside the plant room. The day tank shall have sufficient capacity to run the engine on full load for a period of 12 hours. The fuel tank shall be free standing and installed on a ± 1 metre high hot dipped galvanized steel frame in order to maintain a positive head above the engine fuel intake level. The day tank shall be fitted with a suitable filter, a full height gauge glass and a 4-20 mA diesel sensor mounted near the base of the tank for provision of the "low and high diesel level" alarms. The connection to the afore-mentioned diesel sensor shall incorporate a ball valve for isolating and maintenance purposes.
5.2	Fuel pump	A self-priming electrically operated pump shall be supplied for filling of the indoor day tank. The fuel pump shall be mounted on the side of the day tank and shall be sufficient to draw a suction head of ± 10 meters, while maintaining sufficient flow to fill the day tank while the gen-set is operating at a 100 % load. The fuel pump shall incorporate an automatic cut-out to prevent pumping when the diesel level in the day tank reaches maximum capacity.

ITEM	DESCRIPTION	REQUIREMENT
6.0	<u>Canopy Enclosure</u>	

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6.1	Construction	Any canopy provided shall be fabricated from 3CR12 steel and shall totally enclose all the generator equipment, control gear and automatic change-over equipment. An appropriate number of padlockable doors shall be provided to allow sufficient and adequate access to all equipment for servicing and maintenance purposes. The access panels / doors shall take into consideration the high likelihood of vandalism and shall be as robust and vandal proof as possible and the padlockable locking mechanisms shall be shrouded to prevent tampering. The design of the access panels / doors shall be done in conjunction with the Engineer. The colour of the canopy shall be deep Brunswick green.
6.2	Cable Entry	The design of the concrete plinth shall allow for the cables to enter directly beneath the generator enclosure. Allowance shall be made for a purpose made cable glanding plate to be installed at the base of the canopy enclosure in this regard. Said glanding plate shall <u>consist of two separate aluminium plates</u>, one for glanding of the cables, and the other to allow easy access to both ends of the cables for working purposes. The glanding plate / s shall be mounted on a raised platform / box inside the canopy, the sides of which shall be watertight in an attempt to maintain the watertight integrity of the whole enclosure.
6.3	Sound Attenuation	Noise suppression via sound attenuating louvres and internal padding shall be provided to limit the generated noise to approximately 80 dB @ 7 metres.
7.0	<u>General</u>	
7.1	Frame	The engine and alternator 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 direct on the concrete of the generator room.
7.2	Drip tray	Separate drip trays must be fitted under the engine and day tank and must be large enough to catch a drip from any part of the engine / tank, as well as from the pipe connections to and from same.
7.3	Piping	All interconnecting fuel piping shall consist of copper tubes and the connection to vibrating components shall be in flexible tubing with armoured covering. A water trap shall be fitted in the fuel pipeline from the day tank to the engine.

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ITEM	DESCRIPTION	REQUIREMENT
7.4	Labels	All distribution boards, motor control panels, etc. supplied via the generator shall be clearly labelled with the following warning, "Essential Supply: Supplied via Standby Generator".
7.5	Manuals	Three copies of a maintenance, fault-localising and operating manuals, plus test certificates (including the controller programme listing if applicable) of all equipment shall be provided to the Engineer on hand-over.

5.4 **Exhaust Silencer and Noise Suppression**

It is essential to keep the noise levels as low as possible. An effective exhaust silencing system of the residential type must be provided. The maximum acceptable sound level, emitted by the engine exhaust, measured 7m from the exhaust point of discharge, shall be 80dB. It shall be the Contractor's responsibility to take such steps as may be necessary to achieve this condition.

The exhaust pipe shall be installed in such a way that the expelled exhaust fumes will not cause discomfort to the pump station operators or 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 to reduce the heat and noise transmission and shall be protected against the ingress of rain via a weather flap installed on same.

5.5 **Control / Indicating Equipment**

The following equipment shall be incorporated into the generator control panel:

- a) Emergency stop pushbutton.
- b) Hour meter with cyclometer counter recording the number of hours the set has run. The smallest figure shall indicate 1 / 10th hours.
- c) 3 x MDI ammeters and CT's, rated for 0-150% of rated output, measuring alternator output.
- d) 0 - 500V voltmeter with 7 position selector switch, measuring alternator voltage.
- e) Frequency meter, vibrating or pointer type, indicating alternator frequency.
- f) START and STOP pushbuttons for manual operation of the set.
- g) MANUAL / OFF / AUTO selector switch.
- h) Timers / controller for AMF operation.
- i) One set fuses or MCB's for potential circuits of meters.
- j) Battery charging, protection and alarm equipment.
- k) 15A double switched socket outlet on earth leakage supply.
- l) Suitable terminals for all control cables / wiring.
- m) Neutral and Earth bars
- n) Any other equipment necessary for the safe and correct operation of the installation.

Items (c) to (g) above may however, be omitted should these be viewable / accessible via the generator control unit.

5.6 **Alarm and Protection Equipment**

The generator control / change-over panel shall be equipped with the protection and alarm devices as described below. Activation of the various alarms shall inhibit operation of the generator.

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- E-Stop
- Temperature High
- Oil Pressure Low
- Over speed
- Start Failure
- Low Water Level
- Battery Charger Failure
- Low day tank fuel Level

Unless otherwise viewable on the generator control unit, all alarms shall be indicated via labeled indicator lamps of a type which can easily be seen when operating in normal daylight. All protection devices shall give a visible and audible alarm. A muting switch shall be installed in the alarm circuit to silence the audible signal, but the fault indication on the control panel must remain until the fault is rectified. The protection and signalling circuits are to be operated from the battery.

5.7 **Telemetry I / O**

The generator controller shall incorporate the necessary communication equipment and comms modules / protocols to communicate with the telemetry / HMI / PLC equipment in order that the complete status of the generator installation i.e. individual alarms, running amps, etc. can be monitored.

However, the following minimum hardwired I / O shall also be allowed for in this regard:

Status Inputs:

E-Stop
Generator Run
Temperature High
Oil Pressure Low
Over speed
Start Failure
Low Water Level
Battery Charger Failure

Analogue Inputs:

Day Tank Fuel Level
Battery Voltage

Control Outputs:

Generator Start / Stop Request

6.0 **CONTROL PANELS**

Where required new MCC control panels shall be supplied and installed as part of this contract.

The exact details of the new MCC panels shall be determined in conjunction with the plant equipment to be supplied and controlled from same. Due to the numerous combinations that may be expected in this regard allowance has been made in the Bill of Quantities for a rate to be provided per cubicle for the various types of typical equipment to be encountered at each pump station / plant.

The control panel shall generally comply with the requirements of the Standard Technical Specification and as detailed below:

6.1 **Control Logic Implementation**

The exact method of the control logic implementation shall be determined in accordance with the complexity of the control philosophy to be implemented.

However, for ease and flexibility in implementing future modifications and fine tuning of the control philosophy, as well as for incorporating user specific requirements during commissioning, it is preferred that the overall control of the MCC be achieved on a PLC / software basis.

A HMI controller installed inside the MCC panel shall allow operators to interact, view and select the necessary options and operational processes as required. The PLC and HMI equipment shall comply with the relevant clauses given hereunder.

Regardless of the above, all alarms, manual controls, etc shall be hardwired such that the pump station will be able to continue to operate in manual mode without fail should the PLC / HMI malfunction or be removed.

Where logic operations are performed using conventional relay ladder logic all relays, timers, etc. being of the modular plug in type. Furthermore, all relays, timers, etc. in use shall be easily replaceable and readily available.

6.2 **Control Philosophy and Mode of Operation**

The actual requirements of the control philosophy to be implemented shall be determined on a per project basis in accordance with the equipment to be supplied / controlled.

The following however is a general operational guideline for various typical standard pump station installations and items of equipment and should be adhered to as far as practical for uniformity's sake.

The overall control of the pumps and equipment shall be provided and displayed via a local HMI controller installed inside the MCC panel as follows:

- (i) A selector switch shall be supplied for each item of equipment to allow switching between Auto / Manual / Off mode. The state of this switch is to be monitored via the HMI and telemetry.

Remotely Operated Pumps: In Auto mode the pumps shall be stop / started via telemetry in accordance with the water levels of some remote water storage facility such as a reservoir usually located some distance away.

The duty pump shall automatically commence operation, following a "Start" signal being received from the telemetry and shall stop operating when a "Stop" signal is received.

A selector switch shall allow the operator to select the required duty pump (i.e. Pump No. 1, Pump No. 2, or automatic change-over). The status of the selector switch shall be monitored via the telemetry. The respective standby pump shall come into operation if the duty pump trips, is in the off position or does not start after an adjustable period (say 30 seconds).

Local Sump Operated Pumps: In Auto mode the operation of the pumps will be automatically controlled by various set points (i.e. start level, standby pump start level, stop level) received from an ultrasonic type sensor installed inside the sump. The instantaneous level reading and set points shall be displayed on the HMI view screen on the control panel. The level settings are to be determined on site with the Municipality's Representative.

The duty pump shall automatically commence operation, following a "Start Level" signal being received via the level sensor and shall stop operating when the level in the sump reaches a "Stop Level".

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The operator shall select the required duty pumps on the HMI, (i.e. Pump No. 1 or Pump No. 2 or automatic change-over). The respective standby pump shall come into operation if the duty pump trips, is in the off position or does not start after an adjustable period (say 30 seconds). Furthermore, if the duty pump is insufficient in reducing the fluid level inside the sump and the "Standby Pump Start Level" is reached the duty pump shall stop and the standby pump shall commence operation.

Two float switches installed inside the sump shall provide the high level and low level alarms. The health of the ultrasonic level sensor shall be monitored and should the 4-20 mA signal go outside the normal range a "Sensor Fail" alarm shall be generated on the HMI and transmitted to the SCADA and the starting / stopping of the pumps shall be controlled automatically by the aforementioned floats.

The afore-mentioned ultrasonic sensor and high level float shall be provided with approximately 12-hour back-up power taken from either a UPS or standby battery installed inside the MCC in order that the fluid level inside the sump can be monitored during power outages. Should the fluid level rise to above the start level than a signal shall be sent to start the standby generator as further detailed in Item (iv) below when in Auto Mode.

The "Start Level", "Standby Start Level" and "Stop Level" signal shall be adjustable via the HMI and SCADA interface and password protected to prevent unauthorised manipulation.

Mixers: In Auto mode the operation of the mixers will be automatically controlled by various set points (i.e. start level, stop level) received from the ultrasonic sensor installed inside the sump. The set points shall be displayed, as well as adjustable on the HMI view screen on the control panel.

The duty mixer shall automatically commence operation, following a "Start Level" signal being received via the level sensor and shall stop operating when the level in the sump reaches a "Stop Level".

The operator shall select the required duty mixer on the HMI, (i.e. Mixer No. 1 or Mixer No. 2 or automatic change-over). The respective standby mixer shall come into operation if the duty mixer trips, is in the off position or does not start after an adjustable period (say 30 seconds).

Mechanical Screens: In Auto mode the water level at the inlet works, measured upstream of the front raked screen, shall be monitored via an ultrasonic sensor. Should the water level rise to above a pre-set maximum (adjustable on the HMI) due to a blockage of the debris screen, a signal shall be given to start the front raked screen. The screen shall operate until the water level drops below a pre-set minimum level. Should the water level remain below the pre-set maximum for an extended period, an adjustable timer on the HMI shall cause the mechanical screen to operate every 30 minutes for a minimum pre-set time (adjustable on the HMI).

The afore-mentioned inlet ultrasonic sensor shall be provided with approximately 12-hour backup battery / UPS power in order that the water level at the inlet works can be monitored during power outages. Should the water level rise to above the pre-set maximum than a signal shall be sent to start the standby generator as further detailed in Item (iv) below when in Auto Mode.

Front raked screens shall be provided with additional jamming / blockage protection by monitoring the running current of the screen motor or via the torque protection sensor on each screen motor. Should a rise above the normal running current or torque setting of a motor be detected, that motor shall immediately stop and then reverse direction for a pre-set time (adjustable on the HMI) and then change again to operate in the forward direction in an attempt to clear the blockage. A maximum of three attempts shall be made to clear the blockage, where after the motor shall trip and a motor overload alarm raised.

Screw Conveyors for Screenings: In Auto mode the wash press shall commence operation together with the mechanical screen and shall continue operating for an adjustable period (set via the HMI) following stopping of the front rake screen, in order to remove the screenings.

Similar to the front rake screen the wash press shall also be provided with jamming / blockage protection by monitoring the running current of the screw motor. Should a rise above the normal running current of a motor be detected, that motor shall immediately stop and then reverse direction for a pre-set time (adjustable on the HMI) and then change again to operate in the forward direction in an attempt to clear the blockage. A maximum of three attempts shall be made to clear the blockage, where after the motor shall trip and a motor overload alarm raised.

Lime Dosing: Should lime dosing equipment be installed the lime feeder, solenoid valve controlling the dosing water supply and hopper vibrator shall be controlled via the HMI and shall automatically function when a pump is started and shall continue to function until the pump stops.

The lime hopper vibrator shall run for a period of $\pm$ three seconds and then switch off. The dosing water shall continue to flow following a pump stop for a further selected period, i.e. $\pm$ 2 minutes.

The complete status / alarms of the lime dosing equipment and adjustment of the various timers shall be provided for on the HMI.

- (ii) No alarm condition shall be overridden when in Auto Mode.
- (iii) In Manual Mode it shall be possible to manually control each item of equipment, i.e. pump, screen, etc. from the Control Panel or via the remotely located Start / Stop push button stations.

The pumps shall start once the Start button has been activated by the operator and shall continue pumping until a stop level signal is received from the ultrasonic sensor or until the Stop Button is depressed.

No alarm condition shall be overridden when in Manual Mode, although the operator shall be able to pump down below the sump stop level by holding in the pump start button.

- (iv) Following a power failure the status of both the inlet works fluid level and sump sewage level shall be monitored on the HMI / PLC and should these exceed the predetermined starting levels a signal shall be sent to start the gen-set.

The generator set shall automatically commence operation and shall complete a full screening / pumping cycle, (i.e. front raked screens shall operate until the inlet works fluid level is below the require value, and the sump shall be pumped down to the stop level regardless of whether a start screen / pump level is present or not) before a generator stop request is initiated via the HMI / PLC, whereupon the generator shall shutdown.

Where power factor correction capacitors are to be installed on motors these power factor correction measures shall be removed from circuit via drop-out contactors (or similar arrangement) during operation of the generator set to prevent possible damage to same.

- (v) All equipment is to be so wired as to allow remote stopping and starting via the telemetry controls. This ability shall only be available when the equipment placed in Automatic Mode and shall not override any normal automatic running condition such as an alarm or low level signal.
- (vi) The pumps are to be electrically interlocked to prevent both pumps operating simultaneously in Auto or Manual Mode.
- (vii) A no flow condition monitored via a limit switch mounted on the counterweight of the non-return valves shall initiate tripping of the motor starter on the occurrence of a no flow condition. The

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output of the 'no flow limit' switch shall be brought into circuit after motor starting ($\pm 30 - 60$ seconds), to ensure a proper flow rate is available. A further adjustable timer set 10 seconds, to delay a trip condition occurring in the event of a momentary drop in the flow rate shall form part of the circuitry.

In the event of a trip due to a no-flow condition it will be necessary to cancel the trip indicator and reset the no-flow relay before the pump can be re-started.

- (viii) A voltage monitor / phase failure relay connected to the incoming supply will isolate the control circuit and inhibit operation of the equipment in the event of a low voltage condition or phase sequence reversal occurring for longer than a selected period, set 20 seconds. The status of the voltage monitor relay shall be monitored via the telemetry equipment and shall initiate a "mains failure" signal upon activation.

The system shall be designed to shut down without damage upon an electrical power failure and shall automatically come back on line and resume normal operating duties following a power failure.

- (ix) Lock-off twist to release emergency stop push buttons shall be provided for each pump / motor on the Control Panel and at remote stations near the pumps. Activation of same shall only trip the pump concerned and shall cause all pumping activities of said pump to immediately cease.
- (x) The running amps of the motors shall also be monitored via the telemetry for trending purposes.
- (xi) A "Drive Not Available" signal indicating tripping of the motor circuit breaker shall be provided for all motors and displayed on the HMI and telemetry.
- (xii) High / Low level floats shall be installed inside the sump and shall provide the emergency "High / Low Level" alarms visible on the HMI and SCADA. All pumping activities shall cease following an emergency low level alarm being received.
- (xiii) All alarms shall be manually resettable at the control panel via the HMI controller.

All alarms are to be monitored via the telemetry. A flashing strobe alarm light mounted against the external wall of the pump station building shall be connected to the alarm circuit of the new control panel.

- (xiv) A test button is to be hardwired to all indication lights in order to test their functionality.
- (xv) The health of the diesel submersible / pressure sensor inside the day fuel tank shall be monitored and should the 4-20 mA signal go outside the normal range a "Sensor Fail" alarm shall be generated on the HMI and transmitted to the SCADA.
- (xvi) The generator set shall be able to be remotely started / stopped via the HMI / PLC, when same is placed in Automatic Mode and shall not override any normal automatic running condition such as an alarm, etc.

Regardless of the above, all alarms, manual controls, etc are to be hardwired such that the pump station will be able to continue to operate in Manual mode without fail should the PLC / HMI equipment malfunction or be removed.

6.3 **Construction**

The MCC panel shall incorporate the motor control equipment and other control systems and facilities as indicated on the relevant drawings.

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The electrical supply will be at 400V 3 phase / 230V single phase, 50Hz system, with a nominal fault level as indicated on the drawings. The circuit breakers in the control panel shall be of one manufacture throughout correctly cascaded for the supply conditions concerned. All electrical equipment, materials and apparatus provided under the contract shall be suitable for operation on the supply system conditions given above.

The MCC panel / switchboard / kiosk shall be IP 44 minimum and shall be a minimally tested assembly, i.e. MTA in accordance with SANS 1973 and 60439 as applicable. Certification / documentation verifying that the panel has been manufactured to SANS 1973-8 MTA shall be provided by the manufacturer.

The board / kiosk shall be of the totally enclosed metal clad type, fabricated from **304 stainless steel** regardless of the mounting position or distance from the nearest sewage handling facility due to the unavoidable presence of corrosive sewage gases in the vicinity. The board shall be flush fronted and hinged covers shall be provided on the front of each compartment except as otherwise indicated. Each front cover shall be lockable by square key operated locks with 3 keys supplied.

The MCC panel / kiosk may be either floor standing or wall mounted depending on its final dimensions and weight. Floor standing boards shall be mounted on a purpose made 300 mm high 3CR12 steel stand to allow for the installation of cable tray beneath the MCC. Outdoor kiosks shall be weatherproof and installed on a purpose made concrete plinth preferably not directly above a sewage sump. No direct conduit or sleeve connection between any sewage sump and into a MCC panel / kiosk shall be installed in order to prevent the ingress of corrosive sewer gases into the panel / kiosk. All sleeves / conduits installed into sumps shall be sealed at both ends using an appropriate expandable type foam sealant.

The MCC / kiosk shall incorporate a purpose made cable entry / glanding compartment to allow for the terminations of the various cables. The total dimensions of the boards shall be designed to suit the space available inside the various plant rooms and the suitability of the dimensions of the board must be verified by the Contractor on site in order to ensure sufficient space is available in this regard and that no interference with other items of equipment will be experienced. The height of the new MCC board shall not exceed 2 100 mm. The heat build-up inside the various compartments shall be vented to the rear of the panel exiting vertically where required.

Internal MCC boards shall be finished with orange peel (structured) type epoxy powder coating, colour orange externally. All internal surfaces shall be finished white, except for front covers which shall be orange. The colour of externally mounted MCC kiosks shall be aesthetically pleasing and in keeping with the surroundings, the default being deep Brunswick Green in this regard.

All outgoing connections to the various items of equipment, including the telemetry facilities, shall be brought to easily accessible and appropriately current rated terminals.

The equipment controls, lights and plug circuit breakers shall all be installed inside the control panel.

Cognisance shall be taken of the potential radiated electrical noise and interference that may be produced by the VSD of the motors and all measures shall be taken to limit same. Attempts shall be made for electromagnetic shielding of the control circuitry and cabling via the screening of same behind the earthed steelwork of the enclosure where possible.

6.4 **LV Metering**

Unless installed elsewhere on the main incoming supply a new Bulk LV meter shall be supplied and installed inside the new MCC panel / kiosk in order to meter the consumption of same.

Said kWh meter shall comply with latest specifications required by the Municipality's Electrical Department, which shall be clarified before manufacture of the new MCC commences.

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The latest requirements in this regard are the direct connect Landis & Gyr 3219 (Ampy) type kWh meter for supplies less than 100A, three phase.

For supplies in excess of a 100A, three phase the kVA / kWh meter shall be the Landis & Gyr type ZMD 405 C7 kWh meter, including LED indicator fuses, test block and cell phone modem for remote metering. The CT's to be provided for the kWh meter shall be rated at in accordance with supply required and shall be Class 0,5.

Allowance must be made in the tender price for the programming of this meter to meet the requirements of the Municipality. The meter shall be tested, commissioned and programmed on site by a specialist contractor to be approved by the Engineer and the Municipality. The contractor shall also check the CT / VT wiring and provide a test certificate to the Municipality on completion to confirm that the meter has been tested in terms of their standard procedure and provide the test results required by them.

Registering of the new consumption meters onto the existing the Municipal system shall be the Contractor's responsibility.

Care shall be taken when installing the meter that same is connected upstream of any incoming standby supply such as a generator, in order that only the electrical consumption of the main incoming supply is metered.

6.5 **Main Incoming / Motor Circuit Breakers and Isolators**

The main incoming and motor circuit breakers shall be correctly rated for the duty required.

Unless supplied directly from an on-site generator change-over panel type arrangement two main incoming MCB's shall be provided inside the board / kiosk. The purpose of said MCB's shall be for the connection of the main incoming supply, as well as for the rapid connection of a mobile genset supply if necessary. The two incoming MCB's shall be mechanically interlocked such that both MCB's cannot be in the on position simultaneously to prevent any possible back feed onto the incoming main supply.

The "Normal" and "Genset" MCB's shall be suitably labeled to prevent any possible confusion, and an auxiliary contact on the Genset MCB shall disable any power factor correction measures installed inside the MCC / kiosk to prevent possible damage to same during operation of a standby generator set.

The door to the main and individual motor compartments shall be interlocked with either the main / motor circuit breaker or isolator such that the circuit breaker or isolator must be in the "off" position before the door can be opened.

The afore-mentioned circuit breakers and isolators must be operable via a rotary handle with the doors closed unless otherwise specified.

6.6 **Soft Starters and Variable Speed Drives (VSD's)**

The soft starters / VSD's shall be similar or equivalent to the Weg type as currently utilised by the Municipality.

The soft starters / VSD shall be selected and rated to suit the load characteristics of the new motors and shall be installed in adequately ventilated cubicles / compartments and, if needed, forced ventilation shall be provided. The temperature of the soft starters / VSD's unit shall be monitored and should the temperature exceed safe operating conditions the soft starters / VSD's shall be turned off.

A main circuit breaker and ultra-rapid fuses shall be supplied and installed inside the soft starters / VSD's cubicles in order to protect the soft starters / VSD's and motor equipment. Spare ultra-rapid fuses shall be supplied and installed inside the various compartments for all soft starter / VSD equipment.

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The soft starters / VSD's modules shall incorporate the necessary communication equipment and comms protocols to communicate with the telemetry equipment in order that the complete status of the soft starters / VSD's, i.e. individual alarms, running amps, etc. can be monitored.

Units offering the maximum degree of self-diagnostic ability are preferred, as are menu driven units. Utmost care should also be taken to ensure that protection systems are appropriately set and do not result in nuisance tripping.

Utmost care is to be taken to ensure that harmonics present on the electrical system do not adversely affect the units and also that harmonics generated by the drive units themselves do not adversely affect the electrical feed system or telemetry equipment.

Allowance shall be made for the installation of harmonic filtering equipment, i.e series / parallel connected line reactors, etc in this regard inside the cubicles. The combined maximum total harmonic distortion (THD_{voltage}) of the soft starter / VSD / harmonic filter equipment provided shall not exceed 5%. In no case shall the combined power factor of the motor soft starter / VSD / harmonic filter be leading more than 95% at 100% speed and load.

6.7 **Power Factor Correction Capacitors**

Power factor correction capacitors shall be provided for non-VSD driven pump motors exceeding 3 kW in rating and the power factor of the motor load shall be between 0.90 and 0.95 lagging.

The capacitors shall be automatically switched in or out by means of suitably rated contactors which shall operate in conjunction with the bypass contactor of the relevant motor soft starter where these are installed, suitably time delayed to avoid transient switching. The power factor correction equipment shall under no circumstances operate during the motor soft starter ramp up / ramp down period and shall be electrically interlocked to prevent same.

Protection for LV systems (400V) shall comprise HRC fuses in fuse-holders for each step.

It shall be ensured that the rupturing capacity of a fuse chosen for a specific application shall be adequate, both as far as short circuit current and applied voltage are concerned.

Fuses shall be chosen to withstand a higher than normal full-load current (1.5 times rated capacitor current) to allow for harmonics, and shall not deteriorate due to the high transients at switch-on.

The power factor correction capacitors must be disabled, i.e. taken out of circuit via drop-out contactors (or similar arrangement) during operation of a standby generator set to prevent possible damage to same.

6.8 **Human Machine Interface (HMI)**

Where an HMI module is to be installed this shall be similar or approved equal to the Delta type, incorporating a LCD touch screen with trending facilities.

The unit shall be programmed in as user friendly manner as possible and all settings shall be accessed and adjusted through touchable images or keys on the afore-mentioned touch screen.

The details of the control system's input, monitoring and alarm screens shall be decided in consultation with the Engineer and as detailed elsewhere in this specification. Various settings as indicated by the Engineer shall also be password protected and provision for this security facility shall also be allowed for.

All programming, etc implemented shall be recorded and a hard and softcopy of same issued to the Engineer on handover.

The tenderer shall also make due allowance in his tender price for a registered copy of the HMI programming software to be supplied to the Municipality, as well as for training for at least three of the Municipality's maintenance personnel on said software. The afore-mentioned training shall consist of a minimum of three days of 8 hours each, to be held at the Municipality's premises, and shall include for all notes, configuration files, manuals, etc required.

6.9 **Programmable Logic Controller (PLC)**

Where a PLC is to be installed this shall be similar or approved equal to the Delta type, incorporating a HMI touch screen display facility.

The required I/O's for the PLC are similar to those required for the telemetry installation detailed elsewhere, and shall be determined in accordance with the number of feeds, indications and controls required, and a minimum of 20% additional I/O's shall also be provided, over and above the required count.

Analogue inputs shall be suitable for 4 – 20 mA, full floating, differential inputs with a minimum resolution of 10 bits. 4 – 20 mA loop isolator modules shall be installed where required. Allowance shall be made for an additional 2 analogue inputs for future monitoring of equipment / transducers.

Digital inputs shall be suitable for 24V AC or DC and shall be opto-isolated. Digital outputs shall be of the voltage free type. All control outputs shall be normally closed on active to ensure a fail safe method of operation.

All PLC inputs shall be protected against voltage surges or transients. Transient protection shall be of the SurgeTech or Phoenix type and rated for 120 Joules, 5 kA at the standard 8 / 20 S transient profile.

All I/O terminations / connections shall be done via DIN rail mounted Klippon or Phoenix terminal blocks, with knife interconnects.

The Central Processing Unit (CPU) shall be selected to cater for the complete I/O count as specified above, as well as the extended I/O count of the additional two future pumpsets.

The PLC / PC communication protocol shall be Modbus based and PLC software shall be written to effect the control and operations as set out elsewhere in this specification and the installation shall not be regarded as complete and a completion certificate shall not be issued until full detailed documentation of the software is received.

Before any programming commences the Contractor shall ensure that he fully understands the sequence of operation and shall draw up all the software flow diagrams and submit same to the Engineer for approval prior to implementation.

Only professionally compiled documentation shall be acceptable and shall include complete flow diagrams of all the programmes. The programmes themselves shall also be provided with comprehensive comments to explain the instructions. All programming, etc. implemented shall be recorded and a hard and softcopy and of same issued to the Engineer on handover.

The tenderer shall also make due allowance in his tender price for a registered copy of the PLC programming software to be supplied to the Municipality, as well as for training for at least three of the Municipality's maintenance personnel on said software. The afore-mentioned training shall consist of a minimum of three days of 8 hours each, to be held at the Municipality's premises, and shall include for all notes, configuration files, manuals, etc required.

6.10 **Temperature Monitoring and Overheat Protection**

PT100 temperature probes, thermistors or klixon type temperature monitoring and overheat protection shall be installed in the Control Panel for each motor rated above 3 kW.

For motors above 30kW temperature probes shall be installed for each motor winding (i.e. red, white, blue), as well as for each motor and pump's drive end and non-drive end bearings.

It shall be possible to reset the temperature controller without having to open the door of the panel. The pump shall not start until it has been manually reset.

The temperature of the motor and pump bearings shall be visible on the MCC panel and monitored via the telemetry.

6.11 **Supply Monitor**

The incoming supply shall be monitored by means of power supply analyzer module similar or approved equal to the Lovato DMG 700 type. The power analyzer shall simultaneously display the voltage and currents of all three phases as well as the record the peak, i.e. maximum values of same. The instantaneous power consumed and power factor shall also be displayed.

6.12 **Under Voltage Indication and Tripping System**

A voltage monitor / phase failure unit shall be provided for the mains supply as shown on the drawings. The operation of the mains system shall be such that on the occurrence of the mains voltage falling to pre-set limits on all or any one phase the VM will initiate the operation of the timer. On expiry of the pre-set period the timer will energize relay UVR to cause the tripping of any motor that may be running and inhibit the starting of any motor. Simultaneously, the UVR will initiate a "mains failure" telemetry signal. When the mains voltage returns to normal the VM will de-energize the system to permit normal function.

6.13 **Control Circuit Voltages**

The pump motor control circuitry and other control circuitry shall operate on a 24V DC system.

6.14 **General**

All equipment mounting such as ammeters, voltmeters, selector switches, indicating lights, push buttons etc., shall be flush mounted in hinged panels to provide ease of access to equipment mounted within the board. Circuit breakers shall, however, be mounted in fixed chassis with cut-outs in hinged panels for switch toggles and escutcheon plates.

Emergency stop (abb. E. Stop) push buttons, of the lock-off / twist to release type with red mushroom heads, shall be provided on the face of each motor control compartment.

Except as otherwise indicated and as is practically possible, all components such as starters, contactors and relays shall be of one manufacture. All circuit breakers shall also be of one manufacture.

6.15 **Surge Arrestors**

Class 2 type surge arrestors, similar or approved equal to the Surge Sentry type, shall be installed inside a clear plastic enclosure inside the MCC panel and connected between each phase and the earth bar, and one between the neutral bar and the earth bar. The arrestors shall have the following minimum specifications:

Max Impulse Current I_{max} 8/20us 40kA

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Maximum peak residual voltage	< 800V
Energy Absorption (W)	550J
Response time	< 25ns

6.16 **Socket Outlet**

A weatherproof double phase 16 amp 3 pin double switch socket is to be installed inside the Control Panel. The socket shall be flush mounted with the exterior surface of the panel so as to be externally accessible and shall be protected via an earth leakage unit.

6.17 **Common Fault Indicators**

The cause of a trip condition shall be indicated on the respective control compartments by means of a coloured LED labelled accordingly eg. "Tripped on O/L", "Tripped on No-Flow", "E-Stop Locked Out", etc.

The individual fault signals shall be brought to terminal connections for connection to the telemetry equipment.

6.18 **Emergency Stop Lock Out Indication**

A fail safe method of operation shall be incorporated in the E-Stop circuitry. The E-Stop should preferably be connected directly into the Main Contactor coil circuit.

When any E-Stop is operated a red LED shall indicate "E-Stop Locked Out".

6.19 **No Flow Trip and Indication**

The pump trip and indication for a no-flow condition, monitored via a limit switch mounted on the counterweight of the non-return valves, shall be initiated after selected time delays, as described in the Modes of Operation above.

6.20 **Reset**

A single reset push button per equipment compartment must be provided to reset all alarms specific to that compartment.

6.21 **Typical Indications**

The following typical indications are required on the face of the new MCC Panel / kiosk as applicable:

Water / Sewage - Green LED labeled	"PUMP RUN" Pumps:
- Red LED labeled "TRIPPED ON VSD / SOFT STARTER	FAULT"
- Red LED labeled "TRIPPED ON MOTOR OVERHEAT"	
- Red LED labeled "TRIPPED ON MOTOR BEARING	OVERHEAT"
- Red LED labeled	"TRIPPED ON PUMP BEARING
	OVERHEAT"
- Red LED labeled	"TRIPPED ON NO FLOW"
- Red LED labelled	"TRIPPED ON SEAL FAIL"
- Red LED labeled	"TRIPPED ON EARTH LEAKAGE
	FAULT"

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	- Red LED labeled - N/O Push button labeled - Selector switch labeled - Start Push Button - Stop Push Button - E-Stop Push Button - Reset Push Button - Hours Run meter	"E-STOP LOCKED OUT" "LAMP TEST" "AUTO / OFF / MANUAL"
Mixers:	- Green LED labeled - Red LED labeled - Red LED labeled - Red LED labeled - Red LED labeled - Red LED labeled - N/O Push button labeled - Selector switch labeled - Start Push Button - Stop Push Button - E-Stop Push Button - Reset Push Button - Hours Run meter - E-Stop Push Button - Reset Push Button - Hours Run meter	"MIXER RUN" "TRIPPED ON VSD / SOFT STARTER FAULT" "TRIPPED ON MOTOR OVERHEAT" "TRIPPED ON SEAL FAIL" "TRIPPED ON EARTH LEAKAGE FAULT" "E-STOP LOCKED OUT" "LAMP TEST" "AUTO / OFF / MANUAL"
Mechanical Screens	- Green LED labeled - Yellow LED labeled - Yellow LED labeled - Red LED labeled - Red LED labeled - Red LED labeled - N/O Push button labeled - Selector switch labeled - Selector switch labeled - Start Push Button - Stop Push Button - E-Stop Push Button - Reset Push Button - Hours Run meter	"PUMP RUN" "FORWARD" "REVERSE" "TRIPPED ON VSD FAULT" "TRIPPED ON TORQUE PROTECTION" "E-STOP LOCKED OUT" "LAMP TEST" "AUTO / OFF / MANUAL" "FORWARD / REVERSE"

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Mechanical Screens	- Green LED labelled	"PUMP RUN"
	- Yellow LED labelled	"FORWARD"
	- Yellow LED labelled	"REVERSE"
	- Red LED labelled	"TRIPPED ON VSD FAULT"
	- Red LED labelled	"E-STOP LOCKED OUT"
	- N/O Push button labelled	"LAMP TEST"
	- Selector switch labelled	"AUTO / OFF / MANUAL"
	- Selector switch labelled	"FORWARD / REVERSE"
	- Start Push Button	
	- Stop Push Button	
	- E-Stop Push Button	
	- Reset Push Button	
	- Hours Run meter	
Lime Dosing	- Green LED labelled	"VIBRATOR RUN"
	- Green LED labelled	"FEEDER RUN"
	- Red LED labelled	"VIBRATOR FAULT"
	- Red LED labelled	"FEEDER VSD FAULT"
	- Red LED labelled	"E-STOP LOCKED OUT"
	- N/O Push button labelled	"LAMP TEST"
	- Selector switch labelled	"AUTO / OFF / MANUAL"
	- Selector switch labelled	"FEEDER FORWARD / REVERSE"
	- Start Push Button	
	- Stop Push Button	
	- E-Stop Push Button	
	- Reset Push Button	
	- Hours Run meter	
Other	- Red LED labelled	"SUMP / RESERVOIR LOW LEVEL ALARM"
	- Red LED labelled	"SUMP / RESERVOIR HIGH LEVEL ALARM"
	- Red LED labelled	"INLET HIGH LEVEL ALARM"
	- N/O Push button labelled	"LAMP TEST"

All indication lights shall be of a type, which can easily be seen when operating in normal daylight.

The following information shall be displayed / set on the HMI / SCADA as a minimum requirement:

Pumps Duty Select, i.e. P1 / P2 / Auto
Mixer Duty Select, i.e. M1 / M2 / Auto
Pump Status (run, alarms, running amps, etc)
Mixer Status (run, alarms, running amps, etc)
Mechanical Screen Status (run, alarms, running amps, etc)
Screw Conveyor Status (run, alarms, running amps, etc)
Lime Dosing Status (run, alarms, running amps, etc)
Inlet Level
Sump Level
Trip Acknowledge and Reset

In addition to the above the complete status of each soft starter / VSD shall be monitored via a modbus, RS485, etc communications link between the PLC / HMI / VSD / soft starter drives. The pump currents as well as all individual VSD / soft starter (i.e. undercurrent, phase imbalance, etc) shall be monitored and displayed accurately on the HMI / SCADA. The information displayed on the HMI unit shall be accessible via the telemetry for monitoring / recording purposes on the SCADA software.

All indication lights shall be of a type which can easily be seen when operating in normal daylight and shall generally comply with the relevant clauses in the Standard Technical Specification.

6.22 **Telemetry Installation**

Allowance shall be made inside the MCC for the necessary signals in order to monitor / control the plant equipment remotely via telemetry. Any telemetry equipment required shall be supplied and installed by the Municipality's preferred Telemetry Contractor to be appointed under a separate contract, however due allowance shall be made under this contract for the necessary liaison required with said Telemetry Contractor to ensure the correct interfacing of signals, etc to monitor the complete status of the new MCC panel and associated equipment.

As a standard any telemetry equipment supplied shall be installed inside a separate wall mounted enclosure, however where necessary the telemetry equipment may be installed inside the MCC panel / kiosk inside a separate cubicle of suitable dimensions to accommodate all the necessary I / O cards, RTU modules and radio communication equipment required.

All telemetry signals shall be configured so that a Mains Failure does not create erroneous signals. It shall also be possible to completely remove the telemetry equipment without adversely affecting the normal functioning or manual operation of the system in any way.

The following typical common I / O shall be allowed inside the MCC for each item of equipment as applicable:

ITEM	DESCRIPTION	DIGITAL I/O		ANALOGUE I/O	
		DIN	DOU	AIN	AOUT
Pumps	Auto	✓	✓		
	Manual	✓	✓		
	Run	✓	✓		
	VSD / Soft Starter Fault	✓	✓		
	Motor Overheat	✓	✓		
	Motor Bearing Overheat	✓	✓		
	Pump Bearing Overheat				
	No Flow Trip				
	Seal Fail				
	Earth Leakage Trip Emergency				
	Stop				
	Drive Not Available				
	Start / Stop		✓		

C3.3.23

Mixers	Auto Manual Run VSD / Soft Starter Fault Motor Overheat Seal Fail Earth Leakage Trip Emergency Stop Drive Not Available Start / Stop	 ✓ ✓ ✓ ✓ ✓ ✓	 ✓		
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ITEM	DESCRIPTION	DIGITAL I/O		ANALOGUE I/O	
		DIN	DOUT	AIN	AOUT
Mechanical Screens	Auto Manual Forward Reverse Run VSD Fault Torque Protection Emergency Stop Drive Not Available Start / Stop	 ✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓		
Screw Conveyor	Auto Manual Forward Reverse Run VSD Fault Emergency Stop Drive Not Available Start / Stop	 ✓ ✓ ✓ ✓ ✓ ✓	 ✓		
Lime Dosing	Auto Manual Vibrator Run Feeder Run Feeder Forward Feeder Reverse Vibrator Fault Feeder VSD Fault Emergency Stop Vibrator Drive Not Available	✓ ✓ ✓ ✓ 			

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	Feeder Drive Not Available				
	Vibrator Start / Stop Feeder Start / Stop		✓ ✓		
Miscellaneous	Intruder Mains Fail	✓ ✓			
	Sump / Reservoir High Level Float	✓			
	Sump / Reservoir Low Level Float	✓			
	Allowance for possible pulse output of future Flow Meter	✓			
	Sump / Reservoir Level Inlet Works Level			✓ ✓	
	Allowance for possible 4-20 mA output of future Flow Meter			✓	

In addition to the above the complete status of each soft starter / VSD shall be monitored via a Modbus, RS485, etc communications link between the telemetry / PLC / HMI equipment and VSD / soft starter drives. The pump currents as well as all individual VSD / soft starter alarms (i.e. undercurrent, phase imbalance, etc) shall be monitored and displayed accurately on the SCADA software.

Similarly, the information displayed on the HMI unit shall be accessible via the telemetry for monitoring / recording purposes on the SCADA software.

7.0 **GENERAL ELECTRICAL**

7.1 **General**

Electrical connections shall only be undertaken by a suitably qualified Installation Electrician registered with the Electrical Contracting Board (ECA), in order that a Certificate of Compliance can be issued for all electrical work upon completion thereof.

Should the Contractor not have a suitably qualified Installation Electrician in his employ he shall acquire the services of a registered Electrical Sub-Contractor to undertake said electrical installations.

7.2 **Electrical Supplies**

It shall be the Contractor's responsibility to make all the necessary arrangements with the Municipality's Electrical / Civil Department to de-energise the connection point, and to pay the department for their related costs. The network downstream from the connection point shall be earthed at all times that work is being carried out on same.

Tenderers must take cognisance of the fact that the pump station / plants are in constant operation and it is therefore imperative that as much preparation as possible be done before time in order to limit the disruption of the electrical supply to a minimum during the installation of the new LV cables.

7.3 **LV and Instrumentation Cabling**

The Contractor shall supply and install all necessary LV and instrumentation cabling as required during the course of the contract.

The LV cables shall be PVC, SWA, MVGP grade to SABS 150-1970 and of appropriate rating to suit the required duty and installation method.

All instrumentation cabling shall be of the overall screened, steel wire armoured, twisted pair type, similar or approved equal to the Dekoron type, with the required sizes and pairs suited for the duty required.

Cable joints shall be permitted in exceptional circumstances only (for example end of standard drum length) and on the written permission of the Engineer. All LV cable joints shall be by means of a "Scotch Cast" joint.

All LV cable terminations shall be done by means of a brass cable gland, brass locknut and a neoprene rubber shroud similar to the Pratley type. Compression type glands shall be employed for screened cable, surfix, and trailing cable terminations. Colour coded neoprene rubber cable lug sleeves or alternative colour coded heat shrink tubing shall be installed on all LV cable lugs. Extreme care is to be taken to ensure that control and other terminations do not fail due to the ingress of moisture or development of damp conditions.

Cable protection covers and galvanized kick pipes shall be supplied and installed to the extent indicated and as may be found necessary.

The LV cabling shall further comply with the relevant clauses of the Standard Technical [Specification, Part C3.5 hereof](#).

7.4 **Trenching / Sleeves**

Where trenching and backfilling for cables is required this shall be the responsibility of the Contractor and same shall ensure that the trenching and backfilling complies with the Standard Specification. Extreme care shall be taken whilst excavating for all cables so as not to damage any existing buried services such as cables, pipes, etc installed on the same route. It shall be the Contractor's responsibility to determine beforehand the location of any existing underground services in the vicinity of the cables to be laid and inspection trenches shall be dug as required.

Any tarred / paved surface disturbed during the trenching process must be repaired / reinstated to its original state after the installation of the sleeves or cables.

All cable routes must be confirmed on site by the Municipality prior to trenching and cable markers shall be installed along all cable routes indicating the voltage, size, number and direction of the cables.

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400 mm wide x 100 micron thick PVC marker tape shall be placed over all cables laid in trenches. Where the dimensions of the trench width dictate, i.e. greater than 400 mm, two or more lengths of marker tape shall be installed adjacent to one another, overlapping by approximately 50 mm, in order to cover the entire width of the trench.

All sleeve ends must be sealed with expandable foam sealant after the installation of the cables to prevent water penetration from the outside.

7.5 **Main Earthing**

As a standard a main LV earth bar shall be provided inside the generator change-over, or where no generator is installed, inside the MCC panel and all equipment shall be earthed to same. The earth bar shall be earthed via two 4,5-metre-long earth spikes and 70 mm² bare copper inter-connecting conductors. The earth resistance shall be tested and same shall not exceed 1 ohm.

The earthing of the equipment to be installed shall be taken from the LV Earth Bar using bare copper conductors in accordance with SANS 10142.

Each pump and pipework shall be bonded to the earth conductor run with the motor supply cables.

All outdoor earth connections shall be covered with "Densal" paste and a double layer of "Denso" tape to prevent deterioration due to corrosion.

All earth conductors shall be terminated in compression type lugs and all connections shall be suitably labelled. Concrete cable markers labelled "Earth Spike" shall be installed above each earth spike.

Earth test certificates for the entire installation shall be provided to Engineer and Municipality before hand-over and energisation of the supply occurs.

The earthing shall further comply with relevant clauses of the Standard Technical Specification and the AMEU Code of Practice for the Application of Neutral Earthing on Low Voltage Distribution Systems.

7.6 **Pump and Equipment Connections**

All cabling connections between the various generator, MCC panels, etc and equipment shall be laid neatly in sleeves / ducts / cable tray or secured to pipework as required. The exact route of all cables shall be determined on site with the Municipality.

7.7 **Lighting**

Where lighting is required same shall generally comply with the relevant clauses in the Standard Technical Specification and shall have the approval of the Municipality.

All light fittings shall be supplied complete with specified lamps and shall bear the approved mark of the S.A. Bureau of Standards. All fluorescent fittings are to be effectively bonded to the earth wire connection.

The internal lighting inside the various pump station, buildings, etc shall typically consist of IP65, enclosed fluorescent type luminaires with 2 x 58W lamps, similar or approved equal to the Lascon Corolite 10N type surface mounted against the concrete ceiling of the building.

The new light switches to be installed shall be rotatable, weatherproof to IP67, vandal-resistant, flush mounted, similar or approved equal to the Matalec or Waco type.

C3.3.27

The external light fittings, in any are required, shall be surface mounted against the outside of the building and shall be of the Bekanova 150 W HPS type with internal eyelids, glass diffusers and decorative skirt.

7.8 **Cable Tray / Conduit Work**

The cable tray / conduit work installation is to be fixed with galvanised steel screws / bolts to the floor, walls and ceilings as required. The Contractor shall make all necessary arrangements to provide holes through concrete floor slabs and brick walls for cable tray / conduit work and shall also allow for the making good of all affected surfaces afterwards.

Conduits shall be preferably be built in during the construction of the new pump station buildings to limit any visible conduiting, and shall be 25 mm diameter and of the PVC type. Surface mounted conduiting shall only be allowed in unavoidable cases, (i.e. against roof purlins) and at the discretion of the Engineer and same shall be galvanized steel bosal mounted with hospital type stand-off saddles, unless shown otherwise.

All electrical wiring inside the building shall comply with SABS 0142 Specification.

7.9 **Small Power Outlets**

If required socket outlets shall be provided and these shall be of the weatherproof, industrial double switched socket outlet type flush mounted with white cover plates. The mounting heights shall typically be 800mm AFFL to avoid possible flooding or as dictated by the relevant site conditions.

7.10 **Start / Stop / E-Stop Push Button Stations**

Where necessary Start / stop / E-stop push button stations shall be installed in close proximity to equipment as required by the Municipality.

The push button stations shall be weatherproof to IP 65 and mounted on vertical sections of 100mm x 50mm channel iron with minimum 2 mm wall thickness, with the pushbuttons 1 200 mm above standing level at each item of equipment, as close as is practical to the motor terminal box of same.

The channel iron shall be welded onto a 200 mm x 200 mm x 6 mm baseplate containing four 12 mm diameter mounting holes, for the assembly to be bolted to the floor with four 10 mm diameter stainless steel bolts. The channel iron and baseplate assembly shall be hot dipped galvanized after drilling and welding. The start / stop station assembly shall be mounted in a such a manner that it is not disturbed when the motor is removed.

The start and stop buttons shall be green and red in colour respectively and the emergency stop button shall be of the latching red on yellow mushroom type. Operation of an emergency stop shall only trip the pump concerned.

7.11 **Fire Extinguishers**

9 kg dry powder fire extinguishers, complete with discharge horn and mounting bracket, shall be supplied and installed as required.

The mounting bracket for the extinguisher shall be installed 1 500 mm above floor level.

8.0 **TRANSDUCERS**

In certain instances, it may be required by the Municipality for the Contractor to install new or replace faulty level sensors, float switches, etc. monitoring the instantaneous levels of sumps, reservoirs, etc.

Any new equipment supplied shall comply with the Municipality's requirements in this regard as follows:

8.1 **Ultrasonic Level Sensors**

These shall be of the Mobrey, loop powered type, usually 0 to 5 m, although the exact range required will need to be confirmed on site.

Typically, the ultrasonic level sensor shall be installed inside the sump to monitor the fluid level inside same and the ultrasonic transducer head shall be mounted on purpose made cantilever type stainless steel bracket above the maximum overflow level of the sump and shall be supplied complete with 15m of instrumentation cable.

8.2 **Pressure Sensors**

Each submersible sensor shall similar or equal to the Wica type and shall be supplied complete with 15 m of instrumentation cable and the measuring range of same shall suit the purpose for which they are intended. All submersible sensors shall be so mounted as to allow easy withdrawal and easy reinsertion to the exact same level for maintenance purposes.

Each pressure transducer shall be installed inside an approximately 50 mm diameter protective PVC pipe / conduit. Said pipe / conduit shall be secured to the concrete structure using stainless steel brackets and bolts and the cable entry into the pipe / conduit shall be by means of threaded PVC compression glands of sufficient dimensions to suit the pipe / conduit / cable.

8.3 **Float Switches**

Any float switches supplied shall be similar or approved equal to the Flygt waterproof float type and shall be supplied complete with fifteen metres of outgoing cable.

The float switches shall be tied to a nylon rope with a lead weight secured to the other end of said rope to prevent movement inside the sump.

8.4 **Flow Meters**

Any flow meters to be installed shall be of the magnetic flow meter type similar or approved equal to the Siemens Magnetic flow type.

The new flow meters shall include a sensor, remotely mounted transmitter, display unit, cabling, supports, grounding rings (if applicable) plus one flange adaptor on the upstream side and one flange adapter on the downstream side for a full-bore, in-line, double flanged unit. Where it is not feasible to install an in-line unit due to the conditions on site, a clamp-on ultrasonic type flowmeter similar or approved equal to the Siemens SITRANS type shall be installed.

The transmitter shall provide local flow indication and a 4-20 mA output. The display shall be digital and indicate instantaneous flow rate, as well as incorporate an integrated totalizer for the total volume of water pumped. Indication of the flow shall be in m³/h and in l/s. Flow integration shall be provided. Indication shall be provided at the unit as well as remotely.

The pressure rating of the sensor shall be the same as the pipework in which it is installed but shall not be lower than PN10. The sensor shall have an IP68 protection and the transmitter IP67. The meter shall have a polyurethane lined, stainless steel tube and the sensor's electrodes shall be provided with automatic timed electrode cleaning.

The external corrosion protection system for the meter sensor shall be suitable for buried applications.

The equipment shall be installed, connected and calibrated by competent persons. The meter shall be installed with a straight pipe length of at least 10 pipe diameters upstream of the sensor and a straight pipe length of at least 5 pipe diameters downstream of the meter. The meter and the cabling shall be provided with protection against electromagnetic interference.

A factory calibration certificate shall be provided before installation and included in the Operating and Maintenance Manual for the pump stations.

9.0 ELECTRIC MOTORS

Where new electric motors are called for it shall be of the modern energy efficient type.

All motors supplied shall be of the totally enclosed, fan cooled, squirrel cage induction type with a **premium efficiency (IE3) rating** in accordance with the latest applicable requirements of SANS 60034, SANS 60072 and SANS 180.

All motors shall be standard catalogue models and shall be readily available. All motors shall preferably be of the same manufacture and motors of the same rating shall be interchangeable. The standard ratings and nominal speeds as required are indicated in the Bills of Quantities, Part C2.2, hereof.

Motors shall be adequately rated for the service for which they are intended, and due allowance shall be made for the operating conditions to be encountered on site.

All motors shall be suitable for operating on a 400V, three phase, 50 Hz electrical supply.

Motor terminal boxes shall be rotatable in 90 degree increments and shall have neoprene gasket seals and tapped threaded conduit entrance holes. Provision for an earthing terminal shall be provided in the main terminal box in accordance with SANS 60034-1. An additional earthing terminal shall be fitted on the motor frame external to the terminal box.

Motor enclosures shall be weatherproof with a minimum protection rating of IP55 and provided with a corrosion resistant coating. The external cooling fan shall be corrosion resistant, non-sparking, bidirectional, keyed, clamped and shouldered onto the motor shaft. A corrosion resistant fan guard shall be provided.

A corrosion resistant stainless steel rating plate shall be affixed to the motor frame with stainless steel or brass drive pins. The rating plate shall be indelibly stamped or engraved with all required data as specified in the relevant part of SANS 60034-1. The information contained on the rating plate shall be clearly visible and accessible after the motor has been painted.

It shall be the Contractor's responsibility to measure up and determine the correct mounting arrangement of the motors, orientation and size of cable boxes, etc. before ordering to ensure that same are compatible with the existing installation.

10.0 VALVES

Valves shall be manually operated by cast iron hand wheels and shall be clockwise closing.

11.0 PIPEWORK

Any pipework to be replaced or installed shall be defined on a per project basis the exact details of which shall be determined in conjunction with the Municipality.

All pipework provided shall comply with the relevant SANS specifications governing the manufacture and installation of medium pressure pipes.

C3.3.30

The Contractor shall allow for all costs involved, including but not limited to the supply of material, related design, manufacturing, testing, transport to site and installation of the purpose made pipework as indicated on the Mechanical drawing(s). The Contractor shall survey the existing structures prior to compilation of the workshop drawing to confirm structure sizes.

All pipework shall be in accordance with SANS 62, with a Heavy wall thickness, or SANS 719, with a wall thickness as per the Standard Specification, for pipework smaller and larger than DN150 respectively. Pipework shall be flanged and drilled to SANS 1123 Table 1600/3. All pipework and fittings shall be 316 Stainless Steel. All underground pipework shall be wrapped in petroleum tape, similar or equal to Denso tape.

The pipework layout shall allow for dismantling to facilitate inspection and maintenance. All pipework shall be properly supported and anchored and be designed so that all stresses caused by static and dynamic forces, including water hammer, are handled by suitable anchors to ensure no resilient forces are carried over to the pump flange connections.

All pipe supports and anchors shall be designed to handle at least 150% of the maximum flange pressure ratings. Pipe supports shall be manufactured out of 316 Stainless Steel profiles in the wet sumps and valve chambers. Where applicable, provision shall be made for proper insulation materials to prevent galvanic corrosion between the Stainless Steel and Zinc. The anchor footings shall be suitably sized to transfer the forces to the floor / wall without providing a point load. It shall have a minimum of 4 chemical anchor, high tensile Stainless Steel bolts per foot, suitably positioned and sized for the specific load rating of the anchor.

12.0 **PUMPS**

Where new pumps are called for it shall be similar or equal approved to the following existing types. The specific ratings required are as listed in the Bills of Quantities, Part C2.2, hereof:

- Stirling
- ABS
- Robot
- Howden Attack
- Sigmund Pulsometer
- Gorman Rupp
- NSW
- KSB
- Grundfos
- Rapid Allweier
- Homa

All pumps shall be supplied and installed in compliance with the relevant SANS specifications in this regard.

Pumps shall be selected to run as closely as possible to their best efficiencies over the operating range required. The design efficiency of any pump shall be minimum 70% to 80%.

Preference will be given to pumps capable of handling solids of diameter approaching that of the suction and delivery pipe connections, but in any case not less than 70mm, or the diameter of the delivery branch minus 10mm, whichever is the greater, and up to a maximum solids diameter of 125mm.

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The water / wastewater to be pumped shall be obtained from various sources and will usually have a PH in the range 6 to 8, but on occasion the PH may drop to as low as 5. It will contain appreciable amounts of grit and solids, and a high iron and manganese concentration may also be encountered with raw water obtained from boreholes. Anaerobic conditions may develop in pump sumps and rising mains resulting in the production of hydrogen sulphide and associated corrosive conditions. The materials used, and the corrosion protection systems applied shall be designed and selected to be suitable for handling sewage effluent.

Any sewage pumps supplied shall be capable of handling unscreened sewage and other liquids containing solids in suspension, up to the size stated above, without clogging. In addition, materials such as plastic bags, rags, sticks, rope and stringy materials shall be effectively handled.

Any sewage pumps supplied which are found during the course of the retention period to be prone to clogging or blocking shall be replaced by the Contractor at his own expense with units which prove satisfactory in service. Such replacement shall be effected within a reasonable time as determined by the Engineer. Pumps shall be of the centrifugal type. The rotating elements shall be accurately and efficiently balanced statically, dynamically and hydraulically to eliminate noise and vibration when running and to avoid unbalanced end thrust when either new or worn. Where end thrust is unavoidable, adequate long wearing thrust bearings shall be provided.

All parts shall be of ample dimensions and strength and of the best and most suitable material, corrosion resistant, free from flaws, accurately machined, properly assembled and fitted so as to avoid initial stresses and to ensure free running. All fittings such as packing glands, shaft assemblies, thrust bearings and plummer blocks shall be of adequate size and sound design.

13.0 DISMANTLING AND RECOVERING OF MATERIAL AND EQUIPMENT

All recovered materials not being utilised on the project shall be delivered to the municipal stores to enable the municipality to refurbish same if financially viable. A receipt shall be obtained from the Municipality, which must be included with any claims for payment in this regard.

14.0 LABELS AND NOTICES

Labels and notices shall be supplied and installed in accordance with the Standard Technical Specification.

Furthermore, notices required under the Occupational Health and Safety Act shall be provided in the Pumpstation and on the external doors leading into the Pumpstation. The signs shall each be fixed with four brass screws or nuts and bolts as applicable.

Statutory notices of what to do in the event of electrocution and fire to be supplied and mounted on the wall within the Pumpstation.

15.0 DOCUMENTATION

The existing operating and maintenance manuals for each plant / pumpstation shall be updated and revised upon completion of the installation to include any new or altered equipment supplied complete with product details, specifications, wiring terminal numbers, etc. The calibration settings of all new equipment installed / modified, e.g. new pressure level sensor, flow meters, etc., shall be provided.

The schematic wiring diagrams of each MCC panel shall be updated to reflect any changes undertaken and a detailed cable schedule for power, data, control and instrumentation cables shall be provided.

C3.3.32

Said schedule shall include the cable type and construction, conductor material, insulation, protection, voltage rating, start and finish points, route length, duty, load, voltage drop, core area, number of cores used and gland size.

16.0 INSPECTION, TESTING AND COMMISSIONING

Testing and commissioning shall be carried out in accordance with the Standard Technical Specification and as follows:

Commissioning shall be carried out by a competent person. If, in the opinion of the Municipality, commissioning is not being carried out in a competent manner, the Municipality reserves the right to employ a competent person at cost to the Contractor's account.

The full load current of each motor shall be measured and the starter overloads set accordingly.

17.0 COMPLETION OF WORK

The provision of the Standard Technical Specification hereof, shall be observed.

C3.4: STANDARD PRELIMINARY AND GENERAL INFORMATION

1.0 PREAMBLE

This Part of the Specification deals with general requirements to be met and standards for plant and workmanship which shall be observed in the execution of the Contract covered by this Specification. "Plant" is defined as machinery, apparatus, materials, articles and things of all kinds to be provided under the Contract other than Constructional Plant.

This Specification is indexed at the beginning hereof. Pages are numbered and Tenderers must check that all pages are included. In the event of any material omission, discrepancy, or otherwise occurring, the attention of the Engineer must be directed thereto at the time of tendering. If this is not done, it will be taken that the Tenderer is in possession of a complete copy and is aware of the contents thereof.

When the requirements of this Part are at variance with any detailed requirement of any other Part hereof or the Drawings, such detailed requirements shall take precedence. All items of plant which are specified in this Specification or by nature of the installation are required, shall comply with this Part, unless stated otherwise elsewhere in this Specification. In the event of ambiguity, the Engineer shall be asked for his clarification prior to submission of the Tender.

Any reference herein to "elsewhere in this Specification" shall be deemed to mean in any of the other Parts of this Specification or on the Drawings.

This Specification covers major items required for this installation but shall not limit the Contractor's responsibility to provide everything necessary to complete the Contract. The works shall be carried out with best quality items of plant and to a high class of workmanship. All items of plant shall be the best of their respective kinds, and the Contractor shall, upon request of the Engineer, furnish him with proof to his satisfaction that they so comply.

This Specification and accompanying Drawings are copyright and are the property of the Engineer and must be returned to him whether a bona-fide tender is submitted or not.

2.0 ALTERNATIVE OFFERS

Tenderers are recommended to tender in accordance with the Specification. While Tenderers may offer alternative materials, makes of equipment, construction techniques, etc. which they believe will be advantageous, it is to be clearly understood that the main tender is to be in full compliance with this Specification.

The total tender price entered on the Form of Tender, all prices entered in any Schedule of Quantities and the prices detailed in the Price Summary, must reflect the price to provide the plant and everything which is or may be necessary for the completion of the Works in complete accordance with this Specification, irrespective of any alternatives that may be offered.

Where alternative offers are submitted, these shall comply in principle with all requirements of this Specification. Tenderers should note that should any accepted alternative subsequently be found not to meet this condition; the Contractor will be liable for all costs incurred in making the necessary alterations.

Should tenderers wish to offer alternative makes and types of equipment to those specified herein, the alternatives are to be listed separately in detail, complete with make, type No., price etc: in the Schedule of Departures from the Technical Specification. In cases where a Schedule of Quantities is applicable, the alternative price for each noted item must be submitted.

The Engineer shall have the right to accept any or all of the alternative offers as he thinks appropriate and must give his written acceptance of these prior to orders being placed.

Failure to comply with the foregoing may result in the Contractor being compelled to meet the requirements of this Specification in full at the tendered price.

3.0 SCHEDULES TO BE COMPLETED

The Tenderer shall, unless relief is given elsewhere in this Specification, complete the Schedules of Amendments and Qualifications, Particulars / Information, Experience, Sub-Contractors, Plant and Equipment in Part T2 hereof, and the Bill/Schedule of Quantities, Schedule of Rates, Schedule of Daywork Rates and the Price Summary in Part C2 hereof. The tender will be considered incomplete and therefore may be disqualified if all of this information is not submitted with the tender.

4.0 SPARE PARTS

Tenderers shall state in the Schedule of Particulars the names of the accredited South African Agents from whom spare parts for all items of plant offered are obtainable and the nearest Centre to the Works at which such spare parts are available. Submission of a tender will be construed as confirmation that spare parts for all equipment offered are readily available, and the Contractor will be held responsible for any costs involved if this should prove to be otherwise.

5.0 DELIVERY TIMES OF MANUFACTURED ITEMS

The Tenderer shall, if required in the Schedule of Particulars, Part T2 hereof, state the times quoted by the Suppliers for both despatch and delivery of major items of plant likely to contribute to an extension of the time for completion.

The Contractor shall, during the continuance of the Contract, keep the Engineer well and sufficiently informed regarding the placing of all orders for materials and the progress of manufacture of any plant so as to ensure that no extension of the time for completion may be occasioned because of non-delivery of plant within the time specified for delivery of same. A delivery status report on each major item of plant shall be submitted by the 7th of every second month.

6.0 PACKING AND DELIVERY

Plant shall be carefully packed and protected to avoid mechanical or other damage during transport and off-loading. The Contractor will be held responsible for any damage occurring prior to its acceptance in writing by the Employer.

Every item of plant is to be clearly labelled with its description and with the Contract number.

All consignments shall be addressed to the Contractor on Site and he shall make prior arrangements for receipt and storage upon arrival. The Employer will not accept delivery of items of plant for the Contractor unless the Contractor has made prior arrangements to this effect with the Employer. The Contractor will be required to make all arrangements for off-loading since no equipment for this will be available on Site unless stated to the contrary in Part C3.1 hereof.

7.0 PROJECT NOTICE BOARD

The Contractor shall, if called for in Part C3.1 hereof, make allowance for the supply and erection of one project Notice Board to be erected in a position to be indicated on Site. The board will be in accordance with the appropriate drawing accompanying this Specification.

Tenderers are advised that all costs, including transportation and erection costs, must be allowed for herein.

Where more than one such board is required, this will be stated elsewhere in this Specification.

8.0 LAYOUT OF INSTALLATION

The layouts shown on the Engineer's Drawings shall be strictly adhered to in principle, only alterations to suit specific plant being provided being acceptable. The Engineer's Drawings show general arrangements of layout but the Contractor is required to prepare detailed Drawings of pipework, fabricated plant, machine and plant rooms, ductwork, switchboards, transformers, sub-stations, etc. The position of services detailed by the Engineer shall not be altered.

All architectural and structural dimensions shown on the drawings are approximate and must be verified by the Contractor on Site. All measurements specially marked on the drawings in connection with engineering services shall be strictly adhered to. If Tenderers require alterations to structure these must be described at the time of tendering. Minor structural alterations which might facilitate the work can be arranged with the Engineer and/or Architect as the work progresses, but no claims will be entertained for alteration of any part of the Works constructed before the necessary dimensions and details have been verified.

Before work on any particular section is commenced, the position of all control equipment and plant shall be approved by the Engineer.

9.0 DRAWINGS, CERTIFICATES AND OPERATING INSTRUCTIONS

9.1 Tenderers shall submit with their tender, outline drawings and pamphlets showing principal dimensions of the plant offered together with a general description of its operation.

9.2 The Contractor shall within one month of the Contract being let, submit duplicate copies of his detailed drawings to the Engineer for approval. A further two copies of the finally approved drawings shall subsequently be supplied to the Engineer. The following drawings shall be submitted, as appropriate:

General arrangement details of all items of plant.

Schematic and wiring diagrams of all switchboards and control systems.

Detailed layout drawings of all pipework, ducting, cable racking etc.

Detailed layouts, sections and elevations of all plant rooms.

Rating plate details of all plant including inter alia- max: kW rating, speed, temperature limitations, no-load voltage, full load current, percentage impedance, etc.

Cable termination arrangements of all transformers, motors etc:

Detailed drawings of all plinths, foundations or bases.

Failure to comply with this requirement may result in the Engineer instructing the Contractor to place the order for the specific item of plant with another Manufacturer. Where failure of the Contractor to ensure that the proposed Manufacturer complies with this requirement necessitates the above action being taken, no increase in price will be considered.

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- 9.3 The Contractor shall, within one month of the Contract being let, or earlier if so required, submit triplicate copies of type test certificates issued by an approved testing station in respect of all items of plant for which such certificates are required by the Engineer.
- 9.4 After completion of manufacture, all test certificates called for in Parts C3.3 and/or C3.5 hereof shall be provided in duplicate.
- 9.5 Prior to the issue of the Completion Certificate the following documents shall be provided, as appropriate, in duplicate, bound in a durable folder bearing the contract title and number:

Test certificates relating to tests done after completion of the installation as called for in Parts C3.3 and/or C3.5 hereof.

Catalogue extracts of all major items of plant with performance curves marked to show operating duties.

List of spare part numbers and local Agents for these parts.

"As built" drawings, including layouts, sections, wiring and control diagrams and plant schematic diagrams. These are to show in detail the positions of poles, stays, cables, joints, sleeves, ducts, heating and cooling coils, dampers, pipes, control and regulating valves, air release valves, expansion joints, fixed equipment and all other pertinent items of plant. In the case of buried services, the route of such services and location of all cables, pipes, joints, valves, tees, access manholes, etc. are to be dimensioned relative to permanent and fixed objects. These drawings must depict the complete installation as finally commissioned.

Detailed instruction manual covering the operation, maintenance and servicing of each item of major plant provided under this Contract and, where the complete plant has been supplied under this Contract, the operation of the plant as a whole.

In addition, one complete set of Engineer's Drawings clearly marked up to indicate all alterations made to the original drawings must be provided.

The Contractor shall note that the Completion Certificate will not be issued until the above has been complied with.

10.0 STANDARDS AND CODES OF PRACTICE

The installation shall comply with the following and all amendments thereto, as appropriate: -

SANS 0142 Code of Practice for the Wiring of Premises, as appropriate (referred to herein as the Wiring Regulations).

The Occupational Health and Safety Act (Act 85, 1993) and Regulations.

The Post Office Act.

The SAIEE Code of Practice for Overhead Power Lines.

The Local Authorities: Standard Electricity Supply By-Law and appropriate Additional By-Law or Regulations.

Any further Specification, Regulation or Code of Practice stated elsewhere in this Specification.

All items of plant supplied and/or installed, whether expressly specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate South African Bureau of Standards Specifications and addenda thereto, or, if no such Specification exists covering any one or more of these requirements, with the relevant requirements of the appropriate

C3.4.5

British Standard Specifications and addenda thereto, except where elsewhere required by this Specification or approved by the Engineer. Where the South African Bureau of Standards has issued a licence for the use of its Mark on products complying with any of its Specifications, only such products which carry the Mark shall be supplied.

Preference will be given to plant manufactured in South Africa.

11.0 APPROVAL OF DRAWINGS

All Drawings, circuit or schematic diagrams prepared by or on behalf of the Contractor for submission to the Engineer in terms of the requirements of this Specification shall have been thoroughly checked, corrected where necessary and signed as approved by the Contractor, prior to such submission.

12.0 CLERK OF WORKS

If a Clerk of Works is to be appointed this will be specified in Part C3.1 hereof.

In cases where a Clerk of Works is appointed to the Project the Contractor shall afford him every facility for the performance of his duty. When the Clerk of Works is appointed on an "ad hoc" basis the Contractor shall arrange to meet him at specific times, to avoid unnecessary interruption of his other duties.

13.0 STORAGE AND ACCOMMODATION

It shall be the responsibility of the Contractor to arrange a site for the purpose of stacking and storing his plant, and for other activities necessary in connection with the execution of the Works. The Contractor shall also be responsible for arranging with the relevant Authorities for water, electricity and telephone connection and shall bear all costs involved, including the cost of supply.

14.0 CONTRACTOR'S REPRESENTATIVE

Immediately the successful Tenderer is advised that his tender is to be accepted and before a formal contract may have been entered into, he shall designate a senior member of his staff to be his Contractor's representative. Such representative shall be an experienced engineer, who will be resident close to the site of the Works and shall be competent and duly authorised to co-ordinate the work in the Contractor's office, and between his office and the Site, and between the Contractor and his Suppliers as well as to maintain liaison with the Employer, Engineer and other parties, to attend progress meetings and generally to represent the Contractor on all aspects of his Contract. In particular, the representative shall attend at the office of the Engineer as and when required, and shall collaborate with him in finalising the drawings of the Works as a whole, so far as the installation which forms the subject of this Contract, is concerned.

15.0 PROGRESS MEETINGS

The Contractor shall ensure that his Supervisor attends all progress meetings. In the case of large building service contracts in major centres these will normally be held weekly and in the case of building services contracts in country districts and all purely engineering contracts, they will be held monthly. Any deviation from the foregoing will be stated elsewhere in this Specification. If the Contractor's progress is such that more frequent meetings are considered necessary by the Engineer, the Supervisor shall also attend these at the Contractor's expense.

16.0 VARIATION ORDERS

The Contractor shall note that all variation orders issued to him must be fully priced and returned to the Engineer within six weeks of the date of issue indicated on the variation orders.

Should this requirement not be complied with, and no correspondence is received by the Engineer within the specified time-period giving good and fair reason why the Contractor has failed to submit fully priced variation orders, the Engineer will price the variation orders without reference to the Contractor and the price thus calculated will be taken as final and no further correspondence will be entered into.

17.0 VALUE OF VARIATIONS

When the Contract is based upon a Schedule of Quantities, approximate Schedule of Quantities, or Schedule of Prices with approximate quantities, the value of all alterations, additions or omissions shall be ascertained by measurement and valuation in accordance with the nett rates of prices for similar work in the Schedules.

Where the nett rates or prices in the Schedules do not apply or it is not practicable to deduce nett rates or prices therefrom, the said value shall be agreed upon between the Engineer and the Contractor if reasonably possible before the commencement of the alterations or additions and where the valuation of the alterations and additions cannot be ascertained by measurement or the value thereof ascertained or agreed upon as aforesaid then the value of the work shall be based on the value of the materials used and labour employed thereon at daywork rates.

18.0 ATTENDING FOR MEASUREMENT

The Contractor, or his Representative shall, from time to time, when required on reasonable notice by the Engineer, attend at the Works to take jointly with the Engineer's Representative any measurements of the work executed that may be necessary for the purpose of preparing the final account. Any such measurements when ascertained and any differences arising thereon, shall be duly recorded in the manner required by the Engineer.

The Contractor shall, without extra charge, provide assistance with every appliance and other thing necessary for measuring the work.

If the Contractor's Representative fails to attend when so required, the Engineer's Representative shall have power to proceed by himself to take such measurements and to prepare the final account, and in that case any decision of the Engineer shall be final and conclusive.

19.0 OPERATING, MAINTENANCE AND SERVICING PROCEDURES

The Contractor shall instruct the Employer's appointed Representative in routine operating, maintenance and servicing procedures of all items of plant supplied under this Contract, and shall ensure that he fully understands the documents provided in terms of Clause 9.5 hereof.

20.0 MAINTENANCE

During the Defects Liability Period, the Contractor shall, if required by Part C3.1 hereof, carry out full maintenance operations specifically recommended by the Suppliers of any item of plant used in the Works to maintain it in full and correct operation. Such maintenance shall include all attention necessary to comply with the Suppliers' recommendations and shall include the provision of all necessary consumable items. The Contractor will also be required to make any adjustments necessary during this period to ensure the satisfactory operation of the plant.

On completion of each such maintenance visit the Contractor shall submit to the Engineer a schedule detailing the work done, which schedule shall have been countersigned by the Employer's representative, whereupon a certificate will be issued for monies due, in respect of the particular maintenance service, as included in the original Tender Price.

Allowance for all costs in relation to the above must be made in the Tender Price. It shall be noted that the Employer reserves the right to omit partly or wholly the prices submitted for the maintenance of the Works, should the installation not be adequately maintained within the stipulated maintenance period. Mutually agreeable conditions will be negotiated by the Employer with the Contractor should the Works not be put into operation immediately on issue of the Completion Certificate.

21.0 VALUE ADDED TAX

The attention of Tenderers is drawn to the Value Added Tax Act (Act 89 of 1991) and any amendments thereto. All tenders submitted shall indicate the nett tender price, the amount of VAT and the gross tender price carried to the Form of Tender as provided for in the Price Summary. The amount stated in the Form of Offer and Acceptance will be taken as being inclusive of any tax due in terms of the said Act and no claims whatsoever in this respect will be considered.

22.0 GUARANTEE

The Contractor shall guarantee to the Employer the material, equipment and workmanship delivered by him, for a period of 12 months or any other period stated elsewhere in this Specification. The guarantee must be valid for a period starting on the date when the Works or portion thereof are accepted by the Engineer as complete and in working condition. The complete installation must be guaranteed against defects as a result of patent and latent defects of the design and equipment, save design defects made or specified by the Engineer, as well as against faulty materials and workmanship. Fair wear and tear is excluded from the guarantee. The guarantee must provide that all material, equipment, parts, spares and appurtenances that become defective during the guarantee period be replaced free of charge of any nature to the Employer or engineer. The costs of labour and transportation required to replace such part of a defective installation shall be borne by the Contractor and shall be included in his guarantee. The Contractor shall cede to the Employer the remainder of any guarantee which he has received from his Suppliers and which extends beyond the period mentioned herein.

If it becomes necessary for the Contractor to replace or remove any defective portions of the Works under this condition, the provisions thereof shall apply to the portions so renewed or replaced until the expiry of the guarantee from the date of such replacement or renewal, and in the event of any defects occurring or being discovered in or to the Works within the guarantee period as aforesaid, the guarantee shall continue until the defects have been made good to the satisfaction of the Engineer.

If any defects are not remedied within a reasonable time, the Employer shall proceed to have the work done at the risk and expense of the Contractor, but without prejudice to any other rights which the Employer may have against the Contractor in respect of such defects.

C3.5 STANDARD SPECIFICATION FOR ELECTRICAL WORKS STANDARD SPECIFICATION FOR ELECTRICAL WORKS

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C3.5 STANDARD ELECTRICAL TECHNICAL SPECIFICATION

1.0 DEFINITION

In this Part, the term “Contractor” means the person, firm or company whose tender has been accepted for the work specified in the document of which it forms a part.

2.0 **ELECTRICAL SUPPLY AND PHASE ROTATION**

The electrical power supply details relative to fault levels, voltage and phase rotation are given elsewhere in this Specification.

The phase rotation specified shall be maintained on all overhead lines, cables, transformers, switchgear and distribution equipment. Where existing connections are to be reconnected to a new system, the phase rotation is to be checked before disconnection and the reconnection made to maintain the same phase rotation.

3.0 **SWITCHING OF POWER SUPPLIES**

Any switching of existing power supplies shall be pre-arranged with the appropriate Authority. All possible preparation shall be made in advance, to minimise the time required for re-energising the system. All such switching shall be carried out by the "responsible person" unless such authority is given to the Contractor by that person, in writing.

4.0 **EARTHING AND BONDING**

4.1 ***Resistance Values***

While every effort should be made to obtain an earth resistance value of 1,0 ohm or less, the maximum values of earth electrode resistance acceptable, unless stated to the contrary elsewhere in this Specification, are 10 ohm at any mini-sub or transformer, 15 ohms at any indoor or outdoor switchboard or HV gang links and 20 ohms at cradle earthing points, lightning arrestors or other pole mounted equipment. In the case of the earthing of LV feeder and overhead line neutrals the combined resistance to earth of all systems shall not exceed 10 ohms.

Transformer neutral earthing shall comply with the sub-Clause "Transformer Earthing" below.

4.2 ***General Earth Systems***

Unless otherwise specified elsewhere in this Specification, the earth systems for distribution transformers, mini-sub and ground or pole mounted switchgear, lightning arrestors, etc. shall generally comprise two earth electrodes with 1,5m long earth spikes located 6,0m apart, linked with 80mm² bare conductor. They are to be located adjacent to pole structures or ends of plinths in the case of minisubs and shall be located at least 1,0m therefrom.

In the case of transformer earthing, if the neutral earth system resistance is not 1,0 ohm or less, two systems as above are to be installed, one for the LV neutral and the other for the tank and associated equipment, in which case they are to be kept at least 6,0m apart and at opposite sides of the transformer position.

The earth system is to be connected with 80mm² insulated earth conductor to the earth bar or transformer tank earth stud as appropriate.

Immediately after installation and before livening up the equipment the Contractor shall test the earth resistance of the earth system, using the respective earth bar or termination as the reference point. If the required value is not obtained, each earth spike, if installed in a sidewalk, shall be increased in length by driving a further length of 1,5m but where located in open ground, two additional spikes are to be installed. These latter spikes are to be perpendicular to the original two, in line with the spike at the point of connection of the insulated earth conductor and each 6,0m therefrom. After installing the additional spikes, the earth resistance shall again be determined. The Contractor shall submit a report in duplicate confirming the values measured, including the first set if appropriate, to the Engineer.

Where the number of spikes called for does not achieve the required values, the Engineer is to be advised and will give further instructions for the improvement of the values obtained. Where more spikes are necessary to obtain the required value, these shall not be installed within 6,0m of any other spike.

The common leg of the secondaries of CT's, other than the secondaries of summation transformers, shall be effectively earthed to the main earth system.

4.3 ***Earth Spikes***

Earth spikes shall comprise 16mm sectional steel cored rods with a minimum of 0,25mm pure copper coating molecularly bonded thereto, complying with SABS 1063, and of "Cadweld" or equivalent manufacture. The top of earth spikes and the interconnecting conductors are to be 1,0m below finished ground level.

Under no circumstances are earth spikes to be located closer than 1,0m to any structure or plinth nor are they to be installed in pole holes.

The connections to earth spikes shall be by means of at least two phosphor bronze mechanical clamps of an approved type for this duty, or a "Cadweld" joint. The clamps shall not be attached to the rod but

must be installed so that the bolt face is in contact with the rod. Brazing will not be accepted. The connection must be wrapped with two layers of "Denzo" tape.

A cable marker as described elsewhere in this Part shall be installed above each spike and shall be labelled "Earth Spike".

4.4

Earth Continuity Conductors

Earth conductors shall be hard drawn bare copper wire complying with SABS 182 or bi-coloured green/yellow PVC covered, the PVC being UV stabilised complying with SABS 1411 Part 2, as elsewhere specified herein. The conductor sizes shall be such that they can carry the short circuit current likely to be imposed upon them but generally shall be half the area of the phase conductors with a maximum size of 80mm² or in accordance with the appropriate Regulations, unless specific sizes are given elsewhere in this Specification. 40mm² conductors shall be 7/2,56 HD.

Bare earth continuity conductors shall be run with all cables constituting a low voltage distribution system except in the case of township reticulation where an earth system as described in the subClause "Neutral Earthing" above shall be installed at kiosks, etc.

A single conductor may be used where two or more cables run together, provided that the conductor cross-sectional area is based on the largest size cable in the run, and that branch earth wires are solidly connected to the main earth conductor using only "Cadweld" connections. Earth continuity conductors shall be connected to main earth bars.

Uninsulated earth conductors shall not be less than 500mm below ground level. Above this level all earth conductors shall be green insulated carried in a PVC conduit sleeve except where galvanised conduit is specified elsewhere herein.

A terminal lug shall be crimped onto the end of the main earth conductor for bolting to the main earth bar of a substation or mini-sub or other outdoor equipment. Two mechanical clamps shall be used for connection onto cradles or other equipment, as appropriate.

Earth connections must not be carried through metal conduits or sleeves, except in the special cases specified elsewhere herein.

Earth connections shall be so made that in the event of any connections being removed the earth connection to the rest of the equipment will not be affected.

5.0

MCB MAIN AND SUB-DISTRIBUTION BOARDS AND CONTROL PANELS

In general, such boards shall comply with SABS 1180 where applicable, or alternatively with BS 5486, and in particular, with the requirements of this Clause.

Larger MCB distribution boards and motor control panels shall be floor standing and arranged for front access unless elsewhere stated in this Specification. Such boards shall be bolted in position. No board shall exceed 2,4m in height nor shall any meter scale, operating handle, button or switch be mounted higher than 1,8m or lower than 600mm from the floor. No part of any equipment shall be mounted closer than 300mm to the floor.

Minor types of main and sub-distribution boards and control panels shall consist of sheet metal trays, suitably built in or secured on the surface in the positions shown on the Engineers drawings.

All structural elements of main and sub-distribution boards and the complete construction of motor control panels shall be of minimum 2,0mm thick material. Non-structural elements shall be of 1,6mm material. Minor bonding trays shall be of 1,2mm material and all bonding trays shall be galvanised. All boards to be mounted outside or specified as being weatherproof shall be constructed of 2,0mm 3CR12 sheet, epoxy powder coated to a thickness of 70 microns to SABS 1274.

The boards shall be of the minimum sizes to accommodate all the equipment specified plus future circuit breakers. Where single phase breakers are used in three phase boards, these must be arranged in three vertical rows, one for the breakers in each phase. Space for the nearest whole number above 20% of each type of circuit breaker installed is to be provided for unless otherwise specified. Unless made specifically to clip in from the front, blanking plates shall be fixed with short cadmium plated bolts and nuts. All openings for future equipment shall be covered with blanking plates fixed on the inside of the opening. Sufficient outgoing terminals shall be provided for the future equipment. Cognisance must be taken of the heat dissipated by equipment and adequate ventilation be provided.

Copper busbars are to be provided for each phase and are to be mounted on suitable insulators or fixed to the terminals of the miniature circuit breakers, and be of sufficient length to accommodate future breakers. Busbar and other connections shall be made using cadmium plated steel (or brass in Coastal areas) bolts, nuts, flat and spring washers.

Copper bars are to be used on MCB type main boards. The main neutral feed to the busbar shall be connected by a lug bolted to the bar, as described above. In sub-distribution boards the neutral busbars

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shall be solid brass with two per-way pinching screws and sufficient ways for the feed and all the circuits connected, including spare ways to the same number as the spare circuits.

HRC fuses are to comply with SABS 172 and fuse holders, which shall be shrouded, with SABS 173. A spare set of HRC fuses for each switch-fuse unit or set of fuse holders installed shall be supplied and the value included in the tender price, except that a maximum of 6 spare fuses of any one size is required. All spares shall be handed to the Employer's representative at the time of the handover inspection.

The equipment on these boards shall be mounted on chassis behind sheet metal panels with operating handles, toggles and control buttons, etc., only protruding through slots cut in the panels. The isolating device for all motors situated remote from the control panel shall be lockable in the "OFF" position. The panels shall be either hinged or removable for ease of access to the wiring, etc. Securing of panels shall be by means of square key latches with vertical locating pins in the case of fixed panels. Sub-distribution board fascia panels shall have moulded knobs for ease of removal of the panel.

The interior of the boards shall be arranged for easy access to all wiring and components. Transformers for low voltage supplies and all low voltage wiring shall be separated by metal barriers from the medium voltage circuits. Positions of transformers are to be indicated by labels attached to the face of the board. All equipment on the boards shall be back-connected and no wire or cable shall be visible from the front. PVC insulated wiring shall be used throughout, the current rating being not less than the rating of the circuit breaker or aggregate rating of the bank of circuit breakers which it connects.

Wiring of the boards shall comply generally with the Clause "Control Equipment and Wiring" elsewhere in this Part.

Distribution boards shall be at least 115mm in depth unless otherwise approved. A maximum of two rows of conduit shall enter the horizontal edges of boards and the width of the board must be sufficient to accommodate all conduits so entering. Where boards are installed in 115mm walls, they shall be provided with expanded metal fixed to the entire back of the board. The trays of flush boards shall be built in or suitably secured to the brickwork in the specified places, and shall be installed in good time to prevent delay to the Principal Contractor. Each shall be mounted with the upper edge at a height of 2,0m above floor level, unless otherwise specified.

Unless otherwise specified elsewhere in this Specification, boards contained in cupboards shall be surface mounted and all conduit shall drop into them neatly, vertically and evenly spaced, in a single row, if possible. Metal doors shall only be fitted if so specified.

Unless otherwise specified elsewhere in the Specification, surface and flush boards shall be provided with doors. All control panel doors shall be fitted with dust and damp proof seals. All instruments, meters, pilot lights, etc., and the main isolator must be operable with the doors closed unless otherwise specified. Flush boards in walls shall be provided with a separately attached metal frame and door which is adjustable so that it may be set plumb. This is to be positioned only after preliminary wall finishes adjacent to the board are complete. Doors shall be secured by a neat flush catch. Boards with a width of 600mm or greater shall be fitted with double doors, the left hand door to be secured with brass barrel bolts, top and bottom, which are readily accessible. Hinges shall be "Barker and Nelson" or "Perana".

All metal surfaces of the boards shall be epoxy powder coated to a thickness of 70 microns to SABS 1274 and of an approved quality and colour. No hammertone or similar finishes will be acceptable and the final colour must be readily matchable. Before painting, all boards shall be bonderised or given some similar rustproof treatment to approval. It is the Contractor's responsibility to ensure that when handed over, the board finish is in first class condition. Under no circumstances will boards be accepted if not finished to a first class standard at hand-over.

In the case of MCB Main Boards cabling arrangements shall be such that outgoing feeder ends can be made off with the board live at all times. This shall be provided for by means of a 2,0mm galvanised gland plate in close proximity to the outgoing terminals of the switchgear. All gland plates shall be bonded to the earth bar by means of a 70mm² bare copper conductor fixed with min. 10mm cadmium plated bolts and nuts.

The underside of the board shall be rendered vermin proof by means of similar plates to the gland plates above.

Where boards are to be mounted in damp situations or where otherwise specified elsewhere in this Specification, black heat anti-condensation heaters are to be fitted. The heaters are to have a separate protective device and are to be so constructed and fitted that they cannot be inadvertently touched. The heater rating is to be such that it will maintain the board at a suitable temperature to prevent the occurrence of condensation while not rising to an excessive temperature.

Boards shall be labelled in accordance with the Clause "Labels and Notices" elsewhere in this Part.

6.0 **INSTRUMENTS, METERS AND PROTECTION RELAYS**

6.1 ***General***

All indicating instruments and meters shall have 5A HRC fuse protection on all voltage connections. All meters and instruments shall have labels fitted below, stating in which circuit they are installed and the multiplying factor, where appropriate.

All instruments shall have a red line marked on the scale at the normal or maximum operating point as appropriate.

The cases of all meters shall afford complete protection from dust and damp and shall be suitable for the attachment of seals.

Selector switches shall be rated at 16A and shall be similar to Sprecher and Schuh, Telux, Kraus and Naimer or equivalent. They shall be provided with an "OFF" position.

All instruments and meters shall comply with the appropriate British Standards Specification.

The Tenderer shall submit full details of the meters, instruments and control switches offered in his tender, including connection diagrams for all equipment.

Protective circuits will operate at 30V DC unless otherwise herein specified elsewhere.

6.2 ***Potential Indicators***

Potential indicators shall comprise three neon indicating lamps each energised from a capacitor bushing connected to indicate that the incoming cable or the busbars, as elsewhere specified, are alive.

6.3 ***Protection Relays***

Protection relays shall be supplied in accordance with the following requirements unless otherwise detailed elsewhere in this Specification. All relays not covered herein will be specified in detail elsewhere in this Specification.

Overcurrent and earth fault relays shall be of the static type with either inverse definite minimum time characteristic adjustable from inverse to extremely inverse or definite minimum times of 2, 4 or 8 seconds selectable on the relay. Overcurrent settings shall be adjustable from 50% to 200% in 2,5% steps and time settings from 5 to 100% of the DMT. Earth fault current settings shall be adjustable from 10% to 40%.

Generally, two overcurrent and one earth fault relay shall be mounted in a common housing. A suitable relay would be the GEC type MCGG52. Any other relay offered must be an approved equivalent to this unit.

Sensitive earth fault relays shall be of the static type. Current settings shall be from 0,5% to 8% in 5 steps. The time delay unit shall be adjustable from 0,1 to 9,9 seconds in 0,1s steps or 10x these times, selectable on the relay. A suitable relay would be GEC type MCSU. Any other relay offered must be equivalent to this unit.

6.4 ***Current Transformers***

Current transformers shall be epoxy-resin encapsulated. The rated burden shall be not less than 10VA, unless specified otherwise elsewhere. They shall comply with BS 3938 and shall comply with the following table.

APPLICATION	PRIMARY CURRENT	CLASS
Indication	All	5
Protection	All	3
Metering	Up to 250A	1
Metering	250 - 600A	0.5
Metering	600 - 800A	0.2
Metering	800A and above	0.1

6.5 ***Voltage Transformers***

Voltage transformers shall comply with BS 3941 Class 0,5 accuracy, and shall be 3 phase oil filled units mounted on top of the HV switch panel, arranged for horizontal draw-out. The output shall be 50VA per

phase at 110V phase to phase unless otherwise specified. Fuse protection shall be provided on both primary and secondary.

Such transformers shall not be affected by single-phasing on the HV side.

6.6 **Indicating instruments**

All instruments shall be square format industrial accuracy grade to BS 89 and shall be flush mounted. All main instruments shall be 96mm square, meters for individual drives or in modular panels being 72mm square.

6.7 **Ammeters**

All ammeters, including whole current ammeters, shall be calibrated to 120% of the rated current. The overload capability shall be 10 x rated current for 1,0 second. Those reading in excess of 100A shall be CT operated with 5A full scale deflection.

Instantaneous reading ammeters shall be of the moving iron type, one instrument being provided, connected via a phase selector switch with "OFF" position.

Maximum demand reading ammeters shall be of the combined maximum demand and instantaneous type, one meter being supplied per phase, unless otherwise specified. They shall comprise a thermal maximum demand ammeter with drag pointer combined with a moving iron instantaneous pointer. The drag pointer reset knob shall be sealable. The bi-metal system shall be ambient temperature compensated and shall have a 15-minute response.

Where dual ratio CT's are specified, ammeter scale plates are to be engraved on both sides to suit these ratios, the plate for the lower ratio being outermost.

6.8 **Voltmeters**

Voltmeters shall be of the moving iron type. One instrument shall be provided in each instance connected via a selector switch to read line to line voltages and also line to neutral voltages. Voltmeters for HV use shall be suitable for operation on the 110V side of the voltage transformer, while LV voltmeters shall operate off a nominal line to line voltage of 400V. The scales between 90% and 110% of nominal voltage shall be graduated in 1,25% divisions.

6.9 **PF Indicators**

Power factor indicators shall be of the moving iron type suitable for use on unbalanced loads.

6.10 **Consumption Meters**

KWh meters shall be of the integrating watt-hour house service type with front connections complying with BS 5685. Such meters shall be whole current up to 80A and thereafter 5A operated by current transformers. All 20/80A whole current meters shall have cyclometer dials. A single 3 phase instrument may be used on a 3 phase circuit but it must be suitable for use on unbalanced loads.

Combined kVA maximum demand and kWh meters shall be 3 phase 4 wire 231/400V or 110V 3 wire with 5A CT operated current coils. They shall generally be Sangamo type CYLP 2½ element or equivalent. Where programmable meters are called for, they shall be Sangamo electronic type KVIP. Full details of programme facilities and operating instructions shall be supplied with these meters.

7.0 **CONTROL EQUIPMENT AND WIRING**

7.1 **Time Switches**

All time switches shall be mounted in an accessible position for ease of adjustment, and shall be provided with re-chargeable nickel cadmium batteries to provide up to 48 hours of operation should a power failure occur.

Motor Control:

Time switches shall be fully programmable to a maximum of 168 switching points with 24 memory addresses permitting hourly, daily and weekly settings. The shortest switching interval shall be 1,0 minute. The units shall include a manual override facility. They shall be suitable for wall or DIN-rail mounting.

Protection shall be at least to IP42 and the units shall operate satisfactorily in the temperature range - 5°C to + 55°C. A suitable time switch would be "Sauter" type Memotime Z5D 7.

General Purpose:

Time switches shall have a crystal controlled stepping motor and be able to perform 48 operations per day with a minimum interval of 30 minutes. A manual override facility must be provided. A suitable time switch would be "Heinemann" type SAT-R.

7.2 **Low Voltage Transformers**

Bell and other low voltage transformers shall be of the double wound type having the secondary voltage specified and shall have an adequate capacity for the duty required but, in any case, not less than 50VA

on short-time rating. The transformers shall comply with SABS 743 and shall have one end or the centre point of the low voltage winding earthed.

7.3 **Contactors**

Contactors shall, unless otherwise specified, comply with BS 775 for current making and breaking Category AC1 for non-inductive loads and Category AC3 for inductive loads.

7.4 **Earth Leakage Protection Units**

Earth leakage protection units shall be single or three phase, as indicated, with a sensitivity of 30mA, unless stated to the contrary elsewhere in this Specification or on the drawings. The unit shall actuate a shunt trip isolator or MCB as specified. The earth leakage units shall comply with SABS 767 and shall carry the SABS Mark to ensure that they comply with Compulsory Specification VC 8035 promulgated in Government Gazette No 10987.

7.5 **Motor Starters**

Starters are to be of first class quality and shall be of Cutler-Hammer, Square "D", Siemens, KlocknerMoeller, Telemecanique or Sprecher & Schuh manufacture. All starters are to be of the same make. Star-Delta starters are to be provided with both electrical and mechanical interlocks.

Starters are to be protected by moulded case circuit breakers as specified in the sub-Clause "Moulded Case Circuit Breakers" elsewhere in this Part. The starters are to be so selected that they are not subjected to a higher fault current than that for which they are designed. HRC fuse protection must be provided, if necessary, in which case the MCB is to be replaced by an on-load isolator. MCB's and isolators are to be lockable in the "OFF" position where motors are situated remote from the control panel. The starters for all motors shall comprise magnetically operated contactors. They shall be of robust design, operate without undue noise and vibration and comply with BS 587 or BS 4941 as appropriate. Unless otherwise stated, they shall be of continuous rating, current making and breaking Category AC3. Contactors shall be of the hold-in type capable of operating satisfactorily without overheating for a period of 10 minutes if the supply voltage falls to two thirds nominal. Contactors shall not chatter when opened at two thirds voltage, or at a frequency 10% below nominal. Low voltage release is to be inherent in the operating coil. All starters are to be equipped with a voltage free auxiliary change-over contact to provide a "RUN" signal during operating.

No motor control gear shall have a continuous rating of less than 10A at Category of duty AC3. Contactors shall be capable of making and breaking the starting current of the motor and of carrying this current without damage for a period of one minute. They shall also be capable of withstanding, without damage, the passage of the maximum fault MVA of the circuit until such time as the fault can be cleared by the operation of the back-up protection.

Where anti-condensation heaters are fitted, these must be fitted with suitable ammeters and be disconnected by the starter main switch.

Overloads of the thermal type shall be matched to the motor ratings and are to be manually reset. The overloads are to be so set that the motor will trip within 30 seconds of a single phase condition arising when the motor is hot and operating at 80% of full load current. If the starter is not capable of this, then single phase protection devices are to be fitted for all motors of 10kW and over. All overload devices must be fitted with a voltage free auxiliary changeover contact to provide a "tripped" signal. If this facility is not available on the overload offered, an interposing relay is to be provided to perform the same function. Such a relay must be energised upon an overload trip occurring.

Where electronic motor protection is specified the relay shall be a "NewElec", "Sprecher and Schuh" or equivalent motor protection relay. Matched CT's or CT modules shall be provided. The following shall be included as standard features: -

Overload protection; Phase unbalance and single phase protection; Locked rotor and excessive re-starts protection; Thermal memory; Auxiliary supply dip-proofing; Fail-safe operation on main trip relay; Analogue or LED indication of percentage motor load and thermal memory. Optional features which may be specified elsewhere in this Specification are:- Earth fault protection; Short circuit protection, etc.

In the case of dual-speed motors, protection shall be provided by a dual-operation relay separately configured to provide full protection at each speed.

7.6 **Pilot Lights**

Pilot lights are to be either cluster LED, neon, transformer or resistor reduced wattage type. Under no circumstances will 230V pilot lamps, except in the case of neon, be accepted. Care shall be taken to select pilot lights which can be easily seen when operating in normal daylight. Where pilot lights are connected to remote equipment by multi-core control cables neon lamps shall not be used because of the inductive effect of the control cores. 100% spare lamps are to be provided for all pilot lights.

Unless otherwise specified elsewhere herein, in motor control and other multiple control panels pilot lights are to be controlled by an adjustable timer to limit the duration of operation from 1 to 5 minutes. The timer is to be activated by a suitably labelled push button mounted on the face of the panel. In such cases lamp test facilities, with the test button mounted adjacent to the button described above, must be provided. Pilot lights are to be of the colours indicated below, unless elsewhere specified.

Power on -	Amber
Fault -	Red
Run -	Green

Pilot lights indicating "STARTER CLOSED" and "OVERLOAD TRIP" shall be fitted to all motor circuits.

7.7 **Hour Meters**

Hour meters shall be of the digital type reading up to 99999 hours. They shall be suitable for 230V, 50Hz. AC operation.

7.8 **Duty Selector Switches**

The control of all items of equipment which can act as standby to each other must include a duty selector switch to enable the lead duty to be selected as well as second and third preference, i.e. 1,2,3; 2,3,1; 3,1,2 for a three motor system.

7.9 **Hand/Off/Auto Switches**

A hand/off/auto switch shall be fitted to each starter subject to automatic control. The hand control circuit, which shall comprise stop-start push button, shall be fed from a fuse other than that for the automatic control system.

7.10 **Phase Failure Relays**

All phase failure relays are to provide reverse phase rotation protection. The relay is to operate a shunt trip coil in an on-load isolator to be provided to disconnect all but non-motor load feeders from the board, or in the control circuit, as indicated on the schematic diagram.

The relay is to be so arranged with a timer that it will only initiate a trip upon a single phase condition occurring and not upon restoration of power. Provision is to be made to ensure that a trip occurs irrespective of which phase is lost.

7.11 **Relays**

All relays and timing relays are to be of Sprecher and Schuh, Telemecanique, Klockner-Moeller, or approved equivalent manufacture. Each relay is to be numbered and this number must appear on both relay and adjacent to its respective base in the case of the plug-in type. All adjustable timing relays must be labelled with their function.

7.12 **Photo-electric Controls**

Photo-electric switches shall be of the type comprising a photo-sensitive resistor, thermal actuator with an inherent operating delay to make it insensitive to short duration changes in light levels and a change-over switch mechanism, all housed within a tough, translucent, weather and ultra-violet resistant cover. The operating level shall be factory preset to switch on at approximately 50 lux and off at approximately 100 lux. The response time after sudden changes in light level shall be not less than 15 seconds. Integral protection against voltage surges shall be provided. A suitable unit would be the "National" type ZS20AR.

7.13 **Main and Control Circuits**

All control equipment shall be mounted in a separate hinged panel fitted with square key latches to permit ease of access to terminals, etc., at the rear of the panel. Where busbars are located directly behind such panels, a separate removable insulated panel shall screen them.

All wiring shall be carried out using suitably rated, colour coded insulated wire. Internal wiring to and from contactors shall be sized according to the contactor Manufacturer's recommendation for the duty selected.

All main terminals are to be connected in strict phase rotation. Wires shall not be joined between terminal points and no terminal shall have more than two wires connected to it unless they are lugged connections. Spare terminals are to be provided to accommodate all spare control cable cores. All terminals shall be either bolted or screwed. All terminals for wires smaller than 16mm² shall have pressure plates. All terminals for the connection of external control wiring shall be of the "disconnect" type.

All terminations shall be fitted with numbered ferrules, the numbers corresponding to those on the appropriate wiring diagrams to be prepared by the board Manufacturer. All terminal strips are to be similarly numbered.

Generally, wiring shall be enclosed in strategically placed plastic wireways. Small numbers of wires to remote positions may be neatly strapped, using plastic buckle clips or hard plastic "loom formers". Where wiring is run to equipment mounted on hinged doors, the wiring shall be carried in a plastic "loom former" which is so installed that the wiring is not strained with the door fully open. The colour of all panel wiring shall comply with the following: -

Colour Of Wire**Circuit Particulars**

Red, White and Blue Phase connections in current and voltage transformer circuits and in all three phase circuits.

Green/Yellow bi-colour Insulated earth wires.

Black Neutral connections. Grey Control connections.

White Connections in DC alarm circuits.

All control circuits shall have 5A HRC fuse protection.

7.14 **Labelling**

All control equipment both within the panel as well as all projecting items, are to be labelled in accordance with the Clause "Labels and Notices" elsewhere in this Part. Any device which can be unplugged is to be labelled at the base and on the device.

8.0 **LV CIRCUIT BREAKERS**

8.1 **General**

The supply voltage, normal current, fault capacity and type, as well as any special characteristics required of circuit breakers, shall be as stated elsewhere in this Specification.

All main circuit breakers shall be equipped with adjustable instantaneous magnetic and inverse time delay thermal overload releases on each phase and shall be arranged for flush mounting. They shall be connected to the busbars with solid copper connections of adequate section to resist short circuit stresses that may be imposed by faults up to the maximum rupturing capacity of the breaker.

Where circuit breakers are used to control supply taken directly from the Supply Authority, they shall be of a make approved by that Authority, and shall be set to trip within the specified limits laid down by that Authority.

8.2 **Moulded Case Circuit Breakers**

Moulded case circuit breakers shall comply with SABS 156 with time delay tripping on low overloads and high speed tripping on short circuit. Except where larger rupturing capacity MCB's are elsewhere specified, these shall be Class 5kA 240V or 415V, as applicable, and where various current and breaking capacities are required, all MCB's are to be of one make throughout the installation. All MCB's are to carry the SABS Mark to ensure that they comply with Compulsory Specification VC 8036.

The Engineer will not accept a mixture of circuit breakers from various Manufacturers to meet the various duties required.

In the case of motor control, all MCB's shall be supplied with "slow" tripping curve (Curve D or curve 1) except that those MCB's controlling motor starters located in the same control panel shall not have overcurrent trip elements, this feature being provided by the adjacent starter overload device, magnetic high current protection only being required.

Where MCB's are required to be connected to cables larger than 70mm², the terminals shall be of the stub busbar or rear connecting stud types. For all other cables, box type terminals shall be provided. Three phase MCB's shall be fitted with suitable phase barriers.

MCB's shall be fitted with purpose made terminal shrouds where no fascia plate is provided.

9.0 **MOTOR STARTERS**

9.1 **General Requirements for Motor Starters**

Starters are to be of first class quality and shall be of Cutler-Hammer, Allen Bradley, Square "D", Siemens, Klockner-Moeller, Telemecanique or Sprecher & Schuh manufacture. All starters are to be of the same make. Star-Delta starters are to be provided with both electrical and mechanical interlocks.

Starters shall comply with the relevant requirements of BS 4941/IEC 292 and IEC 947.

Starters are to be protected by moulded case circuit breakers designed to provide full short circuit protection to the contactors, overloads, the interconnecting cables and the motor. The circuit breaker shall be correctly coordinated with the motor overload protection. It shall be of a type specifically designed for motor protection duty fitted with high speed tripping devices which are calibrated to avoid nuisance tripping during starting. Thermal overcurrent trip elements, if provided, shall be correctly coordinated with the starter overload protection under all normal starting and operating conditions. Circuit breakers from the same supplier as the motor overload protection devices which have been specifically designed to coordinate with these devices shall be used wherever possible. The starters are to be so selected that they are not subjected to a higher fault current than that for which they are designed. HRC fuse protection must be provided, if necessary, in which case the MCB is to be replaced by an on-load isolator. MCB's and isolators are to be lockable in the "OFF" position wherever motors are situated remote from the control panel.

Contactors used in starters shall be magnetically operated. They shall be of robust design, operate without undue noise and vibration and shall comply with BS 587 or BS 4941 as appropriate. Unless otherwise stated, they shall be of continuous rating, current making and breaking Category AC3. They shall be selected to provide an expected service life of not less than 1 million switching cycles or 10 years service under the anticipated operating conditions, whichever is the more arduous requirement.

Contactors shall be of the hold-in type capable of operating satisfactorily without overheating for a period of 10 minutes if the supply voltage falls to two thirds nominal. Contactors shall not chatter when opened at two thirds voltage, or at a frequency 10% below nominal. Low voltage release is to be inherent in the operating coil. All starters are to be equipped with a voltage free auxiliary change-over contact to provide a "RUN" signal during operating.

No motor control gear shall have a continuous rating of less than 10A at Category of duty AC3. Contactors shall be capable of making and breaking the starting current of the motor and of carrying this current without damage for a period of one minute. They shall also be capable of withstanding, without damage, the passage of the maximum fault MVA of the circuit until such time as the fault can be cleared by the operation of the back-up protection.

Where anti-condensation heaters are fitted, these must be fitted with suitable ammeters and be disconnected by the starter main switch.

Overloads of the thermal type shall be matched to the motor ratings and are to be manually reset. The overloads are to be so set that the motor will trip within 30 seconds of a single phase condition arising when the motor is hot and operating at 80% of full load current. If the starter is not capable of this, then single phase protection devices are to be fitted for all motors of 10kW and over. All overload devices must be fitted with a voltage free auxiliary changeover contact to provide a "tripped" signal. If this facility is not available on the overload offered, an interposing relay is to be provided to perform the same function. Such a relay must be energised upon an overload trip occurring.

Where electronic motor protection is specified and unless another relay type is called for, the relay shall be a Sprecher and Schuh type CET 3 motor protection unit, or approved equal, equipped with appropriately rated current transformers. The following shall be included as standard features: -

Overload protection, phase unbalance and single phase protection, locked rotor and excessive re-starts protection, thermal memory, auxiliary supply dip-proofing, fail-safe operation on main trip relay, analogue or LED indication of percentage motor load and thermal memory.

Optional features which may be specified in the Particular Specification are: -

Earth fault protection, short circuit protection, etc.

In the case of dual-speed motors, protection shall be provided by a dual-operation relay separately configured to provide full protection at each speed.

Each starter and its associated equipment shall be accommodated in a separate cubicle forming part of a motor control panel meeting the requirements specified elsewhere herein.

Equipment shall be so arranged that all routine operations can be carried out from the front panel and all status indications are clearly visible without opening any doors or covers. Alarm accept, alarm cancel, trip resets and similar controls shall be operable from the front panel.

The door to each compartment shall be interlocked with the motor circuit breaker or isolator such that the circuit breaker or isolator must be in the "off" position before the door can be opened.

9.2

Direct on line Starters

Unless specifically otherwise stated in the particular specification or required due to the nature of the driven machine, all motor starters shall be of the fully automatic direct-on-line type.

Direct-on-line starters shall comply with the relevant requirements of IEC 292-1 / BS 4941, Part1.

Starters shall comprise the following major components: -

A circuit breaker for short circuit protection and isolation. Alternatively, where necessary due to fault level considerations, a fuse switch unit or fuses and an on-load fault make, load break isolator may be used as detailed above.

A suitably rated contactor.

An overload relay to match the motor characteristics. For larger motors and motors operating under difficult starting conditions with long acceleration times, the overload relay shall incorporate matched current transformers designed to saturate and limit the peak current applied to the thermal elements.

A thermistor winding temperature protection relay for all motors exceeding 15kW rating or where called for in the particular specification.

Where electronic motor protection is called for a temperature rise indicator is required.

A current transformer operated motor ammeter with 100% over scale. The motor full load current shall be clearly marked in red on the ammeter scale.

Where specifically called for, a running hour meter shall be provided.

Pilot lights for status indication which shall include, as a minimum, indication of motor running and motor tripped.

Power supply circuit breaker and controls for motor anticondensation heaters were provided.

All necessary terminals, times, auxiliary contacts, etc to suit the specified control and indication requirements detailed in the particular specification.

Sheet steel of polycarbonate enclosure forming part of a motor control panel complying with the requirements set out elsewhere herein.

9.3

Star-Delta Starters

Star-delta starters shall only be provided if called for in the particular specification or if recommended by the manufacturer of the driven machine.

Star-delta starters shall comply with the relevant requirements of IEC 292-2 / BS 4941, Part2.

Starters are to be fully automatic in operation utilising electrically operated mechanically and electrically interlocked contactors. Control of the transition from star to delta shall be by means of an adjustable timer unless control by means of an undercurrent relay is called for in the particular specification. The timer shall normally be set to allow the motor to accelerate to at least 80% of its rated speed before change over occurs.

The overload relay shall be connected in series with the windings so that it is in circuit during both star and delta configurations. Care shall be taken to ensure that the relay is correctly set, taking into account the fact that the current seen by the relay is 0,58 times the line current drawn by the motor.

Where an undercurrent relay is used to initiate the star to delta transition, the overload device shall be of a type which will adequately protect the motor should the undercurrent relay fail to operate due to mechanical faults or other similar problems which prevent the motor accelerating to the normal transition point. If this cannot be assured, then a separate safety circuit shall be incorporated into the starter to trip the motor if the transition does not occur within an acceptable time limit. This circuit shall have its own independent trip indication so that the cause of the motor tripping can be distinguished from overload trips.

Where arduous starting conditions exist, causing the overload relay to operate during acceleration in star, the Employer may permit the overload relay to be connected in the line connections between the motor circuit breaker and the starter. The relay shall then be set to the rated current of the motor and adjusted during commissioning as described under "Commissioning" elsewhere herein. This connection must be approved before it is used.

Only in exceptional circumstances will the Employer permit connections where the overload is not in circuit while the motor is connected in star.

Great care shall be taken to ensure the correct connections on the motor terminals to minimise the differential voltage at transition. For clockwise rotation the correct connections are red phase to U1, white phase to V1 and blue phase to W1 with the delta connection made as follows, U1-V2, V1-W2 and W1-U2. (The motor will also run clockwise if connected U1-W2, V1-U2 and W1-V2 but the differential voltage at transition will be higher and will result in an increase in the current surge). For anti-clockwise rotation, the correct connections are red phase to V1, white phase to U1 and blue phase to W1 with the delta connections made as follows, U1-W2, V1-U2 and W1-V2. The above assumes normal phase rotation on the supply. If the phase rotation of the supply is reversed then use the anti-clockwise connection to achieve clockwise rotation and vice versa.

If called for in the particular specification or recommended by the manufacturer of the driven machine, closed transition star-delta starters may be required. In closed transition starters the star contactor shall be of the same size and rating as the main and delta contactors.

Sizing of the transition resistors shall take into account the anticipated operating frequency as well as the load characteristics and the consequent minimum motor speed during the transition.

Transition resistors shall be of the wire wound ceramic type or of the cast iron grid resistor type, depending on the required resistance and rating. The resistance value shall be calculated to minimise the current surge during the star-delta transition.

The major components of star-delta starters shall be as listed for direct-on-line starters with the addition of the necessary extra contactors, interlocks, timers or undercurrent relays and, where closed transition starters are called for, transition resistors.

10.0 WIRING IN CONDUIT

PVC insulated wire to SABS 1507 and SABS 1574 shall be used and shall be from full coils of fresh stocks delivered to site with the original packing or seals undisturbed. Lighting circuits shall be wired with 1,5mm², socket outlet circuits with 2,5mm² and heater and water heater circuits with 4mm² wire unless otherwise specified. All other circuits shall be wired with the sizes indicated or in accordance with the Wiring Code, as appropriate. All phase conductors shall be coloured red and neutral conductors black.

The ends of all wires, whether single or looped, which have to be connected to the connecting terminals of switches, plugs, holders, fittings and distribution boards, are to be tightly twisted together. Cutting away the wire strands will not be allowed.

The loop-in system is to be adopted throughout any conduit installation and joints will be permitted only in special circumstances and subject to the approval of the Engineer. Such joints shall be made only with approved connectors in approved boxes.

The circuit wiring for different services, e.g. lighting and power, shall be run in separate conduits.

Where switches fed from different phases are mounted adjacent, they must be mounted in separate boxes or a single box with a fixed metal barrier between each switch. Where such switches are on the same circuit, multiple switches in a single box shall be used.

Metal conduit shall be heavy gauge solid lap welded steel to SABS 1065, screwed or plain-end and black enamelled or galvanised, both as specified elsewhere in this Specification. All metallic conduit shall be manufactured from mild-steel with a minimum thickness of 1,6mm in respect of screwed and 0,9mm for plain-end conduit except that when used in concrete slabs, plain-end conduit shall have a minimum wall thickness of 1,2mm and when laid in screed on top of concrete slabs, 1,6mm.

Non-metallic conduit shall comply with to SABS 950. Installation of non-metallic conduit shall be in accordance with Amendment No.2 of SABS 950 Appendix C. Only plastic saddles and compatible fittings shall be used. Earth wires shall be installed with all non-metallic conduits.

All conduit fittings for steel conduit shall be malleable iron or pressed steel except for brass bushes. Plastic fittings shall be used with non-metallic conduit. Conduit fittings shall comply with SABS 950 or 1065 as appropriate. The use of inspection tees or elbow pieces and internally screwed solid bends will not be permitted. However, internally screwed solid bends for 40mm and 50mm dia conduit may be accepted in certain circumstances if approved by the Engineer.

All conduit shall, wherever possible, be concealed by being cast in concrete slabs, chased in, built in or run in roof spaces. Where black enamel conduit is called for, this shall be substituted with galvanised when run in non- suspended floor slabs such as ground floor or basement floor slabs. When run in surface beds conduit is to be galvanised and is to be laid in concrete on the surface bed so that it is completely covered.

Conduit cast in concrete shall be fixed at intervals to the formwork, if such formwork is of wood or, if of steel plates, to the steel reinforcing.

Where hollow tile slabs are being used in the structure, as indicated elsewhere in this Specification, back entry conduit boxes shall be used. All outlet boxes for lighting points shall be of the long spout, deep type. Where additional depth of box is required, standard conduit box extension rings, firmly screwed to the box, shall be used.

Where structural expansion joints occur, conduits shall, as far as possible, be laid to avoid crossing the joint. When crossings are unavoidable, the following arrangement shall be made. From a drawbox, or the nearest outlet within 4,0m of the joint, conduit of one size larger than necessary for the wire sizes, shall be run straight, and at right angles to the joint, finishing at the joint. Conduit of the required size shall then be passed into this from the other side of the joint, bushed inside the draw-box, but not mechanically connected otherwise. Care shall be taken to prevent concrete from entering the end of the larger conduit. The conduits approaching from both sides of the expansion joint shall be wrapped with two layers of corrugated cardboard from a point 1,0m from the joint. A bare earth wire of the same size as the wiring in the conduit shall be run from the draw box to the next outlet, connecting firmly and solidly to each box. Care shall be taken to exclude the ingress of dirt or moisture to partially completed runs, and all open ends shall be plugged temporarily while work is not actually in progress. The plug may consist of a conduit socket with brass ET plug or conduit fishtail, or purpose made tightly fitting plastic sealing caps. Wooden or paper plugs will not be acceptable.

The Contractor shall take all possible precautions during the construction stages of the building to prevent damage to projecting conduits, etc. In vulnerable positions projecting conduits shall be painted in a bright colour or, if necessary, shielded by a large covering. A responsible workman shall be present

at all times during casting of concrete containing conduit work to ensure that the conduitwork is not disturbed by the casting or vibration of the concrete.

Conduit in false ceiling spaces shall be run surface. The conduit into the space shall either extend through the decking or shall be terminated in a back entry box with a coupling inside the box to enable the conduit to be extended when shuttering is removed.

In roof spaces all conduit runs shall be parallel or at right angles to trusses and joists. Where conduits run along trusses and joists they shall not be run or fixed on the top but on the side. Conduit shall lead into and out of back entry conduit boxes at all fitting positions. All such boxes shall be finished flush with the underside of the ceiling and the lighting fittings shall be screwed directly onto the box. Where necessary additional fixing of a fitting and conduit box shall be provided.

At ceiling positions where conduit runs do not have to continue to the next truss (e.g. last point in a row), the conduit shall be extended beyond the box to the next truss. This conduit extension shall be plugged. Where conduit is run on the surface, it shall be fixed with stand-off saddles, multiple spacer saddles being used for conduits run together. The maximum distance between the saddles shall not exceed 1,5m. Where a conduit box carries a lighting fitting it shall be fixed within 100mm on either side of the box.

Where conduits have to run adjacent to gas or cold water pipes, communication or data circuits, they shall be prevented by spacing or other means from coming into contact with these other services under any condition.

Under canopies, outlets for future signs, etc., which have been terminated in round conduit boxes, are to be blanked off with 75mm dia galvanised cover plates finished with a zinc plumbate primer. These are to be fitted prior to painting and are to be fixed using cheeseheaded brass machine screws.

Where conduit enters boards, trays, etc., all burrs around holes shall be removed before insertion. Locknuts shall be used inside and outside, with female bushes inside. Couplings and male bushes shall not be used. The same arrangement shall be used wherever possible for entry into switch boxes, control gear, etc., provided with clearance holes. Where this arrangement does not allow sufficient wiring space, however, couplings and hexagonal male bushes may be used, but must be very tightly screwed up. In the case of multiple back entries into a conduit box, male bushes and couplings are to be used. Care must be exercised when laying conduit in the vicinity of distribution boards of any type to ensure that conduits radiate from these points in order. Under no circumstances are more than two conduits to cross at any point where cast in concrete and a space of at least 20mm must be left between all conduits both vertically and horizontally after emerging from the distribution point. Careful planning of conduit work can prevent a mass of conduit in the slab, and any rearrangement necessary to provide an acceptable layout will be at the Contractor's own expense.

Drops to switch and other high level outlets shall be from ceiling while conduit to low level outlets shall be run in the floor unless specified to the contrary. In basements and ground floor areas which are below natural ground level, all conduits to any type of outlet shall drop from ceiling level.

No draw boxes which are not, in themselves, outlets shall be permitted except with authority from the Engineer. Notwithstanding the Wiring Code, if it proves necessary to draw conductors round more than two 90° bends, or the equivalent, or on very long straight runs, draw boxes are required. The maximum length of straight runs between draw boxes shall not exceed 20m. Such draw boxes shall be provided with oversize flat covers fitted flush with the ceiling, fixed with cheese-headed screws.

The Contractor is responsible for checking with the Building Contractor by reference to the drawings on site, of the positions where panelling, tiling, tile edging or dados, etc., may affect the exact positioning of outlets. No allowance for extras will be allowed if boxes have to be moved to comply with the above unless the details are altered after completion of the conduit work. Exact positioning in general means centring outlets on panels, fitting box edges to tile edges, and dropping or raising switch points below or above dados as close to the specified position as possible. Where any doubt arises the Engineer shall be consulted before installation of the outlet. The same requirement applies to the positioning of lighting outlets in false ceilings, with particular regard to fixing fittings to correspond to ceiling panel modules. Ceiling light points are normally either on a centreline between walls and/or beams or spaced evenly with half a unit between wall or beam and the first point. Where outlet positions deviate from this scheme the scaled dimensions to the centre of the symbol are to be taken as the centre of the outlet.

All setting of conduit shall be done with approved tools. No kinks will be accepted. Where necessary boxes with special configurations shall be used to avoid the necessity for too many sets in conduitwork. The conduit shall be run or erected as far as possible in straight or symmetrical lines, with easy sets or bends. Care shall be taken when installing conduit that cut ends are completely free from burrs and sharp edges which might damage the conductors. All open ends shall be fitted with brass bushes. Composition bushes will not be accepted. All bushes are to be fitted prior to wiring. All running joints

shall be fitted with lock-nuts, and lock-nuts shall be provided wherever necessary to ensure that all conduit joints in the installation are tight.

Where flexible conduit connections are required, only "Kopex" or "Adapterflex" flexible conduit or similar approved shall be used. Sprague conduit will not be accepted.

Where conduit only is required, draw-wires shall be left in each such conduit, irrespective of the service for which it is required. Draw-wires shall be minimum 1,6mm dia hot dipped galvanised steel.

Conduit run on the surface within ducts shall be painted an approved colour under this Contract. Conduit in false ceilings and roof spaces is not to be painted, except as hereunder. Painting shall be carried out by a qualified Painter. Any exposed screw threads or areas where the galvanising or enamel has been damaged shall be painted after erection with two coats of anti-corrosive paint, and, where installed in concrete, before casting, unless otherwise approved by the Engineer.

The Contractor must ensure that, prior to final completion, all openings left at the conduit exit from switch rooms or between floors in rising ducts, are made good.

11.0 SWITCHES, SOCKET OUTLETS, PLUGS AND BOXES

Switches shall comply with SABS 163 and shall be reasonably silent in operation. They shall be of 16A rating unless otherwise specified. Socket outlets shall be to SABS 164. Samples of all switches and socket outlets shall be approved by the Engineer before installation.

Cover plates shall comply with SABS 1084. For flat type plates minimum 1,6mm thick metal and for pressed shaped plates minimum 1,0mm shall be used, the thick plates being finished in white, unless otherwise specified elsewhere in this Specification. They shall be fixed perpendicularly, and the tops of groups of plates shall be level. Plates for multiple switch positions shall be of the same style and type as for single switch positions. Samples of all plates are to be submitted before ordering.

Submersible (WT/S) switched socket outlets are to comprise "Ceeform" or approved equivalent surface mounted units complying with IP67 of the sizes elsewhere specified in this Specification so installed that the action of removing the plug does not dislodge the fixed portion. A minimum of two plugs shall be provided, any further plugs required being as elsewhere specified.

Watertight (WT) switch socket outlets are to be as for Submersible above, but to IP65.

Weatherproof (WP) socket outlets are to comprise a socket outlet with aluminium plate and non-ferrous screws set into a "York" model S15 fibreglass box with sliding cover.

Weatherproof (WP) switches are to be "Wallsall" square pattern flush type or "Lewden" No.PD 145.

Weatherproof and watertight switches and socket outlets are to be semi-recessed in a manner to be discussed with the Engineer to ensure their acceptable mounting, especially in the case of facebrick walls.

Where industrial pattern switches or socket outlets are called for, the components are to comply with the foregoing requirements and are to be mounted in approved metal casings. All switch toggles are to be protected. Where flush conduit work is required, the industrial units are to be semi-recessed up to the back of the cover section. Care is to be taken that the boxes are adjusted to suit the finished plaster work and close co-operation with the Plasterer is necessary to achieve an acceptable result.

Flush switches shall be mounted vertically in standard hot dip galvanised mild steel boxes 100mm x 50mm x 50mm complying with SABS 1085, socket outlets being in standard

100mm x 100mm x 50mm boxes, unless otherwise specified or approved. Attention is drawn to the Clause "Wiring in Conduit" elsewhere in this Part with regard to the configuration required for multiple switches on the same or different circuits. Up to three switches in a vertically mounted 100mm x 50mm x 50mm box will be acceptable if designed for such mounting. The Contractor is to ensure that the Plasterer covers right to the edge of various boxes since gaps between plates and plaster will not be accepted, and it is deemed the Contractor's responsibility to ensure that no such gaps are visible.

Switches shall be mounted at 1400mm, socket outlets at 350mm above finished floor level, except in hospitals where socket outlets shall be at 450mm, unless otherwise specified. Where shown adjacent to walls on the same wall as the doors, switches shall be situated with the centre line between 125mm and 230mm from the edge of door frames except where wall nibs are smaller than 250mm wide, in which case they shall be positioned centrally. Heights above finished floor are taken to the underside of rectangular boxes or to the centre of circular boxes. The scaled dimensions to the centre of the symbol are to be taken as the centre of the outlet in the absence of specified dimensions on the drawings.

12.0 **LIGHT FITTINGS**

12.1 ***General***

Allowance shall be made for the supply and installation of light fittings as specified elsewhere in this Specification with the exception of those fittings for which PC Sums are allowed. Allowance for the installation only of these PC fittings shall be made.

Each incandescent fitting shall be supplied with a gas filled pearl or opal lamp of the wattage specified on the drawings complying with SABS 56 and Compulsory Specification VC 8043. Allowance shall also be made for appropriate lamps for Mercury or Sodium fittings. The size of each fitting must suit the wattage of the lamp specified. In the case of PC fittings, these will be supplied with lamps.

Fittings to be installed at each point are detailed on the drawings according to the code types set out elsewhere in this Specification. Supply of fittings marked PC is covered by a PC amount in the Price Summary. Catalogue numbers refer to fitting type only, not necessarily to size, which is to suit the wattage shown.

Fittings shall be directly fixed to ceiling or structure in addition to being fixed to the conduit box.

12.2 ***Incandescent Fittings***

Glass used on bowl fittings, etc., shall be of the best quality free from flaws and seams, and where possible, shall screw to galleries. Incandescent fittings shall be adequately ventilated for dissipation of heat produced by lamps.

Lamp holders shall be of brass to SABS 165. Porcelain holders may be offered for approval. Bayonet cap holders shall be used for lamps up to and including 150W. Above this rating Edison or Goliath Edison screw type holders, as may be appropriate to the lamp wattage, shall be used. Where small holders are required these shall be SBC not SES. The outer terminal of all screw type holders shall be connected to the neutral wire.

In all incandescent lighting fittings where the fitting is mounted directly on to the conduit box and no provision is made for adequate ventilation of the lamp holder, and also all ceiling fittings where the rating is 200W or more, silicon or similar heat resisting insulated wiring shall be used from the lamp holder to a PVC taped porcelain terminal block inside the conduit box.

For all pendant incandescent light fittings supplied without metal suspension rods or chains, either best quality PVC insulated and white PVC served flex or PVC insulated steel wire cored white PVC served flex shall be used. In either case the weight of the fitting shall be effectively removed from the conductors using suitable clamping devices. Connection shall be made to a terminal block as above. White plastic ceiling cups shall be provided and, unless otherwise specified, cords shall be 1,0m long.

12.3 ***Fluorescent Fittings***

Fluorescent fittings and their components shall comply with all the SABS Specifications relating to them. Bodies are to be constructed of cold rolled sheet steel, bonderised or similarly treated for the inhibition of rust, treated with anticorrosion undercoats of paint followed by high quality white baked enamel. No patched up scores or other damage to enamelling will be accepted. Nuts, screws, washers, etc., are to be non-ferrous or plated to prevent rusting. No equipment is to be rivetted to the bodywork, all equipment being easily removable. The back plate is to be free of all protruding screw heads. All such screws are to be countersunk headed.

Recessed fittings shall be provided with a raceway cover over control gear, thus preventing control gear from accidentally falling onto the diffuser. Capacitors used in such fittings shall be so manufactured that in the event of failure, they do not present a fire hazard.

Fluorescent fittings are to be removable and not held in position by bolts shot through the back plate. If this system is used, the fittings will have to be removed and remounted at the Contractor's expense.

The fittings are to be wired throughout and wiring brought to terminal strips or connectors close to the conduit entry. Each of the incoming terminals shall be large enough to accommodate two 1,5mm² wires without difficulty.

Lamp holders are to be mounted on rigid material and so spaced apart that any natural expansion of the lamp will not exert horizontal forces on the holder. Each fitting is to be supplied with 3500°K white tubes, unless otherwise specified.

Low loss, high power factor ballasts approved by SABS tested in accordance with Section 7 of SABS 890, or ballasts which at least provide the minimum values laid down by the SABS shall be employed. Ballasts shall be of best quality self-contained metal clad type, suitable for operation on 220/250V 50Hz supplies. The voltage rating at each tap of the ballast terminal block shall be clearly and indelibly marked. Ballasts are to be silent in operation and shall be power factor corrected to not less than 0,9 lagging. Multilamp fittings shall be stroboscopically corrected. Operation shall not cause radio or television interference.

Where ballasts bearing the SABS Mark of Approval are available for a particular type of lamp and associated circuit, ballasts of that category which do not bear the Mark will not be accepted.

13.0 TRENCHING, EXCAVATION AND COMPACTION

13.1 General

The Contractor shall allow for all excavation and backfilling of cable trenches and holes for planting of poles unless this is stated to be done by others elsewhere in this Specification. In this case the Contractor shall provide the Trenching Contractor with details of his requirements in this regard prior to work being commenced and shall be responsible for ensuring that these requirements are met.

He shall also be responsible for ensuring that any trenches opened by him or for him do not constitute a hazard to the public. Where necessary he shall provide barriers and warning lights at night or any other protection of trenches or excavations as required by the Engineer or any Statutory or Local Authority requirements.

The Contractor shall be responsible for leaving all areas affected by cable trenches, holes in the ground, and any other work done by him or on his behalf, in a clean and tidy state, and for making good all tarmacadam, concrete, paved or grassed surfaces.

It will be the Contractor's responsibility to make good any subsidence that may occur within six months of back-filling trenches, and, in the case of tarred surfaces, to remove and re-tar with new material.

13.2 Routing

The routes for the underground cables are shown on the drawings. Any proposed variation of these routes by the Contractor, shall be approved by the Engineer or Clerk of Works before trenching is done.

It shall be the Contractor's responsibility to ensure that the routes of the cables are correct. Where the Contractor is in any doubt regarding peg positions, he shall, after having obtained the approval of the Engineer, employ the services of a registered Surveyor to obtain the correct locations. Reimbursement for the cost of such services will, subject to granting of approval, be made from the Provisional Sum included for this purpose. Any major deviation considered necessary must be approved by the Engineer. The Employer will make no payment for claims for extra work arising out of the cable trenches being in the wrong place.

Routes shall run generally in road reserves parallel with and 1,0m from plot boundaries. Where no road exists or is not indicated, the route shall run in open ground adjacent to the plots and 1,0m from the plot boundaries.

13.3 Pegs

All erf boundary pegs will have been installed at the time the site is handed over to the Civil Contractor, who will be responsible for the replacement of any pegs disturbed or removed by him.

In the case of this Contract, the Contractor shall request the Engineer's Representative to check all pegs with him prior to commencing work in any particular area so that the number of missing pegs can be recorded. Should any further pegs have to be replaced after the electrical work is completed, this will be for the Contractor's account. Should he fail to verify the missing pegs as aforesaid, he may be held responsible for the replacement of all such missing pegs.

13.4 Trenching and Excavation by Others

The Contractor is to co-operate closely with the Trenching Contractor at all times and is required to be in attendance during backfilling of all trenches, etc., to ensure that cables are not damaged in any way and that poles are correctly aligned.

13.5 Type of Material

Unless otherwise specified elsewhere in this Specification or Schedule of Quantities, Tenderers shall allow for excavating cable trenches and holes in earth. In addition, unit rates shall be provided for excavating in soft rock and hard rock.

The following definitions shall apply to the three categories. Where the conditions experienced are a combination of two or more of the conditions listed below, the Contractor shall be paid on rates in proportion to the contents of earth, soft rock or hard rock experienced in the excavations.

"Earth" shall mean ground that can be removed by hand and includes loose gravel, clay, made-up ground, loose or soft shale, loose oukclip, and boulders less than 75mm in diameter.

"Soft rock" shall mean all hard ground such as oukclip, hard shale, decomposed rock, loose boulders and large stones, etc., which require the use of pneumatic tools, mechanical rippers and/or excessive hard labour to excavate and remove economically.

"Hard rock" shall mean granite, quartzite, dolomite, or other rock of similar hardness, which can only be excavated and removed economically by blasting, wedging or breaking.

13.6 **Verification of Excavation Claims**

Notwithstanding any Provisional Amounts for excavation in rock included in the Schedule of Quantities, payment will only be authorised for excavation in ground other than earth upon submission of documentary proof of such excavation made and signed as correct at the time trenches or holes were excavated.

It is essential that, in all cases where rock has to be excavated, or where poles, etc., have to be stabilised with concrete or by other means, in loose sand or in soft or waterlogged ground or where substitution of the excavated material is necessary for backfilling, that the Engineer or Clerk of Works be notified before such excavation work is back-filled. This is for the purpose of having the soil conditions encountered noted and confirmed in writing.

The amounts and type of rock encountered shall be measured by the Contractor in the presence of the Engineer or Clerk of Works. This information, together with the date and locality, shall be entered by the Contractor in a suitable triplicate book furnished by him. These entries shall be signed by the above parties. The original sheet shall be submitted to the Engineer and the duplicate copy shall be attached, by the Contractor, to his monthly invoice.

13.7 **Precaution with regard to other Services**

The Contractor shall exercise extreme caution in his work to avoid damage to existing underground services. Certain services may be indicated on the drawings but it is not to be assumed that these are the only services nor that their indicated position is entirely accurate. Such information is given as a guide only and does not negate the above responsibility. All excavation in the vicinity of other services must be undertaken by hand.

13.8 **Compaction**

Particular care shall be taken in compacting pole holes, trenches crossing roads and those crossing or running under or within 1,0m of paved or tarred sidewalks. In trenches, the backfill shall be replaced in 150mm layers and four to six passes with a vibrating pan compactor shall be made per layer. Around poles, a jumping jack shall be used on each 150mm layer. When clay is encountered, the Engineer should be advised and may instruct the Contractor to remove all such excavated material and replace it with more suitable material, which shall then be compacted as above. Where material is too wet for proper compaction, it should be dried out and if too dry, shall be dampened.

When rain is likely to occur, all excavated material shall be suitably protected to prevent the necessity for later drying out.

In the case of road crossings, the excavated base and subbase material shall be mixed and replaced up to the top level of the original sub-base. New material equal in composition to the original base course shall be supplied, this material being used for the full depth of the base course layer.

The degree of compaction required shall be field densities of 95% in respect of poles and road crossings and 90% in respect of sidewalks, of the Modified AASHO density, as measured by the Sand Replacement Method described in the "Standard Method of Testing Materials" issued by the Division of National Roads, Department of Transport, Private Bag 193, Pretoria. The Engineer will, if the compaction is in doubt, arrange to have it independently tested and should the compaction prove to be below standard, the cost of the test will be debited to the Contractor, who will be required, at his own expense, to open and re-fill the trench or pole hole to obtain the specified compaction value.

In all other areas, backfill shall be replaced in 150mm layers and shall be hand tamped, the remaining material being heaped over the trench for later settlement.

14.0 **CABLES**

14.1 **Description**

PVC insulated cables for LV shall be to SABS 1507 and shall consist of PVC insulated conductors, PVC bedding, galvanised steel wire armouring and a PVC sheath.

The abbreviation for this type of cable is PVCAS.

Paper insulated cables shall, unless otherwise specified elsewhere in this Specification, be of the screened type suitable for use on an earthed system and complying with SABS 97.

They shall be lead sheathed, bedded with two bituminised paper tapes and one layer of fibrous material and preferably armoured with two layers of steel tape or alternatively with a single layer of galvanised

steel wires, both served with bituminised fibrous material. Such cables shall comply with Table 19 of SABS 97 and shall be nondraining. They shall have a sheath of lead alloy 'E' and/or be PVC served only if called for elsewhere in this Specification.

The abbreviation for this type of cable is PILCA

Cross-linked polyethylene cables shall be Type A suitable for use on an earthed system and complying with SABS 1339, being individually screened and armoured, unless otherwise called for elsewhere in this Specification.

The abbreviation for this type of cable is XLPE

Service cables may be multi-core PVC insulated and wire armoured and PVC served (PVCAS), concentric neutral or "Airdac" as specified elsewhere in this Specification.

Concentric neutral cables shall be XLPE insulated complying with SABS 1268. "Airdac" cables shall be XLPE insulated with copper conductors, the phase conductor being contained within a radial band of insulated neutral and bare earth conductors, the whole being XLPE served. All cables are to be installed in compliance with the Manufacturer's recommendations.

The sizes indicated are for cables with copper conductors unless otherwise specified. For LV systems aluminium conductor cables may be offered as an alternative, if a price advantage can be shown. In such cases both the resistance and current carrying capacity of the aluminium cables offered must compare suitably with the sizes of copper conductor indicated. Where cables offered are other than those specified, Scheduled Rates for the supplying, laying, jointing and termination of the cable shall be entered in "Departures from the Specification". The Contractor will be responsible for advising equipment suppliers of the type of cable termination required if a cable other than that specified is accepted.

14.2 Cable Lengths

All scheduled cable lengths are for tendering purposes only and the Contractor shall measure the actual lengths required before ordering.

The length of all cables will be re-measured after installation and the lengths indicated in the Schedule of Quantities will be adjusted accordingly. The Contractor will be paid for the actual lengths measured on site and any allowance for snaking, joints or ends must be incorporated in the unit price.

14.3 Handling of Cables

Particular care shall be taken in handling drums of cable. Cable drums shall not be dropped or allowed to roll unchecked. The drums shall, under no circumstances, be rolled in any direction other than that indicated by arrows thereon.

When running cable off a drum, it shall be properly and securely mounted so as to rotate without difficulty and the spindle supporting it shall be straight, horizontal, supported at both ends and of adequate strength. Cable shall only be removed from the drum by rotating the drum. The inner end of the cable shall be released before running any cable off the drum.

Care is to be taken to ensure that each length of cable is run off the drum sequentially so that a crossed core situation does not arise at joints.

No cable shall be bent to a radius less than 12 times the overall diameter of the cable. Bending or straightening shall be done slowly. PILCA cable shall not be laid if the temperature falls below 10°C.

Should a cable inadvertently become damaged or the lead sheath or end cap punctured, this fact shall be brought to the notice of the Engineer immediately, who shall decide what further action is to be taken.

The Engineer shall also be notified immediately should there be any suspicion of moisture having entered a PILCA or XLPE cable.

14.4 Cables fixed to Surface

Where cables enter flush boards from cable sleeves, the sleeve shall turn up to floor level and a duct shall be formed in the wall to accommodate the cable. Care shall be taken to ensure that the bending tolerance of the cable is not exceeded in drawing the cable into the sleeve. The duct shall be of sufficient size to accommodate the cables. The edges of the duct are to be lined with timber battens to which a bevel edged metal cover is to be screwed, using countersunk headed screws and cup washers.

Wherever cable saddles or any other items are to be fixed to structural components, the use of dry plugs of wood will not be permitted. 'Rawl plugs' or other plugs to approval only shall be used. Surface mounted cable protection pipes shall be galvanised and shall be fixed with saddles of 32mm x 3mm galvanised strap bolted to the wall using bolts grouted in, 'Rawlbolts' or similar. All cables rising on the outside of buildings or on poles shall be protected by such pipes to a height of 2.0m above ground level. Where a cable is installed fixed to a pole, it shall be attached to the pole using stainless steel "Bandit" strap or equal. Care shall be taken to ensure that the straps are tightened correctly and that they do not distort or indent the cable sheath.

14.5 Cables in Sleeves

Cables shall pass in and out of buildings and under roadways and pavements in sleeves. In addition, where cables cross or run along a boundary between two plots, these cables shall, where called for, be installed in sleeves. All sleeves shall be installed in accordance with the Clause "Sleeves" elsewhere in this Part.

14.6 **Cables laid in Trenches**

HV cables shall generally be laid 800mm and LV cables at 500mm below ground level. Where two HV cables are run in the same trench, they shall be laid a minimum of 300mm apart with separate cable slabs over each cable. Where HV and LV cables are laid in the same trench, the HV cable shall be located on the road side and the LV cables on the plot side of the trench. A horizontal distance of not less than 400mm shall be maintained between the cables of different voltage groups. Where a number of LV cables are run in the same trench, they shall be laid with a minimum separation of 100mm. This applies to feeder cables only and not streetlighting and service cables which shall be only 25mm apart. Cables shall not cross each other.

Where cables run across even parallel to lateral boundaries, they shall be located 1,0m from the boundary at a depth of 1,0m. If so specified they shall be run in sleeves, otherwise both HV and LV cables shall be protected by cable slabs and a PVC sheet marker laid 300mm above them.

The trench bottom shall be cleared of all sharp or protruding stones. The trench is then to be refilled with 150mm of soft material and compacted. A further layer of soft material shall be installed after the cables are laid to provide 200mm cover for the cable when compacted. Protective cable slabs a minimum of 50mm thick x 230mm wide shall then be laid in the case of HV cables, and PVC sheet cable marker strip 450mm wide with indelibly printed warnings every 150mm along its length, in the case of LV cables. In cases where HV and LV cables run in the same trench, 100mm of soft bedding for the LV cables shall be situated above the protective cable slabs. Where LV service cables or streetlighting cables only are installed, a clean trench bottom and soft material back-fill only is required, and no PVC sheet marker.

The soft material described above may be either sand or backfill material sifted through a 3,0mm mesh grid. Where the bottom of the trench consists of only soft sandy material, the bedding underneath the cable shall be omitted and the cable shall be laid on the trench bottom at the correct depth. Permission must be obtained from the Clerk of Works or the Engineer for the cable bedding to be omitted in such instances. Where sand has to be brought to site, the quantity must be measured and confirmed by the Engineer or Clerk of Works.

The balance of the trench is to be back-filled with excavated material from which all stones, etc. greater than 100mm in size have been extracted. All such material is to be removed from site.

Cable route markers shall be provided for all HV and main LV feeder cables at road, culvert and Telkom cable crossings, at all changes of direction, at joints and at intervals not exceeding 60 metres along the strait. Cable route markers shall comprise concrete blocks in the shape of truncated pyramids 300mm high, 150mm x 150mm at the top and 225mm x 225mm at the base. An aluminium plate 3,0mm thick minimum, with four rods 75mm minimum, welded to it on the underside, shall be cast into the top of the concrete block, and the plate shall have stamped on it the cable data and direction arrows, and at a crossing, the crossing shall be indicated.

The cable route markers shall be placed over the cable, in the trenchway, and shall protrude 25mm above the finished ground level but not where they are likely to cause an obstruction or be in the way of moving traffic. Joint markers shall indicate as such. The Contractor shall ensure that the ground under and around the cable marker is properly compacted.

14.7 **Laying of Cables with other Services**

Where cables are laid in trenches containing water and other pipes, etc., the Contractor shall arrange with the Civil Engineering Contractor and Engineer, to lay the electrical cables along one edge of the trench with the other services occupying the other edge. The cables shall be laid not less than 600mm from such service unless otherwise approved by the Engineer.

At road and services crossings, sleeves as described elsewhere herein shall be provided, one for each HV cable and a separate sleeve for other cables, unless otherwise indicated on the drawings.

At Telkom cable crossings, power cables shall cross 300mm below and at right angles to all such cables or sleeves for future cables. The power cables shall be enclosed in asbestos cement split sleeves with cable slabs over, both of which shall extend 1,0m either side of the crossing. The two sections shall be firmly fastened together with robust stainless steel straps. The full length of all such sleeves shall be covered by cable slabs installed 150mm above the sleeve. No power cable running parallel with a Telkom cable shall be laid within a distance of 1,0m measured horizontally from the Telkom cable. Wherever existing buried Telkom cables are encountered, strict precautions and care shall be taken and close supervision given. Any damage to, or disturbance of Telkom cables whatsoever shall be immediately reported and confirmed in writing to the Engineer.

14.8 **Labelling of Cables**

All cables shall be labelled with 3mm high letters punched onto aluminium tape attached to the cable with aluminium wire. The label shall state the cable size and number of cores. All main feeder cables shall also be labelled to state from whence they are supplied. The labels shall be so installed that they are easily readable.

15.0 **CABLE JOINTS AND TERMINATIONS**

15.1 **General**

Cable jointing and termination shall be carried out by a qualified cable jointer using only approved standard methods for the particular type of cable. Proof of his training may be required.

Joints in all cables shall only be made at full drum length intervals, but where necessary and when approved by the Engineer cable through joints may be used in other approved positions.

Where a cable has steel wire armouring all strands of armouring shall be through jointed.

15.2 **Connections**

Cable connections shall be made by means of crimped or sweated lugs, firmly bolted, one plain and one lock washer being placed under the nut, so that the plain washer is against the lug and there shall be no washer between the lug and the terminal. A plain washer is also required under the bolt head. Alternatively, sweated stems fitting into clamp connections will be acceptable.

Crimped lugs shall be fitted using manual tools up to 70mm² and hydraulic tools from this size upwards. Approved tools are to be used in both cases. An hydraulic tool is to be used on all sizes of aluminium cable. Where a single point hydraulic crimping tool is used, the lug shall be crimped in three places. Where a hexagonal die is used, this shall extend the full length of the lug.

Where aluminium cored cables are to be connected to circuit breakers, the aluminium cable lug shall be bolted to a copper tag or tail which is to be connected to the circuit breaker. The Contractor shall ensure that sufficient Densal paste is installed on the faces of the lugs.

Where an aluminium cable is to connect to copper, the lug shall be a bi-metal type lug with a copper spade and an aluminium ferrule friction welded to the spade.

Cable connections shall be made using brass bolts, nuts and washers, together with a star lock washer, on all kiosks, fused feeder panels and minisubs and with cadmium plated steel bolts and nuts on all indoor equipment. All bolted joints shall be taped with self-vulcanising (not adhesive) tape.

Where cable connections are required to the HV and LV terminals of transformers, these shall be made off as follows: -

Red Phase to Terminal A

White Phase to Terminal B

Blue Phase to Terminal C

All transformer connections shall be kept in strict phase rotation and where two or more units are to operate in parallel, the respective connections are to be checked for phase rotation and polarity. In the case of cable terminations to transformer bushings the cable itself shall be clamped substantially to a post adjacent to the transformer, connections to the bushings being puttied and taped.

All connections are to be colour coded.

15.3 **HV Cable Terminations**

PILCA Cables:

PILCA cable shall not be unsealed until all preparations have been made for making-off or jointing, which shall not be carried out during extremely humid or damp conditions. When a piece of PILCA cable is cut from a long length, the end of the un-used cut length is to be plumbed air and moisture tight.

The end terminations of all PILCA cables at switches, etc., shall be fitted with sealing boxes or chambers, equipped with lead plumbing brass wiping glands duly plumbed to the cable sheath and finally filled with approved compound. The tails of the cable may only be brought out of a cable end box if barrier ferrules are used to prevent the ingress of moisture. Sweated moisture barriers will not be accepted.

For through joints a seamless non-porous type of straight through plumbed joint with cast iron protection box fitted with armour tape clamps and finally filled with compound shall be used. The numbers or colours of the cores shall be matched without twisting at the joints and PILCA cables may, if necessary, be unsealed and then resealed to check this before the second length is laid.

Cable end and through joint boxes shall be filled with MR-3 compound as manufactured by African Bitumen Emulsions.

XLPE Cables:

XLPE cable terminations are to be made in full compliance with the recommendations of the Supplier of the termination system.

Where an XLPE cable is terminated onto an item of equipment with a cable box as in the case of switchgear, whether indoor or outdoor, an outdoor type taped termination complete with silicone tape shall be used. The cable box must be effectively sealed against moisture but shall not be compound filled. A standard compression type gland shall be used where the cable enters the cable box. The gland plate shall be effectively earthed to the equipment earth bar.

All through joints in XLPE cables shall be provided with steel protective sleeves covering the joint.

Outdoor Terminations:

All outdoor cable ends to transformer or similar bushings, overhead line equipment or cable ends within mini-substations shall be made with heat-shrinkable high voltage termination systems suitable for 5 - 69kV as manufactured by Raychem Corporation. The material shall be non-tracking, erosion resistant and shall comply with the Manufacturer's appropriate Quality Assurance Schedules Nos. RK 1700 and 1720 as amended. The material shall not be subject to deterioration due to ultra-violet exposure. Heat shrink sheds shall be used to increase the creepage length. The shed closest to the crotch of the cable shall incorporate all three tails of the cable. In cases where cables are to be connected to overhead lines direct, the tail is to be connected to the lightning arrestor termination.

At all outdoor terminations a minimum of 3,0m of cable slack shall be provided adjacent to the termination point.

Where no intermediate connection is available, the cable tails shall be supported by means of pin insulators every 1,5m to avoid vibration in the crotch of the cable. Where a cold tail is joined to the cable tail, this shall be done by means of a barrier ferrule. The heat-shrink shall cover the barrier ferrule.

Where the cable tail itself is connected to the lug or stud of an item of equipment, a sealed-end lug shall be crimped onto the tail and the lug connected to the equipment. The heat-shrink shall cover all but the spade of the lug to prevent the ingress of moisture.

Where a cable tail connects onto an overhead line, a solid centre sleeve shall be crimped onto the cable tail and the sleeve clamped to the line. The heat-shrink is to overlap the sleeve to prevent the ingress of moisture.

Tenderers are to make due allowance for the length of tails in each particular case, since no claim for additional cost for extra-long tails will be considered.

15.4 LV Cable Terminations

PVCAS cables shall be made off using adjustable mechanical glands. Care shall be taken to ensure that armour wires are correctly seated in the gland and that all parts are properly tightened. Outdoors, in damp situations and in all mini-substations and kiosks, neoprene waterproofing shrouds are to be fitted over all glands.

Where cable connections from mini-substations and kiosks to consumers and street lighting are excluded from this Contract, the Contractor shall, nevertheless, ensure that sufficient space is left on the gland plate for the future cables.

Wherever PVCAS cables are terminated to overhead lines a suitable moulded heat shrinkable glove to effect a watertight seal at the crotch shall be used, in accordance with the Manufacturer's instructions. Alternatively, a PVC cable cap may be used.

15.5 Service Cable Terminations

Service cable ends are to be located in the positions indicated on the drawings. In the general case, the ends are to be located 1,0m from each of the front and lateral boundaries. Where they cross the road in sleeves they are to be located 1,0m into the erf directly opposite the sleeve.

No service cables are to be laid to even directly behind kiosks or at pole positions.

The cables are to be left sealed with a heat shrink cap at a depth of 500mm. Before sealing, each cable is to be checked by the Contractor, in the Engineer's presence if he so decides, to ensure that it is correctly located and labelled at the respective kiosk or pole.

After checking and sealing and while the end of the connection is still exposed, marker posts shall be installed at the end of the connection and vertically above it. The posts shall be manufactured from Y-section fencing standards 1,5m long, split for 75mm at the base and cast into minimum 200 x 200 x 100mm concrete blocks made from the same mix as specified in the Clause "Plinths" elsewhere in this Part. They shall be installed such that 500mm protrudes above ground. Each post shall have a 150mm wide red band painted at the top using an approved exterior enamel paint.

16.0 CABLE TESTING

On completed sections of laid, jointed and terminated HV cables, a high voltage DC test of 15 minutes duration shall be carried out by persons qualified to make such tests.

Contractors must note that where such tests will include sections of cable which have already been in service, the test voltages and duration are to be reduced in accordance with the Engineer's instructions.

Cable tests shall be in accordance with the following:

PILCA cables - SABS 97, Annex A-3.3

XLPE cables - 5000V megger test between cores and to earth unless additional tests are ordered by the Engineer, or are called for elsewhere in this Specification. Method - SABS 0198 : Part XIII

CABLES FOR EARTHED SYSTEMS (Based on SABS 97: Table A-2)							
TYPE	PVCAS ¹	BELTED		SCREENED		XLPE ²	
Rated Voltage	600/1000	11000	22000	11000	22000	11000	22000
Between conductors - DC	3kV	31kV	60kV	-		18kV	36kV
Conductor to screen - DC	-	-	-	19kV	36kV	18kV	36kV
Conductor to earth - DC	3kV	19kV	35kV	19kV	36kV	18kV	36kV

17.0 **CABLE TRAYS**

These consist of two basic types, i.e. perforated and folded or wire mesh comprising Light, Medium and Heavy Duty. The actual type and duty required, and the finish if not as set out below, are specified elsewhere in this Specification.

17.1 **Perforated and Folded Trays**

Light duty 'Marine' tray shall be manufactured from pre-galvanised perforated sheet steel. The minimum material thickness shall be 1,0mm for tray widths not exceeding 150mm and 1,2mm for widths not exceeding 300mm. Turned-up edges shall not be less than 12mm for tray widths not exceeding 230mm and 20mm for widths not exceeding 300mm. Maximum spacing between supports shall be 1000mm.

Medium duty 'Standard' or Marine tray shall be manufactured from 1,2mm thickness perforated sheet steel with turned-up edges of not less than 12mm for tray widths not exceeding 100mm, and 19mm for tray widths not exceeding 600mm. The tray shall be hot-dip galvanised after manufacture. Maximum spacing between supports shall be 1200mm.

Heavy duty 'Heavy Duty' tray shall be manufactured from 2,5mm thickness perforated sheet steel and shall have turned-up edges of not less than 75mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 2400mm.

17.2 **Wire Mesh Trays**

Medium duty tray shall be manufactured from 4,0mm wire and shall have turned-up edges of not less than 50mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 1500mm.

Heavy duty tray shall be manufactured from 4,0mm wire and shall have turned-up edges of not less than 75mm. The tray shall be hot dip galvanised after manufacture. Maximum spacing between supports shall be 1500mm.

Splicing pieces, bends and tee pieces shall be provided to suit the cable tray system. These shall be of an approved make conforming to the width and quality specification of the particular cable tray being used.

Trays are to be installed in accordance with the Manufacturer's recommendations, supported in such a way that they are carried on cross members cantilevered from a vertical support so that cables do not have to be threaded between the supports. Trays on walls are either to be carried horizontally on right angled brackets or fixed vertically to the wall. All hardware, support brackets, etc., shall be hot-dipped galvanised. Support brackets shall be spaced so that a sag of 1/200 is not exceeded with the tray fully loaded. Further, the maximum spacing limit specified above shall not be exceeded.

¹ Test only when specifically called for

² Obtain instructions from the Engineer before testing.

Where trays are likely to be damaged because of their proximity to a working area and could therefore be stepped on or similarly abused, they are, if at all possible, to be installed out of the way of such abuse. Where this is not possible, only heavy duty tray is to be used and additional longitudinal support in the way of angle iron of suitable size is to be installed.

Where the width of cable trays is unspecified elsewhere in this Specification, they shall be sized to accommodate 20% more cables than the number presently to be installed on the basis that the future cables will be of the same average size.

Unless otherwise specified, all cables over 16mm² are to be spaced at least 12mm apart. Where cables are laid flat on trays, fixing is required for all cables larger than 16mm² using heavy duty nylon cable ties. Where fixed in the vertical plane, all cables are to be strapped to the trays using stainless steel strapping applied with an approved tool. This also applies to single cables fixed to trusses or other parts of the structure and to all cables fixed to cable trays in a physically vulnerable situation.

18.0 HOT DIP GALVANISING

Where hot dip galvanising is called for, it shall conform to SABS 763, the required coating thickness being in accordance with Table 1. Unless the galvanised part is to be painted, the coating is to be passivated immediately. Where later painting is required, a suitable primer shall be applied at the galvanising works. Before galvanising, all cutting, drilling, welding, etc., shall be complete. Bolt threads shall be suitably undercut and nut threads over-tapped to ensure the correct fit after galvanising.

All galvanised parts shall be stored under cover and in stacks such that no part is resting on another and there is sufficient ventilation to prevent condensation occurring. No galvanised parts shall be stored directly on the ground but on pallets or similar protection. Any damaged parts or parts attacked by white rust will be rejected.

Any galvanised surface that is subsequently damaged shall, if the Engineer does not require replacement, be touched up in the manner specified in the Clause "Painting" elsewhere in this Part.

19.0 PAINTING

Any metal work which is not galvanised or painted at Works shall be degreased using a solvent and thoroughly cleaned with a wire brush. If rust is present, this shall be removed by grinding. A red oxide self-etching primer shall be applied, followed by a white undercoat and thereafter a coat comprising a mixture of 50% undercoat and 50% finishing coat. The final coat shall comprise oil based outdoor type enamel.

All equipment that is delivered to site painted shall, after installation, and as near as possible to handover, be lightly rubbed down, all damaged paintwork be touched up and thereafter the whole given one coat of oil based outdoor type enamel of the same colour as the original.

Where any galvanised or zinc coated surface has been damaged or cut, this shall be touched up using an organic zinc rich epoxy primer (containing min. 90% zinc) after thorough cleaning with a solvent and grinding away all rust. This is to be followed by a self-etching primer suitable for use on zinc coated surfaces and then an undercoat and two top coats as described above.

20.0 LABELS AND NOTICES

The Contractor shall arrange for the labelling of all equipment, instruments, meters, relays, cables, etc., as indicated below.

Where identical items of equipment can be removed from their housings, e.g. circuit breaker carriages, plug-in relays etc., both the fixed and withdrawable portion are to be labelled identically.

All labels shall be ivory or other back engraved white on black labels of the sizes indicated. They are to be located in purpose made holders or otherwise are to be screwed or riveted into position. "Dymo" tape or similar labels will not be accepted nor will labels which are glued in position only.

Labels on poles shall comprise an aluminium plate with the designated number. These labels shall be nailed to the pole 1,5m above ground level. Nails shall be electro-galvanised clout nails.

Prior to any equipment being labelled, the Contractor shall request the Engineer to provide a complete labelling schedule for all items of equipment. Under no circumstances is equipment to be labelled in accordance with the tender drawings since any description thereon is for identification purposes during construction only and is unlikely to apply to the completed Works.

The following list indicates the general labelling requirements but does not limit the extent of labelling required, which shall encompass the full extent of the equipment supplied, or in the case of existing equipment, any such which is affected by this Contract.

50mm high lettering: -

Substation and minisub designation.

Outdoor switchgear designation. Transformer designation.

Distribution kiosk and fused feeder panel designation.

20mm high lettering: -

Main or sub-main board designation. Control panel designation.

Indoor switchgear designation.

10mm high lettering: -

Individual switches on switchgear.

Cubicles.

Sub-distribution board designation.

Poles for OH lines.

5mm high lettering: -

Mini-sub feeder breakers and isolators.

Distribution kiosk feeder breakers and isolators.

General distribution switchgear.

Meters, instruments and relays.

Multiplying factors.

3mm high lettering: -

This size shall be used to designate the conductor size and number of cores of each cable installed under this Contract. In addition, all feeder cables shall be labelled to state from whence they are fed.

All switchboards shall be provided with a label in both official languages reading "In case of leakage or accidental contact, put off main switch immediately".

All substations, mini-sub, kiosks, transformer rooms and switch rooms shall be provided with notices as required by the Occupational Health and Safety Act. All doors to such locations shall be fitted with the appropriate notices. In the case of mini-sub, these shall comprise at least two 190mm x 190mm design WW7 in accordance with SABS 1186 externally and H^v/_s and L^v/_s respectively on the inside of all doors, while kiosk doors shall meet the LV requirements only. For all other substations, enclosures etc: "Kontra" Safety Signs as supplied by Mine Safety Appliances or approved equivalent are to be provided, Nos.KM115 and KO711 being used externally and KM112, KO706 and KO710 internally.

Where more than one similar item of equipment is fed from the same board or control panel, the item itself shall be labelled, this being fixed in a permanent position, i.e. not attached to motors, pumps, etc., but to bases or adjacent thereto. The lettering shall be 50mm high.

21.0 DISMANTLING

Where dismantling of existing parts of the installation is called for, all components including wire, insulators, poles, cable, switchgear, transformers, etc., are to be removed and handed to the appropriate Authority. Under no circumstances is any material or equipment to be taken over by the Contractor. In the case of reclamation of conductor, this is to be done after removing the binding wires on intermediate insulators so that full strain lengths are recovered. All such material is to be neatly coiled, packed, etc., as appropriate.

Extreme care is to be taken in dismantling all such equipment, since it will be re-used by the Employer. If, in the opinion of the Engineer, unnecessary damage is done, the cost of replacing such equipment will be debited to the Contractor's account.

A receipt detailing all equipment and materials delivered in accordance with the above must be obtained and a copy submitted to the Engineer.

22.0 INSPECTION, TESTING AND COMMISSIONING

The Engineer shall have access at all reasonable times to such parts of the Works or the Contractor's premises or the premises of the Manufacturer of component parts, as may be necessary for the purpose of inspecting, examining and testing the materials, workmanship and performance of any plant or equipment specified for the Works.

The Contractor shall ensure that all equipment such as switchboards, transformers, mini-sub, kiosks, etc., are inspected and tested at the Manufacturers premises, in the presence of the Engineer.

All wiring is to be subjected to a test voltage of 2kV for one minute without insulation failure. A Megger test is to be applied with a 500V instrument immediately thereafter to prove the insulation resistance better than 20 megohms. All meters are to be injection tested to ensure correct operation. All control circuits

including motor overloads, relays, etc., are to be operated to ensure the correct functioning of the entire control system.

All equipment to enable the necessary tests to be carried out shall be provided and shall include, inter alia:

Phase rotation meter	500A primary injection test set
Avometer	25A secondary injection test set
500V megger	2kV DC test set

After completion of manufacture, the following test certificates, signed by the Contractor and the firm executing the tests, shall be provided in duplicate:

Transformer test certificate to SABS.

Test certificate stating that all LV switchboards and control boards have been inspected and their wiring subjected to 2000V DC for 1 minute.

Test certificate stating that all HV switchboards have been inspected and their internal wiring subjected to 2000V DC for 1 minute and HV components to the appropriate voltage as laid down in the applicable SABS or BS Specification.

Any other test certificate for routine tests as laid down in relevant SABS or BS Specification or Codes of Practice applicable to the item in question.

Test certificate in respect of any special tests called for elsewhere herein.

The Contractor shall arrange for any Statutory Government and/or Supply Authority inspection of the installation prior to testing and final commissioning by the Engineer.

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, commissioning shall be carried out by the Contractor, and any tests the Engineer deems necessary shall be conducted. The Contractor shall supply all equipment necessary for the testing and commissioning procedures.

Prior to commissioning of any transformer, the oil shall be tested and, if necessary, shall be dried out by the Contractor. Should this be necessary, the Engineer must be advised that it is suspected the transformer is damp before any work is undertaken. Transformer wheels shall be solidly chocked. No transformer shall be commissioned without the consent of the Engineer.

During commissioning, all tap change switches are to be correctly set and locked. All wedges and packing in switches and relays shall be removed and each switch and each relay circuit operated.

All protection and small wiring shall be tested with a 500V megger and injection currents passed through the secondaries of every circuit to check the proper operation of relays, instruments and protection.

The Contractor shall supply all equipment necessary for the testing and commissioning procedures. The test equipment required at Site shall include, inter alia:

500V megger

Earth resistance test set

After completion of the commissioning tests the Contractor shall provide duplicate test certificates relating to cable tests, current injection tests of all instruments, meters and relays and results of earth mat tests.

The Contractor shall give the Engineer at least 14 days' notice of the date of any testing or commissioning so that he may be present if he so wishes. Where the Engineer does not himself, or through his Representative, attend to witness the tests, then the Contractor may proceed with the tests, duly forwarding to the Engineer certified copies of the results obtained. In such cases, the test shall be deemed to have been made in the presence of the Engineer.

In the event of the equipment or installation not passing the tests, the Employer shall be at liberty to deduct from the Contract Price, all reasonable expense incurred by him or by the Engineer in repeating the tests.

23.0 COMPLETION OF WORKS

Before completion of the Contract any damage which may have been done in the process of the installation shall be repaired and made good, trench or excavation work shall be left in a clean and tidy state and all accumulated debris shall be removed from the Site by the Contractor, to the satisfaction of the Employer and Engineer.

All defects found are to be rectified within one month of written notice of such defects. A penultimate certificate reducing the retention amount to the amount stated elsewhere in this Specification will only be issued upon submission of As-built Drawings and Operating Manuals as called for elsewhere herein, after

completion of all notified defects and once all test certificates called for in the Clause "Inspection, Testing and Commissioning" elsewhere in this Part have been submitted and accepted by the Engineer.

An appropriate Certificate shall acknowledge practical completion of the Works and the commencement of the period during which the Contractor will be responsible for any defects that may become apparent, and of Maintenance as detailed under the Clause "Maintenance" in Section A of this Part, where applicable.

The Contract will not be deemed to be finally complete until the Engineer's final payment certificate is issued.

24.0 CERTIFICATE OF COMPLIANCE

The Contractor shall complete and submit a certificate of compliance as per the relevant contract conditions.

C3.6 STANDARD SPECIFICATION FOR GENERATOR INSTALLATION STANDARD SPECIFICATION FOR GENERATOR INSTALLATION

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C3.15 STANDARD GENERATOR TECHNICAL SPECIFICATION**1.0 GENERAL**

This Specification covers the supply, delivery and complete installation on site in full working order of the equipment detailed in the Particular Specification.

Full particulars, performance curves and illustrations of the equipment offered shall be submitted with the tender. Tenderers may quote for their standard equipment, complying as closely as possible with this Specification, but any deviations from the specification shall be fully detailed.

2.0 REQUIREMENTS

The set shall be capable of delivering the specified output continuously, 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 BSS 5514. Furthermore, the set shall be capable of supplying 3 x full load for 3 seconds under short circuit fault conditions of the load.

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

The engine and alternator of the set shall be built with the alternator flange mounted to the engine, on a common frame, which shall be mounted on a skid base on antivibration mountings. The set shall be placed in the position indicated in the plant room. A drip tray shall be fitted under the engine. The tray shall be large enough to catch a drip from any part of the engine.

The set shall be fully automatic, i.e. it shall start when the main power supply fails, and shall shut down when normal supply is re-established. The set is required to supply the electrical load specified in the event of a mains failure.

3.0 OUTPUT AND VOLTAGE

The set shall have a site output as specified in the Particular Specification.

4.0 DERATING

The engine must be derated for the site conditions as set out in the Particular Specification.

The derating of the engine for site conditions shall be strictly in accordance with BSS 5514 as amended to date. Any other method of derating must have the approval of the Engineer and must be motivated in detail. Such derating shall be guaranteed in writing and proved by the successful tenderer at the site test.

5.0 DELIVERY

Where this specification includes a layout drawing of the generator room, tenderers must confirm that the space is sufficient for the installation of the generating set, control panel and fuel tank. Where no drawing is issued, tenderers must indicate with their tender, the minimum dimensions of room required.

The successful tenderer shall inform the Engineer when the set is ready for installation.

Delivery shall be effected after confirmation by the Engineer that the site is ready for installation.

6.0 **ENGINE**

6.1 **General**

The engine shall comply with the requirements laid down in BSS 5514 and shall be of the solid injection, compression ignition type, running at a speed not exceeding 1500 r.p.m. The engine shall be amply rated for the required electrical output of the set, when running under the given site conditions.

The starting period from cold to the acceptance of the full load in one step shall not exceed 15 seconds. The engine is to be fitted with an alternator and regulator. 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.

6.2 **Starting and Stopping**

The engine shall be easily started from cold, without the use of any special ignition devices, under summer and winter conditions.

Tenderers must state what arrangements are provided to ensure easy starting in cold weather. Full details of this equipment must be submitted. In the case of water cooled engines, any electric heaters shall be thermostatically controlled. The electrical circuit for such heaters shall be taken from the control panel and must be protected by a suitable circuit breaker.

An electrical starter motor must be fitted to the engine. Besides the automatic starting and stopping, provision must be made on the control board for manual starting and stopping of the set.

The automatic control shall make provision for three consecutive starting attempts with 30 sec. intervals. 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. If the type of engine is suitable for hand starting, a crank handle must be supplied.

6.3 **Starter Battery**

Each set shall be supplied with a fully charged lead-acid type battery, complete with the necessary electrolyte. The battery shall have sufficient capacity to provide the starting torque stipulated by the engine makers, and for at least six consecutive starting attempts. The battery shall be housed in a suitable lockable battery box complete with a heavy duty lock and 2 keys. All cables, complete with terminations are to be supplied and installed with the batteries. The battery shall be of the low maintenance type.

6.4 **Cooling**

The engine may be either of the air or water cooled type. In case of water cooling, a built on heavy duty, tropical type pressurised radiator must be fitted.

For either method of cooling, protection shall be provided against running at excessive temperatures. The operation of this protective device shall 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 the coolant. The protection shall operate in the same way as the other cut-outs (e.g. low oil pressures etc.).

All air ducts for the cooling of the engines are to be allowed for. The air shall not re-circulate in the plant room and an air duct shall be supplied from the radiator face to the air intake louvres in the plant room wall, or from the air outlet in the case of air cooled engines to the outlet louver in the plant room wall.

A stainless steel anti-vermin mesh is to be fitted to the air exit end of the radiator exhaust air duct where it meets the plant room wall behind the louvres. The louvres will be provided and installed by the Builder.

Note that the exit area of the exhaust air duct must be at least 1,5 times the duct entrance area (or radiator area). The radiator (or engine) and exhaust air duct are to be joined via an effective heavy canvas or similar material anti-vibration coupling.

Note that, as required by Factories, machinery and Building Work act and Regulations, the cooling air fan must be **fully and effectively guarded**.

Ductwork for intake or exhaust of cooling air shall be manufactured from not less than 2mm thick **galvanised** mild sheet steel. Support steelwork shall be of substantial section and be hot dip galvanised. Welding of galvanised steel is prohibited except by permission of the Engineer.

6.5 **Lubrication**

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

6.6 **Fuel Pump**

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

6.7 **Bulk Fuel Supply System**

A day tank shall be provided, fitted with a suitable fuel filter, full height gauge glass and low level alarm sensor.

A wing-type diesel fuel pump with adequate length of hose shall be supplied for filling the day tank from 200 litre drums.

A water trap shall be provided in the fuel line between the tank and engine.

6.8 **Governor**

The speed of the engine shall be controlled by a governor in accordance with class A1 of BSS 5514. When full load is suddenly switched off or on, the temporary speed variation shall not exceed 10%. The permanent speed variation shall not exceed 4% of the normal engine speed. External facilities shall be provided on the engine, to adjust the nominal speed setting.

6.9 **Flywheel**

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

The cyclic irregularity of the set shall be within the limit laid down in BSS 5514 as amended.

6.10 **Exhaust Silencer**

It is essential to keep the noise level as low as possible. An effective exhaust silencing system of the residential type is to be provided.

The exhaust pipe shall be installed in such a way that the expelled exhaust fumes will not cause discomfort to the public. The exhaust pipe shall be flexibly connected to the engine to take up the vibrations transmitted from the engine, which may otherwise cause breakage. The exhaust piping and silencer shall be lagged inside the plant room to reduce heat and noise transmission. The exhaust pipe must be protected against the ingress of rain.

6.11 **Accessories**

The engine shall be supplied complete with all accessories, air filter, instructions manual, spare parts lists, spares as required, hand crank, tool kit, etc.

7.0 **ALTERNATOR**

7.1 **General**

The alternator shall be of the self excited, brushless type, with enclosed ventilated drip-proof housing, and shall be capable of supplying the above specified output continuously with a temperature rise not exceeding the limit laid down in BSS 5000 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 shall be fully impregnated for tropical climate and shall have an oil resistant finishing varnish.

7.2 **Regulation**

The alternator shall preferably be self-regulated without the use of solid state elements, the inherent voltage regulation not exceeding plus or minus 5% of the nominal voltage specified at all loads with the power factor between unity and 0,8 and within the driving speed variations of 4% between no-load and full load.

7.3 **Performance**

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

7.4 **Coupling**

The engine and alternator shall be directly coupled by means of a first class quality flexible coupling equal and similar to the Holset type.

7.5 **Service Manual**

Three complete sets of spares and maintenance manuals for each alternator and switchboard are to be provided, together with three copies of the circuit diagrams in a suitable folder, with one copy securely mounted in a glass frame and rigidly mounted on the wall in each generator room.

8.0 **CONTROL / CHANGE-OVER PANEL**

The control/alarm indication and change-over functions may be combined into a single switchboard, or separately housed, as stipulated in the Particular Specification.

The panel/s shall comprise totally enclosed floor mounting units, and shall consist of steel panels, carried on a substantial MS angle framework.

The panel shall be flush fronted, all equipment to be mounted back of the front plate on suitable supports.

The equipment, connections and terminals shall be easily accessible. 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.

The steelwork of the panel shall be thoroughly de-rusted, primed with zinc-chromate and finished with two coats of first class enamel paint or epoxy powder coated.

Suitably rated terminals shall be provided for all main, control and protection circuits. Where cable lugs are used, these shall be crimped onto the cables. Screw terminals shall be of a type which prevents 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 the numbering of these markers shall be shown on the wiring diagram of the switchboard. Each component shall be numbered and identified in a similar manner.

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

8.1 **Earthing**

A 50mm x 6mm copper earth bar at least 550mm long is to be provided. The bar is to have not less than ten termination positions spaced 50mm apart. The bar is to be fixed to the generator room wall on insulated stand-offs in a position adjacent to the control panel or as shown on the drawings.

The following earth bonds are to be terminated on this bar:-

Control panel earth point

Alternator neutral point

Alternator frame

All non-current carrying metal in the generator room - This includes items such as the day tank and stand, fuel lines, duct work, control panel frame, engine and base frames, etc.

If asked for in the Particular Specification, provide an earth electrode system as near as possible to the generator. The earth electrode system is to consist of three 3,6m long x 20mm minimum diameter 'Copperweld' or equivalent earth rods driven vertically into the ground and bonded to each other with 70mm² bare copper cable. The top of the rods and the bonding cables are to be not less than 500mm below the ground surface. No earth rod is to be within 6m of the other rods or of any other earth electrode system. A cable marker is to be installed above each earth rod and is to be labelled 'Earth Rod'. In paved areas the head of each rod is to be accessible below 150mm x 150mm castiron inspection covers which are to be concreted into position. Use brass labels engraved 'Earth Rod' to label the inspection covers. If site conditions will not allow this form of earth electrode system, the Engineer's instructions are to be sought and followed. The resistance to earth of the earth system is to be measured and if not 3 ohm or less the Engineer's instructions are to be sought.

8.2 **Alternator Protection**

On the alternator control panel, a triple pole adjustable circuit breaker with instantaneous short circuit trips and thermal overload trips shall be installed, for protection of the alternator against short circuit and overload. The settings of the instantaneous trips shall be well below the short circuit current of the offered alternator and the overload trips shall be set at the rated current of the alternator.

8.3 **Protection and Alarm Devices**

All switchboards shall be equipped with protection and alarm devices as described below. All protection devices shall give a visible and audible alarm. A muting switch shall be installed in the alarm circuit to silence the audible signal, but the fault indication on the control panel must remain until the fault is rectified. The protection and signalling circuits are to be operated from the battery.

Protection shall be provided for high engine temperature, low lubrication oil pressure, overspeed, start failure, and low water level on water cooled engines. The indicators and reset pushes shall be marked as follows:

- Temperature High
- Oil Pressure Low
- Over speed
- Start Failure
- Low Water Level

Any one of these protection devices shall immediately stop the engine and it shall not be possible to restart until the fault is cleared.

In addition, two relays with reset pushes shall be fitted, giving audible and visible signals ONLY, when the fuel level in the fuel tank reaches 30% and the battery charger fails to operate. These indications shall be marked as follows:

- Fuel Low
- Battery Charger Failure

The audible alarm shall be of the continuous duty type and must have a low power consumption.

8.4 **Battery Charging**

Equipment shall be provided for charging the battery from the mains supply. The charger shall operate automatically in accordance with the state of the battery, and shall be of the constant voltage, current limiting type.

A flush ammeter, suitably scaled, reading the charging current, and a flush voltmeter with spring loaded push button or switch, indicating the battery voltage, shall be provided on the alternator control panel. The charger shall operate the 'Charge Fail' indicator on the control panel for a failure of the charger to charge the battery, or the alternator on the motor generator set fails. The smallest scale reading on the ammeters shall be 5 amps and the scale shall be in 5 amp markings up to 60 amps.

8.5 **Control / Indicating Equipment**

The following must be incorporated into the control panel:

- 3 x MDI ammeters and CT's, rated for 0-150% of rated output, measuring alternator output.
- 0-500V voltmeter with 7 position selector switch, measuring alternator voltage.
- Frequency meter, vibrating or pointer type, indicating alternator frequency.
- Hour meter with cyclometer counter recording the number of hours the set has run. The smallest figure shall indicate 1/10th hours.
- One set fuses or mcb's for potential circuits of meters.
- START and STOP pushbuttons for manual operation of the set.
- MANUAL/OFF/AUTO selector switch.
- Timers/controller for AMF operation.
- Battery charging, protection and alarm equipment as previously specified.
- 15A switched socket outlet on earth leakage supply.
- Suitable terminals for all control cables/wiring.
- Neutral and Earth bars
- Any other equipment necessary for the safe and correct operation of the installation.

8.6 **Change-over Switchgear**

The panel shall include the following equipment:

- Triple pole isolator for incoming mains supply (rating as per Particular Specification).
- Triple pole circuit breaker for incoming alternator supply, rated as described elsewhere (alternator protection).
- Mechanically interlocked change-over contactors (3-pole) or, alternatively, interlocked motorised circuit breakers, controlled from the generator control system. Ratings to be as for isolators above.
- Bypass switch as further described elsewhere, rated as for the incoming mains isolator.
- Sub-distribution circuit breakers (if called for in the Particular Specification) supplied from the load side of the change-over arrangement.
- Terminals/gland plate for incoming, outgoing, and control cables.

9.0 BYPASS SWITCH

The switchboard shall be equipped with a manually operated on-load by-pass switch, which shall either connect the in-coming mains to the automatic control gear or directly to the outgoing feeder. In the latter position the automatic control gear, including the main contactors, shall be isolated for maintenance purposes.

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 position of the switchboard cubicle, and that the switches are operated from the front of the compartment.

10.0 LABELS

All labels, markings or instructions on the control panel and switchboard gear shall be in English only.

11.0 INSTALLATION

Tenderers shall include for the complete installation and wiring of the plant, including all cabling between alternator and alternator switchboard.

For the alternator circuit, PVC insulated steel wire armoured PVC sheathed cable shall be used. For the control circuits either multi-core PVC cable or PVC insulated wires in conduit may be used. The neutral of the alternator must be solidly earthed.

The installation shall comply with the following regulations: -

- the latest issue of SABS 0142: 'Code of Practice for the Wiring of Premises.
- the Occupational Health and Safety Act No 85 of 1983.
- the municipal by-laws and any special requirements of the local supply authority.
- the local fire regulations.

12.0 WARNING NOTICES

Tenderers shall allow for all warning notices at each plant room, in accordance with the Occupational Health and Safety Act.

12.1 **Warning Notices for Standby-Sets**

In the plant room, a clearly legible and indelible warning notice shall be mounted in a conspicuous position.

The notice shall be made of a non-corrodible and non-deteriorating material, preferably plastic, and must be read as follows:

Danger: This engine will start without notice. Turn selector switch on control board to 'maintenance' before working on the plant.

13.0 **DUMMY LOAD**

A dummy load for routine testing is generally not required however, if called for in the Particular Specification, provide a dummy load as further detailed.

The rating of the load bank is given by the following formulae: -

Sets rated up to and including 50 kVA.

$$L = 0,8. R \quad \text{kW}$$

Sets rated greater than 50 kVA.

$$L = 0,48 R \quad \text{kW}$$

With L being not less than 40 kW.

Where:

L = rating of load bank in kilowatt.

R = rating generating set in kVA.

The power factor of the load bank is to be unity (1,0).

The bank is to be positioned in the air exhaust duct between the radiator / engine and the louvres.

The load bank is to consist of a three phase balanced set of elements substantially mounted on insulated standoffs. Wiring is to be heat resistant.

For an ambient temperature of 35 °C the temperature of the air leaving the exhaust air louvres must not exceed 80°C when the load bank is fully in service.

The load bank circuit is to be protected by a triple pole circuit breaker mounted in the control panel. Note that the load bank must only come into service when the generator function switch is in the "TEST" position.

14.0 **SURFACE FINISH OF METALWORK**

14.1 **Galvanising**

The Contractor must **strictly adhere** to the following steel finishes:

(a) **Ungalvanised**

Fuel lines

Bulk tank

Day tank

Exhaust line

(b) **Optional Galvanising**

Generator set sub and base frames

(c) **Galvanised**

Sheet metal panels and ductwork

Day tank frame

All steel support brackets and other mounting hardware.

14.2 **Painting**

All metal surfaces shall be given two coats of paint of approved quality and colour. Generally, paintwork will be including derusting, degreasing and cleaning of all surfaces, a prime coat, undercoat and two final coats, all applied **strictly** in accordance with the paint manufactures specification. The final colour of the board shall be a standard S.A.B.S. gloss colour, readily matchable. Before painting, all metal shall be bonderised or given some similar rustproof treatment to approval. It is the Contractor's responsibility to ensure that when handed over, the paintwork on boards is in first class condition. If this is not the case, boards are to be resprayed on site, any damage from over-spray being for the Contractor's account. Under no circumstances will boards be accepted if not finished to a first-class standard at handover.

15.0 **DRAWINGS**

15.1 **Drawings for Approval**

15.1.1 Within one month of receipt of the purchase order for the Standby Generator, the successful Tenderer shall submit to the Engineer for his approval, three copies each of the following drawings:

- a) A complete circuit and control diagram of the switchboard and all circuits connected to the switchboard.
- b) A dimensioned drawing of the proposed Engine room layout.

15.1.2 All components on the drawings must be fully described by Manufacturer, Catalogue numbers and, for the main components, electrical ratings.

15.1.3 The approval of drawings shall not relieve the Contractor of his liability to carry out work in accordance with the terms of the Contract.

15.2 **Final drawings**

15.2.1 Upon completion of the installation, the Contractor shall hand to the Engineer a full set of transparent drawings for 15.1.1 (a) and (b) above.

15.2.2 Schematics and wiring diagrams are to show terminal numbers and wiring numbers and colours as used in the control panel. These drawings shall be up-to-date "as built" drawings containing all modifications.

15.2.3 The Contractor shall mount a copy of the complete circuit and control diagrams for the installation, on a wall in the plant room. The drawings shall be put in an accessible position and shall be mounted in a wooden frame behind perspex or glass.

16.0 **INFORMATION REQUIRED**

Tenderers shall furnish detailed descriptions and illustrations of the equipment offered, and shall complete the questionnaire following this specification.

17.0 **GUARANTEE**

The successful tenderer will be required to guarantee the complete plant for a period of 12 months, from the date of first delivery to the Employer, in running order.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design, or workmanship, the Contractor will be notified, and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site, at his own expense.

18.0 **MAINTENANCE**

18.1 The successful tenderer will be required to maintain the plant in good running order for a period of twelve months from the first delivery to the final delivery, free of any charge.

18.1.1 The Contractor shall at his own expense undertake the regular servicing of the installation during the period stated in 18.1 above, and shall make all adjustments necessary for the correct operation thereof.

18.1.2 If during the said period the installation is not in good working order for any reason for which the Contractor can be held responsible, or if the installation develops defects, the Contractor shall immediately upon being notified thereof, take steps to remedy the defects or faults or to make any necessary adjustment.

18.1.3 Should, however, such malfunctions be so frequent as to become burdensome, or should the installation otherwise prove unsatisfactory during the said period, the Contractor shall, if called upon by the Engineer or Employer, at his own expense or replace the whole installation or such parts thereof as the Engineer or Employer may deem necessary with apparatus specified by the Engineer or Employer.

18.2 Should the Contractor fail to hand over the plant in good working order on expiry of the specified twelve months the Contractor shall be responsible for further monthly maintenance until final delivery is taken.

18.2.1 During this time the Contractor shall undertake to arrange once per month for a visit to the plant by a qualified member of his staff, who shall:

- Report to the official in charge, keeping the maintenance records, and enter into a log book the date of the visit, the tests carried out, and adjustments made, and any further details that may be required.
- When necessary, clean the plant and its components.
- Grease and oil moving parts where necessary.
- Check the air filter and, when necessary, clean the filter and replace filter oil.
- Check the lubricating oil, and top-up when necessary.
- After the plant has run on one oil change for the number of hours stipulated by the makers, drain the sump and refill with fresh lubricating oil. The reading of the hour meter on the switchboard will be taken to establish the number of hours run by the plant.

Under this heading only the cost of the actual oil used shall be charged as an extra on the monthly account.

- Clean the lubricating oil filter, and/or replace the filter element at intervals recommended by the engine maker, the cost of a new filter element to be charged as an extra on the monthly account.

- Clean or, if necessary, replace fuel filter elements.
- Check and when necessary adjust the valve settings and the fuel injecting equipment.
- Check the battery and top-up the electrolyte when necessary.
- Test-run the plant for ½ hour, check the automatic starting with simulated faults on each mains phase, and check the proper working of all parts, including the electrical gear, the protective devices with fault indicators, the change-over equipment and the battery charger. Make the necessary adjustments.
- Report to the Employer and to the Contractor on any parts that become unserviceable through fair wear and tear, or damaged beyond the control of the Contractor.

The Contractor on receiving the report, shall immediately submit a detailed quotation for the repair or replacement of such parts to the Employer.

- Advise the Employer when it has become necessary to decarbonise the engine, and submit a quotation for this service.
- Top-up the water of the radiator, if applicable.

18.3 After the lapse of the 12 months' period, the Contractor may be required to enter into a maintenance agreement as described under Clause 18.2.1.

This agreement will initially be for one calendar year and monthly visits or at intervals as required by the local authority. The agreement may subsequently be renewed for yearly periods.

19.0 INSTRUCTION OF OPERATOR

After completion of the installation, and when the plant is in running order, the successful tenderer is required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and the handling thereof.

Three copies of a maintenance, fault-localising and operating manual are to be handed over to the Employer's representative on site.

20.0 TESTS

The engineer reserves the right to inspect any equipment covered by this specification at any stage during manufacture, and to be represented at any test performed on such equipment.

The Engineer shall also be given 14 days' notice before any tests are undertaken.

The following tests shall be conducted at the Suppliers works and a comprehensive report of test results shall be provided: -

- Complete correct functioning of the Controls
- Fifteen (15) minutes at approximately three-quarter load.
- One (1) hour at full load.
- Fifteen (15) minutes at 10% overload.

Increase the load gradually until the set trips on overload.

Reset the tripped protective devices and restart the set against the same load. The set shall again trip on overload. The contractor shall provide the necessary dummy loads for these tests to be undertaken for the specified periods of time as required.

- The sets shall be run at the specific loads in the specified sequence and the supplier will record the following readings at ten minute intervals.

- Oil temperature
- Water temperature
- Turbo charger temperature
- Exhaust temperature
- Engine alternator charge rate
- Alternator frequency
- Alternator phase to phase voltages
- Alternator phase currents
- Voltage regulation (No load to full load)
- Governor reaction (No load to full load)
- Sound level
- Vibration
- Exhaust smoke (Amount and Colour)

The sets shall have all their protective devices comprehensively tested.

The supplier shall provide all equipment and instruments for the tests to be undertaken.

On completion of the site installation the set shall be functionally tested to check correct starting and change-over operation, as well as operation of control/safety systems.

C3.3 STANDARD SPECIFICATION FOR CIVIL INSTALLATION

All civil associated installations, i.e. pumps, piping, valves, filters, screens, etc. shall comply with the relevant SANS specifications and Knysna Municipality's standard technical specifications governing the manufacture and installation thereof.

1.0 APPLICABLE SANS 1200 STANDARDIZED SPECIFICATIONS

The following SANS 1200 Standardized Specifications for civil engineering construction are also applicable to this contract:

SANS 1200 A	: General (1986)
SANS 1200 C	: Site clearance (1980)
SANS 1200 D	: Earthworks (1988)
SANS 1200 DB	: Earthworks (pipe trenches) (1989)
SANS 1200 DK	: Gabions and pitching
SANS 1200 DM	: Earthworks (roads, subgrade) (1981)
SANS 1200 G	: Concrete (structural) (1982)
SANS 1200 H	: Structural steelwork (1990)
SANS 1200 HA	: Structural steelwork (sundry items) (1990)
SANS 1200 HC	: Corrosion protection of structural steelwork (1988)
SANS 1200 L	: Medium-pressure pipelines (1983)
SANS 1200 LB	: Bedding (pipes) (1983)
SANS 1200 LC	: Cable ducts (1981)
SANS 1200 LD	: Sewers (1982)
SANS 1200 M	: Roads (general) (1996)
SANS 1200 ME	: Subbase (1981)

PART C4 - SITE INFORMATION

All sites are located within the Knysna Municipal Boundaries and the prevailing site conditions are as follows:

Altitude above sea level ± 0 to $\pm 700\text{m}$

Max temperature 45°C

Min temperature $- 5^{\circ}\text{C}$

Max relative humidity 95%

Ambient atmosphere Coastal climate with severely corrosive conditions

ANNEXURE A