

**METSIMAHOLO LOCAL MUNICIPALITY****UPGRADING OF SASOLBURG WATER PUMP STATION****BID NO.: MLM 29/2022/23****CIDB GRADING: 6 ME OR HIGHER  
(VOLUME 3)****ISSUED BY:**

Metsimaholo Local Municipality  
Municipal Building  
10 Fichardt Street  
Sasolburg  
4800



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<b>Name of Company</b>	:	.....
<b>Contact Name</b>	:	.....
<b>Contact No</b>	:	.....
<b>Email Address</b>	:	.....
<b>CSD Supplier Number</b>	:	.....
<b>CIDB: CRS Number</b>	:	.....
<b>Tender Amount (VAT incl.):</b>		<b>R</b> .....

**TENDER NUMBER: MLM 29/2022/23**

**UPGRADING OF SASOLBURG WATER PUMP STATION**

**LIST OF CONTRACT DOCUMENTS**

The following documents form part of this contract:

- Volume 1: The General Conditions of Contract for Construction Works, Second Edition (GCC 2015), published by the South African Institute of Civil Engineers, which the Tenderer shall purchase himself (see note 1 below).
- Volume 2: SANS 1200 The Standard Specifications for Civil Engineering Construction
- Volume 3: The Project Document containing the Tender Notice, Conditions of Tender, Tender Data, Returnable Schedules, Form of Offer, General and Particular Conditions of Contract, Pricing Schedule, Project Specifications and Site Information, issued by the Employer (see note 4 below). The Employer's Form of Acceptance and any correspondence from the selected Tenderer, performance security-demand guarantee and all addenda issued during the period of tender will also form part of this volume once a Tenderer has been appointed.
- Volume 4: The civil, mechanical, and electrical drawings are part of Volume 3

**Notes to Tenderer**

1. **Volume 1 is obtainable from SAICE, Private Bag X200, Halfway House, 1685.**  
**Tel: +27 11 805 5947 Fax: +27 11 805 5971, email: civilinfo@saice.org.za.**  
**Website: <http://www.saice.org.za>**
2. **Volume 2 is obtainable from SA Bureau of Standards Dr Lategan Road; Groenkloof; Pretoria; 0001. Private Bag X191, Pretoria, 0001.**
3. **Volume 3 is obtainable from SAICE, Private Bag X200, Halfway House, 1685.**  
**Tel: +27 11 805 5947 Fax: +27 11 805 5971, email: civilinfo@saice.org.za.**  
**Website: <http://www.saice.org.za>**
4. **Volume 3 is issued at tender stage as per tender advertisement. The pricing data is available on request in Excel format**  
  
**At contract stage Volume 3 will be a bound signed paper copy containing the following documents:**
  - Returnable schedules relevant to the project
  - Agreements and Contract Data
  - Pricing Data
  - Scope of Work
  - Site Information
5. **SUBMISSION OF TENDER – Refer to clause F2 in the Tender Data**

**Information provided by a Tenderer over and above the above elements of Volume 3 shall be treated as information only and will only be bound into the document if the tenderer**

**notes on Form A4: Schedule of Variations or deviations that the information has a bearing on the tender price.**

- 6. For alternative offers, the Tenderer shall refer to clause F2.12 in the Tender Data**

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# **METSIMAHOLO LOCAL MUNICIPALITY**

**BID NO: MLM 29/2022/23**

## **UPGRADING OF SASOLBURG WATER PUMP STATION**

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**METSIMAHOLO LOCAL MUNICIPALITY**

**BID NO: MLM 29/2022/23**

**UPGRADING OF SASOLBURG WATER PUMP STATION**

**PART T1: TENDERING PROCEDURES**

**PART T2: RETURNABLE DOCUMENTS**



## T.1.1 TENDER NOTICE AND INVITATION TO TENDER



### **TENDER NOTICE**

**BID NO: MLM 29/2022/23**

**METSIMAHOLO LOCAL MUNICIPALITY** invites tenders for the **UPGRADING OF SASOLBURG WATER PUMP STATION.**

Tenderers should have a CIDB Contractor grading designation of **6ME** or higher.

Bid documents will be available during working hours upon payment of R1000.00 at The Municipal Building, 10 Fichardt Street, Sasolburg. Documents can also be downloaded for the e-tender portal [www.e-tenders.gov.za](http://www.e-tenders.gov.za) for free.

**No clarification meeting will be required.**

It is a pre-requisite that Bidders must be in good standing with SARS, have the requisite CIDB certificate, and must be registered on the Central Supplier Database (CSD).

The closing time and date for receipt of tenders is **22 May 2023, 11H00**. Bid documents, clearly marked BID MLM 29/2022/23; UPGRADING OF SASOLBURG WATER PUMP STATION must be deposited in the bid box at the Municipal Building, 10 Fichardt Street, Sasolburg before the closing time. Bid documents will be opened in public soon after the closing time. Telegraphic, telephonic, telex, e-mail, facsimile and late tenders will not be accepted. Requirements for sealing, addressing, delivery, opening and assessment of tenders are stated in the Tender Data.

Service providers will be adjudicated according to the Supply Chain Management Policy using the 80/20 point system, based on the Preferential Procurement Policy Framework Act 5 of 2005 and MFMA, Act 56 of 2003 as well as the Broad-Based Black Economic Empowerment Act, Act 53 of 2003.

Queries relating to the issues of these documents may be addressed to:

**Administrative:**

Sibusiso Bila  
Tel No. +27 16 973 8487  
E-mail: [sibusiso.bila@metsimaholo.gov.za](mailto:sibusiso.bila@metsimaholo.gov.za)

**Technical:**

Mr P. Ramasimong  
Tel No.+27 18 462 1575  
E-mail: [pule@prdcon.co.za](mailto:pule@prdcon.co.za)

## T1.2 CONDITIONS OF TENDER

### T1.2 CONDITIONS OF TENDER

#### F.1 General

##### F.1.1 Actions

**F.1.1.1** The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

**F.1.1.2** The employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

- Note:
- 1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.
  - 2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.

**F.1.1.3** The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

##### F.1.2 Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

##### F.1.3 Interpretation

**F.1.3.1** The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

**F.1.3.2** These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

**F.1.3.3** For the purposes of these conditions of tender, the following definitions apply:

- a) **conflict of interest** means any situation in which:
  - i) Someone in a position of trust has competing professional or personal interests which make it difficult to fulfil his or her duties impartially;
  - ii) an individual or organisation is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or
  - iii) in compatibility or contradictory interests exist between an employee and the organisation which employs that employee.

- b) **comparative offer** means the tenderer's financial offer after all tendered parameters that will affect the value of the financial offer have been taken into consideration in order to enable comparisons to be made between offers on a comparative basis
- c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents, *or any official in the public service or in the employ of an Organ of State*, in the tender process; and
- d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels
- e) **organization** means a company, firm, enterprise, association or other legal entity, whether incorporated or not, or a public body
- f) **quality (functionality)** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs
- g) **tenderer** means any organisation who is represented by a duly authorised employee, partner, shareholder or director that responds to the Tender Notice by drawing tender documents
- h) **these conditions of tender** mean the Standard Conditions of Tender (as published and amended from time to time by the Construction Industry Development Board) and the employer's Special Conditions of Tender, the latter are demonstrated by appearing in italics.

#### F.1.4 Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

#### F.1.5 The employer's right to accept or reject any tender offer

**F.1.5.1** The employer *does not bind itself to accept the lowest or any other tender, and may, in addition, accept or reject any variation, deviation, tender offer, or alternative tender offer, and may cancel the tender process and reject all tender offers at any time before the formation of a contract.* The employer shall not accept or incur any liability to a tenderer for such cancellation and rejection, but will give written reasons for such action upon written request to do so.

**F.1.5.2** The employer may not subsequent to the cancellation or abandonment of a tender process or the rejection of all responsive tender offers re-issue a tender covering substantially the same scope of work within a period of six months (*measured between the relevant closing dates of the abandoned tender and the re-issued tender*) unless only one tender was received and such tender was returned unopened to the tenderer, *or if there is agreement by the participating tenderers.*

#### F.2 Tenderer's obligations

##### F.2.1 Eligibility

**F.2.1.1** Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with the employer.

**F.2.1.2** Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

##### F.2.2 Cost of tendering

Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of *attending any clarification meeting* and any testing necessary to demonstrate that aspects of the offer complies with the requirements.

**F.2.3 Check documents**

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

**F.2.4 Confidentiality and copyright of documents**

Treat as confidential, *regardless whether or not a tender offer is submitted*, all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

**F.2.5 Reference documents**

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

**F.2.6 Acknowledge addenda**

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

**F.2.7 Clarification meeting**

Attend, where required, *in person or designate a suitably qualified person in the direct employ of the tenderer*, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

**F.2.8 Seek clarification**

Request clarification of the tender documents, if necessary, by notifying the employer at least five working days before the closing time stated in the tender data. *Any variation or deviation based on a point for which clarity should have been requested may render a tenderer's offer non-responsive in terms of F.3.8.*

**F.2.9 Insurance**

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

**F.2.10 Pricing the tender offer**

**F.2.10.1** Include in the rates, prices, and the tendered total of the prices (if any) all *costs prescribed as being applicable to the specified pay items as well as all* duties, taxes except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable 14 days before the closing time stated in the tender data.

**F.2.10.2** Show VAT payable by the employer separately as an addition to the tendered total of the prices.

**F.2.10.3** Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

**F.2.10.4** State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

**F.2.11 Alterations to documents**

Not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations. Erasures and the use of masking fluid are prohibited.

**F.2.12 Alternative tender offers**

**F.2.12.1** Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed. *Alternative tender offers shall not alter any contingency pay items provided in the tender documents, or offer fixed prices (except where such are provided in the postulated pricing schedule) or a fixed price contract.*

**F.2.12.2** Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

**F.2.12.3** *Qualify a tender offer (except that no qualifications shall be in conflict with F.2.8) but undertake to do so by submitting such qualification in terms of F.2.12.1 and F.2.12.2.*

**F.2.13 Submitting a tender offer**

**F.2.13.1** Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

**F.2.13.2** Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

**F.2.13.3** Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

**F.2.13.4** Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

**F.2.13.5** Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

**F.2.13.6** Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked "financial proposal" and place the remaining returnable documents in an envelope marked "technical proposal". Each envelope shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

**F.2.13.7** Seal the original tender offer in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

**F.2.13.8** Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

**F.2.13.9** Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

#### **F.2.14 Information and data to be completed in all respects**

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

#### **F.2.15 Closing time**

**F.2.15.1** Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

**F.2.15.2** Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

#### **F.2.16 Tender offer validity**

**F.2.16.1** Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

**F.2.16.2** If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

**F.2.16.3** Accept that a tender submission that has been submitted to the employer may only be *modified, corrected, withdrawn* or substituted by giving the employer written notice before the closing time for tenders that a tender is to be *modified, corrected, withdrawn* or substituted.

**F.2.16.4** Where a tender submission is to be substituted, submit a substitute tender in accordance with the requirements of F.2.13 with the packages clearly marked as "SUBSTITUTE".

#### **F.2.17 Clarification or withdrawal of tender offer after submission**

**F.2.17.1** Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors or *adjusting of imbalanced rates*, by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

**F.2.17.2** *Accept that the employer may, at its sole discretion, accept a less favourable tender from those already received or invite fresh tenders if a tenderer, at any time after the opening of his tender offer but prior to the signing of a contract based on his tender offer:*

- a) *withdraws his tender; or*
- b) *gives notice of his inability to execute the contract in terms of his tender; or*
- c) *fails to sign a contract or furnish the performance security within the period fixed in the letter of award or any extended period fixed by the employer; or*
- d) *fails to comply with a request made in terms of F.2.17.1 or F.2.18.1,*

*in which case such tenderer shall be automatically barred from tendering on any of the employer's future tenders for a period to be determined by the employer, but not less than twelve (12) months, from the date of tender closure. The employer may fully or partly exempt a tenderer from the provisions of this condition if he is of the opinion that the circumstances justify the exemption.*

Note: Sub-clause F.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.

#### **F.2.18 Provide other material**

**F.2.18.1** Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive *and may invoke the same remedy as provided for under F.2.17.2.*

**F.2.18.2** Dispose of samples of materials provided for evaluation by the employer, where required.

**F.2.18.3** *Accept the employer's right, at its sole discretion, to appoint suitably qualified persons to report on the financial resources, standing with the South African Revenue Service regarding all taxes, management structure and ownership details of any tenderer and/or to verify the correctness of any information furnished to the employer in terms of F.2.17.1. Comply with the employer's request within the time stated in the request. Failure on the part of the tenderer to cooperate with such an inquiry shall entitle the employer to declare such tender offer as non-responsive and may invoke the same remedy as provided for under F.2.17.2.*

#### **F.2.19 Inspections, tests and analysis**

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

#### **F.2.20 Submit securities, bonds, policies, etc.**

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

#### **F.2.21 Check final draft**

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

#### **F.2.22 Return of other tender documents**

If so instructed by the employer, return all retained tender documents within 28 days after the expiry of the validity period stated in the tender data.

#### **F.2.23 Certificates**

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

#### **F.3 The employer's undertakings**

##### **F.3.1 Respond to requests from the tenderer**

**F.3.1.1** Unless otherwise stated in the tender data respond to a request for clarification received up to five working days before the tender closing time stated in the tender data and notify all tenderers who drew *tender* documents.

**F.3.1.2** Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence: -



- a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;
- b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or
- c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

### **F.3.2 Issue Addenda**

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three working days before the tender closing time stated in the tender data. If, as a result a tenderer applies for an extension to the closing time stated in the tender data, the Employer may grant such extension and, shall then notify all tenderers who drew *tender* documents.

### **F.3.3 Return late tender offers**

Return tender offers *withdrawn in terms of F.2. 16.3* or received after the closing time stated in the tender data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

### **F.3.4 Opening of tender submissions**

**F.3.4.1** Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

**F.3.4.2** Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, preferences claimed and time for completion for the main tender offer only.

**F.3.4.3** Make available the record outlined in F.3.4.2 to all interested persons upon request.

### **F.3.5 Two-envelope system**

**F.3.5.1** Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

**F.3.5.2** Evaluate the quality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the quality evaluation *equal to or more than* the minimum number of points for quality stated in the tender data, and announce the total price. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for quality.

### **F.3.6 Non-disclosure**

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.



### **F.3.7 Grounds for rejection and disqualification**

**F.3.7.1** Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices. *In addition, any such disqualification shall entitle the employer, at its sole discretion, to impose a specified period during which tender offers will not be accepted from the offending tenderer.*

**F.3.7.2** *Communicate to other state tender boards, provincial tender boards or parastatal tender boards any tenderer disqualified in terms of special condition F.3.7.1.*

**F.3.7.3** *Consider rejecting any tender offers received from tenderers who are involved in any form of litigation or legal proceedings by or against the Employer.*

**F.3.7.4** *Reject any offer from a tenderer who has not purchased the tender documents in his own name or in the name of a fellow member of a joint venture.*

**F.3.7.5** *Reject any offer from a tenderer that contains information or data that is not in compliance with the minimum key staff qualification requirements.*

### **F.3.8 Test for responsiveness**

**F.3.8.1** Determine, after opening and before detailed evaluation, whether each tender offer properly received:

- a) complies with the requirements of these Conditions of Tender,
- b) has been properly and fully completed and signed, and
- c) is responsive to the other requirements of the tender documents.

**F.3.8.2** A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer's opinion, would:

- a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,
- b) significantly change the Employer's or the tenderer's risks and responsibilities under the contract, or
- c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation *unless it can be subsequently rendered responsive by correction of non-material deviations.*

### **F.3.9 Arithmetical errors, omissions, discrepancies and imbalanced unit rates**

**F.3.9.1** Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amount in words, the amount in words shall govern.

**F.3.9.2** Check *responsive* tender offers for:

- a) the gross misplacement of the decimal point in any unit rate;
  - b) omissions made in completing the pricing schedule or bills of quantities; or
  - c) arithmetic errors in:
    - i) line-item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or
    - ii) the summation of the prices.
- F) *imbalanced unit rates.*

**F.3.9.3** Notify the tenderer of all errors or omissions that are identified in the tender offer and either confirm the tender offer as tendered or accept the corrected total of prices.

**F.3.9.4** Where the tenderer elects to confirm the tender offer as tendered, correct the errors as follows:

- a) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the unit rate shall be corrected.
- b) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall be corrected.
- c) *Where the unit rates are imbalanced request tenderers to amend and adjust any rates declared imbalanced by the employer while retaining the total of the prices derived after any adjustment made.*

**F.3.9.5** Consider the rejection of a tender offer if the tenderer does not correct or accept the correction of his arithmetical errors or amend/adjust an imbalanced unit rate in the manner described above.

#### **F.3.10 Clarification of a tender offer**

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

#### **F.3.11 Evaluation of tender offers**

##### **F.3.11.1 General**

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate them using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

##### **F.3.11.2 Method 1: Financial offer**

In the case of a financial offer:

- a) Rank tender offers from the most favourable to the least favourable comparative offer.
- b) Recommend the highest ranked tenderer for the award of the contract, unless there are compelling and justifiable reasons not to do so.
- c) Re-rank all tenderers should there be compelling and justifiable reasons not to recommend the highest ranked tenderer and recommend the highest ranked tenderer, unless there are compelling and justifiable reasons not to do so and the process set out in this sub clause is repeated.

##### **F.3.11.3 Method 2: Financial offer and preference**

In the case of a financial offer and preferences:

- a) Score each tender in respect of the financial offer made and preferences claimed, if any, in accordance with the provisions of F.3.11.7 and F.3.11.8.
- b) Calculate the total number of tender evaluation points ( $T_{EV}$ ) in accordance with the following formula:

$$T_{EV} = N_{FO} + N_P$$

where:  $N_{FO}$  is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;

$N_P$  is the number of tender evaluation points awarded for preferences claimed in accordance with F.3.11.8.

- c) Rank tender offers from the highest number of tender evaluation points to the lowest.
- d) Recommend the tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.
- e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points, and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this sub clause is repeated

#### **F.3.11.4 Method 3: Financial offer and quality**

In the case of a financial offer and quality:

- a) Score each tender in respect of the financial offer made and the quality offered in accordance with the provisions of F.3.11.7 and F.3.11.9, rejecting all tender offers that fail to score the minimum number of points for quality stated in the tender data, if any.
- b) Calculate the total number of tender evaluation points ( $T_{EV}$ ) in accordance with the following formula:

$$T_{EV} = N_{FO} + N_Q$$

where:  $N_{FO}$  is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;

$N_Q$  is the number of tender evaluation points awarded for quality offered in accordance with F.3.11.9.

- c) Rank tender offers from the highest number of tender evaluation points to the lowest.
- d) Recommend tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.
- e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this sub clause is repeated.

#### **F.3.11.5 Method 4: Financial offer, quality and preferences**

In the case of a financial offer, quality and preferences:

- a) Score each tender in respect of the financial offer made, preference claimed, if any, and the quality offered in accordance with the provisions of F.3.11.7 to F.3.11.9, rejecting all tender offers that fail to score the minimum number of points for quality stated in the tender data, if any.
- b) Calculate the total number of tender evaluation points ( $T_{EV}$ ) in accordance with the following formula, unless otherwise stated in the tender data:

$$T_{EV} = N_{FO} + N_P + N_Q$$

where:  $N_{FO}$  is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;

$N_P$  is the number of tender evaluation points awarded for preferences claimed in accordance with F.3.11.8;

$N_Q$  is the number of tender evaluation points awarded for quality offered in accordance with F.3.11.9.

- c) Rank tender offers from the highest number of tender evaluation points to the lowest.
- d) Recommend the tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.
- e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this sub clause is repeated.

### F.3.11.6 Decimal places

Score financial offers, preferences and quality, as relevant, to two decimal places.

### F.3.11.7 Scoring Financial Offers

Score the financial offers of remaining responsive tender offers using the following formula:

$$N_{FO} = W_1 \times A$$

where:  $N_{FO}$  is the number of tender evaluation points awarded for the financial offer.  
 $W_1$  is the maximum possible number of tender evaluation points awarded for the financial offer as stated in the tender data.  
 $A$  is a number calculated using the formula and option described in Table F.1 as stated in the tender data.

**Table F.1: Formulae for calculating the value of A**

Formula	Comparison aimed at achieving	Option 1 <sup>a</sup>	Option 2 <sup>a</sup>
1	Highest price or discount	$A = (1 + \frac{P - P_m}{P_m})$	$A = P_m / P$
2	Lowest price or percentage commission / fee	$A = (1 - \frac{P - P_m}{P_m})$	$A = P_m / P$
$P_m$ is the comparative offer of the most favourable comparative offer (excluding all Provisional and Prime Cost Sums and the associated VAT). $P$ is the comparative offer of the tender offer under consideration (excluding all Provisional and Prime Cost Sums and the associated VAT).			

### F.3.11.8 Scoring preferences

Confirm that tenderers are eligible for the preferences claimed in accordance with the provisions of the tender data and reject all claims for preferences where tenderers are not eligible for such preferences. Calculate the total number of tender evaluation points for preferences claimed in accordance with the provisions of the tender data.

### F.3.11.9 Scoring quality

Score each of the criteria and sub-criteria for quality in accordance with the provisions of the tender data.

Calculate the total number of tender evaluation points for quality using the following formula:

$$N_Q = W_2 \times S_0 / M_S$$

where:  $S_0$  is the score for quality allocated to the submission under consideration;  
 $M_S$  is the maximum possible score for quality in respect of a submission; and  
 $W_2$  is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data.

### F.3.12 Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer's information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

### **F.3.13 Acceptance of tender offer**

Accept the tender offer, if in the opinion of the employer, it does not present any unacceptable commercial risk and only if the tenderer:

- a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,
- b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,
- c) has the legal capacity to enter into the contract,
- d) is not insolvent, in receivership, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,
- e) complies with the legal requirements, if any, stated in the tender data, and
- f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

### **F.3.14 Prepare contract documents**

**F.3.14.1** If necessary, revise documents that shall form part of the contract and that were issued by the employer as part of the tender documents to take account of:

- a) addenda issued during the tender period,
- b) inclusion of some of the returnable documents, and
- c) other revisions agreed between the employer and the successful tenderer.

**F.3.14.2** Complete the schedule of deviations attached to the form of offer and acceptance, if any.

### **F.3.15 Complete adjudicator's contract**

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

### **F.3.16 Notice to unsuccessful tenderers**

**F.3.16.1** Notify the successful tenderer of the employer's acceptance of his tender offer by completing and returning one copy of the form of acceptance before the expiry of the validity period stated in the tender data, or agreed additional period.

**F.3.16.2** After the successful tenderer has been notified of the employer's acceptance of the tender, notify other tenderers that their tender offers have not been accepted.

### **F.3.17 Provide copies of the contracts**

Provide to the successful tenderer the number of copies stated in the tender data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

### **F.3.18 Provide written reasons for actions taken**

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

### **F.3.19 Delegation of authority**

*The Employer may delegate any power vested in him by virtue of these Conditions of Tender to an officer or employee of the Employer.*

## T1.3 TENDER DATA

The conditions of tender are the Standard Conditions of Tender as contained in Annex F of the CIDB Standard for Uniformity in Construction Procurement (May 2010) as published in Government Gazette No 33239, Board Notice 86 of 2010.

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 of inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross-referenced to the sub clause in the Standard Conditions of Tender to which it mainly applies.

Sub- clause	Data
F.1.1	The Employer is Metsimaholo Local Municipality.
F.1.2	<p>The Project Document issued by the Employer consists of the following:</p> <p><b>THE TENDER</b></p> <p>Part T1: Tendering procedures:</p> <p style="padding-left: 40px;">T1.1 Tender notice and invitation to tender</p> <p style="padding-left: 40px;">T1.2 Tender Data</p> <p>Part T2: Returnable documents</p> <p style="padding-left: 40px;">T2.1 Returnable Schedules required for Tender Evaluation</p> <p style="padding-left: 40px;">T2.2 Other Documents required for Tender Evaluation</p> <p style="padding-left: 40px;">T2.3 Returnable Schedules that will be incorporated into the Contract</p> <p><b>THE CONTRACT</b></p> <p>Part C1: Agreements and contract data</p> <p style="padding-left: 40px;">C1.1 Form of Offer and Acceptance</p> <p style="padding-left: 40px;">C1.2 Agreement in terms of Occupation Health and Safety Act</p> <p style="padding-left: 40px;">C1.3 Form of Guarantee</p> <p style="padding-left: 40px;">C.1.4 Contract Data</p> <p>Part C2: Pricing data</p> <p style="padding-left: 40px;">C2.1 Pricing instructions</p> <p style="padding-left: 40px;">C2.2 Bills of quantities</p> <p>Part C3: Scope of work</p> <p>Part C4: Site information</p> <p style="padding-left: 40px;">Drawings</p>

Tender data contd.

<b>Sub-clause</b>	<b>Data</b>
<b>F.1.3</b>	The Tender Document is available upon payment of <b>R1000.00</b> or can be downloaded free of charge from the e tender website.
<b>F.1.4</b>	<p>Name: <b>Pule Ramasimong Development Consultant</b></p> <p>Address: 06 De La Harpe Street, Kleksdorp, 2570</p> <p>Contact person: Pule Ramasimong</p> <p>Tel: +27 18 462 1575</p> <p>Cell: +27 83 745 8693</p> <p>E-mail: pule@prdcon.co.za</p>
	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 6 ME 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 an 6ME class of construction work, are eligible to have their tenders evaluated.
	<p>a) 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 6 ME 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 an 6ME class of construction work, are eligible to have their tenders evaluated.</p> <ol style="list-style-type: none"> <li>every member of the joint venture is registered with the CIDB;</li> <li>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 an 6ME class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.</li> </ol>

Tender data contd.

Sub-clause	Data
F.1.4	<p>b) The following tenderers who are registered with the CIDB, or are capable of being so registered prior to the evaluation of submissions, are eligible to have their tenders evaluated:</p> <ol style="list-style-type: none"> <li>1. contractors who have 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) of 25(7A) of the Construction Industry Development Regulations, for an 6 ME class of construction work; and <ul style="list-style-type: none"> <li>• the employer is satisfied that such a contractor has the potential to develop and qualify to be registered in that higher grade as determined in accordance with the provisions of the CIDB Specification for Social and Economic Deliverables in Construction Works Contracts; and</li> <li>• the employer agrees to provide the financial, management or other support that is considered appropriate to enable the contractor to successfully execute that contract.</li> </ul> </li> </ol> <p>c) No clarification meeting will be required.</p>
F.2.1	<p><b>Eligibility</b></p> <p>Only those tenderers who satisfy the following eligibility criteria and who provide the required evidence in their tender submissions are eligible to submit tenders and have their tenders evaluated:</p> <ol style="list-style-type: none"> <li>a) 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 6 ME 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 6ME class of construction work, are eligible to have their tenders evaluated.</li> </ol> <p>Joint ventures are eligible to submit tenders provided that:</p> <ul style="list-style-type: none"> <li>- every member of the joint venture is registered with the CIDB;</li> <li>- 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 an 6 ME class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.</li> </ul>



Tender data contd.

Sub-clause	Data
F.2.1	<p>b) The following tenderers who are registered with the CIDB, or are capable of being so registered prior to the evaluation of submissions, are eligible to have their tenders evaluated:</p> <p>I. contractors who have 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) of 25(7A) of the Construction Industry Development Regulations, for an 6 ME class of construction work; and</p> <ul style="list-style-type: none"> <li>the employer is satisfied that such a contractor has the potential to develop and qualify to be registered in that higher grade as determined in accordance with the provisions of the CIDB Specification for Social and Economic Deliverables in Construction Works Contracts; and</li> <li>the employer agrees to provide the financial, management or other support that is considered appropriate to enable the contractor to successfully execute that contract.</li> </ul> <p>c) No clarification meeting will be required.</p>
F.2.10	<p>a) The Valued Added Tax (VAT) rate shall be 15% or as otherwise provided for by legislation.</p> <p>b) The successful Tenderer shall be required to produce a VAT invoice that shall only be prepared once measurements and valuations for work done in terms of the contract offer have been agreed with the Employers agent and a certificate of payment issued.</p> <p>Payment of VAT to previously non-VAT vendors shall be processed from the month in which the Tenderers liability with the South African Revenue Services is effective.</p>
F.2.11	<p>A Tender offer shall not be considered if alterations have been made to the forms of tender data or contract data (unless such alterations have been duly authenticated by the Tenderer) or if any particulars required therein have not been completed in all respects.</p>
F.2.12	<p>No alternative tender offers will be considered</p>
F.2.13.1	<p>The Tenderer may not make an offer for only part of the services as defined in the Scope of Work.</p>

Tender data contd.

Sub-clause	Data																		
F.2.13.3	Parts of each tender offer communicated on paper shall be submitted as original, plus 0 copies. Under no circumstances whatsoever may the tender forms be retyped or redrafted.																		
F.2.13.5	The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package is: Municipal Building, 10 Fichardt Street, Sasolburg  Location of tender box: As mentioned on the tender advertisement																		
F.2.15	The closing time for submission of Tender Offers is: <b>11:00 Hrs on 22 May 2023</b> Telephonic, telegraphic, telex, electronic or emailed tenders will not be accepted.																		
F.2.16	The tender offer validity period is 90 days																		
F.2.23	<table border="1"> <thead> <tr> <th colspan="2">Returnables</th></tr> <tr> <th>RETURNABLES</th><th>NOTES</th></tr> </thead> <tbody> <tr> <td>Form of Offer</td><td> <ul style="list-style-type: none"> <li>Fully completed in handwriting and signed in black ink pen.</li> </ul> </td></tr> <tr> <td>A copy of a CSD summary report <b>OR</b> CSD number.</td><td> <ul style="list-style-type: none"> <li>CSD full report or summary report <b>OR</b> CSD number.</li> <li>Municipality may not make any award to a person whose tax matters are not complaint with SARS, please note that tax compliance will be verified before any award.</li> </ul> </td></tr> <tr> <td>Proof of company registration documents with the Director's details must be attached.</td><td> <ul style="list-style-type: none"> <li>The company registration documents must indicate the company and Director's details.</li> <li><b>In a case where the Director has changed names, proof of name change must be attached.</b></li> </ul> </td></tr> <tr> <td>Fully completed and signed MBD forms</td><td> <ul style="list-style-type: none"> <li><b>Fully Completed</b> and <b>signed</b> in handwriting and in black ink pen.</li> </ul> </td></tr> <tr> <td>Fully Completed and signed MBD 5 form for Bidders quoted over R10 Million <b>(Submitted Annual Financial Statements must clearly stating that they are Audited, Reviewed AFS won't be expected)</b></td><td> <ul style="list-style-type: none"> <li>If required by law submit Audited Financial Statements for the past 3 years or since the date of establishment if established within the past 3 years. Audited Financial Statements signed by the CA/RA/PR Accountant &amp; Director of the company <b>(MBD 5 form)</b></li> </ul> </td></tr> <tr> <td>Joint Venture Agreement <b>(Must indicate the lead partner, if the bidders grading is not the same the lead partner must have the higher grading)</b></td><td> <ul style="list-style-type: none"> <li>If applicable submit a complete and signed JV agreement.</li> <li>JV agreement stating who the lead partner is with the shared percentages.</li> <li>Note: JV agreement must be as per CIDB regulation of 2001 regulation 25 (5)(a),(b) and (6)</li> </ul> </td></tr> <tr> <td>Latest Municipal rates and taxes account for the <b>COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/ SHAREHODERS.</b></td><td> <ul style="list-style-type: none"> <li>Submit <b>strictly</b> April 2023 or May 2023 municipal rates &amp; taxes statement must be attached</li> <li>The submitted account must not be in arrears for more than 3 months.</li> <li>In a case of Rates &amp; Taxes Account being in a</li> </ul> </td></tr> </tbody> </table>	Returnables		RETURNABLES	NOTES	Form of Offer	<ul style="list-style-type: none"> <li>Fully completed in handwriting and signed in black ink pen.</li> </ul>	A copy of a CSD summary report <b>OR</b> CSD number.	<ul style="list-style-type: none"> <li>CSD full report or summary report <b>OR</b> CSD number.</li> <li>Municipality may not make any award to a person whose tax matters are not complaint with SARS, please note that tax compliance will be verified before any award.</li> </ul>	Proof of company registration documents with the Director's details must be attached.	<ul style="list-style-type: none"> <li>The company registration documents must indicate the company and Director's details.</li> <li><b>In a case where the Director has changed names, proof of name change must be attached.</b></li> </ul>	Fully completed and signed MBD forms	<ul style="list-style-type: none"> <li><b>Fully Completed</b> and <b>signed</b> in handwriting and in black ink pen.</li> </ul>	Fully Completed and signed MBD 5 form for Bidders quoted over R10 Million <b>(Submitted Annual Financial Statements must clearly stating that they are Audited, Reviewed AFS won't be expected)</b>	<ul style="list-style-type: none"> <li>If required by law submit Audited Financial Statements for the past 3 years or since the date of establishment if established within the past 3 years. Audited Financial Statements signed by the CA/RA/PR Accountant &amp; Director of the company <b>(MBD 5 form)</b></li> </ul>	Joint Venture Agreement <b>(Must indicate the lead partner, if the bidders grading is not the same the lead partner must have the higher grading)</b>	<ul style="list-style-type: none"> <li>If applicable submit a complete and signed JV agreement.</li> <li>JV agreement stating who the lead partner is with the shared percentages.</li> <li>Note: JV agreement must be as per CIDB regulation of 2001 regulation 25 (5)(a),(b) and (6)</li> </ul>	Latest Municipal rates and taxes account for the <b>COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/ SHAREHODERS.</b>	<ul style="list-style-type: none"> <li>Submit <b>strictly</b> April 2023 or May 2023 municipal rates &amp; taxes statement must be attached</li> <li>The submitted account must not be in arrears for more than 3 months.</li> <li>In a case of Rates &amp; Taxes Account being in a</li> </ul>
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Latest Municipal rates and taxes account for the <b>COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/ SHAREHODERS.</b>	<ul style="list-style-type: none"> <li>Submit <b>strictly</b> April 2023 or May 2023 municipal rates &amp; taxes statement must be attached</li> <li>The submitted account must not be in arrears for more than 3 months.</li> <li>In a case of Rates &amp; Taxes Account being in a</li> </ul>																		

		family member's name, <b>ONLY MUNICIPAL</b> Account where the address of the Account matches the address on the company registration documents will be accepted) if not in arrears for more than 3 months.
	In the event of a tenant renting a lease agreement <b>MUST</b> be attached for the <b>COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/ SHAREHOLDERS.</b>	<p>The lease agreement must include the following:</p> <ul style="list-style-type: none"> <li>• A valid copy of the lease agreement must be signed by (both Lessor and lessee).</li> <li>• The lease agreement must indicate dates of commencement and expiry or duration.</li> <li>• In a case where the lease agreement has expired and there is a clause indicating an automatic renewal the original lease agreement and a confirmation letter signed by Lessor must be attached.</li> <li>• In the occasion where the lease agreement has expired the original lease agreement <b>AND</b> extension must be attached with commencement and expiry dates or duration.</li> <li>• In a case of lease agreement being in a family member's name, <b>the lease agreement will be accepted</b> if the address on the lease matches the address on the company registration documents, <b>AND ONLY</b> if the lease agreement is valid.</li> </ul>
	<b><i>Note: If the company registration document's physical address on lease agreement or the municipal rates and taxes statement is the same as the Director's physical address, we will accept for both Company &amp; Director.</i></b>	
	Municipal rates and taxes for bidders who are from the rural areas for the <b>COMPANY AND DIRECTORS/TRUSTEES/ MEMBERS/ SHAREHOLDERS.</b>	<ul style="list-style-type: none"> <li>• In the event that the bidder is from the rural area a letter from the municipality that the area is not liable to pay municipal rates and taxes <b>OR</b> a signed letter from the chief indicating that the bidder is from that particular rural/tribal area.</li> </ul>
	CIDB Grading	<ul style="list-style-type: none"> <li>• Copy of Company CIDB Grading designation 6 ME or Higher</li> </ul>
	<b><u>Failure to comply with the above mentioned terms and conditions will deem your bid to be disqualified.</u></b>	
	<b><u>Bidders must keep a copy of a completed excel spreadsheet BOQ which may be required during the evaluation processes</u></b>	
	<b>Functionality Returnable</b> <ol style="list-style-type: none"> <li>1 Completion certificates of similar projects</li> <li>2 Company Equipment and registrations</li> <li>3 Key Staff / Personnel CV</li> <li>4 Financial Stability</li> </ol>	
<b>F.3.4</b>	<b>Opening of Tender Submissions</b>	

F.3.4.2	Tenders will be opened in public soon after closing time and recording of received documents but not later than 11:00 at the Tender office. Tenderers' names and total prices where practical will be read out														
F.3.5	A two-envelope procedure will not be followed														
F.3.8.2	The Employer shall reject a non-responsive tender offer and not allow it to be subsequently made responsive by correction or withdrawal of non-conforming deviation or reservation.														
F.3.11	<p>Tenders will be evaluated for Functionality. Tenderers who qualify for Functionality will be evaluated further for Price and Preference only. Points for Functionality will not contribute to further evaluation. Tenderers who do not qualify will not be evaluated further. Functionality will be scored out of 100 points. A Tenderer who scores less than 75 points will automatically be disqualified.</p> <p>The 80/20 evaluation criteria will be used where Price will be allocated 80 points and Preference will be scored out of 20 points.</p>														
F.3.11.1	The procedure for evaluation of responsive Tender Offers will be Method 4: Financial Offer, Functionality and Preferences. The responsive tender with the highest total points as defined below is the preferred tender														
F.3.11.2	<p>The financial offer will be scored in terms of Formula 2, Option 1 of Table F.1 of SANS 294:2004, which reads as follows:</p> $Nfo = W1 \times A$ <p>Where: Nfo = number of tender evaluation points awarded for the financial offer; W180 points for rand value less than R50 000 000;</p>														
F.3.11.3	<p>(a) Functionality will include the following:</p> <table border="1"> <thead> <tr> <th>Functionality</th><th>100 Points</th></tr> </thead> <tbody> <tr> <td>A. PROJECT EXPERIENCE AND PERFORMANCE</td><td>40</td></tr> <tr> <td>B. CONSTRUCTION PLANT</td><td>35</td></tr> <tr> <td>C. COMPANY KEY PERSONNEL</td><td>15</td></tr> <tr> <td>D. FINANCIAL STABILITY</td><td>10</td></tr> <tr> <td><b>Total</b></td><td><b>100</b></td></tr> <tr> <td><b>Minimum Threshold</b></td><td><b>75</b></td></tr> </tbody> </table>	Functionality	100 Points	A. PROJECT EXPERIENCE AND PERFORMANCE	40	B. CONSTRUCTION PLANT	35	C. COMPANY KEY PERSONNEL	15	D. FINANCIAL STABILITY	10	<b>Total</b>	<b>100</b>	<b>Minimum Threshold</b>	<b>75</b>
Functionality	100 Points														
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D. FINANCIAL STABILITY	10														
<b>Total</b>	<b>100</b>														
<b>Minimum Threshold</b>	<b>75</b>														

Criteria	Evaluation Indicators	Points Allocated	Weight
<b>A. PROJECT EXPERIENCE AND PERFORMANCE</b>			<b>MAX. 40 POINTS</b>
Company experience with regards to Water/ Sewer pump station projects	<p>Required submission to claim points:</p> <p>1. Project signed Appointment letter <b>(letter must be within the past 10 years and the value of the project must be above R6 000 000.00)</b> &amp; corresponding reference letter or Completion certificate/ letter as a main contractor.</p> <p>2. <b>A minimum of one project must be submitted from a State/Government/ SOE.</b> Non-submission of a state project will render any submission for experience as nonresponsive and Zero (00) point will be allocated for Company experience.</p>	10 points per project	<b>40</b>
<b>B. COMPANY EQUIPMENT</b>			<b>MAX. 35 POINTS</b>
Ownership of Mechanical/ Electrical workshop. For equipment to be hired attach rental confirmation	<p>Attach list confirming workshop equipped with the following tools and equipment, but is not limited to,</p> <p>3-phase electrical power, standby generator power, welding and lifting equipment.</p>	<p>15 points if owned</p> <p>10 points if rented</p>	<b>Max 15 Points</b>
OHS Compliance	Attach Letter/ Certificate confirming Workshop complies with OHS ACT	10 points	<b>Max 10 points</b>
4 Ton Truck or higher	Vehicle Registration Certificates in a company or directors name/ Signed letter from Rental Company on rental company letterhead	<p>10 points if owned</p> <p>05 point if rented</p>	<b>Max 10 Points</b>
<b>C. COMPANY KEY PERSONNEL</b>	<b>BIDDERS MUST SUBMIT CVS AND COPIES OF QUALIFICATIONS</b>		<b>MAX. 15 POINTS</b>
<b>Contracts Manager</b>	<p><b>Personnel 1-</b> is required to attach a National Diploma qualification or higher in the Built environment/ Project management and have project construction experience.</p> <p><b>NB: Submit CV and Copies of Qualifications</b></p>	10 years or more	<b>Max 5 points</b>
<b>Installation Manager</b>	<b>Personnel 2-</b> National Diploma (Mechanical or Electrical	10 years or more	<b>Max 4 points</b>

	Engineering) with minimum 10 years' experience <b>NB: Submit CV and Copies of Qualifications</b>		
<b>Mechanical Fitter</b>	Qualifications in Mechanical with minimum 8 years experience <b>NB: Submit CV and Copies of Qualifications</b>	8 Years or more	<b>Max 3 points</b>
<b>Electrician</b>	Minimum 8 years' experience in MV and LV, with <b>WIREMAN'S LICENSE</b> <b>NB: Submit CV and Copies of Qualifications</b>	8 Years or more	<b>Max 3 points</b>
<b>D. FINANCIAL STABILITY</b>			<b>MAX 10 POINTS</b>
Bank Rating Letter	Submit bank rating letter not older than 3 months of rating of A, B or C	10 Points	<b>Max 10 POINTS</b>
<b>MINIMUM SCORE</b>			<b>75</b>
<b>TOTAL</b>			<b>100</b>

*In order to qualify for the second round of evaluation the tenders must score a minimum of 70 functionality points.*

Bidders must complete the following table; points will be allocated for the below mentioned key personnel.

COMPANY PERSONNEL	KEY	NAME AND SURNAME
<b>Contracts Manager</b>		
<b>Installation Manager</b>		
<b>Mechanical Fitter</b>		
<b>Electrician</b>		

- Bidders must ensure that the same personnel are made available during site handover. If listed personnel are not available, they must be replaced by personnel with the same or higher qualification and experience.
- The recommended bidders company personnel and completed projects may be verified before appointments can be finalised. Misrepresentation of information will lead to the disqualification of the bidder.

**For points calculation, submit the following:**

<b>SPECIFIC GOALS</b>	<b>RETURNABLE</b>
BBBE Certificate or Affidavit	<p>Proof of B-BBEE status level of contributor</p> <ul style="list-style-type: none"><li>• The B-BBEE status level certificate issued by an authorized body or person</li><li>• A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice; or</li><li>• Any other requirement prescribed in terms of the Broad-Based Black Economic Empowerment Act.</li></ul>

**NB: THE MUNICIPALITY RESERVES THE RIGHT TO VERIFY THE SUBMITTED FUNCTIONALITY DOCUMENTS**

Tender data contd.

Sub- clause	Data
<b>F.3.13</b>	<b>Acceptance of Tender Offer</b>
F.3.13.1	<p>Tender offers will only be accepted if:</p> <ul style="list-style-type: none"> <li>a) the tenderer is registered on the Central Supplier Database (CSD) for the South African government (see <a href="https://secure.csd.gov.za/">https://secure.csd.gov.za/</a>)</li> <li>b) the tenderer is in good standing with SARS according to the Central Supplier Database;</li> <li>c) the tenderer submits 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</li> <li>d) the tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation;</li> <li>e) 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;</li> <li>f) the tenderer has not: <ul style="list-style-type: none"> <li>i. abused the Employer's Supply Chain Management System; or</li> <li>ii. failed to perform on any previous contract and has been given a written notice to this effect;</li> </ul> </li> <li>g) the tenderer has completed the Compulsory Declaration 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;</li> <li>h) the tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer;</li> <li>i) 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.</li> </ul>
F.3.17	The number of paper copies of signed contract to be provided by the Engineer is one (1).





# **METSIMAHOLO LOCAL MUNICIPALITY**

**BID NO: MLM 29/2022/23**

**UPGRADING OF SASOLBURG WATER PUMP STATION**

## **PART T2 : RETURNABLE DOCUMENTS**

**T2.1 LIST OF RETURNABLE DOCUMENTS**

The Tender Document must be submitted as a whole. All forms must be properly completed as required, and the document shall not be taken apart or altered in any way whatsoever.

All the certificates and forms to be provided with the tender are listed in the Tender Data under F2.23: Certificates, and under the returnable schedules and forms in T2.2 hereafter.

The list of returnable documents comprises the following:

1. All the certificates listed in the Tender Data under F2.23: Certificates;
2. All the returnable schedules and forms listed in T2.2.1: Returnable Schedules Required for Tender Evaluation Purposes;
3. All the returnable documents listed in T2.2.2: Preferential Procurement Schedules and Affidavits that will be incorporated into the Contract;
4. All the agreements and forms listed in T2.2.3: Forms to be completed by Successful Tenderer;
5. All the forms and agreements in the Contract Data in C1.2, where some of the forms (agreements) need to be completed only by successful Tenderer;
6. Pricing Data in C2.2: Bill of Quantities.

**T2.2        RETURNABLE SCHEDULES**

**NOTE:**        The Tenderer is required to complete each and every schedule and form listed above to the best of his ability, as the evaluation of tenders and the eventual contract will be based on the information provided by the Tenderer. Failure of a Tenderer to complete the schedules and forms to the satisfaction of the Employer will inevitably prejudice the tender and may lead to rejection on the grounds that the tender is not responsive.

**SCHEDULE A: MUNICIPAL BIDDING DOCUMENTS**

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**PART A**  
**INVITATION TO BID**

<b>YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE METSIMAHOLO LOCAL MUNICIPALITY</b>					
BID NUMBER	MLM 29/2022/23	CLOSING DATE:	22 May 2023	CLOSING TIME:	11H00
DESCRIPTION	UPGRADING OF SASOLBURG WATER PUMP STATION				
<b>THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT (MBD7).</b>					
BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN					
BOX SITUATED AT <i>(STREET ADDRESS)</i>					
<b>Metsimaholo Local Municipality</b>					
<b>No 10 Fichardt Street</b>					
<b>Finance Building</b>					
<b>Ground Floor</b>					
<b>SUPPLIER INFORMATION</b>					
NAME OF BIDDER					
POSTAL ADDRESS					
STREET ADDRESS					
TELEPHONE NUMBER	CODE		NUMBER		
CELLPHONE NUMBER					
FACSIMILE NUMBER	CODE		NUMBER		
E-MAIL ADDRESS					
VAT REGISTRATION NUMBER					
TAX COMPLIANCE STATUS				CSD No:	
	TCS PIN		OR		
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE	<input type="checkbox"/> Yes		B-BBEE STATUS LEVEL SWORN		<input type="checkbox"/> Yes
[TICK APPLICABLE BOX]					<input type="checkbox"/> No

	<input type="checkbox"/> No	AFFIDAVIT	
<b>[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES &amp; QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]</b>			
<b>ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES, ENCLOSE PROOF]	<b>ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED?</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES, ANSWER PART B:3 ]
<b>TOTAL NUMBER OF ITEMS OFFERED</b>		<b>N/A</b>	<b>N/A</b>
<b>SIGNATURE OF BIDDER</b>	..... ...	<b>DATE</b>	
<b>CAPACITY UNDER WHICH THIS BID IS SIGNED</b>			
<b>BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:</b>		<b>TECHNICAL INFORMATION MAY BE DIRECTED TO:</b>	
DEPARTMENT		CONTACT PERSON	<b>MR S BILA</b>
CONTACT PERSON		TELEPHONE NUMBER	<b>016 973 8487</b>
TELEPHONE NUMBER		FACSIMILE NUMBER	
FACSIMILE NUMBER		E-MAIL ADDRESS	sibusiso.bila@metsimaholo.gov.za
E-MAIL ADDRESS			

**MBD1**

**PART B**

**TERMS AND CONDITIONS FOR BIDDING**

<p><b>1. BID SUBMISSION:</b></p> <p>1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.</p> <p>1.2. <b>ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE</b></p> <p>1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.</p>
<p><b>2. TAX COMPLIANCE REQUIREMENTS</b></p> <p>2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.</p> <p>2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.</p> <p>2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.</p> <p>2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.</p> <p>2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.</p> <p>2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.</p> <p>2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.</p>
<p><b>3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS</b></p> <p>3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?  <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA? <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?  <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?  <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?  <input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p><b>IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.</b></p>

**NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.**

**NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.**

SIGNATURE OF BIDDER: .....

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

DATE: .....



**MBD 4**

**DECLARATION OF INTEREST**

1. No bid will be accepted from persons in the service of the state<sup>1</sup>.
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.

**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 or his or her representative: .....

3.2 Identity Number: .....

3.3 Position occupied in the Company (director, trustee, hareholder<sup>2</sup>): .....

3.4 Company Registration Number: .....

3.5 Tax Reference Number: .....

3.6 VAT Registration Number: .....

3.7 The names of all directors / trustees / shareholders / members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below.

3.8 Are you presently in the service of the state? YES / NO

3.8.1 If yes, furnish particulars. ....

.....

<sup>1</sup>MSCM Regulations: "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.

<sup>2</sup> Shareholder" means a person who owns shares in the company and is actively involved in the management of the company or business and exercises control over the company.

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

3.9.1 If yes, furnish particulars.....

.....

3.10 Do you have any relationship (family, friend, other) with persons?

in the service of the state and who may be involved with the evaluation and or  
adjudication of this bid? ..... YES / NO

3.10.1 If yes, furnish particulars.

.....

.....

3.11 Are you, aware of any relationship (family, friend, other) between any other bidder  
and any persons in the service of the state who may be involved with the evaluation  
and or adjudication of this bid.....YES / NO

3.11.1 If yes, furnish particulars

.....

.....

3.12 Are any of the company's directors, trustees, managers, principle shareholders or  
stakeholders in service of the state.....YES / NO

3.12.1 If yes, furnish particulars.

.....

.....

3.13 Are any spouse, child or parent of the company's directors, trustees, managers,  
principle shareholders or stakeholders in service of the state? ..... YES / NO

3.13.1 If yes, furnish particulars.

.....

.....

3.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether contract or not they are bidding for this..... YES / NO

3.14.1 If yes, furnish particulars:

.....  
 .....

Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	State Number	Employee

.....  
**Signature**

.....  
**Date**

.....  
**Capacity**

.....  
**Name of Bidder**

**MBD 5**

**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? **YES / NO**

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? **YES / NO**

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

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? **YES/NO**

3.1 If yes, furnish particulars

.....

.....

4. Will any portion of goods or services be sourced from outside 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 / NO**

- 4.1 If yes, furnish particulars

.....

.....

### **CERTIFICATION**

**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

## MBD 6.1

### PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

**NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022**

#### 1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

- 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 To be completed by the organ of state

- a) The applicable preference point system for this tender is the **80/20** preference point system.
- b) **80/20 preference point system** will be applicable in this tender. The lowest/ highest acceptable tender will be used to determine the accurate system once tenders are received.

1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:

- (a) Price; and
- (b) Specific Goals.

#### 1.4 To be completed by the organ of state:

The maximum points for this tender are allocated as follows:

	POINTS
PRICE	80
SPECIFIC GOALS	20
Total points for Price and SPECIFIC GOALS	100

- 1.5 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed.
- 1.6 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

## 2. DEFINITIONS

- (a) **“tender”** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation;
- (b) **“price”** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;
- (c) **“rand value”** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;
- (d) **“tender for income-generating contracts”** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and
- (e) **“the Act”** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

## 3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

### 3.1. POINTS AWARDED FOR PRICE

#### 3.1.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

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

$$P_s = 80 \left( 1 - \frac{P_t - P_{min}}{P_{min}} \right) \quad \text{or} \quad P_s = 90 \left( 1 - \frac{P_t - P_{min}}{P_{min}} \right)$$

Where

- $P_s$  = Points scored for price of tender under consideration
- $P_t$  = Price of tender under consideration
- $P_{min}$  = Price of lowest acceptable tender

### 3.2. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

#### 3.2.1. POINTS AWARDED FOR PRICE

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

$$\begin{array}{ccc}
 \mathbf{80/20} & \mathbf{or} & \mathbf{90/10} \\
 \\
 \mathbf{P_s = 80 \left( 1 + \frac{P_t - P_{max}}{P_{max}} \right)} & \mathbf{or} & \mathbf{P_s = 90 \left( 1 + \frac{P_t - P_{max}}{P_{max}} \right)}
 \end{array}$$

Where

- P<sub>s</sub> = Points scored for price of tender under consideration
- P<sub>t</sub> = Price of tender under consideration
- P<sub>max</sub> = Price of highest acceptable tender

### 4. POINTS AWARDED FOR SPECIFIC GOALS

- 4.1. In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:
- 4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—
  - (a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or
  - (b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,
 then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.



**Table 1: Specific goals for the tender and points claimed are indicated per the table below.**

**Note to tenderers: The tenderer must indicate how they claim points for each preference point system.)**

The specific goals allocated points in terms of this tender	Number of points allocated (80/20 system) (To be completed by the organ of state)	Number of points claimed (80/20 system) (To be completed by the tenderer)
BBBEE	80/20	

Black economic empowerment in terms of the B-BBEE

Points will be allocated in terms of the B-BBEE scorecard as follows: <b>B-BBEE Status Level of Contributor</b>	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	8	16
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

A bidder must submit proof of its B-BBEE status level contributor [scorecard] or B-BBEE sworn affidavit

#### **Proof of B-BBEE status level of contributor**

- the B-BBEE status level certificate issued by an authorised body or person
- a sworn affidavit as prescribed by the B-BBEE Codes of Good Practice; or
- any other requirement prescribed in terms of the Broad-Based Black Economic Empowerment Act.

## DECLARATION WITH REGARD TO COMPANY/FIRM

4.3. Name of company/firm.....

4.4. Company registration number: .....

4.5. TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One-person business/sole propriety
- ☐ Close corporation
- ☐ Public Company
- ☐ Personal Liability Company
- ☐ (Pty) Limited
- ☐ Non-Profit Company
- ☐ State Owned Company

[TICK APPLICABLE BOX]

4.6. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I 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 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;
- iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –

- (a) disqualify the person from the tendering 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 tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted 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, if deemed necessary.

.....  
**SIGNATURE(S) OF TENDERER(S)**

**SURNAME AND NAME:** .....

**DATE:** .....

**ADDRESS:** .....

.....

.....

.....

## MBD 8

### 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	<p>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?</p> <p>(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>audi alteram partem</i> rule was applied).</p> <p><b>The Database of Restricted Suppliers now resides on the National Treasury's website(<a href="http://www.treasury.gov.za">www.treasury.gov.za</a>) and can be accessed by clicking on its link at the bottom of the home page.</b></p>	<p>Yes</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>
4.1.1	<p>If so, furnish particulars:</p>		

4.2	<p>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)?</p> <p><b>The Register for Tender Defaulters can be accessed on the National Treasury's website (<a href="http://www.treasury.gov.za">www.treasury.gov.za</a>) by clicking on its link at the bottom of the home page.</b></p>	<p>Yes <input type="checkbox"/></p>	<p>No <input type="checkbox"/></p>
4.2.1	<p>If so, furnish particulars:</p>		
4.3	<p>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?</p>	<p>Yes <input type="checkbox"/></p>	<p>No <input type="checkbox"/></p>
4.3.1	<p>If so, furnish particulars:</p>		
<b>Item</b>	<b>Question</b>	<b>Yes</b>	<b>No</b>
4.4	<p>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?</p>	<p>Yes <input type="checkbox"/></p>	<p>No <input type="checkbox"/></p>
4.4.1	<p>If so, furnish particulars:</p>		
4.5	<p>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?</p>	<p>Yes <input type="checkbox"/></p>	<p>No <input type="checkbox"/></p>

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 bids<sup>1</sup> 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).<sup>2</sup> 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. takes all reasonable steps to prevent such abuse;
  - b. rejects 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 (MBD 9) must be completed and submitted with the bid:

<sup>1</sup> Includes price quotations, advertised competitive bids, limited bids and proposals.

<sup>2</sup> 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

**MBD 9**

**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



## MBD 9

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 consortium<sup>3</sup> 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 (market allocation)
  - (c) methods, factors or formulas used to calculate prices;
  - (d) the intention or decision to submit or not to submit, a bid;
  - (e) 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.

**<sup>3</sup> 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.**

.....  
Signature

.....  
Date

.....  
Position

.....  
Name of Bidder

**SCHEDULE B: RECORD OF ADDENDA TO TENDER DOCUMENTS**

I / We confirm that the following communication/s, amending the tender documents, received from the Employer or his representative before the closing date for submission of this tender offer, have been taken into account in this tender offer.

ADD. No	DATE	TITLE OR DETAILS
1		
2		
3		
4		
5		
6		
7		
8		

SIGNATURE: .....

## SCHEDULE C: CERTIFICATE OF AUTHORITY

Indicate the status of the Tenderer by ticking the appropriate box hereunder. The Tenderer must complete the certificate set out below for the relevant category.

(I) COMPANY	(II) CLOSE CORPORATION	(III) PARTNERSHIP	(IV) JOINT VENTURE	(V) SOLE PROPRIETOR

### (i) CERTIFICATE FOR COMPANY

I, ....., Managing Director of the Board of Directors of ....., hereby confirm that by resolution of the Board (copy attached) taken on ..... 20....., Mr/Ms ....., acting in the capacity of ....., was authorized to sign all documents in connection with this tender and any contract resulting from it, on behalf of the company.

**Managing Director:** .....

### (ii) CERTIFICATE FOR CLOSE CORPORATION

We, the undersigned, being the key members in the business trading as .....

.....  
hereby authorise Mr/Ms ....., acting in the capacity of ....., to sign all documents in connection with this tender ..... and any contract resulting from it, on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

**Note:** *This certificate is to be completed and signed by all of the key members upon whom rests the direction of the affairs of the Close Corporation as a whole.*

(iii) CERTIFICATE FOR PARTNERSHIP

We, the undersigned, being the key partners in the business trading as, .....

.....

hereby authorize Mr/Ms ..... acting in the capacity of  
....., to sign all documents in connection with this  
tender and any contract resulting from it, on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

**Note:** *This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.*

(iv) CERTIFICATE FOR JOINT VENTURE

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorize Mr/Ms  
....., authorized signatory of the company,  
....., acting in the capacity of lead partner, to sign all  
documents in connection with this tender offer and any contract resulting from it, on our behalf. This  
authorization is evidenced by the attached power of attorney signed by legally authorized signatories of  
all the partners to the Joint Venture.

NAME OF FIRM	ADDRESS	AUTHORIZING SIGNATURE, NAME AND CAPACITY
(Lead partner)		

**Note:** *This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.*

(v) CERTIFICATE FOR SOLE PROPRIETOR

I, ....., hereby confirm that I am the sole owner of the  
business trading as .....

Signature of Sole owner: .....

## REGISTRATION CERTIFICATE / AGREEMENT / ID DOCUMENT

***Important note to Tenderer:***

***Registration Certificates for Companies, Close Corporations and Partnerships, or Agreements and Powers of Attorney for Joint Ventures, or ID documents for Sole Proprietors, all as referred to in the foregoing forms and in T2.1, must form part of this submission either separately as separate bunch of supporting documents or at the end of the this bid document and must be properly referenced.***

## SCHEDULE D: 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. The questionnaires for the other partners must be inserted after this questionnaire.**

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

Section 2: VAT registration number: .....

Section 3: CIDB registration number:.....

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	Identity number*	Personal income tax number*

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

### Section 5: Particulars of companies and close corporations

Company registration number .....

Close corporation number .....

Tax reference number .....

### Section 6: Record of service of the state

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

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

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

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

Insert separate page if necessary

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

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

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

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

Name of spouse, child or parent	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		current	Within last 12 months

Insert separate page if necessary

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

- 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;
- 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;
- confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the Tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
- 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 \_\_\_\_\_





# **METSIMAHOLO LOCAL MUNICIPALITY**

**BID NO MLM 29/2022/23**

**UPGRADING OF SASOLBURG WATER PUMP STATION**

## **THE CONTRACT**

- PART C1 : AGREEMENTS AND CONTRACT DATA**
- PART C2 : PRICING DATA**
- PART C3 : SCOPE OF WORK**
- PART C4 : SITE INFORMATION**

## **PART C1: AGREEMENTS AND CONTRACT DATA**

## C1.1 FORM OF OFFER AND ACCEPTANCE

### OFFER

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

#### **BID NUMBER MLM 29/2022/23: UPGRADING OF SASOLBURG WATER PUMP STATION**

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

By the representative of the Tenderer, deemed to be duly authorized, 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:**

R .....

(In words ..... )

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.

**Signature:** (of person authorized to sign the tender): .....

**Name:** (of signatory in capitals): .....

**Capacity:** (of Signatory): .....

**Name of Tenderer:**  
(organisation): .....

Address:  
.....  
.....  
.....

Telephone number: ..... Fax number: .....

Cell phone number: .....

#### **Witness:**

**Signature:** .....

**Name:** (in capitals): .....

**Date:** .....

## ACCEPTANCE

By signing this part of the 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 as set out in the General and Special Conditions of Contract, and 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 1 Agreement and Contract Data, (which includes this Agreement)

Part 2 Pricing Data, including the Bill of Quantities

Part 3 Scope of Work

Part 4 Site Information

and the schedules, forms, drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C4 above.

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 authorized representatives of both parties.

The Tenderer shall deliver the Guarantee in terms of Clause 7 of the General Conditions of Contract 2004 within the period stated in the Contract Data, and he shall, immediately after 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 other bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data, within 14 days of the date on which 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 the fully completed original of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now Contractor) within five working 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.

**Signature:** .....

**Name:** .....

**Capacity:** Municipal Manager

**For:** METSIMAHOLO LOCAL MUNICIPALITY  
10 FICHARDT STREET, SASOLBURG, 4800

**Witness:** .....Name: .....

**Date:** .....

## SCHEDULE OF DEVIATIONS

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 Tender Data and the Conditions of Tender.

A Tenderer's covering letter will not necessarily be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid becomes the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here.

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.

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.

1. Subject: .....

Details: .....

2. Subject: .....

Details: .....

3. Subject: .....

Details: .....

4. Subject: .....

Details: .....

5. Subject: .....

Details: .....

6. 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:**

**Witness:..**

**Name:** .....

**Date:** .....

**FOR THE EMPLOYER:**

**Signature:** .....

**Name:** .....

**Capacity:** .....

**Witness:..**

**Name:** .....

**Date:** .....

## **C1.2 CONTRACT DATA**

## C1.2.1 CONDITIONS OF CONTRACT

### GENERAL CONDITIONS OF CONTRACT

This Contract will be based on the "General Conditions of Contract for Construction Works –3Ed Edition 2015, Third print", issued by the South African Institution of Civil Engineering. (Short title: "General Conditions of Contract 2015").

It is agreed that the only variations from the General Conditions of Contract 2015 are those set out hereafter under "Contract Specific Conditions".

### CONTRACT SPECIFIC CONDITIONS

#### 1. GENERAL

These Contract Specific Conditions (CSC) form an integral part of the Contract. The Contract Specific Conditions shall amplify, modify or supersede, as the case may be, the General Conditions of Contract 2015 to the extent specified below, and shall take precedence and shall govern.

The clauses of the Special Conditions hereafter are numbered "CSC" followed in each case by the number of the applicable clause or sub-clause in the General Conditions of Contract 2015, and the applicable heading, or (where a new special condition that has no relation to the existing clauses is introduced) by a number that follows after the last clause number in the General Conditions, and an appropriate heading.

#### 2. AMENDMENTS TO THE GENERAL CONDITIONS OF CONTRACT

##### CSC 1.1.25 DEFINITIONS, INTERPRETATIONS AND GENERAL PROVISIONS

*Add the following definitions:*

**"Labour-based Construction"** means the effective employment of appropriate technologies and labour-intensive construction methods on projects specifically designed to maximize the workforce with limited use of machines.

**"Community"** shall mean all persons deemed to reside in the immediate vicinity of the project.

**"Materials Provided by Client (MPC)"** shall mean the materials provided to the Contractor by the Client as set out later in the technical specifications, preamble to the BoQ and the BoQ.

##### CSC1.10 *Add the following Sub-Clause 1.10:*

Training will be provided by the employer through various training providers. Training will be theoretical and practical and will be conducted in class rooms and on site. No separate payment of any nature will be made to the contractor for attendance of training sessions by the contractor or the contractor's staff. The Construction Project Manager will program and manage all training to ensure limited disruption to the contractors and the overall project.

##### CSC 2.3 Specific Approval of the Employer required

**The Engineer has to obtain specific approval or consent from the Employer for the decisions in the following clauses:**

Clauses 6.2, 6.6, 3.2.1, 3.2.4, 4.7, 8.2.2.2, 6.3.2, 6.4.1.4, 5.8.1, 5.11.1, 5.11.3, 6.6.1, 2.2.3, 6.10, 6.11, 5.14.1, 5.16.1, 7.8.2.2, 5.7.3 and 7.8.2.

##### CSC 4.5 Compliance with applicable laws

##### CSC 4.5.2 Health and Safety



*Add the following:*

"The Occupational Health and Safety Act No. 85 and Amendment Act No 181 of 1993 and the Construction Regulations 2003 will in all respects be applicable to this contract."

#### **CSC 6.6.2 Payment to subcontractor**

*Add the following:*

"The above-mentioned procedure shall adhere to the **Preferential procurement regulations, 2011, pertaining to the Preferential Procurement Policy Framework Act, Act No. 5 of 2000, published by National Treasury on 1 December 2011** and to any prescribed regulations of the FREESTATE Provincial Government pertaining to procurement.

#### **CSC 40 PROGRESS OF THE WORKS**

*Add the following to Sub-Clause 40.1 :*

*Delete the last sentence and add the following:*

The contractor shall within 3 days of receipt of notification submit to the Engineer in writing the action(s) the contractor intends to take to expedite the rate of progress, and within 7 days of receipt of notification implement such steps. The contractor shall as part of his actions submit to the Engineer a detailed revised program accommodating the agreed steps to meet the Due Completion date.

#### **CSC 49.6 GUARANTEE IN LIEU OF RETENTION**

Add to all references to a "Bank" also "*or an accredited Insurance Company*"

*Add the following sub-clause*

#### **CSC 46: CONTRACT PRICE ADJUSTMENT SCHEDULE**

##### **Paragraph 1**

**Adjust the definitions of "L", "P", "M" and "F" in the 4th to the 7th subparagraphs with the following:**

Definition of "L":

*Insert "(Consumer Price Index)" after "P0141.1" in the third line*

*Insert "(Consumer Price Index and Percentage Change according to Urban Area)" after "Table 21" in the third line*

Definition of "P":

*Insert "(Production Price Index)" after "P0142.1" in the second line*

*Insert "(Production Price Index for Selected Materials, item 'Civil Engineering Plant')" after "Table 16" in the second line*

Definition of "M":

*Insert "(Production Price Index)" after "P0142.1" in the second line*

*Insert "(Production Price Index for Materials used in Certain Industries, item 'Civil Engineering Plant')" after "Table 15" in the second line*

Definition of "F": *Insert "(Production Price Index)" after "P0142.1" in the second line*

*Insert "(Production Price Index for Selected Materials, item Diesel Oil – Coast and Witwatersrand)" after "Table 16" in the second line*

*[Note: The indices are obtainable in [www.statssa.gov.za](http://www.statssa.gov.za). The latest indices for L (certain urban areas only), P, M and F, are more readily obtainable in [www.safcec.org.za](http://www.safcec.org.za) under "CPAF Indices"]*

**Paragraph 2 : Assessment of Amount subject to Adjustment:** *Add the following to the paragraph defining "E":*

"Where the amount is based on current costs de-escalated to the base month, or where daywork is calculated at rates tendered in a daywork schedule, the costs shall not be included in the value of "E".

## C1.2.2 CONTRACT SPECIFIC DATA

### General

This section contains the Contract Specifications Data referred to under Clause 1(1) of the General Conditions of Contract. Electrical and Mechanical Engineering Work (1985)

Should any requirements of the Specific Data conflict with the requirements of the General Conditions of Contract, then the requirements of the Specific Data shall prevail.

### Clause

#### 1 Definitions and interpretation

The “**Employer**” as defined under Clause 1(1) of the General Conditions shall be the METSIMAHOLO LOCAL MUNICIPALITY

MUNICIPAL BUILDING  
10 FICHARDT  
SASOLBURG  
4800

The “**Engineer**” as defined under Clause 1(1)(d) of the General Conditions shall be PULE RAMASIMONG DEVELOPMENT CONSULTANT.

06 De La Harpe Street  
Wilkoppies  
KLERKSDORP  
2570

Tel: + 27 18 462 1575

#### 4.1 Language

English

#### 4.2 Law

The governing law shall be that of the Republic of South Africa.

#### 5.13.1 Penalty for delay

The penalty applicable to and be applied to the completion of the Permanent Works as may be specified in terms of the requirements of the Contract Data and Scope of Work.

**R 5 000** per calendar day

Add the following at the end of Clause 5.13.1:

For non-compliance with submitting EPWP Reports And Labour sheets and ID's, the penalty will be as follows :

If the Contractor shall, in terms of Clause 4.10.2, fail to deliver the information (monthly EPWP Report and Labour sheets and ID's) timeously and adequately, the Contractor shall be liable to the Employer for the sum calculated by the Engineer as a penalty for every

calendar day which shall lapse between the monthly due date and the actual date of receiving such information.

The penalty shall be R 5000 per calendar day.

For non-compliance with OHS requirements, the penalty will be as follows :

Per occurrence – R 5000-00

Per day after the occurrence until satisfactory remedied in order to meet compliance - R 1000-00 per day

For non-compliance with Micro Enterprises (SMME) targets, the penalty will be as follows :

For non compliance with Local Labour targets, the penalty will be as follows :

Should the contractor fail to meet the minimum requirement of creating 10 employment opportunities on site for the duration of the contract, a penalty of 1,5 \* the value of the amount of employment that was not created, calculated at R200-00 per day per person, will be calculated and imposed. This amount will be deducted from the Contractor's payment certificate.

#### **7.1 Time for Completion**

..... \* (months). To be completed by Tenderer\*.

#### **9.1 Performance Board or Surety**

10 % of Contract amount.

#### **12.1 Programme**

The limit for submission of programme – one week.

#### **14.3 Electricity, water and gas**

Contractor to arrange and pay for.

#### **16.4 Limitation of liability**

Contractor's liability shall not exceed 100 % of the Contract Sum.

The contractor's liability shall expire on the date of issue of the Final Certificate.

#### **17.1 Insurance of Works**

Amount of insurance during Defects Liability Period: 100 % of the Contract Sum.

#### **17.2 Minimum Amount of Third Party Insurance**

R1 000 000 for any single claim, number of claims unlimited.

#### **20.6 Import permits and licenses**

The Contractor shall obtain and provide all necessary import permits and licenses required.

#### **31.1 Amount of Reduction for delay**

R5 000,00 per Calendar Day of delay.

#### **Maximum Reduction**

15 % of Contract Price.

**32.1 Bonus**

No bonus will apply.

**33.1 Defects liability period**

**12 Months** with use of works assumed 24 hours per day.

33.4 Maximum permitted extension: **12 months**

**34.1 Variations**

The total variation shall not be more than 20 % of the Contract Sum for any single Contract.

**37.3 Certificates and Payment**

Payment certificates shall be paid within 28 days of submission of the approved invoice by the engineer to the PMU. 10 % Retention retained up to Completion Certificate.

**Builders lien is not applicable in this contract.**

**40. Payment Conditions**

For Mechanical and Electrical Work ninety-five percent (95 %) of the quoted price will be payable on completion of delivery, installation and commissioning. A further 5 % will be payable at the end of the defect liability period. For Civil and Structural Work payment up to the Completion Certificate will be @ 90 % of tendered rates with 10 % retention held back, 5 % retention paid on issue of Completion Certificate and 5 % after the Defects Liability period.

**41.4 Payment in foreign currencies**

No payment will be made in foreign currencies.

**52.1 Changes in Cost and Legislation**

(Labour, Materials and Transport)

Prices to be fixed if award is made within 90 days of closing of date of tender.

**53.1 Customs and import duties**

All customs and import duties shall be paid for by the Contractor.

.....  
SIGNATURE

### C1.2.3 DATA PROVIDED BY THE TENDERER

Clause 6.8.3 of the GCC 2015:

Special materials	Unit on which variation will be determined *	Rate or price for the base Month (Excl. VAT) **
Not applicable		

**Notes:**

\* Indicate whether the material will be delivered in bulk or in containers.

\*\* The price for special materials is only the price for the material and does not include the cost of transport, labour or any other costs. When called upon to do so, the Tenderer shall substantiate the above prices with acceptable documentary evidence.

.....  
SIGNATURE

### C1.3 FORM OF GUARANTEE

**BID NO MLM 29/2022/23**

WHEREAS **METSIMAHOLO LOCAL MUNICIPALITY** (hereinafter referred to as the Employer") entered into, a Contract with:

.....  
(hereinafter called "the Contactor") on the ..... day of .....20.....,  
for **UPGRADING OF SASOLBURG WATER PUMP STATION.**

AND WHEREAS it is provided by such Contract that the Contractor shall provide the Employer with security by way of a guarantee for the due and faithful fulfilment of such Contract by the Contractor;

AND WHEREAS ..... has / have at the request of the Contractor, agreed to give such guarantee;

NOW THEREFORE WE ..... do hereby guarantee and bind ourselves jointly and severally as Guarantor and Co-Principal Debtors to the Employer under renunciation of the benefits of division and excussion for the due and faithful performance by the Contractor of all the terms and conditions of the said Contract, subject to the following conditions:

1. The Employer shall, without reference and / or notice to us, have complete liberty of action to act in any manner authorized and/or contemplated by the terms of the said Contract, and/or to agree to any modifications, variations, alterations, directions or extensions of the completion date of the works under the said Contract, and that its rights under this guarantee shall in no way be prejudiced nor our liability hereunder be affected by reason of any steps which the Employer may take under such Contract, or of any modification, variation, alterations of the completion date which the Employer may make, give, concede or agree to under the said Contract.
2. This guarantee shall be limited to the payment of a sum of money.
3. The Employer shall be entitled, without reference to us, to release any guarantee held by it, and to give time to or compound or make any other arrangement with the Contractor.
4. This guarantee shall remain in full force and effect until the issue of the Certificate of Completion in terms of the Contract, unless we are advised in writing by the Employer before the issue of the said Certificate of his intention to institute claims, and the particulars thereof, in which event this guarantee shall remain in full force and effect until all such claims have been paid or liquidated.
5. Our total liability hereunder shall not exceed the Guaranteed Sum of .....  
..... Rand (in words); R .....  
..... (in figures)
6. The Guarantor reserves the right to withdraw from this guarantee by depositing the Guaranteed Sum with the beneficiary, whereupon our liability hereunder shall cease.
7. We hereby choose our address for the serving of all notices for all purposes arising here from as

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



IN WITNESS WHEREOF this guarantee has been executed by us at .....  
on this ..... day of ..... 20 .....

Signature .....

Duly authorized to sign on behalf of .....

Address .....  
.....  
.....

As witnesses:

1 .....

2 .....



## C1.4 ADJUDICATOR'S AGREEMENT (Pro Forma only)

### To be entered into when required

This agreement is made on the ..... day of ..... between:

..... (name of company / organisation)

of .....

..... (address) and

..... (name of company / organization)

of .....

..... (address)

(the Parties) and

..... (name)

of .....

..... (address)

(the Adjudicator).

Disputes or differences may arise/have arisen\* between the Parties under a Contract dated ..... and known as. ....  
and these disputes or differences shall be/have been\* referred to adjudication in accordance with GCC 2004, Clause 58.3, and the Adjudicator may be / has been\* requested to act.

\* Delete as necessary

**IT IS NOW AGREED** as follows:

1. The adjudication shall be conducted in accordance with the rights and obligations of the Adjudicator and the Parties as set out in the Procedure as per Clause 58.3.1 of the GCC 04.
2. The Adjudicator hereby accepts the appointment and agrees to conduct the adjudication in accordance with the Procedure.
3. The Parties bind themselves jointly and severally to pay the Adjudicator's fees and expenses in accordance with the Procedure.
4. The Parties and the Adjudicator shall at all times maintain the confidentiality of the adjudication and shall endeavour to ensure that anyone acting on their behalf or through them will do likewise, save with the consent of the other Parties which consent shall not be unreasonably refused.
5. The Adjudicator shall inform the Parties if he intends to destroy the documents which have been sent to him in relation to the adjudication and he shall retain documents for a further period at the request of either Party.
6. The Adjudicator shall be paid at the hourly rate of R. .... in respect of all time spent upon, or in connection with, the adjudication including time spent travelling.
7. The Adjudicator shall be reimbursed in respect of all disbursements properly made including, but not restricted to:

- (a) Printing, reproduction and purchase of documents, drawings, maps, records and photographs.
- (b) Telegrams, telex, faxes, and telephone calls.
- (c) Postage and similar delivery charges.
- (d) Travelling, hotel expenses and other similar disbursements.
- (e) Room charges.
- (f) Charges for legal or technical advice obtained in accordance with the Procedure.

8. The Adjudicator shall be paid an appointment fee of R . . . . . This fee shall become payable in equal amounts by each Party within 14 days of the appointment of the Adjudicator, subject to an Invoice being provided. This fee will be deducted from the final statement of any sums which shall become payable under item 6 and/or item 7. If the final statement is less than the appointment fee the balance shall be refunded to the Parties.
9. The Adjudicator is/is not\* currently registered for VAT.
10. Where the Adjudicator is registered for VAT it shall be charged additionally in accordance with the rates current at the date of invoice.
11. All payments, other than the appointment fee (item 8) shall become due 7 days after receipt of invoice, thereafter interest shall be payable at 5% per annum above the Reserve Bank base rate for every day the amount remains outstanding.

SIGNED

by: \_\_\_\_\_

Name: .....

who warrants that he / she is  
duly authorized to sign for and  
on behalf of the first Party in the  
presence of

SIGNED

by: \_\_\_\_\_

Name: .....

who warrants that he / she is  
duly authorized to sign for and  
on behalf of the second Party in  
the presence of

SIGNED

by: \_\_\_\_\_

Name: .....

the Adjudicator in the presence  
of

Witness

\_\_\_\_\_

Name:

\_\_\_\_\_

Address:

\_\_\_\_\_

Date:

\_\_\_\_\_

Witness:

\_\_\_\_\_

Name

\_\_\_\_\_

Address:

\_\_\_\_\_

Date:

\_\_\_\_\_

Witness:

\_\_\_\_\_

Name:

\_\_\_\_\_

Address:

\_\_\_\_\_

Date:

\_\_\_\_\_

\* Delete as necessary



# **METSIMAHOLO LOCAL MUNICIPALITY**

**BID NO. MLM 29/2022/23**

**UPGRADING OF SASOLBURG WATER PUMP STATION**

## **PART C2: PRICING DATA**

## C2.1 PRICING INSTRUCTIONS – CIVIL AND STRUCTURAL, MECHANICAL AND ELECTRICAL WORK

1. Measurement and payment shall be in accordance to SANS 1200.
2. The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in the Bill of Quantities are as follows:

%	=	percent
h	=	hour
ha	=	hectare
kg	=	kilogram
kl	=	kiloliter
km	=	kilometer
km-pass	=	kilometer-pass
kPa	=	kilopascal
kW	=	kilowatt
ℓ	=	liter
m	=	meter
mm	=	millimeter
m <sup>2</sup>	=	square meter
m <sup>2</sup> -pass	=	square meter-pass
m <sup>3</sup>	=	cubic meter
m <sup>3</sup> .km	=	cubic meter-kilometer
MN	=	mega newton
MN.m	=	mega newton-meter
MPa	=	megapascal
No.	=	number
Prov sum	=	Provisional Sum
PC sum	=	Prime Cost Sum
R/only	=	rate only
Sum	=	lump sum
t	=	ton (1000 kg)
W/day	=	work day

3. For the purpose of the Bill of Quantities, the following words shall have the meanings hereby assigned to them:

Unit:	The unit of measurement for each item of work as defined in the SANS 1200
Quantity:	The number of units of work for each item.
Rate:	The agreed payment per unit of measurement.
Amount:	The product of the quantity and the agreed rate for an item.
Lump sum:	An agreed amount for an item, the extent of which is described in the Bill of Quantities but the quantity of work of which is not measured in any units.

4. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.
5. It will be assumed that prices included in the Bill of Quantities are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders. (Refer to [www.stanza.org.za](http://www.stanza.org.za) or [www.iso.org](http://www.iso.org) for information on standards).

6. The prices and rates in the Bill of Quantities are fully inclusive prices for the work described under the items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the Works described in accordance with the provisions of the Scope of Work, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the Contract Data, as well as overhead charges and profit. These prices will be used as a basis for assessment of payment for additional work that may have to be carried out.
7. Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amounts tendered under such items.
8. An item against which no price is entered will be considered to be covered by the other prices or rates in the Bill of Quantities. A single lump sum will apply should a number of items be grouped together for pricing purposes.
9. The quantities set out in the Bill of Quantities are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in the Bill of Quantities.
10. The short descriptions of the items of payment given in the Bill of Quantities are only for the purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work.
11. The item numbers appearing in the Bill of Quantities refer to the corresponding item numbers in the "SANS 1200 as prepared by South African National Roads Agency Limited" and additional Project Specifications as per the Scope of Work.
12. Those parts of the contract to be constructed using labour-intensive methods have been marked in the Bill of Quantities with the letters LI in a separate column filled in against every item so designated. The works, or parts of the Works so designated are to be constructed using labour-intensive methods only. The use of plant to provide such Works, other than plant specifically provided for in the Scope of Work, is a variation to the contract. The items marked with the letters LI are not necessarily an exhaustive list of all the activities which must be done by hand, and this clause does not over-ride any of the requirements in the generic labour intensive specification in the Scope of Works.
13. Payment for items, which are designated to be constructed labour-intensively (either in this schedule or in the Scope of Works), will not be made unless they are constructed using labour-intensive methods. Any unauthorized use of plant to carry out work which was to be done labour-intensively will not be condoned and any works so constructed will not be certified for payment.
14. The General Conditions of Contract, the Contract Data, the Scope of Works (including the Standardized Specifications) and the Drawings shall be read in conjunction with the Bill of Quantities.
15. Bill of Quantities should be filled out in black ink and no correctional fluid will be used. Tenders not adhering to these requirements will not be considered.

## **C2.3**

# **BILL OF QUANTITIES**

<b>Project no. : 29/2022/23</b>						
<b><u>METSIMAHOLO LOCAL MUNICIPALITY</u></b>						
<b><u>BILL A: UPGRADING OF SASOLBURG WATER PUMP STATION P &amp; G,s</u></b>						
<b>Item</b>	<b>Payment</b>	<b>Item Description</b>	<b>Unit</b>	<b>Quantities</b>	<b>Rate</b>	<b>Amount</b>
<b>Number</b>	<b>reference</b>					<b>Rands.cents</b>
	SANS	<b>Schedule 1</b>				
	1200	<b>Preliminary and general</b>				
1.1		<b>Fixed charge items</b>				
1.1.1	A8.3.1	Contractual requirements affecting the Contractor	sum	1		
	A8.3.2	<b><u>The Contractor to provide the following items or as amended in the Tender Document :</u></b>				
1.1.2	PSAB 3.1	Name board (2 number) as specified in the Tender Document	sum	1		
1.1.3	PSA8.3.2.1	Furnished office for the Engineer's use	sum	1		
	PSAB3.2					
1.1.4	PSAB 5.5	Survey assistant as & when required by the Engineer	sum	1		
1.1.5	PSAB 5.6	Survey equipments as & when required by the Engineer	sum	1		
1.1.6	PSAB4	Telephone facilities for the Engineer	Prov	1	26,000.00	26,000.00
1.1.7	PSAB5.7	Personnel computer & digital camera	sum	1		
1.1.8	A8.3.2.2a	Offices & storage facilities for the Contractor	sum	1		
1.1.9	A8.3.2.2b	Workshops for the Contractor as required by The Contract	sum	1		
1.1.10	A8.3.2.2d	Living accommodations for the Contractor's personnel	sum	1		
1.1.11	A8.3.2.2e	Ablution & latrine facilities for the Contractor's personnel	sum	1		
1.1.12	A8.3.2.2f	Supply tools & equipment's as required by The Contract	sum	1		
1.1.13	A8.3.2.2g	Water, electricity & communications as required by The Contract	sum	1		
		<b><u>Other obligations by the Contractor :</u></b>				
1.1.14	A8.3.2.2h	Deal with rain and/or ground water in all type of excavations on site	sum	1		
		as described in SANS 1 200 A section 5.5				
1.1.15	A8.8.1	Establish access road to site where it is necessary	sum	1		

1.1.16	A8.3.3	Fixed charge obligations by the Contractor	sum	1		
1.1.17	A8.3.4	Removal of site establishment	sum	1		
1.2		Time related items				
1.2.1	A8.4.1	Contractual requirements on a monthly bases affecting the Contractor	sum	1		
		<b><u>The Contractor to maintain the following items or as amended in the</u></b>				
		<b><u>Tender Document - for the duration of the Contract :</u></b>				
1.2.2	A8.4.2.2	All facilities on the site for the Engineer & for the Contractor	sum	1		
		<b><u>Other obligations by the Contractor on a time bases for the duration</u></b>				
		<b><u>of the Contract :</u></b>				
1.2.3	A8.4.3	<u>Full time supervision of the site</u> as specified in the Tender Document	sum	1		
1.2.4	A8.4.4	Company & head office administration costs pertaining to the Contract	sum	1		
1.2.5	A8.4.5	Other time related obligations by the Contractor	sum	1		
1.3		Provisional sums by the Engineer				
1.3.1	PSA5.10.1	Provisional sum for various tests requested by the Engineer	Prov	1	200,000.00	200,000.00
1.3.2	A8.8.2	Provision for traffic control as requested by the Engineer	Prov	1	30,000.00	30,000.00
1.3.3	PSA5.10.1	Provisional sum for community involvement/CLO payment	Prov	1	120,000.00	120,000.00
13.4	PSA5.10.1	Provisional sum for Training of two (2) Students	Prov	1	100,000.00	100,000.00
1.3.5	A8.5b	Contractor's overhead and profit on Item 1.3.3	%			
<b>SUB-TOTAL BILL A TO MAIN SUMMARY PAGE</b>						



<b>BILL B: MECHANICAL</b>						
<b>Ite</b>	<b>Pay Ref.</b>	<b>Description</b>	<b>Unit</b>	<b>Qt</b>	<b>Rate</b>	<b>Amount</b>
1.		<b>Distribution Pump Sets (Option 1)</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
1.1		Design & G.A. Drawings.	Sum	1		
1.2		Supply/ Manufacture Of Pump Sets Complete.	Each	4		
1.3		Supply/ Manufacture of Pipe Work Sets Complete.	Each	4		
1.4		Install Pump Sets Complete.	Each	4		
1.5		Install Pipe Work Sets Complete.	Each	4		
1.6		Commission Pump & Pipe Work Sets.	Each	4		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				
2.		<b>Distribution Pump Sets (Option 2)</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
2.1		Design & G.A. Drawings.	Sum	1		Rate Only
2.2		Supply/ Manufacture of Pump Sets Complete.	Each	4		Rate Only
2.3		Supply/ Manufacture of Pipe Work Sets Complete.	Each	4		Rate Only

Ite	Pay Ref.	Description	Unit	Qt	Rate	Amount
2.4		Install Pump Sets Complete.	Each	4		Rate Only
2.5		Install Pipe Work Sets Complete.	Each	4		Rate Only
2.6		Commission Pump & Pipe Work Sets.	Each	4		Rate Only
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				
<b>3.</b>		<b>Suction Actuated Isolation Valves</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
3.1		Design & G.A. Drawings.	Sum	1		
3.2		Supply/ Manufacture of Metal Seat Gate Valves Complete.	Each	4		
3.3		Supply/ Manufacture of Valve Actuator Complete.	Each	4		
3.4		Install Valves Complete.	Each	4		
3.5		Install Actuators Complete.	Each	4		
3.6		Commission Actuated Valves.	Each	4		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				

<b>4.</b>		<b>Delivery Actuated Isolation Valves</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
<b>Ite</b>	<b>Pay Ref.</b>	<b>Description</b>	<b>Unit</b>	<b>Qt</b>	<b>Rate</b>	<b>Amount</b>
4.1		Design & G.A. Drawings.	Sum	1		
4.2		Supply/ Manufacture of Metal Seat Gate Valves Complete.	Each	4		
4.3		Supply/ Manufacture of Valve Actuator Complete.	Each	4		
4.4		Install Valves Complete.	Each	4		
4.5		Install Actuators Complete.	Each	4		
4.6		Commission Actuated Valves.	Each	4		
		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>5.</b>		<b>Delivery Check Valves</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
5.1		Design & G.A. Drawings.	Sum	1		
5.2		Supply/ Manufacture of Nozzle Check Valves Complete.	Each	4		
5.3		Install Valves Complete.	Each	4		
5.4		Commission Valves.	Each	4		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				

Ite	Pay Ref.	Description	Unit	Qt	Rate	Amount
<b>6.</b>		<b>Drainage Pump Sets</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
6.1		Design & G.A. Drawings.	Sum	1		
6.2		Supply/ Manufacture of Pump Sets Complete.	Each	2		
6.3		Supply/ Manufacture of Pipe Work Sets Complete.	Sum	1		
6.4		Install Pump Sets Complete.	Each	2		
6.5		Install Pipe Work Sets Complete.	Sum	1		
6.6		Commission Pump & Pipe Work Sets.	Sum	1		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				
<b>7.</b>		<b>Ventilation</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
7.1		Design & G.A. Drawings.	Sum	1		
7.2		Supply/ Manufacture of Ventilation System Complete.	Sum	1		
7.3		Install of Ventilation System Complete.	Sum	1		
7.4		Commission of Ventilation System Complete.	Sum	1		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				

<b>8.</b>		<b>Lifting Equipment</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
<b>lte</b>	<b>Pay Ref.</b>	<b>Description</b>	<b>Unit</b>	<b>Qt</b>	<b>Rate</b>	<b>Amount</b>
8.1		Design & G.A. Drawings.	Sum	1		
8.2		Supply/ Manufacture of Electrical Hoists Complete.	Each	2		
8.3		Install of Electrical Hoists Complete.	Each	2		
8.4		Commission of Electrical Hoists Complete.	Each	2		
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				
<b>9.</b>		<b>Inflow Meter</b>				
! The Contractor must include for the following; Design, G.A. drawings, manufacture/supply, deliver/store, install, commission, up-hold during the 12-month defects liability period and training, of the equipment listed below. All work and equipment must comply with the specifications forming part of the contract document.						
9.1		Design & G.A. Drawings.	Sum	1		
9.2		Supply/ Manufacture of Electromagnetic Flow Meter Complete.	Each	1		
9.3		Install of Electromagnetic Flow Meter Complete.	Each	1		
9.4		Commission of Electromagnetic Flow Meter Complete.	Each	1		
9.5		Provisional sum for modification to existing pipe work to fit flow meter.	PC Sum	1	550,000.00	550,000.00

Ite	Pay Ref.	Description	Unit	Qt	Rate	Amount
9.6		Provisional sum for modification to existing chamber to fit flow meter.	PC Sum	1	150,000.00	150,000.00
		<b>TOTAL CARRIED TO MECHANICAL SUMMARY PAGE</b>				

<b>BILL B: Total Summary Page for Mechanical Works</b>			
1	Distribution Pump Sets (Option 1)		R
2	Distribution Pump Sets (Option 2)		R
3	Suction Actuated Isolation Valves		R
4	Delivery Actuated Isolation Valves		R
5	Delivery Check Valves		R
6	Drainage Pump Sets		R
7	Ventilation		R
8	Lifting Equipment		R
9	Inflow Meter		
<b>SUB-TOTAL BILL B TO MAIN SUMMARY PAGE</b>			R

BILL C: ELECTRICAL EQUIPMENT						
Ite	Pay Ref.	Description	Un	Qt	Rate	Amount
1		<b>Medium Voltage Switchgear</b>				
1.1	EPS-01	Remove existing <b>Medium Voltage Switchgear</b> , as specified in the project specification.	eac	2		
	!	<i>The item will be certified for payment when the drawings is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered or manufactured without approval of the drawings.</i>				
1.2	EPS-01	Design and complete panel Layout Drawings and line -diagrams for the <b>Medium Voltage Switchgear</b> , to submit for the approval of the engineer, as specified in the project specification.	eac	2		
	!	<i>The item will be certified for payment when the drawings is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered or manufactured without approval of the drawings.</i>				
1.3	EPS-01	Supply, manufacture, deliver an safe keeping of the <b>Medium Voltage Switchgear</b> and all ancillary equipment, as specified in the project specification and approved drawings and diagrams.	eac	2		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been factory tested and inspected by the engineer.</i>				
1.4	EPS-01	Install and terminate the <b>Medium Voltage Switchgear</b> with all the ancillary equipment, as specified in the project specification.	eac	2		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be</i>				

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2.3	EPS-02	Supply, manufacture, deliver and safe keeping of the <b>500kVA 11kV/400V Transformer</b> and all ancillary equipment, as specified in the project specification and approved drawings and diagrams.	eac	2		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been factory tested and inspected by the engineer.</i>				
2.4	EPS-02	Install and terminate the <b>500kVA 11kV/400V Transformer</b> with all the ancillary equipment, as specified in the project specification.	eac	2		
	!	<i>The equipment must be installed And terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
2.5	EPS-02	Commission the <b>500kVA 11kV/400V Transformer</b> and Ancillary equipment, as specified in the project specification.	eac	2		
	!	<i>The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has been approved and accepted by the engineer.</i>				
2.6	EPS-02	Training of the plant operators on the <b>500kVA 11kV/400V</b>	sum	1		

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BILL C: ELECTRICAL EQUIPMENT						
It	Pay Ref.	Description	Un	Qt	Rate	Amount
3		<b>Main MCC</b>				
3.1	EPS-03	Remove existing <b>Main MCC</b> , as specified in the project specification.	sum	1		
	!	<i>The item will be certified for payment when the drawings is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered or manufactured without approval of the drawings.</i>				
3.2	EPS-03	Design and complete panel layout drawings and line -diagrams for the <b>Main MCC</b> , to submit for the approval of the engineer, as specified in the project specification.	eac	2		
	!	<i>The item will be certified for payment when the drawings is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered or manufactured without approval of the drawings.</i>				
3.3	EPS-03	Supply, manufacture, deliver and Safe keeping of the <b>Main MCC</b> and all ancillary equipment, as specified in the project specification and approved drawings and diagrams.	eac	2		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been factory tested and inspected by the engineer.</i>				
3.4	EPS-03	Install and terminate the <b>Main MCC</b> with all the ancillary equipment, as specified in the project specification.	eac	2		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				

3.5	EPS-03	Commission the <b>Main MCC</b> and Ancillary equipment, as specified in the project specification.	eac	2		
	!	<i>The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has been approved and accepted by the engineer.</i>				
3.6	EPS-03	Training of the plant operators on the <b>Main MCC</b> and accessories.	sum	1		
	!	<i>The contractor must facilitate a Training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.</i>				
3.7	EPS-03	Design and complete panel layout drawings and line -diagrams for the <b>LV Bus Coupler</b> , to submit for the approval of the engineer, as specified in the project specification.	sum	1		
	!	<i>The item will be certified for payment when the drawings is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered or manufactured without approval of the drawings.</i>				
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		TOTAL	CARRIED TO			
			SUMMARY PAGE			

## BILL C: ELECTRICAL EQUIPMENT

Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
4		<b>Electrical Cables</b>				
		Allow for all the costs for the design, manufacture, testing, factory acceptance, supply, delivery, offloading and safe keeping, installation, testing and commissioning, of the following:				
		Supply Cu PVC/SWA/PVC 600/1000V multicore cable with stranded conductors.				
4.1	EPS-04	2.5mm <sup>2</sup> x 4-core	m	10		
4.2	EPS-04	4mm <sup>2</sup> x 4-core	m	1		Rate only
4.3	EPS-04	6mm <sup>2</sup> x 4-core	m	10		
4.4	EPS-04	10mm <sup>2</sup> x 4-core	m	1		Rate only
4.5	EPS-04	16mm <sup>2</sup> x 4-core	m	1		Rate only
4.6	EPS-04	25mm <sup>2</sup> x 4-core	m	10		
4.7	EPS-04	35mm <sup>2</sup> x 4-core	m	1		Rate only
4.8	EPS-04	50mm <sup>2</sup> x 4-core	m	1		Rate only
4.9	EPS-04	70mm <sup>2</sup> x 4-core	m	40		
4.10	EPS-04	95mm <sup>2</sup> x 4-core	m	1		Rate only
4.11	EPS-04	120mm <sup>2</sup> x 4-core	m	1		Rate only

4.12	EPS-04	150mm <sup>2</sup> x 4-core	m	1		Rate only
4.13	EPS-04	185mm <sup>2</sup> x 4-core	m	1		Rate only
4.14	EPS-04	240mm <sup>2</sup> x 4-core	m	1		Rate only
4.15	EPS-04	300mm <sup>2</sup> x 4-core	m	1		Rate only
4.16	EPS-04	630mm <sup>2</sup> x 1-core	m	80		
		Supply Cu 6.35/11kV PILC screened cable				
4.17	EPS-04	25mm <sup>2</sup> x 3-core	m	10		
		-				
		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				

## BILL C: ELECTRICAL EQUIPMENT

Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
5		<b>Electrical Cables: Terminations</b>				
		Allow for all the costs for the design, manufacture, testing, factory acceptance, supply, delivery, offloading and safe keeping, installation, testing and commissioning, of the following:				
		Supply of Cable terminations for Cu PVC/SWA/PVC Sheathed 600/1000V multicore cables, complete, including gland shroud, lugs, number tags, etc and connection.				
5.1	EPS-05	2.5mm <sup>2</sup> x 4 core	eac	10		
5.2	EPS-05	4mm <sup>2</sup> x 4 core	eac	1		Rate only

5.3	EPS-05	6mm <sup>2</sup> x 4 core	eac	6		
5.4	EPS-05	10mm <sup>2</sup> x 4 core	eac	1		Rate only
5.5	EPS-05	16mm <sup>2</sup> x 4 core	eac	1		Rate only
5.6	EPS-05	25mm <sup>2</sup> x 4 core	eac	4		
5.7	EPS-05	35mm <sup>2</sup> x 4 core	eac	1		Rate only
5.8	EPS-05	50mm <sup>2</sup> x 4 core	eac	1		Rate only
5.9	EPS-05	70mm <sup>2</sup> x 4 core	eac	20		
5.10	EPS-05	95mm <sup>2</sup> x 4 core	eac	1		Rate only
5.11	EPS-05	120mm <sup>2</sup> x 4 core	eac	1		Rate only
5.12	EPS-05	150mm <sup>2</sup> x 4 core	eac	1		Rate only
5.13	EPS-05	185mm <sup>2</sup> x 4 core	eac	1		Rate only
5.14	EPS-05	240mm <sup>2</sup> x 4 core	eac	1		Rate only
5.15	EPS-05	300mm <sup>2</sup> x 4 core	eac	1		Rate only
5.16	EPS-05	630mm <sup>2</sup> x 1 core	eac	20		
		Supply of Cable terminations for Cu 6.35/11kV PILC screened cables, complete, including gland shroud, lugs, number tags, etc and connection.				
5.17	EPS-05	25mm <sup>2</sup> x 3-core	m	4		
		-				
		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				



BILL C: ELECTRICAL EQUIPMENT						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
6		<b>Electrical Cables: BCEW</b>				
		Allow for all the costs for the design, manufacture, testing, factory acceptance, supply, delivery, offloading and safe keeping, installation, testing and commissioning, of the following:				
		Supply of Bare Copper Earth Wire including terminations				
6.1	EPS-06	2.5mm <sup>2</sup>	m	10		
6.2	EPS-06	4mm <sup>2</sup>	m	10		
6.3	EPS-06	6mm <sup>2</sup>	m	1		Rate only
6.4	EPS-06	10mm <sup>2</sup>	m	1		Rate only
6.5	EPS-06	16mm <sup>2</sup>	m	10		
6.6	EPS-06	25mm <sup>2</sup>	m	1		Rate only
6.7	EPS-06	35mm <sup>2</sup>	m	40		
6.8	EPS-06	50mm <sup>2</sup>	m	1		Rate only
6.9	EPS-06	70mm <sup>2</sup>	m	1		Rate only
6.10	EPS-06	95mm <sup>2</sup>	m	1		Rate only
6.11	EPS-06	120mm <sup>2</sup>	m	1		Rate only
6.12	EPS-06	150mm <sup>2</sup>	m	1		Rate only
6.13	EPS-06	185mm <sup>2</sup>	m	1		Rate only
6.14	EPS-06	240mm <sup>2</sup>	m	1		Rate only
6.15	EPS-06	300mm <sup>2</sup>	m	20		

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		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>7</b>		<b>Excavations</b>				
		Excavate and set excavated material aside for reuse as filling for cable or sleeve trench not exceeding 1m deep				
7.1	EPS-07	In earth	m³	25		
7.2	EPS-07	In soft rock	m³	5		
7.3	EPS-07	In rock	m³	1		
7.4	EPS-07	Bedding material imported from off-site source (provisional)	m³	50		
7.5	EPS-07	Danger tape - 400mm wide overlapping	m	82		
7.6	EPS-07	Cable marker with engraved steel plate	eac	17		
7.7	EPS-07	Bonding of all extraneous conductive parts.	sum	1		
7.8	EPS-07	Labelling of Cables and Equipment	sum	1		
7.9	EPS-07	Testing and Commissioning	sum	1		

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		TOTAL CARRIED TO SUMMARY PAGE				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
8		Electrical Cables Supports				
8.1	EPS-08	Compile a cable route plan, electrical motor and cable schedule for all the <b>Electrical cables Supports</b> , to submit for the approval of the engineer, as specified in the project specification.	sum	1		
	!	The item will be certified for payment when the drawings & schedules is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered without approval of the drawings & schedules..				
8.2	EPS-08	Supply, deliver and safe keeping of the <b>Electrical cables Supports</b> and all ancillary equipment, as specified in the project specification and approved drawings and schedules.	sum	1		
	!	The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the				

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		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>9</b>		<b>Control and Instrumentation cables</b>				
9.1	EPS-09	Compile a cable route plan, electrical motor and cable schedule for all the <b>Control and Instrumentation cables</b> , to submit for the approval of the engineer, as specified in the project specification.	sum	1		
	!	<i>The item will be certified for payment when the drawings &amp; schedules is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered without approval of the drawings &amp; schedules..</i>				
9.2	EPS-09	Supply, deliver and safe keeping of the <b>Control and Instrumentation cables</b> and all ancillary equipment, as specified in the project specification and approved drawings and schedules.	sum	1		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
9.3	EPS-09	Install and terminate the <b>Control and Instrumentation cables</b> with all the ancillary equipment, as specified in the project specification.	sum	1		

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		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>10</b>		<b>Small Power &amp; Lighting</b>				
10.1	EPS-010	Compile a schedule for the replacement of all the <b>Small Power &amp; Lighting</b> , to submit for the approval of the engineer, as specified in the project specification.	sum	1		
	!	<i>The item will be certified for payment when the drawings &amp; schedules is approved by the engineer. The contractor will be liable for any costs incurred for equipment ordered without approval of the drawings &amp; schedules..</i>				
10.2	EPS-010	Supply, deliver and safe keeping of the <b>Small Power &amp; Lighting</b> and all ancillary equipment, as specified in the project specification and approved drawings and schedules.	sum	1		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
10.3	EPS-010	Install and terminate the <b>Small Power &amp; Lighting</b> with all the ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
10.4	EPS-010	Commission the <b>Small Power &amp; Lighting</b> and ancillary equipment, as specified in the project specification.	sum	1		

	!	The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has been approved and accepted by the engineer.				
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		TOTAL CARRIED TO SUMMARY PAGE				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
11		Programmable Logic Controllers				
11.1	EPS-011	Supply, deliver and safe keeping of the <b>Programmable Logic Controllers</b> and all ancillary equipment including RIO and HMI, as specified in the project	sum	1		



		specification.				
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
11.2	EPS-011	Program & Install the <b>Programmable Logic Controllers</b> with all the ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
11.3	EPS-011	Commission the <b>Programmable Logic Controllers</b> and ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has been approved and accepted by the engineer.</i>				
11.4	EPS-011	Training of the plant operators on the <b>Programmable Logic Controllers</b> and accessories.	sum	1		

	!	<i>The contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.</i>				
		General PLC Components as in the PLCs above				
11.5	EPS-011	8 Analogue Inputs Card	eac	1		Rate only
11.6	EPS-011	8 Analogue Outputs Card	eac	1		Rate only
11.7	EPS-011	16 Digital Inputs Card	eac	1		Rate only
11.8	EPS-011	16 Digital Outputs Card	eac	1		Rate only
11.9	EPS-011	Fieldbus interface	eac	1		Rate only
11.1	EPS-011	ASI bus interface	eac	1		Rate only
11.1	EPS-011	2 port Ethernet Card	eac	1		Rate only
		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>12</b>		<b>Telemetry</b>				
12.1	EPS-012	Supply, deliver and safe keeping of the <b>Telemetry</b> and all ancillary equipment, as specified in the project specification.	sum	1		

	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
12.2	EPS-012	Install and terminate the <b>Telemetry</b> with all the ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
12.3	EPS-012	Commission the <b>Telemetry</b> and ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has been approved and accepted by the engineer.</i>				
12.4	EPS-012	Training of the plant operators on the <b>Telemetry</b> and accessories.	sum	1		
	!	<i>The contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the</i>				

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		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>14</b>		<b>Flow Meter</b>				
14.1	EPS-014	Supply, deliver and safe keeping of the <b>Flow Meter</b> and all ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
14.2	EPS-014	Install and terminate the <b>Flow Meter</b> with all the ancillary equipment, as specified in the project specification.	sum	1		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
14.3	EPS-014	Commission the <b>Flow Meter</b> and ancillary equipment, as specified in the project specification.	sum	1		

[illegible]

		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
<b>15</b>		<b>Ultrasonic Level Meters</b>				
15.1	EPS-015	Supply, deliver and safe keeping of the <b>Level Metes</b> and all ancillary equipment, as specified in the project specification.	eac	1		
	!	<i>The equipment must be stored on-site, or an extended site, accepted by the client and the engineer. The item will be certified for payment when the equipment has been inspected by the engineer.</i>				
15.2	EPS-015	Install and terminate the <b>Level Metes</b> with all the ancillary equipment, as specified in the project specification.	eac	1		
	!	<i>The equipment must be installed and terminated if and when the civil and mechanical works has been completed and the contractor has permission from the engineer. The item will be certified for payment when the equipment has been inspected, after installation on-site, by the engineer.</i>				
15.3	EPS-015	Commission the <b>Level Metes</b> and ancillary equipment, as specified in the project specification.	eac	1		
	!	<i>The equipment will be commissioned if and when the equipment can be put in operation for their intended use. The equipment will be dry commissioned before wet commissioning can commence. As part of the commissioning, the contractor shall submit his/her operation and maintenance manual for approval. The item will be certified for payment when the equipment has been wet commissioned, the equipment can operate and perform as per the project specification and their intended use and the operation and maintenance manual has</i>				



		been approved and accepted by the engineer.				
15.4	EPS-015	Training of the plant operators on the <b>Level Metes</b> and accessories.	sum	1		
	!	The contractor must facilitate a training session to the necessary plant personnel to instruct and explain the operation and maintenance of the equipment to them. The operation and maintenance manual will serve as the study material of this training session. The item will be certified for payment when the engineer has proof that this training was done.				
		-				
		TOTAL CARRIED TO SUMMARY PAGE				
<b>BILL C: ELECTRICAL EQUIPMENT</b>						
Item	Pay Ref.	Description	Uni	Qt	Rate	Amount
16		Provisional Amounts				

[illegible]

		-				
		<b>TOTAL CARRIED TO SUMMARY PAGE</b>				

METSIMAHOLO LOCAL MUNICIPALITY		
UPGRADING OF SASOLBURG WATER PUMP STATION		
REFURBISHMENT of ELECTRICAL WORKS		
Contract No. MLM 29/2022/23	6 MARCH 2023	
ELECTRICAL BILL OF QUANTITIES		
ITEM	DESCRIPTION	Amount
BILL C: ELECTRICAL EQUIPMENT		
1.	Medium Voltage Switchgear	R
2.	500kVA 11kV/400V Transformer	R
3.	Main MCC	R
4.	Electrical Cables	R
5.	Electrical Cables: Terminations	R
6.	Electrical Cables: BCEW	R
7.	Excavations	R
8.	Electrical Cables Supports	R
9.	Control and Instrumentation cables	R
10.	Small Power & Lighting	R
11.	Programmable Logic Controllers	R
12.	Telemetry	R
13.	Scada	R
14.	Flow Meter	R
15.	Ultrasonic Level Meters	R
16.	Provisional Amounts	R
	SUB-TOTAL Bill C to be carried to Summary Page	R

<b>BILL D: BUILDING &amp; STRUCTURAL (2 Guard Houses)</b>					
<b>2</b>	<b>Earthworks</b>				
<b>Item</b>	<b>Description</b>	<b>unit</b>	<b>quant</b>	<b>rate</b>	<b>amount</b>
2.1	Site clearance	m2	12000		
2.2	Setting out	1	sum		
2.3	Excavations	m3	20		
2.4	Landscape the Site	Prov	1	250 000	250 000.00
2.5	EO for hard rock	m3	50	rate only	
2.6	EO for soft rock	m3	50	rate only	
	<b>Subtotal carried to summary Building Works</b>				
<b>3</b>	<b>Concrete works-foundations</b>				
3.1	Cast strip foundations with 20Mpa concrete	m3	10		
	<b>Subtotal carried to summary Building Works</b>				
<b>4</b>	<b>DPC</b>				
4.1	Dpc under walls	m	60		
	<b>Subtotal carried to summary Building Works</b>				
<b>5</b>	<b>Brickwork sub structure</b>				
5.1	one brickwall	m2	6	rate only	
5.2	Half brickwall	m2	30		
5.3	Brickforce in every course	m	200		
	<b>Subtotal carried to summary Building Works</b>				
<b>6</b>	<b>Filling</b>				
6.1	Use filling from excavations and compact	m3	4		
6.2	Use imported approved gravel filling and compact	m3	12		
	<b>Subtotal carried to summary Building Works</b>				
<b>7</b>	<b>DPM</b>				
7.1	Install 250mm micron damp proof membrane under concrete slab	m2	40		
	<b>Subtotal carried to summary Building Works</b>				
<b>8</b>	<b>Electrical-first installation</b>				
8.1	Allow electrical installation for db sleeves under floor	Pc Sum	1	6000.00	6000.00
8.2	Allow for installation of complete high must light on Site (cabling, Concrete footing, connection, and commission). <b>The light must be both electrical and solar dependant</b>	sum	1		
	<b>Subtotal carried to summary Building Works</b>				

<b>9</b>	<b>Plumbing -first installation</b>				
<b>Item</b>	<b>Description</b>	<b>unit</b>	<b>quant</b>	<b>rate</b>	<b>amount</b>
9.1	Allow sleeves for under floor slab	pc sum	1	6000.00	6000.00
	<b>Subtotal carried to summary Building Works</b>				
<b>10</b>	<b>Concrete works-floor slab</b>				
10.1	Cast floor slab 75mm thick	m3	4		
	<b>Subtotal carried to summary Building Works</b>				
<b>11</b>	<b>Dpc under walls</b>				
11.1	110mm walls	m	12		
11.2	220mm walls	m	40		
	<b>Subtotal carried to summary Building Works</b>				
<b>12</b>	<b>Brickwork superstructure</b>				
12.1	One brickwall	m2	100		
12.2	Half brickwall	m2	30		
	<b>Subtotal carried to summary Building Works</b>				
<b>13</b>	<b>Brickforce</b>				
13.1	110mm brickforce	m	150		
13.2	220mm brickforce	m	200		
13.3	Allow for 6mm double anchor roof wires	each	12		
	<b>Subtotal carried to summary Building Works</b>				
<b>14</b>	<b>Pre-cast lintels</b>				
14.1	SABS Approved concrete lintels	no	12		
	<b>Subtotal carried to summary Building Works</b>				
<b>15</b>	<b>Steel windows</b>				
15.1	Type NC2F windows	no	4		
15.2	Type W1 windows (1.2x1.2m)	no	4		
	<b>Subtotal carried to summary Building Works</b>				
<b>16</b>	<b>Steel door frames</b>				
16.4	Steel door frames	no	2		
16.5	Steel door -Heavy duty bugler door with lock	no	2		
	<b>Subtotal carried to summary Building Works</b>				
<b>17</b>	<b>Timber doors</b>				
17.1	Meranti open braced door	each	2		
17.2	Veneer internal door	each	4		
	<b>Subtotal carried to summary Building Works</b>				

<b>18</b>	<b>Locksets</b>				
<b>Item</b>	<b>Description</b>	<b>unit</b>	<b>quant</b>	<b>rate</b>	<b>amount</b>
18.1	four lever locksets	each	2		
18.2	three lever locksets	each	4		
	<b>Subtotal carried to summary Building Works</b>				
<b>19</b>	<b>Plumbing</b>				
19.1	PC Amount for Plumbing as per plan	Pc Sum	1	70000.00	70000.00
	<b>Subtotal carried to summary Building Works</b>				
<b>20</b>	<b>Electrical</b>				
20.1	PC Amount for electrical as per plan	Pc Sum	1	40000.00	40000.00
	<b>Subtotal carried to summary Building Works</b>				
<b>21</b>	<b>Glazing</b>				
21.1	4mm obscure glass to bathroom windows	m2	10		
21.2	6mm Safety glass to w1 windows	m2	10		
	<b>Subtotal carried to summary Building Works</b>				
<b>22</b>	<b>Windowsills</b>				
22.1	10mm approved fibre cement internal windowsills	m	12		
22.2	Approved concrete external windowsills	m	12		
22.3	Dpc to underside of sills	m	12		
	<b>Subtotal carried to summary Building Works</b>				
<b>23</b>	<b>Ceilings</b>				
23.1	Pvc ceilings on Branderings to supplier's details	m2	32		
23.2	Approved Cornice with Approved glue	m	72		
	<b>Subtotal carried to summary Building Works</b>				
<b>24</b>	<b>Roofing</b>				
24.1	Allow pc sum for trusses and purlins	pc	1	30000.00	30000.00
	<b>Subtotal carried to summary Building Works</b>				
<b>25</b>	<b>Fascia's and Bargeboards</b>				
25.1	230mm Fascia	m	23		
25.2	230mm Bargeboards	m	40		
	<b>Subtotal carried to summary Building Works</b>				
<b>26</b>	<b>Plastering</b>				
26.1	15mm plaster to internal and external walls	m2	180		
26.2	EO for Corners	m	56		
26.3	25mm screed to floors	m2	30		
	<b>Subtotal carried to summary Building Works</b>				

<b>27</b>	<b>Painting</b>				
<b>Item</b>	<b>Description</b>	<b>unit</b>	<b>quant</b>	<b>rate</b>	<b>amount</b>
27.1	Plaster undercoat	m2	180		
27.2	2 layers Dulux Paint to walls	m2	180		
27.3	2 layers enamel paint to steel windows and door frames including primer coat	m2	80		
27.4	Approved Varnish to doors	m2	30		
	<b>Subtotal carried to summary Building Works</b>				
<b>28</b>	<b>Gutters and downpipes</b>				
28.1	Approved gutters on gutter brackets	m	10		
28.2	Approved downpipes with approved holder bats	m	6		
	<b>Subtotal carried to summary Building Works</b>				
<b>29</b>	<b>Tiles</b>				
29.1	Ceramic floor tiles to floors	m2	30		
29.2	150mm white glazed tiles to walls and splash tiles at basins and sinks	m2	4		
	<b>Subtotal carried to summary Building Works</b>				
<b>30</b>	<b>Renovation of Existing Pump Station 1</b>				
30.1	Replacement of the existing roof structure (old trusses and old roof sheets) with steel roof structure and new roof sheets with new gutters and ceiling, paint work, replace existing wooden door with steel door, waterproofing the pump house	Prov	1	500000	500000.00
	<b>Subtotal carried to summary Building Works</b>				
<b>D: Total Summary Page for Building Works</b>					
<b>Item</b>	<b>Description</b>	<b>amount</b>			
2	Earthworks				
3	Concrete works-foundations				
4	DPC				
5	Brickwork sub structure				
6	Filling				
7	DPM				
8	Electrical-first installation				
9	Plumbing -first installation				
10	Concrete works-floor slab				
11	Dpc under walls				
12	Brickwork superstructure				
13	Brickforce				
14	Pre-cast lintels				
15	Steel windows				
16	Steel door frames/Steel door				
17	Timber doors				

18	Locksets	
19	Plumbing	
20	Electrical	
21	Glazing	
22	Window sills	
23	Ceilings	
24	Roofing	
25	Fascias and Bargeboards	
26	Plastering	
27	Painting	
28	Gutters and downpipes	
29	Tiles	
30	Renovation of Pump Station 1	
	<b>SUB-TOTAL BILL D TO MAIN SUMMARY PAGE</b>	



Item	Description	unit	quant	rate	amount
	<b>BILL E - OCCUPATIONAL HEALTH &amp; SAFETY</b>				
<b>1</b>	<b>Notification of Construction Work</b>				
	Allow for the costs on notification of the Provincial Director of construction work Regulation	sum	1		
<b>2</b>	<b>Program</b>				
	Allow for the costs on setting up a Health and Safety Program including File on site Regulation 3 & 5. Include the costs to compile the following documents for the file to be kept on site.				
	Copy of Construction Regulations				
	Copy of tender document				
	Copy of drawings				
	Notification of construction work				
	Letters of appointment				
	Company safety Policy				
	Company organogramme				
	Notice in respect of machinery				
	Ten commandments of safety				
	Emergency telephone numbers				
	List of subcontractors				
	Proof of Registration with COID Insurer				
	Training material				
	Risk Assessments and method statements				
	Registers as specified elsewhere				
	Safe work procedures				
	The file shall be a lever arch file				
	With original colour documents of acceptable standards.				
	The file will be expanded during				
	The project as and when required				
	By the Client.	sum	1		
<b>3</b>	<b>Risk Assessment</b>				
	Allow for the costs of a competent person to carry out a Risk Assessment	sum	1		
<b>4</b>	<b>She Co-ordinator</b>				
	Allow for the appointment of a SHE Coordinator to do monthly Inspections (Control on SHE Representative)	months			
	<b>Provisional sum</b>				
<b>5</b>	<b>Health &amp; Safety Induction Trainer</b>				
	Allow for the appointment of a H & S Induction Trainer				
		sum	1		
<b>6</b>	<b>Safe Work Procedures</b>				
	Allow for the costs of setting up safe work procedures by competent person.	sum	1		

7	<b>She Representative</b>				
	Allow for the appointment of a SHE Representative to be permanently on site.	months			
	<b><u>Allow for the following appointments to be part of the functions of the SHE Representative</u></b>				
	<b>Accident Investigator</b>				
	Allow for the appointment of an Accident Investigator				
	<b>Construction Vehicle and Mobile Plant Inspectors</b>				
	Allow for the appointment of a full time inspector of construction vehicles				
	<b>Hand Tool Inspector</b>				
	Allow for the appointment of a full time Hand Tool Inspector				
	<b>Portable Electrical Equipment Inspector</b>				
	Allow for the appointment of a full time Portable Electrical Equipment Inspector				
	<b>Stacking and Storage Inspector</b>				
	Allow for the costs of a competent person to supervise all stacking and storage				
	<b>Hygiene and Facility Inspector</b>				
	Allow for the appointment of a full time Hygiene and facility Inspector				
	<b>Fire Equipment Inspector</b>				
	Allow for the costs of a competent person to inspect all fire equipment				
	<b>First Aid Box Inspector</b>				
	Allow for the costs of a competent person to inspect the first -aid box				
	Provisional sum for above	months			
	<b><u>Allow for the following appointments of personnel with responsibilities towards H&amp;S Supervisors</u></b>				
	Allow for the appointment of full time employees as the construction supervisors				
		months			
	<b>Fire Fighting Equipment</b>				
	Provide 3 kg firefighting equipment suitable for electrical fires on each site	ea	2		
	<b>First Aid</b>				
	Allow for the cost of a basic First Aid Kit and Stretcher	ea	1		

	<b>Personal Protective clothing</b>				
	Provisional rates for the following Items will be remeasurable				
	Shoulder length PVC Gloves	ea	1		
	Plastic Trousers	ea	1		
	Safety Goggles	ea	1		
	Gum Boots	ea	1		
	Welding Helmet	ea	1		
	Gas Welding Safety Goggles	ea	1		
	Safety Shoes	ea	1		
	Dust Masks	ea	1		
	Leather Aprons	ea	1		
	Hard Hats	ea	1		
<b>Total Carried Forward to Main Summary Page</b>					

<b>MAIN TOTAL SUMMARY PAGE</b>					
<b>A</b>	<b>P &amp; G,s</b>	Page	<b>90</b>		
<b>B</b>	<b>MECHANICAL WORKS</b>	Page	<b>96</b>		
<b>C</b>	<b>ELECTRICAL WORKS</b>	Page	<b>125</b>		
<b>D</b>	<b>BUILDING WORKS</b>	Page	<b>130</b>		
<b>E</b>	<b>OHS</b>	Page	<b>133</b>		
<b>F</b>	<b>SUB-TOTAL</b>				
<b>G</b>	<b>CONTINGENCIES @ 10%</b>				
<b>H</b>	<b>TOTAL EXCL VAT</b>				
<b>I</b>	<b>VAT @ 15%</b>				
<b>J</b>	<b>TOTAL TENDER AMOUNT CARRIED TO FORM OF OFFER</b>				



# METSIMAHOLO LOCAL MUNICIPALITY

BID NO MLM 29/2022/23

UPGRADING OF SASOLBURG WATER PUMP STATION

## C3: SCOPE OF WORK

### PART C3: SCOPE OF WORKS

	<u>Pages</u>
C3.1 Description of the Works .....	135
C3.2 Engineering .....	141
C3.3 Procurement .....	142
C3.4 Construction (Civil and Structures) .....	145
C3.5 Management .....	270

#### Status

Should any requirement or provision in the parts of the Scope of Work conflict with any requirement of any Standardised Specification, or any drawings, the order of precedence, unless otherwise specified, is:

- Project Specifications
- Drawings
- Scope of Works
- The following variations and additions to the SABS 1200 Standardized Specifications referred to shall apply to this Contract.

### **C3.1 DESCRIPTION OF THE WORKS**

#### **CONTENTS**

1. EMPLOYER'S OBJECTIVES
2. OVERVIEW OF THE WORKS
3. EXTENT OF THE WORKS
4. CONSTRUCTION PROGRAMME
5. CONTRACTOR'S CAMP SITE AND SITE FACILITIES AVAILABLE
6. SITE FACILITIES REQUIRED
7. FEATURES REQUIRING SPECIAL ATTENTION
8. ACCOMMODATION OF TRAFFIC

#### **1. EMPLOYER'S OBJECTIVES**

The Municipality also intends for the communities directly or indirectly affected by the project to benefit by being involved in the project. All the representatives on the Community forums should be democratically elected and recognized by the community as their legal representatives.

#### **2. OVERVIEW OF THE WORKS**

The work comprises mainly the refurbishment of the Sasolburg water pump station and replacement of pumps, motors, valves including refurbishment of the existing pump house. Construction of two (2) new guard houses. LV switchgear, transformers, motor control equipment, cabling, protection, control, instrumentation, automation, small power and lighting associated with the project.

##### **2.1 Location of the Site**

The proposed site for the Upgrading of Sasolburg Pump Station is located at Sasolburg Water Treatment Works in Sasolburg, in the Metsimaholo Local Municipality, in the Free State Province. The geographic coordinates of the site are 26°48'51.8"S / 27°50'36.9"E. The site is located within the boundaries of the Sasolburg Water Treatment Works. Sasolburg Pump Station is approximately 5km East West of Sasolburg.

## **2.2 General description of scope of works**

**The scope of works is divided into three Civil, Mechanical and Electrical Engineering parts, namely the following:**

### **I. PUMP STATION 2**

1. Upgrade the complete Electrical Infrastructure of the water works pumpstation, LV switchgear, transformers, motor control equipment, cabling, protection, control, instrumentation, automation, small power and lighting associated with the project.
2. Replace three (3) pumps and motors,
3. Add two (2) new sump pumps into the sump hole in other to have to pumps working simultaneously and the other one will work as a standby.
4. Replace the old plant control system with the new Telematics/Scada system,
5. Refurbish the existing building structure to a building regulation compliant structure.  
(Replace the old roof, rafters, facia boards and waterproof the building on the inside)
6. Provide the new fan to supply the cool air at the pump section for better air circulation,
7. All sluice gates to be supplied with new packing inside them,
8. Replace the current wooden door with heavy steel door for theft protection,
9. Build two guardhouses and install the gate next to the pumpstation 2.

### **2.3 Temporary Works**

The contractor is to design, supply, construct, demolish and spoil at his own cost any temporary works required in order to carry out the construction works as required.

### **2.4 Access**

Furthermore, it is a requirement of this Contract that the contractor ensures that all residents have access to their properties after hours and on weekends; all businesses are to have access during business hours. The Contractor is to implement temporary measures / deviations as required in order to achieve this outcome. Prior to the implementation of any deviation, written permission for such deviations shall be obtained from the Principal Agent. The Contractor shall advise all residents, community leaders and other stakeholders at least 2 weeks prior to the commencement of construction activities in an area. The Contractor is to employ a Community Liaison Officer in conjunction with the community structures in the area in order to achieve this outcome.

## **3. EXTENT OF THE WORKS**

1. Upgrade the complete Electrical Infrastructure of the water works pumpstation, LV switchgear, transformers, motor control equipment, cabling, protection, control, instrumentation, automation, small power and lighting associated with the project.
2. Replace three (3) pumps and motors,
3. Add two (2) new sump pumps into the sump hole in order to have two pumps working simultaneously and the other one will work as a standby.
4. Replace the old plant control system with the new Telematics/Scada system,
5. Refurbish the existing building structure to a building regulation compliant structure.  
(Replace the old roof, rafters, fascia boards and waterproof the building on the inside)
6. Provide the new fan to supply the cool air at the pump section for better air circulation,
7. All sluice gates to be supplied with new packing inside them,
8. Replace the current wooden door with heavy steel door for theft protection,
9. Build two guardhouses and install the gate next to the pumpstation 2.

### **A. SERVICES**

A schedule of affected services with the respective service authorities can be found in the provided tender drawings.

#### **C.1. Telkom**

The relocation of Telkom infrastructure is not envisaged. If any damages occur (as a result of the Contractor's operations) the Contractor will be required to contact Telkom to arrange for timeous reparations to the services (at the Contractor's expense). The Contractor may not repair any damages himself unless specifically instructed (in writing) by Telkom to do so.

## **C.2. Municipal Services**

Relocation of municipal services is not foreseen at this stage. The existing services must be identified and clearly marked to prevent damages to these services.

## **C.3. Fibre Optic Cables**

The relocation of fibre optic is not envisaged. If any damages occur (as a result of the Contractor's operations) the Contractor will be required to contact the relevant service provider to arrange for timeous reparations to the services. The Contractor may not repair any damages himself unless specifically instructed (in writing) by the relevant service provider, to do so.

The cost of the repairs will be for the Contractors account.

## **4. CONSTRUCTION PROGRAMME**

The time for completion, as stated in the Contract Data in terms of Clause 1.1.1.14 of the Conditions of Contract, is \_\_\_\_\_ **months**, excluding the year end break (builder's holidays). The Contractor shall plan and programme his construction sequence for completion within the time period specified.

## **5. CONTRACTOR'S CAMP SITE AND SITE FACILITIES AVAILABLE**

### **5.1 Location of Contractor's Camp Site**

No specific land has been made available for the Contractor's camp site and office facilities for the Engineer. The Contractor shall make his own arrangements concerning a suitable approved site and location, as well as the provision of water, electricity and other services for the camp site and office facilities.

The Contractor's camp site shall be maintained in a neat and tidy condition and on completion of the Works, the camp area shall be cleared and reinstated; all to the satisfaction of the Engineer. Any damage to property shall be made good to the satisfaction of the Engineer and at the Contractor's expense.

### **5.2 Provision for Services**

The Contractor shall make his own arrangements concerning the supply of electrical power and all other services. No direct payment will be made for the provision of electrical and other services. The cost thereof shall be deemed to be included in the rates and amounts tendered for the various items of work for which these services are required.

## **6. SITE FACILITIES REQUIRED**

Office facilities as scheduled are required on the site for the Engineer or his representative.



## **7. FEATURES REQUIRING SPECIAL ATTENTION**

### **7.1 Existing Services**

Various types of services, both overhead and underground, exist within the boundaries of the site. It is envisaged that it will be necessary for the Contractor to arrange for the removal, relocation and protection of existing services. Should any work become necessary due to unforeseen circumstances then all work shall be done strictly in accordance with the requirements of the relevant service owner and in accordance with the requirements of these Works Specifications.

Procedures for the protection and/or relocation of such services are outlined in the Project Specifications. All costs related to the contents of this paragraph shall be deemed to be included in the rates and amounts tendered for the various items of work for which these services are required.

### **7.2 Proposed Services**

No new services are envisaged in this contract except roads and stormwater.

### **7.3 Damage to Unknown Services**

Where damage is incurred to services not shown in the services drawings and unknown to the contractor at the time of construction, then the costs to repair and reinstate such services shall be borne by both the Contractor and the Client in a 50% proportion to each party.

### **7.4 Construction in restricted areas**

It will be necessary for the Contractor to work within restricted areas. No additional payment will be made for work done in such areas, despite indications to the contrary in the Standard Specifications.

### **7.5 Water for construction purposes**

The Contractor must make adequate provision in his tender for all negotiations and procurement of water for construction activities and all related costs will be deemed to be included in his tendered rates.

### **7.6 Weatherproof Protection for Workers**

All staff required to continue working during rain shall be provided with approved protective clothing and footwear.

### **7.7 Night Work and Work on Public Holidays**

Where the Contractor requires staff to work overtime, in accordance to the Basic Condition of Employment Act, he shall make the necessary arrangements with the Engineer and obtain written approval from the Engineer. The Contractor shall bear the cost of his overtime work.

## **7.8 Environmental Requirements**

The Contractor shall take particular note of the environmental requirements contained in Part C of the Works Specifications.

Personnel and plant shall not enter property beyond the road reserve boundary irrespective of whether or not the boundary is fenced.

The Contractor shall take every precaution to avoid damage to vegetation within that area of the road reserve which falls outside the designated work area as indicated on the drawings. Any damage caused is to be repaired at the Contractor's expense.

Storage and stockpiling of materials within the road reserve will not be permitted without the written consent of the Engineer. Excess material from excavations and waste material shall be spoiled off site at suitable locations.

## **C3.2 ENGINEERING**

### **1. DRAWINGS**

The Works shall be constructed in accordance with the design drawings included in the Contract Documents.

The reduced drawings listed and included in C5 of the tender documents shall be used for tender purposes only.

The Contractor will be supplied with three (3) unreduced paper prints of each of the drawings and any others required for construction. These copies are issued free of charge and the Contractor shall make any additional copies he may require at his own cost.

Only figured dimensions shall be used and drawings shall not be scaled unless otherwise instructed.

The levels given on construction drawings are subject to confirmation on site, and the Contractor shall submit all levels to the Engineer for confirmation before he commences any construction work. The Contractor shall also check all clearances given on the drawings and shall inform the Engineer of any discrepancies.

The Contractor shall ensure that accurate as-built records are kept of all infrastructure installed or relocated during the contract. The position of pipe bends, junction boxes, duct ends and all other underground infrastructure shall be given by either co-ordinates, or stake value and offset. Where necessary, levels shall also be given. A marked-up set of drawings shall also be kept and updated by the Contractor. This information shall be supplied to the Engineer's Representative on a regular basis.

Any information in the possession of the Contractor, which the Engineer requires to complete his record drawings shall be supplied to the Engineer's Representative before a certificate of completion will be issued.

## C3.3 Procurement

### 3.3 PROCUREMENT

#### 3.3.1 Requirements

The contractor shall be required to adopt labour based techniques through the full spectrum of the works with the proviso that the Clients specific objectives regarding time and quality are not compromised. **Maximisation of employment shall be of the essence on this contract.**

Together with their tenders, all Tenderers are required to submit a comprehensive **implementation plan** clearly stating the labour content and number of jobs that shall be created. The employment of labour shall be reflected in a programme in sufficient details to enable the Project Manager to monitor and compare it with the implementation plan.

The Contractor shall be required to submit employment data on a monthly basis to the Project Manager.

**Tenderers are to also note that it is an explicit condition of this tender that all unskilled labourers on the project are to be employed from the local community. The Contractor shall in general, maximise the involvement of the local community and employ a minimum of 10 people.**

#### 3.3.2 Subcontracting – Special Conditions of Contract

##### Participation and Advancement of Start-Up, Small and Micro Enterprises

The Metsimaholo Local Municipality (MLM) has identified job creation and access to procurement opportunities by Start-ups, Small and Micro enterprises (SMMEs) as an essential requirement towards building an economically viable City. In this regard the following definitions are applicable:

“Start-up Enterprises” means an enterprise that has been in existence and operating for less than two years.

“Small Enterprises” means an enterprise that has a CIDB grading designation of 1 or 2.

“Micro Enterprises” means an enterprise that has a CIDB grading designation of 3.

“Locally based SMMEs” means enterprises that have their operational base in the ward in which the project is to be executed or, alternatively, the members of the enterprise are resident in the particular ward. Should suitable locally based SMME contractors as defined above not be available in the particular ward, then they shall be sourced from adjacent wards.

If it is established that the SMMEs are sufficiently resourced to execute the proposed works as a complete package the Contractor may conclude full sub-contract agreements with locally based SMMEs.

The Contract Data must record the specific requirements in respect of penalties, retention and payment. With regard to the latter, the Contractor is to allow for fortnightly certificates from the SMMEs and for payment to the SMMEs to be effected within 7 days of certification. In order to achieve the goals of this policy and to ensure that the SMMEs are treated fairly and given every opportunity to advance their business whilst delivering a successful project, the Contractor is to note the following and provide for any cost that may be associated therewith.

1. If appropriate, the SMME bill of quantities is to provide for market related P&G items in order that the SMME may be compensated for any unforeseen delays or events that impact on his ability to complete his works.
2. The Contractor will be expected to have clearly specified the programme dates to the SMME contractors and these dates are to be included in the contract of agreement between the two parties. The Contractor is to monitor the SMME contractor's progress against the programme and hold progress meetings with the SMME contractors where minutes are to be kept and signed off by both parties.
3. The Contractor is to assess the skills of the SMME contractor and provide the relevant support and training where it is necessary in order for the SMME contractor to complete the works to programme, budget and specification. The Managing Contractor will be expected to provide on-site training to the SMME contractors that will ensure that the SMME contractor's staff is suitably trained to execute the works and that they receive sufficient relevant experience on the project.
4. The Contractor is responsible for safety compliance on the project and will assist the SMME contractors in all aspects to achieve safety compliance, that will include:
  - a) Assisting the SMME contractors with developing their safety files, legal appointments, etc
  - b) Assisting the SMME contractors with achieving safety on site.
  - c) Having tool box talks with the SMME contractor's employees on a daily basis.
  - d) Providing all safety equipment and signage.
  - e) Providing safety training where necessary.
5. Contractor is to provide all the necessary equipment for the timeous monitoring and the checking of the quality of works as carried out by the SMME contractors. The Contractor will be expected to monitor the SMME contractor's works for quality compliance and provide all the necessary support to the SMME contractors in order to achieve quality requirements. The Contractor is to ensure that if the SMME contractor's quality of works does not achieve specification the Contractor will assist the SMME contractors to achieve specification and not allow the works to continue until the quality requirements are achieved.
6. The Contractor is to generate monthly reports for submission to the MLM that includes the following:
  - a) SMME contractor resources on the site, ie supervisors, labour, plant tools and equipment
  - b) SMME contractor progress of works on site.
  - c) SMME contractor quality control on site.
  - d) SMME contractor expenditure on the project versus target expenditure.
  - e) Copies of minutes of the SMME contractor and Contractor progress meetings.
  - f) Concerns and improvements to be made.

**The Tenderers are to price the works to achieve full compliance with the above requirements. Failure of the Contractor to achieve these requirements may result in the MLM enforcing compliance by appointing 3<sup>rd</sup> parties if necessary to assist and deducting all reasonable costs for achieving compliance from money due to the Contractor.**

Following from the above, the SMME's to be contracted on the project must be selected from the provided database which is attached on this document contract. The data base includes SMME that are youth, women owned, disabled and ex-combats. The contractor will be expected to give preference to SMME's that comply with all/most of these groups. The following information must be provided by said contractor on the date of tender closure.

1. Detailed approach and methodology on the employment of local SMME's
2. SMME/s company name/s to be employed on the project.
3. SMME contact persons
4. Works to be executed by SMME/s
5. Programme (anticipated start, duration and end dates) applicable to the works defined in item 4 above.
6. Estimated value of the works identified in item 4 above.

**The Metsimaholo Local Municipality (MLM) reserves the right to withdraw our acceptance of offer, should the appointed Contractor fail to satisfactorily address the above requirements (1 to 6) within 14 days of the commencement date of the contract. Approved documentation will form part of the contract.**

## **MEASUREMENT AND PAYMENT**

	<b>Item</b>	<b>Unit</b>
<b>3.3.3</b>	<b>Mark Up for Management of Micro Enterprises (SMME's)</b>	<b>%</b>
	The percentage Mark Up tendered on the value of the Micro Enterprises work shall include full compensation for all guidance, supervision, mentoring, setting out and monitoring activities that may be deemed necessary to ensure the Works carried out by MEs are in accordance with the technical and OHS specifications and within the agreed timeframes.	
	The payment will be made on a monthly basis, based on the actual certificate value of the ME, for the said month.	
<b>3.3.4</b>	<b>Penalty Calculation</b>	
	<b>Use of Micro Enterprises (SMME's)</b>	

The Contractor is to indicate to the Municipality via a report certified by their auditors indicating that at least a portion of the Contract value excluding PC Sums, Main Contractors P&G's and Vat, has been paid to SMME's at the end of the Contract before the retention money is released

## **C3.4 CONSTRUCTION**

### **WORKS SPECIFICATIONS**

#### **CONTENTS**

#### **C3.4.1 PART A: GENERAL**

##### **A1 GENERAL**

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### **C3.4.1 PART A: GENERAL**

#### **A GENERAL**

##### **A 1 Particular generic specifications**

For the purpose of this Contract:

- a) where gender terms are used, it shall be applicable to both male and female.
- b) "VAT" shall mean Value Added Tax in terms of the Value Added Tax Act 89 of 1991 as amended.

##### **A 2 Plant and materials**

The Contractor is required to provide all plant and materials necessary to carry out the works as required. No additional allowances other than those already specified in the schedule of quantities shall be allowed for with respect to plant and materials.

##### **A 3 Construction equipment**

The Contractor is required to provide all equipment necessary to carry out the works as required. No additional allowances other than those already specified in the schedule of quantities shall be allowed for with respect to equipment.

##### **A 4 Existing services**

The Contractor:

- a) must make provision for the possible existence of numerous services (e.g.: Stormwater, Water, Electrical, Sasol, PRASA, Rand Water, Eskom, Telkom, Neotel etc.) within and in close proximity to the work areas.
- b) shall be provided with record information from services authorities to enable him to apply for wayleave at the Metsimaholo Local Municipality.
- c) is to record on as built drawings the location of existing services or services which have been relocated during Contract Period.
- d) must inform the relevant service provider immediately (within 2 hours of incident) such that procedures for the reinstatement of the service can be effected, should he damage or break an existing service (whether known or unknown).
- e) is responsible to provide his own equipment in order to determine the location of existing services. The provision of such equipment shall be deemed to have been included in the rates.

##### **A 5 Site usage**

Site usage shall be limited to hours as specified in the Contract Data, unless prior arrangement is made with the Engineer.

##### **A 6 Permits**

The Contractor will be required to obtain permits from all the applicable service provider's within the jurisdiction of the Municipality. It is the Contractor's responsibility to obtain final permit approval according to applicable procedures and specifications. Permits associated costs shall be deemed to have been included in the scheduled rates for excavation and location of existing services under the relevant section of SANS 1200 A.



**A 7 Inspection of adjoining properties**

The Contractor shall carry out inspections and evidence collection of properties adjoining the works to ensure that in the event of a claim arising from any of the owners of the adjoining properties for damage to property and the like, the Contractor has substantial evidence to support or refute such claims. The Contractor accepts full liability and responsibility for damage which he causes to adjoining properties as well as any costs involved in refuting or processing of such claims.

**A 8 Electricity for construction purposes**

The Contractor shall make arrangements with the relevant authority for the supply and distribution of power for purposes of this Contract, the cost of which shall be deemed to be included in the rates inserted in the Schedule of Quantities.

Power used for carrying out of the works in accordance with these Specifications will not be subject to measurement or payment.

**A 9 Survey control and setting out of the works**

The Contractor is to confirm the levels and coordinates of all benchmarks prior to commencing with construction.

**A10 Method Statement**

The Contractor shall provide the Engineer with a method statement indicating the manner and sequence in which he intends to construct the works, for each work area, with the program. In the method statement the Contractor must address at least the following items:

1. Sequence of the works for the relevant works area
2. Target dates for the tasks identified in sequence of the works for the relevant works area
3. Materials requirements
4. Construction Plant to be used
5. Services affecting construction
6. Any factors that could affect construction progress after commencement

The method statement must be approved by the Engineer before commencement of construction. In order to minimize the impact on traffic, pedestrians and business the Contractor will be required to segment the works in such a manner that no portion of the works is more than one day ahead of the following position i.e. trenches cannot be excavated more than one day ahead of pipe laying, pipes more than one day in advance of manhole construction and finishing off etc. These segments of the works shall be clearly defined in the Contractor's method statement for each work area.

The approval by the Engineer of any program shall have no contractual significance other than that the Engineer would be satisfied if the work is carried out in accordance to such program and that the Contractor undertakes to carry out the work in accordance with the program. It shall not limit the right of the Engineer to instruct the Contractor to vary the program should circumstances make this necessary.

**A11 Software application for programming**

The construction programme shall be completed in Microsoft ® Project 2010 or compatible software. The construction programme and updated versions thereof shall be made electronically available to the Engineer.

**A12 Methods and procedures**

The methods and procedures for the execution of the works shall be in accordance with the standard specifications and the variations and additions thereto.

**A13 Quality plans and control**

The Contractor shall be required to provide and maintain a quality plan to ensure that the quality of all work components is of a high standard. Such a quality plan shall be approved by the Engineer.

**A14 Accommodation of traffic on public roads occupied by the Contractor**

a) Accommodation of traffic

The Contractor shall ensure the safe accommodation of traffic at all areas where the work may impact on traffic and shall provide all drums, watching, lighting, signs and barricades required by the road authorities, and in accordance with the South African Road Traffic Signs Manual. Penalties shall be imposed on the Contractor for non-compliance.

b) Access to properties

Adequate access shall at all times be maintained to public and private properties unless otherwise arranged and approved. Details of the proposed means of access shall be submitted before any such access is restricted. Claims arising from impeded access shall be the responsibility of the Contractor.

At least 2 days before commencing any work affecting access to a property, the Engineer and the occupier/owner of each such property shall be notified of the Contractor's intention to commence work, the date of commencement, expected duration and arrangements which will be made regarding maintenance of access.

c) Transport Department requirements

The Contractor must provide a bridge with side rails across excavations to allow pedestrians access to the sidewalk. Allowance for the costs associated with providing pedestrian access to sidewalks will be deemed to have been included under relevant Items in the Schedule of Quantities.

d) Services

Services to a property shall remain unimpeded. Where necessary for access or egress, excavated and filled works, concrete or asphalt surfaces shall be satisfactorily covered temporarily to protect the work from damage and to maintain access.

**A15 Other contractors on site**

There may be other contractors working in close proximity and/ or within the site boundaries road reserve completing other projects. As such, the Contractor is required to make adequate allowances for such possibilities. No claims with respect to works being carried out by other contractors will be entertained by the Employer.

**A16 Testing, completion, commissioning and correction of defects**

The onus is on the Contractor to produce work which will conform in quality and in accuracy of detail to the requirements hereinafter specified. The Contractor must clearly understand that it is not a duty of the Engineer or his representative to act as foreman or surveyor on the Works.

The Contractor shall, at his own expense, provide experienced engineers, foremen and surveyors together with all transport, instruments and equipment for supervising, checking and controlling the work.

The act of passing any completed work for payment by the Engineer shall not be construed as signifying approval or acceptance thereof. Failure on the part of the Engineer to reject any defective work or material shall not in any way relieve the Contractor of his obligations under the Contract, nor prevent later rejection when such work or material is discovered.

The contractor shall keep files of all the test results, which shall be accessible by the Engineer at any time. Two copies of these files shall be provided to the Engineer at the end of the project.

**A17 Key personnel**

The Contractor is to provide the Curriculum Vitae's of key personnel to be employed on the project as well as the person's position and responsibilities within the project team. The Contractor shall provide the following minimum key staff:

- a) Contracts manager;
- b) Site Agent;
- c) Health and Safety Officer; and
- d) Foremen.

**A18 Management meetings**

Bi-Weekly site meetings shall be arranged and facilitated by the Engineer. Senior Contractor management staff attendance shall be compulsory. The Contractor shall be required to provide reporting with regard to project progress, resources (human, plant and equipment), community issues, environmental and health and safety aspects.

**A19 Forms for contract administration**

The Contractor shall maintain files which shall contain project information related to project progress, resources (human, plant and equipment), community issues, environmental, health and safety aspects, penalties imposed, claims lodged and outcomes, disputes and resolutions, payment and variations.

**A20 Daily records**

The Contractor shall keep daily site records as required by the Employer and as specified herein. Daily records shall include, labour, plant, materials, rainfall, daily diary and the like.

**A21 Payment certificates**

Payment certificates shall be submitted to the Engineer, in the format required, for approval and final submission to the Employer on a monthly basis.

## **A22 FEATURES REQUIRING SPECIAL ATTENTION**

### **A22.1 Security**

The Contractor is responsible to provide his own security on site, as he deems necessary. The Employer shall not be held responsible for any loss or damage suffered by the Contractor, his plant, equipment, materials, subcontractors or employees as a result of a security incident of any nature.

### **A 22.2 Community liaison and community relations**

The Contractor will be required to employ a community liaison officer for each section of the works for the duration of the construction activities, taking place within such area. The community liaison officer is to be appointed in consultation with the relevant ward councillor.

### **A 22.3 Notices and warning to the public**

The Contractor must provide written notice to all consumers affected by the construction activities. The written notice shall outline the:

- a) nature of the works;
- b) expected inconvenience / disruption that the consumers can expect;
- c) timeframes for construction; and
- d) contact details in case of problems encountered.

### **A 22.4 Causes for rejection**

Causes for rejection of the works shall include but is not limited to:

- a) incorrect grades and crossfalls;
- b) poor kerbing alignment and broken kerbs
- c) incorrect vertical and horizontal alignments
- d) layerworks and surfacing fail density and other prescribed tests
- e) Incorrect pipe grades, water infiltration at joints, poor workmanship to kerb inlets, manholes, etc.

**C3.4.1            PART B: PROJECT SPECIFICATIONS REFERRING TO THE  
STANDARD       SPECIFICATIONS**

**Notes to the tenderer**

**C3.4.1            VARIATIONS AND ADDITIONS TO SABS 1200 STANDARDIZED SPECIFICATIONS  
AND PARTICULAR SPECIFICATIONS**

The following variations and additions to the SABS 1200 Standardized Specifications referred to shall apply to this Contract.

The prefix “PS” indicates an amendment to SABS 1200. The prefix “PSA” indicates an amendment to SABS 1200 A, “PSDB” to SABS 1200 DB and so on.

The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SABS 1200 to which the variation or addition thereto applies.

An asterisk (\*) placed next to a PS Subclause number denotes the inclusion of an additional Subclause for which no equivalent appears in SABS 1200.

The terms “project specification” or “Portion 2 of the project specification” appearing in any of the SABS 1200 Standardized specifications shall be replaced with the term “Scope of Work”.

The term “Scope of Work” shall mean Part 3 of The Contract.

Further to the above it should be noted that where in a specific Standardized Specification reference is made to a Subclause in another Standardized Specification, any amendment or addition to the Subclause referred to, as provided for in the Specification, shall apply. The aforementioned shall also apply with respect to Clauses referred to in a Particular Specification.

**The variations and additions to the SANS 1200 Standardized Specifications follows herewith:**

**PSA                      GENERAL**

**PSA 1                  SCOPE**

Replace the contents of Clause 1.1, including the notes, with the following:

“1.1 This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to civil, mechanical and electrical engineering construction and building works contracts, as well as the requirements for the Contractor’s establishment on the Site.”

**PSA 2                  INTERPRETATIONS**

**PSA 2.3              DEFINITIONS**

In the opening phrase, insert the words: “the definitions given in the Conditions of Contract and” between the words “specification” and “the following”.

a)      General

Add the following definitions:

“General Conditions / Conditions of Contract. The General Conditions of Contract specified for use with this Contract as amended in the Contract Data.

Specified As specified in the Standardized Specifications, the Drawings or the Scope of Work. “Specifications” shall have the corresponding meaning.”

c)      Measurement and payment

Replace the definitions for “Fixed charge”, “Time-related charge” and “Value-related charge” with the following:

“Fixed charge. A charge that is not subject to adjustment on account of variations in the value of the Contract Price or the time allowed in the Contract for the completion of the work.

Time-related charge. A charge, the amount of which varies in accordance with the Time for Completion of the Works, adjusted in accordance with the provisions of the Contract.

Value-related charge. A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract.”

## **PSA 2.4                      ABBREVIATIONS**

### **a)        Abbreviations relating to standard documents**

Add the following abbreviation:

“CKS: SABS Co-ordinating Specification.”

## **PSA 3                      MATERIALS**

### **PSA 3.1                  QUALITY**

Where applicable, materials shall bear an official standardization mark.

Add the following:

"Where proprietary materials are specified, it is to indicate the quality or type of materials or articles required, and where the terms “or other approved” or “or approved equivalent” are used in connection with proprietary materials or articles, it is to be understood that the approval shall be at the sole discretion of the Engineer."

### **“PSA 3.3\*              ORDERING OF MATERIALS**

The quantities set out in the Bill of Quantities have been carefully determined from calculations based on data available at the time of its compilation but are to be considered as approximate quantities only. Before ordering materials of any kind the Contractor shall be solely responsible for determining, from the Drawings issued or approved by the Engineer for construction purposes, the actual quantities of materials required for the execution of the Works. No liability or responsibility whatsoever shall be attached to the Employer or the Engineer in respect of materials ordered by the Contractor except when ordered in accordance with the Drawings issued or approved by the Engineer for construction purposes."

## **PSA 4                      PLANT**

### **PSA 4.1                  SILENCING OF PLANT**

Replace the contents of Clause 4.1 with the following:

“The Contractor’s attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act (Act No. 85 of 1993) as amended.

The Contractor shall at all times and at its own cost, be responsible for implementing all necessary steps to ensure full compliance with such

regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other Plant which would otherwise cause a noise level in excess of that specified in the said regulations.

Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise in order to comply with the said regulations."

## **PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES**

Add the following at the end of the first paragraph of Clause 4.2:

"The Contractor's buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.

A suitable and dedicated material storage container as well as a furnished office shall be provided for the exclusive and sole use of the Micro Enterprise (SMME's) Subcontractors.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours

The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 15 workmen, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The Contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil."

## **PSA 5 CONSTRUCTION**

### **PSA 5.1 SURVEY**

#### **PSA 5.1.1 Setting out of the Works**

The installed benchmarks and erf boundary pegs shall be used by the Contractor for setting out the works.

Add the following paragraph:

"The Contractor shall be required to check and verify, prior to commencement of any construction work, all benchmarks and boundary reference pegs, as shown and detailed on the Drawings. Reference and



benchmark pegs disturbed and/or removed during the construction period shall be replaced by a Professional Land Surveyor and the Contractor shall bear the cost of such replacement. Payment to check and verify the reference and benchmark pegs will be made in terms of PSA 8.8.5."

**PSA 5.1.2     Preservation and replacement of survey beacons and pegs subject to the Land Survey Act**

Delete from the second sentence "Before the commencement . . . "to" . . . apparently in their correct positions" and replace with the following:

"Immediately on taking over the site, the Contractor, in consultation and liaison with the Engineer, shall search for all pegs and the Contractor shall compile a list of pegs that are apparently in their correct position."

Replace the third sentence of Clause 5.1.2 with the following:

"At completion of the Contract, the Contractor shall expose and mark all pegs that were listed at the commencement of the construction as being in order and the Contractor shall arrange with a registered Land Surveyor the replacement of pegs that have become disturbed or damaged. The Contractor shall, as a precedent to the issue of the Certificate of Completion, provide to the Engineer, a certificate from the Registered Land Surveyor, certifying that all the pegs listed at the commencement of construction in accordance with the provisions of this Clause, have been checked and that those found to have been disturbed, damaged or destroyed have been replaced in their correct positions, all in accordance with the provisions of the said Act.

The costs of replacement and certification as aforesaid shall be entirely for the Contractor's account, provided always that the Contractor shall not be held liable for the cost of replacement of pegs which:

- (a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the Permanent Works; and
- (b) the Contractor can prove beyond reasonable doubt and to the satisfaction of the Engineer, were disturbed, damaged or destroyed by others beyond its control, and
- (c) were in close proximity to the work and which would unavoidably be removed, subject to the Engineer's approval being given to remove such pegs."

## **PSA 5.2 WATCHING, BARRICADING AND LIGHTING AND TRAFFIC CROSSINGS**

Add the following:

“The Contractor shall comply in all aspects with the requirements of the Occupational Health and Safety Act (Act 85 of 1993), refer also PSA 5.7, PSA 5.9 and PSA 5.10.”

## **PSA 5.3 PROTECTION OF STRUCTURES**

Replace: “Machinery and Occupational Safety Act, 1983, (Act No. 6 of 1983)” with: “Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended,” and insert the following after “(Act No. 27 of 1956)”: “as amended”.

## **PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES**

Replace the heading and the contents of Clause 5.4 with the following:

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

### **PSA 5.4.1 Location of existing services**

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent Contractor to be present on, under, over or within the Site.

Without in any way limiting its liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Engineer, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where it intends to work.

Neither the Employer nor the Engineer offer any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the Engineer, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the requirements of Clauses 4.4 and 5.1.2.2 of SABS 1200 D (as amended) shall also apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the Site.

All services, the positions of which have been determined as aforesaid at critical points, shall henceforth be designated as “Known Services” and their positions shall be indicated by the Contractor on a separate set of Drawings, a copy of which shall be furnished to the Engineer without delay.

As soon as any service which has not been identified and located as described above is encountered on, under, over or within the Site, it shall henceforth be deemed to be a “Known Service” and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the Site shall apply. The Contractor shall notify the Engineer immediately should any such service be encountered or discovered on the Site.

Whilst it is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to:

- (a) Known Services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognisance being taken of such deviations in line and level which may reasonably be anticipated; and
- (b) any other service which ought reasonably to have been a Known Service in accordance with the provisions of this Clause;

as well as for consequential damage, whether caused directly by the Contractor's operations or by the lack of proper protection ; provided always that the Contractor will not be held liable in respect of damages occurring to services not being Known Services.

No separate payment will be made to the Contractor in respect of any costs incurred in preparing and submitting to the Engineer, the Drawings as aforesaid and these costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor's in respect of exposing services at the positions agreed by the Engineer and as described above will be made under the payment items (if any) as may be provided therefore in the respective sections of the Specifications pertaining to the type of work involved.

#### **PSA 5.4.2    Protection during construction**

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all known

services during the period which the Contractor has occupation and/or possession of the Site.

Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising there from to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

**PSA 5.4.3     Alterations and repairs to existing services**

Unless the contrary is clearly specified in the Contract or ordered by the Engineer, the Contractor shall not carry out alterations to existing services. When any such alterations become necessary, the Contractor shall promptly inform the Engineer, who will either make arrangements for such work to be executed by the owner of the service, or instruct the Contractor to make such arrangements himself.

Should damage occur to any existing services, the Contractor shall immediately inform the Engineer, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted by the Contractor, unless approved by the Engineer.

The Employer will accept no liability for damages due to a delay in having alterations or repairs effected by the respective service owners. The Contractor shall provide all reasonable opportunity, access and assistance to persons carrying out alterations or repairs of existing services."

**PSA 5.7     SAFETY**

Replace the contents of subclause 5.7 with the following:

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations there under, the Contractor shall at his own expense (except only where specific provision (if any) is made in the Contract for the reimbursement to the Contractor in respect of particular items), provide the following:

- (a) Provide to its Employees on the site of the works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational Health and Safety Act (Act No 85 of 1993) and associated Regulations as amended (hereinafter referred to as the Act) at all times, and shall institute appropriate and effective measures to ensure the proper usage of such safety materials, clothing and equipment at all times; and

- (b) Provide, install and maintain all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the site, as well as the general public; and
- (c) Implement on the site of the works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times; and
- (d) Implement all necessary measures so as to ensure compliance with the Act by all subcontractors engaged by the Contractor and their employees engaged on the works; and
- (e) Full compliance with all other requirements pertaining to safety as may be specified in the Contract.

The Employer shall in terms of the Regulations make such inspections on the site, as they shall deem appropriate, for the purpose of verifying the Contractor's compliance with the requirements of the Act. For this purpose, the Contractor shall grant full access to the site of all parts of the site and shall co-operate fully in such inspections and shall make available for inspection all such documents and records as the Employer's representative may reasonably require.

Where any such investigations reveal, or where it comes to the Employer's attention that the Contractor is in any way in breach of the requirements of the Act or is failing to comply with the provisions of this clause, the Engineer shall, in accordance with the provisions of Clause 5.11 of the Conditions of Contract, be entitled to suspend progress on the works or any part thereof until such time as the Contractor has demonstrated to the satisfaction of the Employer, that such breach has been rectified.

The Contractor shall have no grounds for a claim against the Employer for extension of time and/or additional costs if the progress on the works or any part thereof is suspended by the Engineer in terms of this clause, and the Contractor shall remain fully liable in respect of the payment of penalties for late completion in accordance with the provisions of Clause 5.13 of the Conditions of Contract should the Contractor fail to complete the Works on or before the specified due completion date in consequence of the suspension.

Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute grounds for the Engineer to act in terms of Clause 9.12 of the Conditions of Contract and for the Employer to terminate the Contract in accordance with the further provisions of the said Clause 55."

**"PSA 5.9\* MAINTAINING SERVICES IN USE**

The Contractor shall take note that he shall not cut off any service in use without the prior approval of the Engineer and the knowledge of the residents. Further, no existing services in use shall remain cut off for more than 8 hours or overnight.

Failure on the part of the Contractor to comply with any of the above provisions will constitute sufficient reason for the Engineer to stop the works until the situation has been remedied, or should he deem it necessary, arrange for the situation to be remedied at the Contractor's cost.

No direct payment will be made for the cost of maintaining services in use. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

**"PSA 5.10\* DEALING WITH AND ACCOMMODATING TRAFFIC**

The Contractor shall take note that the existing roads and pedestrian walkways within the Site, shall remain operational throughout the contract period as set out earlier in the document. To this end the Contractor shall provide and maintain all temporary fences, security, barriers, kerb ramps, signs, markings, flagmen, drums, lighting, personnel and all other incidentals necessary to ensure safe and easy passage of all traffic.

Traffic accommodation and signage shall be erected and maintained by the Contractor and the number and layout of the traffic signs shall comply with the South African Development Community's South African Road Traffic Signs Manual, Volume 2 – Chapter 13, Roadworks Signing.

Traffic signs shall have a yellow background with either a red / black border.

No direct payment will be made for the cost of dealing with and accommodating traffic. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the contract. Further, the provision of PSA 5.2 shall apply."

**"PSA 5.11\* SITE MEETINGS**

The Contractor or its authorised agent will be required to attend regular site meetings, which shall normally be held once a month on dates and at times determined by the Engineer, but in any case whenever reasonably required by the Engineer. Unless otherwise indicated in the Contract or instructed by the Engineer, such meetings shall be held at the Contractor's offices on the Site. At such monthly meetings, matters such as general progress on the Works, quality of work, problems,

claims, payments, and safety etc, shall be discussed, but not matters concerning the day-to-day running of the Contract.

**“PSA 5.12\* PROVIDING ACCESS TO ERVEN AND PROPERTIES**

Access to erven and properties along the route of trenches and roads shall be provided by the Contractor at all times as indicated earlier in the document. To this end suitable crossings shall be constructed where required.

Temporary crossings shall be in the form of portable bridges, temporary backfill or other approved means and shall be capable of permitting the safe passage of all vehicles and pedestrians. The Contractor shall also be responsible for maintaining crossings and for removing same when they are no longer required.

If as a result of restricted road reserve widths and the nature of the Works the construction of bypasses is not feasible, construction shall be carried out under traffic in order to provide access to the properties.

The Contractor may, with the approval of the Engineer, arrange with the occupiers of the affected properties to temporarily close off a portion of a road, footpath entrance, property access road or other access, provided that the Contractor shall give due notice of the intended closure and its probable duration to the occupiers and shall as punctually as possible re-open the route at the prescribed time. Where possible, roads shall be made safe and re-opened to traffic overnight. Any such closure shall be an arrangement between the Contractor and the occupiers and shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs and drums shall be provided by the Contractor to suit the specific conditions.

No direct payment will be made for the cost of providing access. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract.”

**“PSA 5.13\* ACCOMMODATION OF OTHER CONTRACTORS**

The Contractor shall be required to accommodate other contractors on the Site of the Works during the entire Contract period.

Adequate access to the site of their works shall be given the contractors at all times.

No direct payment will be made for the cost of providing adequate access and accommodating the stated contractors on the Site of the Works, as well as the cost of any inconvenience or disruption experienced in attending to the aforementioned. Payment shall be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract.



**“PSA 5.14\* ENVIRONMENTAL MANAGEMENT PLAN, RECORD OF DECISION AND SPECIFICATIONS**

The Contractor shall be required to comply with and assume responsibility for compliance with the National Environmental Management Act, (Act 107 of 1998) in respect of the execution and completion of the Works.

Non-compliance in any way whatsoever will be adequate reason for the suspension of the Works.

No extension of time will be considered for delays due to non-compliance with the abovementioned.

No direct payment will be made for the cost of complying with the above-mentioned or disruption experienced in attending to the aforementioned. Payment shall be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract. (Refer also to the contents of Clause 4.3 of the Conditions of Contract.”



## **PSA 6 TOLERANCES**

### **"PSA 6.4\* USE OF TOLERANCES**

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified, or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorized' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Engineer, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorized' dimensions.

If the work is constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the calculation of quantities will be based on the 'authorised' dimensions, regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Engineer may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be calculated based on the actual dimensions as constructed."

## **PSA 7 TESTING**

### **PSA 7.1 PRINCIPLES**

#### **PSA 7.1.2 Standard of Finished Work Not to Specification**

Insert the words "or checks by an approved laboratory ..." after the words "Where the Engineer's checks ..." in the first line of Clause 7.1.2.

### **PSA 7.2 APPROVED LABORATORIES**

Replace the contents of Clause 7.2 with the following:

"Unless otherwise specified in the relevant specification or elsewhere in the Scope of Work, the following shall be deemed to be approved laboratories in which design work, or testing required in terms of a specification for the purposes of acceptance by the Engineer of the quality of materials used and/or workmanship achieved, may be carried out:

- (a) any testing laboratory certified by the South African National Accreditation Systems (SANAS) in respect of the nature and type of testing to be undertaken for the purposes of the Contract;
- (b) any testing laboratory owned, managed or operated by the Employer or the Engineer;
- (c) any testing laboratory established and operated on the Site by or on behalf of the Employer or the Engineer;
- (a) any testing laboratory designated by the Engineer.”

**PSA 8 MEASUREMENT AND PAYMENT**

**PSA 8.1 MEASUREMENT**

**PSA 8.1.1 Method of measurement, all sections of the Schedule**

Delete the words "and South-West Africa".

**PSA 8.1.2 Preliminary and General item or section**

**PSA 8.1.2.1 Contents**

Replace the contents of item (c) with the following:

"The 'duration of construction' applicable to a time-related item shall be the tendered contract period for the total works, plus as applicable, the Civil, Mechanical and Electrical Engineering Industry Holiday (Dec / Jan) and all gazetted public holidays for the Engineering Industry."

**PSA 8.1.2.2 Tendered sums**

Replace the contents of this Sub-Clause with the following:

"Except only where specific provision is made in the Specifications and/or the Bill of Quantities for separate compensation for any of these items, the Contractor's tendered sums under items PSA 8.3.1 and PSA 8.4.1 shall collectively cover all charges for:

- risks, costs and obligations in terms of the Conditions of Contract and of this standardized specification; and
- head-office and site overheads and supervision; and
- profit and financing costs; and
- expenses of a general nature not specifically related to any item or items of the permanent or temporary work; and
- providing such facilities on site as may be required by the Contractor for the proper performance of the Contract and for its personnel, including, but without limitation, providing offices, storage facilities, workshops, ablutions, services such as water, electricity, sewage and rubbish disposal, access roads and all other facilities required, as well as for the maintenance and removal on completion of the works of these facilities and cleaning-up of the site of the Contractor's establishment and reinstatement to not less than its original condition, and
- providing the facilities for the Engineer and his staff as specified in the Contract and their removal from the site on completion of the Contract."

## **PSA 8.2 PAYMENT**

### **PSA 8.2.2 Time-related items**

Replace the contents of Clause 8.2.2 with the following:

"Subject to the provisions of sub clauses 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered Contract period in months, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the Works as a whole.

Should the Engineer grant an extension of time for the completion of the total works, the Contractor will be entitled to an increase in the sums tendered for time-related items, which increase shall be in the same proportion to the original tendered sums, as the extension of time is to the duration of construction as defined in PSA 8.1.2.1. The Contractor shall however note that the aforementioned will not apply to extensions of time granted in terms of PSA 8.4.6.

Payment of such increased sums will be taken to be as full compensation for all additional preliminary and general costs, either time-related costs or fixed costs that result from the circumstances pertaining to the extension of time granted."

The payment to the Contractor for Time-Related Items shall be adjusted in accordance with the following formula in the event of the Contract being extended by means of a Variation Order:

Sum of Tendered amounts for Time Related Items    x

Extension of Time authorised by Variation Order  
Tender Contract period

For the purposes of applying this formula "Extension of Time" will exclude the Contractor's December / January close-down period, if applicable.

The abovementioned adjustment of the payment for Time-Related Items shall be made in the completion Payment Certificate and shall be the only payment for additional Time-Related costs irrespective of the actual period required to complete the Contract including its authorised extensions.

In the case of fixed price contracts, the amount by which the Time-Related Items is adjusted shall not be subject to the Contract Price Adjustment formula. Similarly, in the case of contracts subject to Contract Price Adjustment the amount by which the time-related items are adjusted shall be subject to the Contract Price Adjustment formula."

## **PSA 8.3 SCHEDULED FIXED-CHARGE AND VALUE RELATED ITEMS**

### **PSA 8.3.1 Contractual requirements**

Add the following:

"The sum tendered shall cover all costs incurred in complying with the requirements of the Conditions of Contract, the Scope of Work as well as the fixed costs applicable to the obligations and requirements applicable to the Micro Enterprises Subcontract work as detailed under C3.3: Procurement and C3.5 Management of Part 3: Scope of Work, including the calling and evaluations of such tenders.

Where applicable in terms of the Contract, the sum tendered shall include for the cost of providing and maintaining the special risks insurance stipulated in the Conditions of Contract."

#### **PSA 8.3.2.1 Facilities for Engineer**

Replace the contents of this Clause with the following:

"(a) Two Contract Nameboards ..... Unit: Sum  
(b) Engineers Offices ..... Unit: Sum

The facilities provided shall comply with the applicable requirements of SABS 1200 AB and PSAB."

#### **PSA 8.3.2.2 Facilities for Contractor**

Notwithstanding the detail breakdown of items provided (items a to j), a single sum shall be tendered to cover all these items under the heading of "Facilities for Contractor" and shall include facilities for the Subcontractors.

### **PSA 8.3.3 Other Fixed-charged Obligations**

Add the following:

"The sum tendered shall in addition cover the fixed costs of all obligations and requirements applicable to the subcontract work as detailed under C3.3: Procurement and C3.5 Management of Part 3: Scope of Work."

## **PSA 8.4 SCHEDULED TIME RELATED ITEMS**

### **PSA 8.4.1 Contractual requirements.....Unit: Sum**

Add the following:

"The sum tendered shall cover all costs incurred in complying with the requirements of the Conditions of Contract, the Scope of Work as well as any time-related costs applicable to the obligations and requirements applicable to the Subcontract work as detailed under C3.3: Procurement and C3.5 Management of Part 3: Scope of Work, including the calling and evaluations of such tenders.

Where applicable in terms of the Contract, the sum tendered shall include for the cost of providing and maintaining the special risks insurance stipulated in the Conditions of Contract.

The sum shall further cover all the time-related establishment costs and be the full compensation to the Contractor for:

- (i) The maintenance of his whole organisation as established for this Contract.
- (ii) The maintenance of all insurances, indemnities and guarantees required in terms of the Conditions of Contract, where applicable.
- (iii) Compliance with all general conditions and requirements which are not specifically measured elsewhere for payment in these Contract Documents.

Payment shall be made monthly in compliance with the method laid down in PSA 8.2.2.

The Contractor will not be paid Time-Related Preliminary and General Charges for any special non-working days, as stipulated in the Conditions of Contract, which shall be deemed to have been allowed for within his rates."

### **PSA 8.4.2.1 Facilities for Engineer**

Replace the contents of this Clause with the following:

- "(a) Two Contract Nameboards.....Unit: Sum
- (b) engineers Offices.....Unit:Sum

The facilities provided shall comply with the applicable requirements of SABS 1200 AB and PSAB.

Payment for the provision of survey labourers will be made pro-rata the period the labourers are provided."

**PSA 8.4.2.2 Facilities for Contractor**

Notwithstanding the detail breakdown of items provided (items a to j), a single sum shall be tendered to cover all these items under the heading of "Facilities for Contractor" and shall include facilities for the Subcontractors.

**PSA 8.4.2.3** Replace the words "periods stated" in the second line of this Clause with the following:

"duration of construction as defined in PSA 8.1.2.1".

**PSA 8.4.5 Other Time-related Obligations**

Add the following:

"The sum tendered shall in addition cover the time-related costs of all obligations and requirements applicable to the subcontract work as detailed under C3.3 Procurement and C3.5 Management of Part 3: Scope of Work."

**"PSA 8.4.6\* Compensation in terms of Subclause 5.12.2.4 and Clause 9.1 of the Conditions of Contract for delays incurred:**

- (a) Plant .....Unit: Sum per working day
- (b) Labour.....Unit: Sum per working day
- (c) Supervision .....Unit: Sum per working day
- (d) Other services, facilities etc. not covered by  
(a), (b) and (c) .....Unit: Sum per working day

The sum tendered for each item shall cover the full and final standing cost per day of delaying the specified resource or facility and no additional compensation shall apply, notwithstanding any provisions to the contrary in the contract documents, or in respect of any extension of time granted in relation to the circumstances described in Subclauses 5.12.2.4 and 9.1 of the Conditions of Contract.

For the purposes of calculating the total delay, a working week shall be held to consist of five working days and a working day 9 hours.

Payment for the partial standing of any of the scheduled resources for a day or part thereof, or the standing of a complete resource for a part day, will be made pro-rata in proportion to an appropriate factor assessed by the Engineer.

The amount by which compensation for delays is adjusted shall be subject to the contract price adjustment formula as defined in the Conditions of Contract.

This payment item shall only apply to delays which in the opinion of the Engineer are due to the circumstances described in Subclauses 5.12.2.4 and 9.1 of the Conditions of Contract. No Payment will be made for any salary related or other internally caused strikes. The cost of delays incurred for all other circumstances shall be treated as provided for in the Conditions of Contract.

The provision of this Clause shall in no way prejudice the right of either the Employer or the Contractor to determine the Contract in terms of the provisions of Clause 9.1 of the Conditions of Contract.

The Contractor shall take note that no payment will be considered for any additional cost incurred in protecting his plant and site establishment, as well as for costs incurred in respect of damage to constructional plant and equipment."

## **PSA 8.5 SUMS STATED PROVISIONALLY BY THE ENGINEER**

Replace the contents of Clause 8.5 with the following:

### **"PSA 8.5.1 Works Executed by the Contractor ..... Unit: Prov Sum**

Note that these Provisional Sums are allocated for anticipated work that must be executed by the Contractor and which, at tender stage, could not have been determined or quantified. Refer Clause 6.6 of the Conditions of Contract.

The work identified and stated will not constitute a variation in terms of the Contract although the value of such work will be determined in accordance with the principals pertaining to the value of a Variation Order as set out in Clause 6.4 of the Conditions of Contract.

The Contractor will be reimbursed in substitution of the Provisional Sums (if any) allowed in the Bill of Quantities for work to be executed by the Contractor, in the amounts determined in accordance with the provisions of Clauses 6.4 and 6.6.1 of the Conditions of Contract.

The description of the payment item in the Bill of Quantities will specify and dictate the work to be executed."

### **"PSA 8.5.2\* Additional testing required by the Engineer.... Unit : Provisional Sum**

The provisional sum provided in the Schedule of Quantities is to cover the payment of the SANAS registered soils Laboratory to conduct CBR, MOD's and Atterberg Limit tests as directed by the Engineer."

### **PSA 8.5.3\* Overhead, charges, profit etc on item PSA 8.5.2..... Unit : %**

The percentage tendered shall be paid to the Contractor on the actual amount paid to the soils laboratory and shall cover the following:



- all costs involved in rectifying and arranging the tests with the laboratory.
- setting out the positions for the tests to be taken by the laboratory as indicated by the Engineer.
- making good all test holes with subbase.
- the cost of all overheads, charges and profits

## **“PSA 8.6 PRIME COST ITEMS**

### **PSA 8.6.1 Prime Cost Sums**

- (a) Description of Item to which Prime Cost Sum Applies Unit: PC Sum
- (b) Charge Required by Contractor on Sub-item (a) above ..... Unit: %

Refer Clause 6.6 of the Conditions of Contract.

Sub-items (a) and (b) will be provided in the Bill of Quantities for each different item to which a Prime Cost Sum applies.

The Contractor shall be reimbursed under sub-item(s) (a) in substitution of the respective Prime Cost Sums included in the Contract, the actual price(s) paid or payable by him in respect of the goods, materials or services supplied, but excluding any charges for the Contractor's labour, profit, carriage, establishment or other charges related to such goods, services or materials, all in accordance with the provisions of Clause 6.6.2 of the Conditions of Contract.

The description of the payment item in the Bill of Quantities will specify and dictate the work to be executed.

The Contractor shall be paid under sub-item (b), the respective percentage, as stated by the Contractor in its Tender, of the amount certified by the Engineer for payment under the related sub-item (a). The percentages tendered by the Contractor for each respective sub-item (b) included in the Bill of Quantities shall be deemed to in full and final compensation to the Contractor in respect of any charge by the Contractor for labour, carriage profit, establishment and for any other charges related to the goods, services or materials supplied under the related sub-item (a).

If the Contractor shall have omitted within its Tender to insert a tendered percentage under sub-item (b), or tendered a zero percentage, the Contractor's tendered rate for sub-item (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under sub-item (b).

Only payments for successful test will be made under the Prime Cost Sum provided in the Bill of Quantities for acceptance control testing by the Engineer.

The Contractor is responsible for the cost of all process control testing. Payment in terms of the above will only be made for acceptance control testing specifically ordered and specified by the Engineer."

**"PSA 8.7 DAYWORK**

Add the following:

"To ensure that the plant is achieving a reasonable output of work, the Engineer's personnel will randomly monitor and measure work produced. Poor performance of any item of plant will be noted by the Engineer and certain reductions in payment may be applied.

Furthermore, should the performance of a machine be poor, or persistently break down, the Engineer may order that it be replaced, all at the cost of the Contractor."

**PSA 8.8 TEMPORARY WORKS**

**PSA 8.8.2 Dealing with Traffic**

Delete the entire Clause. The provision of PSA 5.10 shall apply. Refer also PSA 5.2, PSA 5.3, PSA 5.7 and PSA 5.12"

**PSA 8.8.4 Existing services**

Replace the heading of paragraph (c) with the following:

"c) Excavate by hand in soft material to expose existing services Unit: m<sup>3</sup>

Add the following:

"The rate tendered for (c) shall further cover the cost of backfilling the excavation with excavated material compacted to 90% of modified AASHTO maximum density, loading, transporting within a free haul distance of 0,5 km and disposing of surplus material as directed, keeping the excavation safe, dealing with water, protecting the exposed services, and any other operation necessary to complete the work.

No distinction will be made between the various types of services to be exposed, or the depths to which excavations are taken.

Excavation in excess of that authorised will not be measured for payment."

**PSA 8.8.5 Cost of survey in terms of Land Survey Act**

Replace the contents of subclause 8.8.5 with the following:

"(a) Locate, record and protect erf boundary and survey pegs .... Unit: Sum

The sum tendered shall cover the cost of complying with the requirements of 5.1.2 and PSA 5.1.2 as well as the cost of exposing and marking the pegs on completion of the Works.

(b) Replace pegs recorded as missing at commencement of Contract as well as pegs removed in terms of PSA 5.1.2 (a), (b) and (c) .....Unit: No

The rate tendered shall cover the cost of arranging for a registered surveyor to replace the pegs, as well as the payment of the surveyor. The Contractor shall however note that pegs recorded as missing at the start of the work and subsequently found by the surveyor to be in their correct position will not be measured for payment.

NOTE:

The cost to set out the Works in terms of 5.1.1 and PSA 5.1.1 shall be deemed to be covered by the sums tendered for other obligations under Subclauses 8.3.3 and 8.4.5."

**"PSA 8.8.7\* Compliance with the occupational health and safety act (Act 85 of 1993) and all relevant and applicable regulations, especially the construction regulations, 2014 as promulgated on 7 February 2014 under Section 43 of the occupational health and safety act (Act 85 of 1993), as amended from time to time, for the duration of the contract**

(a) Contractor ..... Unit: Sum

(b) Subcontractors (own) / Micro Enterprises (smme's) ..... Unit: Sum

The tendered sums shall include full compensation to the Contractor for compliance with all the requirements of the OHS Act and the Construction Regulations 2014 at all times, as described in the Scope of Work and Employer's health and safety specification (Refer Particular Specification PA). The successful tenderer shall provide the Engineer with a complete breakdown of each tendered sum, if so required.

The Contractor shall note that all obligations contained in the Act, Regulations and Employers health and safety specification shall be included in this item. No additional claims will be considered; neither will an extension of time be considered for delays due to non-compliance with the Contractor's health and safety plan.

The sums will be paid to the Contractor in equal monthly amounts.

Refer also PSA 5.2, PSA 5.3, PSA 5.7 PSA 5.10, PSA 5.12, PSA 5.13 and PSA 5.14"

**PSAB ENGINEER'S OFFICE**

**PSAB 3 MATERIALS**

**PSAB 3.1 NAMEBOARDS**

Notwithstanding the provisions of this Sub-Clause, two Contract Nameboards shall be provided. The nameboards shall further comply with regard to size, painting, decorating and detail as detailed on the drawings.

**PSAB 3.2 OFFICE BUILDING(S)**

Add the following after "Engineer." in the second last sentence:

"The Engineer will require an office, as follows :

- At least 15 m2
- One desk
- 3 chairs
- Two lights
- Air conditioner
- 2 electric plugs
- One car port"

**PSAB 4 PLANT**

**PSAB 4.1 TELEPHONE**

A telephone for the Engineer's use is not required.

**PSAB 5 CONSTRUCTION**

**PSAB 5.1 NAMEBOARDS**

Replace the contents of this Clause with the following:

"The Contract Nameboard shall be erected within fourteen days of the Commencement Date and shall be placed where ordered. Any damage to this board shall be repaired within seven days of a written instruction issued by the Engineer.

Further to the above the Contractor will not be allowed to erect more than two of his own nameboards in the area of the Works. The position of these shall be agreed to by the Engineer. No payment will be made for the supply, erection or maintenance of the Contractor's nameboards and the Engineer reserves the right to order the removal of the nameboards if not properly maintained.

All nameboards shall be removed within 7 days of the issue of the "Certificate of Completion".

**PSAB 5.4 TELEPHONE**

Delete the entire contents of this Clause.

**PSAB 5.5 SURVEY ASSISTANTS**

A survey assistant will be required from time to time to assist the Engineer's Representative.

**PSAB 8 MEASUREMENT AND PAYMENT**

Delete the contents of this Clause. The appropriate measurement and payment clauses have been included under Clause 8 of SABS 1200 A and PSA.

**PSC SITE CLEARANCE**

**PSC 3 MATERIALS**

**PSC 3.1 DISPOSAL OF MATERIAL**

Delete the first two sentences of this clause and replace with:

“Debris arising from clearing and grubbing operations or from the demolition of structures on site shall be removed by the Contractor and disposed of at any approved tip site.

The rates tendered for the various items under this section shall further cover the cost of loading, transporting and disposing of material at the approved tip site as well as for any fees payable.”

**PSC 5 CONSTRUCTION**

**PSC 5.3 CLEARING**

Add the following after subclause f):

“g) The clearing, breaking up, removal and spoiling of all concrete, brick-paved or bitumen surfaced slabs, walkways and roadways as well as any obstructions, concrete edging, slabs, playground equipment, bollards and other unwanted debris within the road verges and park areas.”

**PSC 5.5 RECLEARING OF VEGETATION**

Add the following:

“Except if otherwise agreed, where areas have to be re-cleared on the written instruction of the Engineer, such re-clearing shall be carried out at the Contractor’s own cost and the Contractor is advised therefore, not to clear areas at such an early stage that re-clearing may become necessary.”

**PSC 8 MEASUREMENT AND PAYMENT**

**PSC 8.1 BASIC PRINCIPLES**

Add the following:

"The thickness layer that will unavoidably be stripped during clearing of vegetation will be taken as 100mm.

This implies that levels used in earthworks quantity calculations shall be 100mm lower than the original levels excluding stripping of topsoil to stockpile, where applicable.”

Levels to be used for earthworks quantity calculations will be surveyed once the clearing operations have been completed."

**PSC 8.2 PAYMENT**

**PSC 8.2.1 Clear and grub**

Replace the first line with the following:

"The areas designated by the Engineer to be cleared and grubbed will be measured in square metre or to the nearest square metre or,"

Delete "(except where 8.2.9 is applicable)" in the seventh line of this Clause.

Add the following:

"The tendered rate shall also cover the cost of loading, transporting and disposing of all rubble, spoil and other unwanted debris encountered in the parks, road reserves or along service routes, irrespective of distance. (Refer also PSC 8.1)"

**PSC 8.2.8 Demolish and remove structures / buildings and dismantle steelwork, etc.**

Add the following:

"The sum tendered shall cover all costs for the provision of labour, equipment and incidentals necessary to demolish, remove, transport and dispose of the scheduled structures / buildings, including foundations, at an approved tip site."

**PSC 8.2.9 Transport material and debris to unspecified sites and dump**

Delete this subclause.

Notwithstanding the fact that a disposal site will not be designated by the Engineer, the transportation of all material and debris generated by any clearing and grubbing operations, will not be measured for payment."

**"PSC 8.2.11\*Remove and dispose of existing concrete kerbing and channelling combination.....Unit : m**

The rate tendered shall cover the provision of all labour and equipment necessary to remove, transport and dispose of existing concrete kerbing and channelling combination, including backing and screed, at an approved tip site, regardless of volume and the type kerbing.

**PSC 8.2.12\* Remove and dispose of existing concrete kerbing ..... Unit: m**

The rate tendered shall cover the provision of all labour and equipment necessary to remove, transport and dispose of existing concrete kerbing, including backing and screed, at an approved tip site, regardless of volume and the type kerbing.

**PSC 8.2.13\* Saw-cut asphalt surfacing ..... Unit: m**

The rate tendered shall cover the provision of all labour and equipment necessary to saw-cut asphalt surfacing to a minimum depth of 50 mm.

**PSC 8.2.14\* Remove and dispose of existing asphalt and bituminous surfacing  
Unit: m<sup>2</sup>**

The rate tendered shall cover the provision of all labour and equipment to remove, transport and dispose of all existing asphalt and bituminous surfacing at the approved tip site (saw-cutting will be compensated for under item PSC 8.2.13).

Where existing bituminous sidewalks are retained with concrete edge strips, the rate under this item shall include for the removal and spoiling of such.

No separate payment will be made under PSC 8.2.12.

**PSC 8.2.15\* Saw-cut concrete in roadway / sidewalks ..... Unit: m**

The rate tendered shall cover the provision of all labour and equipment to saw-cut concrete surfacing to a minimum depth of 250 mm.

**PSC 8.2.16\* Remove and dispose of concrete surfacing (up to a thickness of 250 mm) ..... Unit: m<sup>2</sup>**

The tendered rate shall cover the provision of all labour and equipment to remove, transport and dispose of concrete surfacing at the approved tip site (saw-cutting will be compensated for under item PSC 8.2.16).

**PSC 8.2.17\* Remove and dispose of existing brickwork (up to a thickness of 300 mm) ..... Unit: m<sup>2</sup>**

The sum tendered shall cover the provision of all labour and equipment to remove on the instruction of the Engineer, transport and dispose of existing brickwork at the approved tip site.

The rate shall be based on brickwork with a wall thickness of 300 mm."



**PSD            EARTHWORKS**

**PSD 2        INTERPRETATIONS**

**PSD 2.1      SUPPORTING SPECIFICATIONS**

Replace Clause 2.1.2 with the following:

"PSD 2.1.2:        Any of the other SABS 1200 Specifications or Particular Specifications may form part of the Contract Documents."

**PSD 2.3      DEFINITIONS**

Replace the word and the definition for "borrow" with the following:

"Borrow material: Material, other than material obtained from excavations required for the Works, obtained from sources such as borrow pits or the authorised widening of excavations. 'Borrow' shall have a corresponding meaning."

Replace the definition for "specified density" with the following:

"Specified density: The specified dry density expressed as a percentage of modified AASHTO dry density."

Replace the definition for "stockpile" with the following:

"Stockpile (verb): The process of selecting and, when necessary, loading, transporting and off-loading material in a designated area for later use for a specific purpose."

Add the following definitions:

"Commercial Source: A source of material provided by the Contractor, not the Employer, and including any borrow pit, provided by the Contractor.

Fill: An embankment or terrace constructed of material obtained from excavations or borrow pits.

Fill (material): Material used for the construction of an embankment or terrace.

Roadbed: The natural in situ material on which the fill, or in the absence of fill, the pavement layers, are constructed."

**PSD 3 MATERIALS**

**PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES**

**PSD 3.1.1 Method of Classifying**

Add the following:

"The classification of material other than 'soft excavation' shall be agreed upon before excavation may commence.

The Contractor shall immediately inform the Engineer if and when the nature of the material being excavated changes to such an extent that a new classification is warranted for further excavation. Failure on the part of the Contractor to advise the Engineer in good time shall entitle the Engineer to reclassify, at his discretion, such excavated material."

**PSD 3.1.2 Classes of excavation**

Notwithstanding the provisions of this subclause no distinction will be made between soft and intermediate excavation. All excavation, other than in hard rock and boulder excavation, shall for measurement and payment purposes be classified as soft excavation.

**PSD 3.2.1 Material suitable for embankments and terraces**

Add the following to paragraph (b):

Provided sufficient fines are mixed with the rock to ensure a dense compacted mass can be achieved.

**PSD 3.2.3 Material Suitable for Backfill or Fill against Structures**

Replace the contents of this sub-clause with the following:

"Material used for backfill behind structures shall generally be the material excavated, subject to the following conditions:

- (a) The material shall not contain an excessive number of stones retained on a 50 mm sieve; and
- (b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment; and
- (a) The liquid limit of the material shall not exceed 40, neither shall the PI exceed 18.
- (b) The minimum compaction shall be 93% of modified AASHTO maximum density."

**PSD 3.3      SELECTION**

**PSD 3.3.1    General**

Replace the second paragraph with the following:

"The Contractor shall deal selectively with materials from all excavations to ensure that no acceptable backfill or bedding material is contaminated by material unfit for use. No additional payment shall be made in this regard and all costs related to the above selection process shall be included in the applicable payment items. Should useful material be contaminated to such an extent that it is regarded as unfit for use the Contractor shall at his own cost dispose of this material and replace it with material of an equivalent standard to the acceptable in situ material."

**PSD 3.3.2    Backfilling and embankments**

With reference to the last line of this subclause the material to be used for backfill shall be either 15MPa/19 concrete or material complying with 3.2.2 compacted in 150mm layers to 90% of modified AASHTO maximum density, as ordered on site.

**"PSD 3.3.3\*   Selection in Excavations and Borrow Pits**

Approval of a borrow area for a certain purpose does not necessarily mean that all the material in that area is suitable for the specified purpose. It does mean that the borrow area contains some suitable material. The onus shall rest on the Contractor to ensure that only material that is indeed suitable is removed and used for the specified purpose.

When the Contractor has to select excavated material for a specific purpose, the above provisions relating to borrow areas shall apply *mutatis mutandis* to excavations.

The Contractor shall not waste or contaminate material that has been selected for a specific purpose."

**PSD 4        PLANT**

**PSD 4.4      DETECTORS**

Replace the contents of Clause 4.4 with the following:

"The Contractor shall, for the purposes of detecting and locating underground services in accordance with the provisions of Subclause 5.4 of SABS 1200 A and Subclause 5.1.2 of SABS 1200 D, at its own cost, provide and use detecting equipment which is suitable for the detection of underground cables and pipes."

**PSD 5 CONSTRUCTION**

**PSD 5.1 PRECAUTIONS**

**PSD 5.1.1 Safety**

**PSD 5.1.1.1 Barricading and lighting**

Replace "Machinery and Occupational Safety Act, 1983 (Act 6 of 1983)" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Construction Regulations 2014".

**PSD 5.1.1.2 Safeguarding of excavations**

Replace "Machinery and Occupational Safety Act" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Construction Regulations 2014".

Add the following to paragraph (b) (1):

"Payment for supporting the sides of excavations and trenches shall be deemed to be included in the rates tendered for excavations. No separate payment will be made in this regard and it will be the Contractor's responsibility to ensure the safety and stability of all excavations.

Where trenches have to be widened to accommodate manholes, junction boxes, etc., the cost of supporting the vertical sides of such additional excavations will be deemed to be included in the rates tendered for excavation."

Add the following to paragraph (b) (2):

"The slope of the sides of an excavation or trench may never be steeper than 60° to the horizontal and all costs incurred to slope the sides of an excavation or trench will, irrespective of the angle of the slope, be deemed to be included in the rates quoted for excavation."

**PSD 5.1.1.3 Explosives**

Replace the contents of this subclause with the following:

"No overbreak allowance shall apply to this Contract.

The Contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures, and for other purposes where explosives are normally required, subject to the following conditions:

- (a) The Engineer may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Engineer does

not entitle the Contractor to additional payment for having to resort to less economical methods of construction.

- (b) The Engineer's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.
- (c) The Contractor shall comply fully with the requirements of the Explosives Act, Act 83 of 1997 and all other legislation and regulations as may be applicable to blasting and the use of explosives.
- (d) Before blasting is undertaken, the Contractor shall satisfy the Engineer that he has established whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting.

Should such inspections be required, the Contractor shall, together with the Engineer and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before the commencement of blasting operations.

- (e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (e.g. cover-blasting, to reduce the risk of damage.
- (f) All accidents, injury to persons and animals and damage to property shall be reported to the Engineer in detail and in writing as soon as is practicable.
- (g) The Engineer shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.
- (h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at its own expense, any additional excavation necessitated by the shattering of rock in excess of any overbreak allowances specified in the Scope of Works or given on any drawing.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations."

### **PSD 5.1.2 Existing services**

#### **PSD 5.1.2.2 Detection, location and exposure**

Replace the contents of Clause 5.1.2.2 with the following:

“The exposure by the Contractor of underground services, as required in terms of Clause 5.4 of SABS 1200 A and PSA 5.4 shall be carried out by careful hand excavation at such positions and to such dimensions as are agreed to by the Engineer.

Unless otherwise instructed or agreed by the Engineer, no service shall be left exposed after its exact position has been determined and all excavations carried out for the purposes of exposing underground services shall be promptly backfilled and compacted to the following densities:

(a) In roadways: 95% Mod AASHTO density; and

(b) In all other areas: 93% Mod AASHTO density.

Where hand excavations to expose underground services have to be carried out in roadways, the Contractor shall reinstate the road layerworks in accordance with the provisions of the Contract or as directed.

Payment in respect of the exposing of the services by means of hand excavation as described above shall be deemed to be covered by the rates tendered under items PSA 8.8.4(c).”

Payment in respect of the reinstatement of layerworks in road ways will be made in accordance with PSDB 8.3.6.1 and subclause 8.3.6.1 of SABS 1200 DB.”

#### **PSD 5.1.2.3 Protection of cables**

Replace Clause 5.1.2.3 with the following:

##### **“5.1.2.3 Protection during Construction**

Further to the requirements of PSA 5.4.2 and Subclause 5.4.2 of SABS 1200 A, major excavating equipment and other Plant shall not be operated dangerously close to Known Services. Where necessary, excavation in close proximity to Known Services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. **No additional payment will apply to such more difficult work.**

Should any service not being a Known Service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of Sub-clause 5.4.2 of SABS 1200 A (as amended), immediately notify the Engineer thereof and

implement such measures as will prevent damage of such service or, if it was damaged in the course of discovery, will prevent and minimise the occurrence of any further damage occurring.”

#### **PSD 5.1.2.4 Negligence**

The Contractor shall not repair any service damaged. Where the damage is the result of the Contractor's negligence he shall bear all costs of the repairs undertaken by the owner, as well as the costs of associated damages.”

#### **PSD 5.1.6 Road traffic control**

Delete the contents of Clause 5.1.6 and replace with the following:

“The provisions of PSA 5.10 shall apply as applicable. Where the work affects the operation or safety of public road traffic, vehicular and/or pedestrians in addition, to complying with the requirements of 5.1.1.1, the Contractor shall provide, erect and maintain traffic signs, personnel and equipment that conform to the requirements, layout and guidelines of the “South African Road Traffic Signs Manual”, as well as the Site Manual entitled “Safety at Roadworks in Urban Areas” as published by the Department of Transport, in number and in layout, as shown in these manuals.

Where necessary and as shown in these manuals, warning lights, an adequate number of flagmen and appropriate barricades, clearly visible to oncoming traffic at all times of the day and night shall be provided. If steel drums are used for this purpose, they shall be ballasted with soil, sand or stones and the outside shall be whitewashed and provided with retro-reflective material (in the case of tape, of minimum width 10 mm), red on the left-hand side facing oncoming traffic and white on the right-hand side. The drums shall be maintained in a clean and effective condition and no stones shall be placed on them.

No direct payment will be made for the cost of providing and complying to the aforementioned. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract.”

## **PSD 5.2 METHODS AND PROCEDURES**

### **PSD 5.2.1 Site preparation**

#### **PSD 5.2.1.2 Conservation of topsoil**

Add the following:

“Topsoil ordered to be stripped and conserved for later use shall be stockpiled in a manageable heap where designated by the Engineer. The material together with such vegetation and small roots as may occur within the specified depth shall be stripped, loaded, transported to stockpile within a freehaul distance of 0,5 km, maintained and wetted (dust control) for the full duration of the Contract or until use.”



**PSD 5.2.2 Excavation****PSD 5.2.2.1 Excavation for General Earthworks and for Structures**

Add the following to paragraph (b):

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. In general, payment will be made for excavating a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."

Replace the first sentence of paragraph (e) with the following:

"Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel material compacted to 98% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.

Where excavations for structures have been carried out in hard material, the Engineer may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall re-trim the excavations if necessary and, unless other remedial measures are agreed to by the Engineer, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

**PSD 5.2.2.3 Disposal**

Replace the second sentence with the following:

"The Contractor shall provide necessary spoil sites for the spoiling of all surplus and unsuitable materials and shall make the necessary arrangements with the owner of the site where the material is disposed of and pay all charges and levies as may be applicable for the use of such spoil sites.

Every spoil site provided by the Contractor shall be approved by the local authority in whose area it is located and the spoiling shall comply with the applicable statutory and municipal regulations as well as the requirements of the owner of the spoil site.

No direct payment will be made for locating and making arrangements for suitable spoil sites and for the spoiling and haul of material at and to such

sites. Payment will be deemed to be covered by the various rates tendered and paid."

#### **PSD 5.2.2.4\* Selection and Stockpiling**

Approval or designation of the material in a particular borrow pit or excavation for a particular purpose does not imply that all the material in the borrow pit or excavation is suitable for the particular purpose for which the said approval or designation relates, nor that all material in the borrow pit or excavation should be used for the particular purpose. The Contractor shall select suitable material from that borrow pit or excavation, discard unsuitable material and reserve material for other purposes as necessary.

The Contractor shall organise and carry out its operations in such a manner as will prevent the contamination of suitable embankment, fill and backfill material with unsuitable materials. Any excavated material which becomes, in the Engineer's opinion, unsuitable for use in embankments, fills or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Engineer and shall be replaced by the Contractor with materials acceptable to the Engineer, all at the Contractor's cost.

When required, or when ordered by the Engineer, material shall be temporary stockpiled at sites indicated by the Engineer for later use. The additional costs of stockpiling material shall be paid to the Contractor in accordance with the provisions of Sub-clause PSD 8.3.14.

#### **PSD 5.2.3 Placing and Compaction**

##### **PSD 5.2.3.1 Embankments**

Replace the first sentence of the sixth paragraph with the following:

"Each layer shall be compacted at OMC to a density as specified and in the case of cohesive soil and 100% of modified AASHTO maximum density in the case of non-cohesive soil."

PSD 5.2.3.3\* The material of each area of fill shall, unless otherwise approved, be deposited in layers of thickness, before compaction, not exceeding 150 mm. The material shall be spread to form a layer that is approximately uniform thickness, and graded over the whole area of the fill site.

Each layer shall be compacted at OMC to a density of at least 93% of modified AASHTO density in the case of cohesive soil or 100% in the case of non-cohesive soil. Should the material be too wet, owing to rain or any other cause, it shall be harrowed and allowed to dry out to the correct moisture content before compaction is undertaken.

The contractor shall ensure that stormwater will at all times be discharged uniformly over the full fill area or through specially prepared and protected drainage ditches to prevent scouring of the slopes."

**"PSD 5.2.3.4 Backfilling over-excavation and overbreak**

The material to be used shall comply with 3.2.1, except that the maximum particle size shall not exceed  $\frac{2}{3}$  of the thickness of the layer being placed, and shall be compacted to at least 95% of modified AASHTO maximum density.

**PSD 5.2.4.3 Grass and other vegetation**

Add the following:

"Grass sods shall be fine kweek (Cynodon Dactylon) as specified by the Engineer.

The grass sods shall be nursery grown, cut, delivered and laid within 36 hours from harvesting. It shall be free of weeds and disease and contain a minimum soil thickness of at least 30 mm.

The area to be harvested shall be well watered prior to harvesting and handled with extreme care to retain the maximum amount of moisture and soil within the roots. The contractor shall place and plant the sods on the areas indicated by the Engineer. Prior to the placement, the area to receive sods shall be fertilized by applying 40g/m<sup>2</sup> of super phosphate fertiliser and thereafter be well watered.

Sods shall be fitted closely together and any hollows shall be filled with topsoil to produce an even and smooth surface. During and directly after the laying the sods, the sods shall be well watered and rolled to obtain a level and even surface."

**PSD 5.2.5 Transport for Earthworks**

Replace the entire contents of Sub-clause 5.2.5 with the following:

"The transport and haul of all materials, as well as material imported from commercial sources or borrow pits selected by the Contractor, irrespective of the distance and source, shall be deemed to be freehaul, the cost of which shall be included in the Contractor's tendered rates and prices for the excavation of the materials.

No separate compensation shall apply for the transportation of excavated materials."

**PSD 6 TOLERANCES**

**PSD 6.1 POSITIONS, DIMENSIONS, LEVELS, ETC.**

Add the following:

**“PSD 6.1(c) Bulk earthworks**

The tolerances applicable to excavations for structural foundations (degree of accuracy II), as specified in Subclause 6.1(a) shall apply, provided no ponding areas or adverse grades result.”

**PSD 7 TESTING**

**PSD 7.2 TAKING AND TESTING OF SAMPLES**

Replace the contents of this subclause with the following:

"The Contractor shall arrange with the approved independent laboratory engaged by the Contractor in terms of clause C3.4.9 of the Scope of Works, to carry out sufficient tests on a regular basis as agreed between it and the Engineer to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Engineer in a form approved by him.

The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five percentage points below the specified value."

**PSD 8 MEASUREMENT AND PAYMENT**

**PSD 8.3 SCHEDULED ITEMS**

**PSD 8.3.1 Site Preparation**

Replace Clauses 8.3.1.1 and 8.3.1.2 with the following:

"Where Site preparation such as clearing, grubbing, the removal of large trees or the removal and stockpiling of topsoil or surface obstructions are required, the provisions and scheduled items of SABS 1200 C shall apply."

**PSD 8.3.2 Bulk Excavation**

Replace the contents of subclause 8.3.2 with the following:

**“PSD 8.3.2.1 Excavate in all materials and use for embankment fills, platforms, berms, backfill or dispose, as ordered .....Unit: m<sup>3</sup>**

The unit of measurement shall be the cubic metre measured in place in accordance with Subclause 8.2 of SABS 1200 D.

Separate items will be scheduled for each type of excavation or structure and for each type or manner of disposal of excavated material.

The tendered rates shall cover the cost of excavation in all material, complying with all the precautions required in terms of Subclause 5.1 of SABS 1200 D (as amended) in addition to the cost of excavation, for basic selection and keeping selected material separate, for loading, transporting within the applicable freehaul distance, off-loading at the spoil or stockpile site, maintaining and finishing the spoil site, spreading, backfilling, watering, compacting as specified on the Drawings, final grading, shaping and trimming, for complying with the requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications.

The rate shall further also provide for backfilling any over-excavation or overbreak in accordance with the requirements of PSD 5.2.3.3.”

**PSD 8.3.2.2 Extra-over Items PSD 8.3.2.1 for:**

- (a) Hard rock excavation ..... Unit : m<sup>3</sup>
- (b) Boulder excavation, Class A ..... Unit : m<sup>3</sup>
- (c) Boulder excavation, Class B ..... Unit : m<sup>3</sup>

The rate shall cover the additional cost of the operations enumerated in Subclauses 8.3.2.1 above for any portion of the excavation that is classified as hard rock, boulder excavation class A or boulder excavation class B as applicable.

**NOTE:**

The rates tendered for Subclauses 8.3.2.1 and 8.3.2.2 above shall also provide for backfilling any over-excavation or overbreak in accordance with the requirements of PSD 5.2.3.3.”

**PSD 8.3.3 Restricted excavation**

Replace the heading of subclause 8.3.3 (a) and the contents of the first two paragraphs with the following:

“PSD 8.3.3(a) Excavate for restricted foundations, footings, aprons, beams, landscaping, structures, pathways, bollards, streetlights as well as for walls and drains, in all materials, and use for fill, backfill, berm or dispose, as ordered.....Unit: m<sup>3</sup>

Separate items will be scheduled for each category of excavation and for each class or manner of disposal of excavated material.

All restricted excavation shall be measured by volume.

Replace “in 5.2.2.1 – 5.2.2.3 (inclusive)” at the end of subclause (a) with “in Clauses 5.2.2.1 to 5.2.2.4 (inclusive).”

Delete Clause 8.3.3(b) (1) as well as any reference to intermediate excavation in subclause (b). For the purposes of measurement and payment, excavation other than hard rock and boulder excavation will not be separately classified (refer PSD 3.1.2).”

#### **PSD 8.3.6 Overhaul**

Delete Sub-clause 8.3.6.

No overhaul will be paid on material for the purposes of this Contract and all costs for transporting material shall be included in the applicable tendered rates and amounts.

#### **PSD 8.3.12 Road traffic signs and markings**

Delete the contents of this Sub-Clause.

The provisions of PSA 5.10 shall apply.

#### **“PSD 8.3.14\* Extra over items 8.3.2.1 and PSD 8.3.3 for temporary stockpiling ..... Unit: m<sup>3</sup>**

The unit of measurement shall be the cubic metre of material from necessary excavations, temporarily stockpiled by the Contractor on the instructions of the Engineer, before being used in embankments, fills or backfill.

Measurements shall be taken in place in compacted embankment, fills or backfill as the case may be.

The tendered rate shall include for the costs, additional to those provided for in PSD 8.3.2.1 and PSD 8.3.3 of off-loading, forming and maintaining the stockpile for as long as is required, reloading and transporting regardless of the distance involved from the stockpile.

Payments to the Contractor under this item will only be made in respect of that material stockpiled on the instructions of the Engineer (which instruction shall state specifically that payments for such stockpiling will be paid for under this item) and no payments will be made to the Contractor under this item in respect of materials stockpiled by the Contractor on its own volition, nor for materials necessarily stockpiled by the Contractor in

consequence of the sequence of operations adopted by it in the course of executing the Works, whether such stockpiling was avoidable or otherwise.”

**“PSD 8.3.15\*Trees and individual plants complete as detailed .....Unit: No**

Trees / plant installation type stated. (Refer details in schedule)

The rate tendered shall cover all costs to procure, collect, plant/install, construct and execute the following:

- The collection of the trees / plants from the nursery / supplier .
- The excavation of a 1 m<sup>3</sup> hole to accommodate the tree and required soil.
- The excavation of the plants bed to accommodate the plant and the required soil.
- Planting of the trees / plants and backfilling the remainder of the hole using a soil mix consisting of 40 % red soil, 50 % black soil and 10% mushroom compost. Each tree shall receive 500 grams super phosphate mixed into above-mentioned soil mix.
- The provision and installation of the tree support and guard as detailed on the drawings.
- The provision and installation of the specified tree grid and frame complete with all incidentals necessary, as detailed on the drawings.
- The tree shall be secured to the tree support with 3 x 500 mm x 30 mm rubber bands.
- The addition of 2 x 100 grams “AGRIFORM” tablets for each tree.
- Directly after planting, each tree shall receive 50 litres of water twice a week.
- Directly after the commencement of the Defects Liability Period, each tree shall be watered and maintained for a period of 6 months.
- Each tree shall receive at least 60 litres of water once a week and all unwanted weeds shall be removed from the soil base around the tree.
- Pruning required: None.

The tendered rate shall include for all fixings shown and detailed on the drawings.

Payment for this item will be as follows :

60% of the rate will be paid once the tree / plants have been delivered and planted to the satisfaction of the Landscaper.

A further 20% will be paid 3 months after initial planting based on the growth and health of the trees and plants as determined by the Landscaper.

The balance will be paid at the release of the retention period (12 months after the certificate of completion has been issued) if the trees and plants have been fully established as determined by the Landscaper.

Note: The Contractor's attention is drawn to Clause C3.4.5.1 under Part 3: Scope of Work.

**PSD 8.3.16\* Install root barrier geotextile..... Unit : m<sup>2</sup>**

The rates tendered shall cover the cost of supplying and installing a suitable root guard geotextile barrier to protect existing services adjacent to trees planted under PSD 8.1.15.

The geotextile shall comply with the following specifications:

- 17.5% : Active Chemical\*: Trifluralin (a,a,a-Trifluro 2,6 - dinitro - N,N, - Dipropyl - p - toluidine)
- 82.5% : Inert Ingredients: 100% Spunbonded Polypropylene, Polyethylene and Carbon"



**PSDA        EARTHWORKS (SMALL WORKS)**

**PSDA 3       MATERIALS**

**PSDA 3.1    Classification For Excavation Purposes**

Delete SABS 1200 D Clause 3.1 and replace with the following:

**PSDA 3.1.1 Method of Classifying**

The Contractor may use any method he chooses to excavate any class of material but his chosen method of excavation shall not determine the classification of the excavation. The Engineer or his Representative will decide on the classification of materials. In the first instance classification will be based on inspection of the material to be excavated and on the criteria given in PSD 3.1.2(a) and (b).

**PSDA 3.1.2 Classes of Excavation**

All materials encountered in any excavation for any purpose including restricted excavation will be classified as follows:

**(a)     Hard rock excavation**

Hard rock excavation shall be excavation in material (including undecomposed boulders exceeding 0.17 cubic metres in individual volume) that cannot be efficiently removed without blasting, wedging and splitting, or hydraulic hammers.

This classification includes materials such as:

- solid unfractured rock occurring in bulk
- solid ledges thicker than 200mm
- igneous rock intrusions
- cemented sedimentary rocks.

**(b)     Soft Excavation**

Any material which can be removed by bulldozers or backhoes, shall be classified as soft excavation.  
Soft excavation shall be material not falling into the category of hard rock excavation.

## **PSDA 5 CONSTRUCTION**

### **PSDA 5.1. Precautions**

#### **PSDA 5.1.1.2 Safeguarding of excavations**

Safeguarding of excavations will be the contractors full responsibility.

#### **PSDA 5.1.1.3 Explosives**

No blasting will be allowed

#### **PSDA 5.1.2.4 Negligence**

The applicable requirements of subclause 5.4 of SABS 1200A shall apply.

#### **PSDA 5.1.8 Road traffic control**

Traffic signs, barriers and flagmen will be required and shall be installed / placed as required. The requirements of subclause PSA 5.11\* will also apply.

#### **PSD 5.2.6.2 Overhaul**

Delete the contents of this clause. For the purpose of this contract, all haul shall be deemed to be freehaul, and the contractor is to include the cost of haul / transport in the relevant tendered rates.

## **PSDA 8 MEASUREMENT AND PAYMENT**

### **PSDA 8.3.3 Restricted excavation**

Replace the heading of subclause 8.3.3(a) and the contents of the first two paragraphs with the following:

**“PSDA 8.3.2(a)Excavate for restricted foundations, footings, trenches, stormwater drains, and landscaping as if in soft material and use for backfill or berm or dispose, as ordered.....Unit : m<sup>3</sup>**

Separate items will be scheduled for each category of excavation and for each class or manner of disposal of excavated material.

All restricted excavation will be measured by volume.

Delete subclause 8.3.3(b)(1) as well as any reference to intermediate excavation in subclause (b). For the purposes of measurement and

payment, excavation other than hard rock excavation (Class A or Class B) will not be separately classified (refer PSD 3.1.2).

**“PSDA 8.3.2 (c)\* Extra over PSDB 8.3.2(a) for hand excavation where ordered**  
Unit : m<sup>3</sup>

The rate tendered shall cover the additional cost, extra over that provided for under 8.3.2(a), for carrying out trench excavation by hand where ordered by the Engineer.

The volume shall be computed from the dimensions specified, shown on the drawings or ordered by the Engineer.”

Note: Normal handwork required to clean and trim the sides and bottoms of mechanically excavated trenches will not qualify for payment in terms of this clause”

**“PSDA 8.3.9\* Excavate and dispose of unsuitable material from sides or bottom of restricted foundations, footings, trenches and stormwater drains where ordered and replace with:**

- (a) Selected material complying with subclause 3.2.2 of SABS 1200 ME compacted to 90% of modified AASHTO maximum density (Source to be stated) ..... Unit : m<sup>3</sup>
- (c) 15MPa/19 concrete ..... Unit : m<sup>3</sup>

Separate items will be scheduled for each type of excavation, source of backfill material and manner of backfill.

The rates tendered shall cover the cost of excavating the unsuitable material to the extent ordered by the Engineer, disposing of the material as directed within a free haul distance and subsequent backfilling of the excavation using selected material or concrete as ordered.

NOTE: The work required to construct the selected layer beneath areas to be concrete lined will be measured for payment under (a) as applicable. The unit of measurement shall be the cubic metre of selected material placed and compacted. Any excavation required to accommodate the concrete lining will be deemed to be covered by subclause 8.3.4 of SABS 1200 DM.”

**PSGA CONCRETE (SMALL WORKS)**

**PSGA 1 SCOPE**

Add the following:

"This specification shall also cover the construction of the concrete walkways, traffic circles and concrete slabs."

**PSGA 3 MATERIALS**

**PSGA 3.2 CEMENT**

**PSGA 3.2.1 Applicable Specifications**

Replace the contents of this subclause with the following:

"Notwithstanding the contents of this Clause, where reference is made in this specification or the standard specifications to any cement specification, it shall be replaced with the following specification, SABS EN 197-1-Cement-Part 1: Composition, specifications and conformity criteria for common cements.

On this Contract cement grade CEM I 42, 5 shall be used."

**PSGA 3.2.2 Storage of cement**

Add the following:

"Cement shall not be stored for longer than 12 weeks without the Engineer's permission."

**"PSGA 3.8\* Curing compound**

Curing compound shall be white pigmented natural resin based liquid curing compound complying with ASTM 309-74."

**"PSGA 3.9\* STAINLESS STEEL**

The following grades of stainless steel shall be used:

- 316L for welded applications,
- 316 for not-welded applications."

## **“PSGA 3.10\* MATERIALS FOR BUILDING WORK**

### **PSGA 3.10.1 Cement**

The requirements stipulated for subclause 3.2.1 and PSGA 3.2.1 shall apply.

### **PSGA 3.10.2 Sand**

Sand for mortar shall comply with SABS 1090.

### **PSGA 3.10.3 Bricks**

Brickwork shall be built in stretcher bond. The walls shall be built to the dimensions shown on the Drawings or ordered. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course.

Walls shall be carried up regularly so that no brickwork is more than 1m higher than adjoining brickwork.

All bricks shall comply with SABS 227 and shall be NFX burnt clay masonry units free of stones, cracks and other defects. The bricks shall be obtained from an approved manufacturer and samples of the bricks shall be submitted to the Engineer for approval.

### **PSG 3.10.4 Mortar**

Mortar shall comprise of the cement, lime and sand mixed in the proportions given below:

Cement:	50 kg
Lime:	0 – 40L
Sand:	130L (measured loose and damp)”

## **PSGA 4 PLANT**

### **"PSG 4.4.2 Finish**

The finish to all exposed concrete shall be smooth and that to buried or backfilled surfaces, rough.

## **PSGA 5 CONSTRUCTION**

### **PSGA 5.4 CONCRETE**

#### **PSGA 5.4.1.5 Strength Concrete**

Add the following:

"The Contractor shall when requesting approval of a mix design, submit the constituent proportions of the proposed mix together with the results of compressive strength tests carried out."

#### **PSGA 5.4.2 Batching**

Notwithstanding the requirements of this Clause, the method of batching shall be subject to approval.

#### **PSGA 5.4.7 Curing and protection**

Notwithstanding the provisions of this subclause, all cast in situ concrete shall, except where otherwise authorised, be cured in accordance with the requirements of subclause (c) using curing compound of the type specified in PSGA 3.8.

#### **PSGA 5.4.8 Concrete surfaces**

All unformed concrete surfaces shall, except where otherwise ordered, be given a wood float finish.

### **“PSGA 5.5\* CONSTRUCTION OF CONCRETE SURFACING**

The surfaces on which concrete are to be cast shall, after being trimmed and compacted, be covered with a sprayed bitumen emulsion primer or polyethylene sheeting of nominal thickness 0, 25 mm, all joints in the sheeting being overlapped at least 150mm. Care shall be taken not to damage the bitumen layer or the polyethylene sheeting (as relevant) during the placing of reinforcement and during concreting.

Joints in concrete shall be sealed and shall be constructed as shown on the drawings. The paving shall be cast in alternate panels and, after the concrete in the alternate panels has set, the exposed end surfaces shall be painted with bituminous emulsion before the intermediate slabs are cast.

The exposed surfaces of the concrete shall be given a broom textured finish and shall be cured as specified in 5.4.7 and PSGA 5.4.7.”

## **“PSGA 5.6\* BRICKWORK**

Brickwork shall be built in stretcher bond, except for the top course of the walls which shall be built in soldier course. The walls shall be built to the dimensions shown on the drawings or ordered. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course.

Walls shall be carried up regularly so that no brickwork is more than 1m higher than adjoining brickwork.

Mortar joints shall not exceed 10 mm in thickness and shall be pointed. The mortar used shall be mixed in small quantities and used within 2 hours of mixing. Bricks shall further be clay fire bricks to SABS 227.”

## **PSGA 6 TOLERANCES**

### **PSGA 6.4 PERMISSIBLE DEVIATIONS**

Add the following:

"Notwithstanding the tolerances specified for the construction of the embankment, the following tolerances shall apply to the construction of the apron slab:

Position in plan	:	Within 100mm of its designated position, provided that over any length of 30m, the deviation from a straight line joining the extremities of the 30m section, shall not exceed 25mm.
Thickness	:	Not less than 95mm.
Width	:	± 25mm provided the requirements with respect to alignment are met.
Level	:	± 10mm provided the requirement with respect to thickness is met and that the distance between the surface and a 3m straight edge placed on the apron slab is nowhere more than 5mm.

## **PSGA 7 TESTS**

### **PSGA 7.1.2 Frequency of sampling**

Notwithstanding the requirements of this subclause, the Contractor shall take note that he is responsible for taking an adequate number of tests to ensure that the concrete being used complies with the specification. The Engineer will only carry out such control testing as he may require.

## **PSGA 8 MEASUREMENT AND PAYMENT**

### **PSGA 8.1.2 Reinforcement**

Replace the contents of this clause with the following:

"The unit of measurement for steel bars shall be the ton of reinforcement in place in accordance with the drawings or as authorised by the Engineer.

The unit of measurement for welded steel fabric shall be the square metre of fabric reinforcement in place and the quantity shall be calculated from the nett area covered by the mesh, excluding laps.

Clips, ties, separators, stools and other steel used for positioning reinforcement shall not be measured unless shown on the bending schedules.

The rate tendered shall cover the cost of the supply, delivery, cutting, bending, placing and fixing of the steel reinforcement, including all tying wire, stools, supports and waste."

### **PSGA 8.1.3 Concrete**

Delete all references to "intermediate excavation" throughout this subclause.

Notwithstanding the provisions of subclause 8.1.3.1 (b) and (d) concrete required to replace overbreak or over-excavation will not be measured for payment (refer PSD 3.2.2, PSD 5.1.1.3 and PSD 5.2.2.1).

Add after "testing" in the second line of subclause 8.1.3.3(a) "including transport to an approved laboratory."

### **PSGA 8.4.4 Unformed surface finishes**

Add the following :

"(c) ..... Broom textured finish Unit : m<sup>2</sup>"

### **"PSGA 8.4.5\*Concrete surfaces (Surface area to be paved, thickness and grade of concrete specified) ..... Unit: m<sup>2</sup>**

The unit of measurement shall be the plan area of concrete surfacing to be placed, irrespective of shape, cross-sectional slope or longitudinal grade.

The rate tendered shall cover the cost of all labour, plant, materials, formwork and incidentals required to construct the surfacing complete as detailed on the drawings, including for the rounding the edges, trimming and compaction of the layer to receive concrete, in the positions and to the extent shown on the drawings, or directed on site, including sprayed



bitumen emulsion primer or polyethylene sheeting, formwork, mesh reinforcement, where applicable, and for texturing. (Expansion joint will be measured elsewhere).

Note :

The testing of the surfacing will be carried out in terms of the applicable requirements of Clause 7 of SABS 1200 MK and PSMK 7 and payment for testing will be effected in terms of PSMK 8.2.3.

The acceptance criteria stated in PSMK 8.2.1 shall also apply to concrete surfacing placed in terms of this specification.

No additional payment will be made for forming voids or boxing out holes.

**“PSGA 8.6\* Construct raised pedestrian crossing complete (Table Top) ... Unit: m**

The unit of measurement shall be the linear meter of crossing constructed measured from one end to the other across the roadway. It should be noted that the average length of crossing is approximately 14 500 mm.

The rate tendered shall cover the cost of all labour, plant, materials, formwork and incidentals required to saw cut the existing bituminous surfacing, to excavate into the existing road surface and layerworks, and to construct the crossing complete as detailed on the drawings, including mortar layer under paving, for trimming and compaction of the layer to receive concrete, in the positions and to the extent shown on the drawings or directed on site, including sprayed bitumen emulsion primer or polyethylene sheeting, formwork, concrete, and for texturing and colouring where applicable as shown. Road signs, road mark painting, kerbing and paving will be measured elsewhere.

**PSLC CABLE DUCTS**

**PSLC 1 SCOPE**

Add the following to subclause 1.1:

“This specification shall also cover the supply, laying and bedding in trenches of pipes as ducts for the provision and protection of telecommunication and data cables.”

**PSLC 2 INTERPRETATIONS**

**PSLC 2.1 SUPPORTING SPECIFICATIONS**

Add the following to this subclause:

“f) SABS 1200 GA

**PSLC 3 MATERIALS**

**PSLC 3.1 DUCTS**

Irrespective of this clause all pipes for cable ducts shall be as follows:

a) Data and telecommunication ducts:

Pipes shall be smooth bore, green, HDPE, Telkom approved ducting pipe, “Kabelflex” or similar approved, complete with push fit couplings and rubber sealing rings.

b) Electrical ducts:

Pipes shall be smooth bore, black, HDPE ducting pipe, “Kabelflex” or similar approved, complete with push fit couplings and rubber sealing rings.

**PSLC 3.2 BEDDING**

Delete sub-clauses 3.2.1 and 3.2.2 and replace with the following:

“Selected granular material shall be an aggregate, sand or granular material all of a non-cohesive nature, the grading analysis of which shows 100% passing a 13.2 mm sieve and not more than 5% passing a 0.075 mm sieve (Metric sizes). The Compactability Factor shall not exceed 0, 4.”

**PSLC 3.3 BACKFILL**

Notwithstanding the provisions of this Clause, the material to be used for backfill in areas subject to road traffic loads shall be subbase quality

material complying with the requirements of Clause 3.2.1 of SABS 1200 ME and PSME 3.2.1.

#### **PSLC 3.4 CABLE DUCT MARKERS**

Where applicable, temporary markers shall be provided at the end of each duct.

The ends of all ducting pipes shall be temporarily marked with a 300 x 100 x 75 mm clay brick planted 200 mm vertically into the ground directly above the end plugs. The ends of the draw ropes shall be attached to this brick marker. The exposed part of the brick marker shall be painted as follows:

Electricity	Red
Telkom	Green
Communication	Yellow

Permanent markers shall be provided in accordance with the requirements of PSLC 5.10.

#### **PSLC 5 CONSTRUCTION**

##### **PSLC 5.1 EXCAVATION OF TRENCHES**

Material excavated other than hard rock, will not be separately classified for the purpose of measurement and payment. The unit rate for excavation shall cover excavation in soft and intermediate material.

##### **PSLC 5.1.1 Trench widths and depths**

Replace the contents of Clauses 5.1.1.1 and 5.1.1.4 with the following:

“Subject to the requirements of 5.2.4, trenches for ducts shall be excavated to widths determined in accordance with the following minimum requirements:

- Minimum trench width, 450 mm
- Minimum side allowance, 100 mm
- Minimum horizontal spacing between ducts measured at a coupling, 50 mm.”

Replace the contents of Clause 5.1.1.2 with the following:

“Subject to the requirements of 5.2.2.1 and 5.2.4 and unless otherwise shown on the drawings or ordered, trenches shall be excavated to such a depth that, after the duct or nest of ducts has been laid, there is a minimum cover to ground level of at least:

- a) 600 mm for communication and data ducts and

- b) 1 200 mm for electrical ducts.”

**PSLC 5.1.3\* Excavation for trenches at road crossings**

The requirements of PSDB 5.4 shall apply with the additional proviso that the minimum depth of cover over ducts shall be 300mm where construction traffic is liable to cross them. Road crossings shall therefore be constructed after the construction of the roadworks has reached the stage where the required cover is available.

**PSLC 5.3.3 Draw wire**

Notwithstanding the requirements of this Subclause, the nominal diameter of draw wire shall be 3 mm.

**PSLC 5.3.5\* Laying to grade**

Where two or more Telkom ducts of internal diameter greater than 75 mm are laid together in the same trench, the ducts shall be laid to a minimum grade of 1:400.”

**PSLC 5.6 LAYING OF TELECOMMUNICATIONS AND DATA DUCTS WITH OTHER SERVICES**

The horizontal separation between telecommunications ducts and other services shall be the maximum possible but in the case of electricity cables at least 300mm. Where the latter cannot be attained the ducts shall be separated from the cables by means of concrete protection slabs (see below) placed vertically.

No service other than telecommunications ducts shall be laid directly above and parallel to a telecommunication duct.

The concrete protection slabs mentioned above shall be 400mm square by 50 mm thick and shall be reinforced with welded mesh Ref. 193. The concrete used shall be 20 MPa/13 and the slabs shall be finished off to the satisfaction of the Engineer.

Replace the heading and contents of Subclause 5.7 with the following:

**“PSLC 5.7 CROSSING OF TELECOMMUNICATION DUCTS WITH OTHER SERVICES**

Telecommunications ducts should preferably cross above other services. The radial separation at such crossings shall be the maximum possible but in the case of electricity cables at least 300mm. Where the latter cannot be attained, concrete protection slabs as specified in PSLC 5.6 shall be placed above the electricity cable for a distance of 800 mm on either side of the crossing (or below as the case may be).”

## **PSLC 5.8 ROAD CROSSINGS**

Delete the last sentence and replace with:

“The duct(s) shall extend a distance of at least 1m beyond the rear of kerb or walkway as applicable.”

## **PSLC 5.10 POSITION TO BE MARKED**

Replace the contents of this Subclause with the following:

Marking is required on both sides of the carriageway.

“The position of each duct shall be marked by imprinting a letter “I”, “T” and “E”, as applicable, into the wet concrete of extruded kerbs, directly above the duct. The imprint shall be 100 mm high and 10 mm deep and the tool used shall be of an approved shape and design.

Where there is no kerb face, or where pre-cast kerbs are used, the duct shall be marked with a concrete marker comprising a 150mm square by 300mm long, 20 moa/19 concrete block, with the appropriate letter imprinted on the square face. The marker shall be placed hard up against the edge of the road surface or the back of the kerb, level with the verge.”

## **PSLC 8 MEASUREMENT AND PAYMENT**

### **PSLC 8.1 GENERAL**

Add the following:

“Material displaced by the pipeline and by imported material from sources other than trench excavation, shall be disposed of at an approved site furnished by the Contractor. No haulage shall be payable for such material.”

### **PSLC 8.2.2 Schedule Items**

Replace the last line of the first paragraph of Subclause (a) “determined ..... drawing” with “determined in accordance with the provisions of PSLC 5.1.1 and that ordered in terms of PSLC 5.6.”

Delete payment clause 8.2.2(b) and add the following:

“8.2.2(b) Extra over item (a) above for:

Hard rock excavation.....Unit: m<sup>3</sup>

**PSLC 8.2.5 Supply, lay, bed and prove duct**

Add after “specified” in paragraph (a) of this clause “as well as the cost of complying with PSLC 5.3.5.”

The tendered rate shall further include all labour, plant, material and incidentals, including push fit couplings, rubber seal rings, end plugs, draw wire, protection during construction and marking of the duct ends.

Replace the heading and contents of Clause 8.2.6 with the following:

**PSLC 8.2.6 “Provision of selected granular material complying with PSLC 3.2**

(a) From commercial or off-site sources located by Contractor ....Unit: m<sup>3</sup>

The rate tendered for shall cover the cost of acquiring, regardless of distance, the required bedding from commercial or off-site sources located by the Contractor, delivering it to points alongside the trench spaced to suit the Contractor’s method of working and disposing of material displaced by each importation within a freehaul distance of 0.5 km.

**PSLC 8.2.9 Overhaul of surplus excavation**

Delete this subclause.

**“PSLC 8.2.10\*Imported backfill (source and quality stated) .....Unit: m<sup>3</sup>**

The provisions of Clause 8.3.3.1 of SABS 1200 DB shall apply, except that the trench width shall be determined in accordance with PSLC 5.1.1 or that called for in terms of 5.6.

**“PSLC 8.2.11\*Compaction in road reserves .....Unit: m<sup>3</sup>**

The provisions of PSDB 8.3.3.3 shall apply, except that the trench width shall be determined in accordance with PSLC 5.1.1 or that ordered in terms of PSLC 5.6 and payment will be extra over that covered by 8.2.2(a)”.

**“PSLC 8.2.12\*Supply and installation of concrete protection slabs ..... Unit: No**

The rate tendered shall cover the cost of all labour, plant and material required to manufacture the protection slabs as specified in PSLC 5.6, as well as placing and bedding the slabs.

## **PART E PROVISION OF THE TEMPORARY WORKFORCE**

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#### **E1. SCOPE**

This Specification covers the provisions and requirements relating to the provision of the temporary workforce.

#### **E2. INTERPRETATIONS**

##### **E2.1 Supporting Documents**

The Tendered Rules, Conditions of Contract, Standard and Construction Specifications, Drawings and statutory minimum requirements relating to the employment and remuneration of labour shall *inter alia* be read in conjunction with this Specification.

##### **E2.2 Definitions and abbreviations**

For the purposes of this specification, the definitions given in the Conditions of Contract, the Standard Specifications and the Construction Specifications, together with the following additional definitions shall, unless the context dictates otherwise, apply:

(i) "Key Personnel" means all contracts managers, site agents, materials and survey technicians, trainers, supervisors, foremen, skilled plant operators, artisans and the like, and all other personnel in the permanent employ of the Contractor or Subcontractor who possess special skills and/or who play key roles in the Contractor's or Subcontractor's operation

(ii) "Project Committee" means a committee consisting of the Employer, the Engineer, the Contractor, (or their nominated representatives) as well as representatives of the temporary workforce, which is convened from time to time at

the discretion of the Engineer, for the purposes of acting as an avenue for effective communication and liaison between all the parties referred to, in all matters pertaining to the Contract

(iii) "Subcontractor" means any person or group of persons in association, or firm, or body corporate (whether formally constituted or otherwise) not being the Contractor, to whom specific portions or aspects of the Works are sublet or subcontracted by the Contractor in accordance with the provisions of the Contract

(iv) "Worker" for the purposes of this Specification means any person, not being one of the Contractor's key personnel, nor any key personnel of any Subcontractor, who is engaged by the Contractor, a Subcontractor or the Employer to participate in the execution of any part of the Contract Works and shall include unskilled labour, semi-skilled and skilled labour, clerical workers and the like

(v) "Workforce" means the aggregate body comprising of all workers and shall, unless the context dictates otherwise, include the workforces of the Contractor and all Subcontractors

(vi) "Liaison Officer" means a representative from the temporary workforce, duly elected by them, to act on their behalf and through whom all matters pertaining to the temporary workforce can be channelised.

### **E2.3 Status**

Where any provisions or requirements of this Specification are in conflict with anything elsewhere set out in the Contract, the provisions and requirements of this Specification shall take precedence and prevail.

### **E3. Permitted Sources Of Temporary Workers**

The Contractor shall as far as possible make optimum use of the human resources outside his own workforce and the workforces of all Subcontractors. The temporary workforce which is to be used in the execution of the Works in terms of Part A may consist of the workers of various communities, and shall not be bound to one particular community.

### **E4. EMPLOYMENT RECORDS TO BE PROVIDED**

The Contractor shall maintain accurate and comprehensive records of all workers engaged on the Contract and shall provide the Engineer at monthly intervals from the commencement of the Contract, with interim records substantiating the actual numbers of employment opportunities which have been generated to date and the amounts actually paid in respect thereof. Such interim records shall be in a format approved by the Engineer.

The Contractor shall, on completion of the Contract, and as a pre-requisite event to the release of any retention money in terms of the Conditions of Contract, provide the Engineer with copies of the Terms of Employment as well as independently audited



documentary evidence of the total number of temporary and permanent employment opportunities actually generated during the Contract.

#### **E5. VARIATIONS IN WORKER PRODUCTION RATES**

Notwithstanding anything to the contrary as may be stated in or inferred from any other provision of this Contract, the Contractor shall not be entitled to any additional payment or compensation whatever, in respect of any differences as may result between the production rates actually achieved by workers in the course of the execution of the Contract Works and those production rates on which he has based his Tendered.

#### **E6. TRAINING OF THE TEMPORARY WORKFORCE**

Selected members of the workforce are to be provided with structured training in accordance with the provisions of Part F.

The Contractor shall make all necessary allowances in his programme of work to accommodate and facilitate the delivery of such structured training and shall comply fully with the requirements of Part F.

The provision of structured training as described in Part F shall not relieve the Contractor of any of his obligations in terms of the Conditions of Contract and the Contractor shall remain fully liable for the provision, at his own cost, of all training of the workforce, additional to that as provided for in Part F, as may be necessary to achieve the execution and completion of the works strictly in accordance with the provisions of the Contract.

#### **E7. RECRUITMENT AND SELECTION PROCEDURES**

The Contractor through the Project committee shall be fully responsible for the recruitment and selection of workers to constitute the temporary workforce.

The Contractor shall advise the Engineer in writing of the numbers of each category of temporary worker which he requires, together with the personal attributes which he considers desirable that each category of worker shall possess (taking due cognisance of the provisions of the Contract relating to training).

The Contractor shall, at his own cost, take all necessary actions to advertise within the communities comprising the personnel resources, the fact that temporary employment opportunities exist and the time and place where recruiting will occur. This shall include making contact with the local ward councillors and or labour forums that may exist. Delays in obtaining temporary workers shall not be accepted as reasonable grounds for seeking an extension of time claim.

The Contractor shall record in writing, the details of all persons applying for employment, including *inter alia*:

- (i) Name, address, age and sex
- (ii) Marital status and number of dependants
- (iii) Qualifications and previous work experience (whether substantiated or not)

- (iv) Period since last economically active
- (v) Preference for type of work or task.

The Contractor shall make his selection of workers from amongst the applicants, taking due cognisance of his requirements for the workforce and the provisions of the contract in regard to the provision of training to the workforce and in accordance with the following principles:

- (i) No potential temporary worker shall be precluded from being employed by the Contractor on the execution of the Works, by virtue of his lack of skill in any suitable operation forming part of the Works, unless -
  - all available vacancies have been or can be filled by temporary workers who already possess suitable skills, or
  - The Time for Completion allowed in the Contract, or the remaining portion of the Contract Period (as the case may be) is insufficient to facilitate the creation of the necessary skills.
- (ii) Preference shall be given to the unemployed and single heads of households.
- (iii) The Contractor shall, in so far as is reasonably practicable, give priority to accommodating the applicants' expressed preferences regarding the types of work for which they are selected.

(iv) The selection process shall not be prejudicial to youth (over the age of fifteen years) and women. After making his selection, the Contractor shall advise the Engineer thereof, in writing and the Engineer shall, without undue delay, ratify the Contractor's selection.

The provisions of this clause shall apply *mutatis mutandis* in respect of the selection of additional or replacement members of the workforce as may be necessary from time to time during the Contract.

The Contractor shall, after selecting his temporary workforce, arrange at his own cost for the appointment of the Liaison Officer as representative of the workforce to act on their behalf with regards to all matters pertaining to the workforce.

## **E8. TERMS AND CONDITIONS PERTAINING TO THE EMPLOYMENT OF THE TEMPORARY WORKFORCE**

**E8.1** All temporary workers engaged in accordance with the provisions of the Construction Specifications, shall be employed on the terms and conditions of employment as are consistent with those as set out in this Contract. The Contractor shall implement and adhere strictly to such terms and conditions relating to the employment of the temporary workforce, and subject only to the provisions of this Contract, shall not employ any temporary worker on terms and conditions which are less favourable to the worker or inconsistent with the standards and norms generally applicable to temporary workers in the Civil Engineering Industry and applicable to the particular area.

**E8.2** The Contractor shall pay to all temporary workers engaged in terms of Part A of the Construction Specifications, not less than the minimum rate of remuneration as specified by the Department of Labour for the free State area.

## **E9. LABOUR RELATIONS AND WORKER GRIEVANCE PROCEDURES**

The Contractor, as the Employer of the workforce, shall be fully responsible for the establishment and maintenance at his own cost, of satisfactory labour relations on site and the resolution of all grievances of temporary workers as may occur.

The Contractor shall at all times adhere to the accepted norms and standards of labour relations prevailing generally in the Civil Engineering Construction Industry and shall conduct himself in a fair and reasonable manner, within the constraints as may be imposed upon him by the terms of the Contract.

In the event of any temporary worker engaged by the Contractor in terms of the Contract, being aggrieved with regard to his terms of employment, working conditions and training, he shall have the right, at his discretion, to be supported in any inquiry or disciplinary hearing or investigation instituted by the Contractor by one member of the temporary workforce and one member of the Project Committee, which persons shall be nominated by the worker.

In the event of any grievance not being satisfactorily resolved through the application of normal dispute resolution procedures, then either the Contractor or the worker concerned may require that the matter be referred to the Project Committee for further consideration, with a view to facilitate the resolution thereof.

## **E10. THE SUBCONTRACTORS' WORKFORCES**

The provisions of this Part F shall apply *mutatis mutandis* to the workforces employed by all Subcontractors engaged by the Contractor and the Contractor shall be fully responsible for ensuring, at his own cost, that the terms of every subcontract agreement entered into are such as to facilitate the application of these provisions in respect of the workforces of all Subcontractors.

The Contractor shall at his own cost and to the extent necessary, assist and **monitor all Subcontractors in the application of the provisions of this Specification, and shall**, in terms of the Conditions of Contract, remain fully liable in respect of the acts, omissions and neglects of all Subcontractors, in respect of the application of the provisions of this Specification.

## **E11. MEASUREMENT AND PAYMENT**

The Contractor will not be separately reimbursed or compensated in respect of the provision of the workforce and creation of temporary employment opportunities and all the Contractor's costs associated with compliance with the provisions of this part of the Construction Specifications shall, except to the extent provided for in Part F as relevant, be deemed to be included in the rates tendered for the various items of work listed in the Bill of Quantities.

## **PART F: PROVISION OF STRUCTURED TRAINING**

### **CONTENTS**

<b>F1</b>	<b>SCOPE</b>
<b>F2</b>	<b>INTERPRETATIONS</b>
<b>F3</b>	<b>ENGINEERING SKILLS TRAINING</b>
<b>F4</b>	<b>ENTREPRENEURIAL SKILLS TRAINING</b>
<b>F5</b>	<b>MEASUREMENT AND PAYMENT</b>

#### **F1. SCOPE**

This specification covers the requirements for the provision of the following training:

- (i) Specified structured training to selected members of the workforce and small, medium and micro enterprises (SMME's) by a selected Subcontractor as appointed by the Employer.
- (ii) Additional training deemed necessary by the Contractor, to members of the workforce and small, medium and micro enterprises (SMME's).

#### **F2. INTERPRETATIONS**

##### **F2.1 Supporting documents**

The Tendered Rules, Conditions of Contract, Standard, Supplementary and Specific Specifications and Construction Specifications and drawings shall *inter alia* be read in conjunction with this specification.

##### **F2.2 Application**

The provisions of this specification shall apply in respect of all workers and small, medium and micro enterprises other than the Contractor's key personnel, who are engaged on the execution of the works.

#### **F3. ENGINEERING SKILLS TRAINING**

The Contractor shall, from the commencement of the contract, implement a structured training programme comprising of the training delivered by the Selected Subcontractor and any additional training as provided for by the Contractor, in which the various skills required for the execution and completion of the works are imparted to the workers, and where applicable, small, medium and micro enterprises engaged thereon, in a

Programmed and progressive manner. Selected workers shall be trained progressively throughout the duration of the contract in the various stages of a particular type of work.

### **F3.1      Training programme**

The skills training programme to be implemented by the Selected Subcontractor shall comply with the following minimum standards:

- a) Be accredited by the Engineering Industry Training Scheme (CEITS) or other institution recognised by the Department of Labour, as being appropriate for application on this project. Accredited training refers to both the trainers as well as to the training materials.
- b) Be delivered by suitably qualified and experienced trainers accredited to do so.

### **F3.2      In house training**

The Contractor shall provide with his Tendered, full details of any additional accredited and in-house training, viewed to be necessary by the Contractor, which he intends to implement at his own cost. These details shall include the following:

- (i) The name of the accredited training institution and programme
- (ii) The various aspects of each type of training comprised in the programme
- (iii) The manner in which the training is to be delivered
- (iv) The numbers and details of the trainers to be utilized.

Details of such additional skills training shall be attached to Form H of the forms to be completed by the Tenderer.

### **F3.3      Additional training**

The Contractor shall be responsible for the provision of the following necessary for the delivery of the specified and additional skills training programme, including the following:

- (i) Sufficient skilled, competent and accredited trainers to deliver the additional training programme to workers in accordance with the training programme
- (ii) A suitably furnished venue
- (iii) Transport of the workers as required
- (iv) Tools, equipment, and teaching aids
- (v) Stationery and all other necessary materials.

### **F3.4      Selection of candidates**

Members of the workforce will be selected by the Engineer, assisted by the Contractor and the Liaison Officer, to receive specific training as approved by the Engineer.

The following will be taken into account in the selection of the workers to receive the specified training:

- (i) Previous experience (if any)
- (ii) Previous courses completed (if any)
- (iii) Module specific requirements.

### **F3.5 Duration of training**

The Contractor shall allow in his programme for the selected members of the workforce to be engaged in the specified training modules.

Provision must also be made by the Contractor for members of the workforce to receive any additional training as provided for by the Contractor.

### **F3.6 Training hours**

All specified skills-related training shall take place only during normal working hours and the Contractor shall ensure that the selected workers are available at the appropriate times to undergo such training.

### **F3.7 Approval of training**

Both the Selected Subcontractor's and the Contractor's additional training programme shall be subject to the approval of the Engineer, and if so instructed by the Engineer, the Contractor shall alter or amend the programme and course content to suit changing conditions on site and all changes in the Contractor's programme of work.

### **F3.8 Training record**

The Contractor shall keep comprehensive records of the training given to each worker involved in training as well as the nature and number of each task executed by the worker and whenever required shall provide copies of such records to the Engineer.

### **F3.9 Remuneration during training**

Workers shall be remunerated in respect of all time spent undergoing the specified training in terms of Clause D03.02, at the minimum specified wage rate for the area of the Works.

### **F3.10 Use of workers**

The Contractor shall, in so far as it is reasonably feasible, take due cognizance of the nature of the works to be executed at any given time and use trained workers on those aspects of the works for which they have been trained.

## **F4. ENTREPRENEURIAL SKILLS TRAINING**

### **F4.1 Selection of Candidates**

Members from selected small, medium and micro enterprises employed by the Contractor as Subcontractors will be entitled to receive a structured training programme, comprising of training delivered by a Selected Subcontractor and any additional training as provided for by the Contractor, the training will comprise both management skills as well as business development skills.

#### **F4.2      Performance and monitoring**

The Contractor shall closely monitor the performance of all the Subcontractors in the execution of their contracts and shall identify all such Subcontractors who, in his opinion, display the potential to benefit from structured training as may be provided for elsewhere in the Contract and where required by the Engineer, and shall make recommendations in this regard. The final list of candidates will be decided between the Contractor, the Engineer and the Project Committee.

#### **F4.3      Delivery of training**

The Contractor shall assist in facilitating in the delivery of the training, by instructing and motivating the Subcontractor's regarding attendance and participation therein.

#### **F4.4      Programming of work and training**

The Contractor shall further make all reasonable efforts to co-ordinate the programming of the Subcontractor's work with that of the delivery of the structured training.

#### **F4.5      Training standards**

The entrepreneurial skills training programme to be implemented by the selected Subcontractor shall comply with the following minimum standards:

(i) Be accredited by the Engineering Industry Training Scheme (CEITS) or other institution recognised by the Department of Labour, as being appropriate for application on this project. Accredited training refers to both the trainers as well as to the training materials.

(ii) Be delivered by suitably qualified and experienced trainers accredited to do so

#### **F4.6      Certificates**

Following completion of the structured training, members of small, medium and micro Subcontractors that have demonstrated understanding of and competence in the training material are to be appropriately certified by the accrediting body.

#### **F4.7      In house training and additional training**

The Contractor shall provide with his Tendered, full details of any additional accredited and in-house training, viewed to be necessary by the Contractor, which he intends to implement at his own cost. These details shall include the following:



- (i) The name of the training institution and programme
- (ii) The various aspects of each type of training comprised in the programme
- (iii) The manner in which the training is to be delivered
- (iv) The numbers and details of the trainers to be utilized.

Details of such additional entrepreneurial training shall be attached to Form H of the forms to be completed by the Tenderer.

#### **F4.8 Provision of entrepreneurial training**

The Contractor shall be responsible for the provision of the following necessary for the delivery of the entrepreneurial training programme, including the following:

- (i) Sufficient skilled and competent trainers to deliver the additional training programme to trainees in accordance with the training programme
- (ii) A suitably furnished venue
- (iii) Transport of the trainees as required
- (iv) Tools, equipment, and teaching aids
- (v) Stationery and all other necessary materials.

#### **F4.9 Training hours**

All specified entrepreneurial training shall take place within normal working hours.

#### **F4.10 Approval of training**

Both the Selected Subcontractor's and the Contractor's training programme shall be subject to the approval of the Engineer, and if so instructed by the Engineer shall alter or amend the programme and course content.

#### **F4.11 Training records**

The Contractor shall keep comprehensive records of the training given to each Subcontractor involved in training and whenever required shall provide copies of such records to the Engineer. At the successful completion of each course each Subcontractor shall be issued with a certificate indicating the course contents as proof of attendance and completion.

#### **F4.12 Remuneration during training**

No remuneration in respect of time spent undergoing specified training in terms of this clause will be made to any of the Subcontractors.



## **F5. MEASUREMENT AND PAYMENT**

### **F5.1 Basic principles**

#### **a) General**

Measurement and payment for all work executed in terms of this contract shall be measured and paid for in accordance with the principles of the Construction Specifications, irrespective of whether the work is executed as an integral part of the provision of training in terms of this specification.

#### **b) Training**

The Contractor shall only be reimbursed for the amounts actually paid by the Contractor to the Selected Subcontractors as appointed by the Employer, in execution of the Engineer's written instruction, plus a percentage as Tendered to cover all his charges and profits.

### **F5.2 Scheduled items**

Payment items are included in the bill of Quantities for the provision of the specified training by selected Subcontractors only.

	<b>Item</b>	<b>Unit</b>
<b>F5.2.1</b>	<b>Conducting of skills audit and the development of a training plan</b>	<b>Provisional</b>
<b>Sum</b>	<p>A provisional sum is allowed for the conducting of a skills audit of the Local Labour, as well as the compilation of a training plan.</p> <p>The provisional sum shall include full compensation for identification of pre-qualification criteria and training needs, staff assessment and evaluation prior to training, all technical research, identification of accredited training courses, and all other actions necessary for commencement of official training sessions in accordance with the specification.</p> <p>Any expenditure under this item requires the written prior approval of the Engineer and Employer.</p>	

<b>Item</b>	<b>Unit</b>
<b>F5.2.1</b>	<b>Presenting accredited training course for Local Labour and MEs</b>
<b>Sum</b>	<p>The provisional sum shall include full compensation for presenting the courses, including lectures, demonstrations, on-site training and hands-on development, and improvement of maintenance personnel's skills to enable them to maintain and repair installations safely and efficiently at the satisfactory functional condition specified.</p> <p>The provisional sum shall also include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such as paper hand-outs and slides for the whole group of trainees, the number of which shall be determined during development of the training course.</p>

Any expenditure under this item requires the written prior approval of the Engineer and Employer.

#### **F5.2.2 Penalty Calculation**

##### **Use of Local Labour**

Should the contractor fail to meet the minimum requirement of creating 10 employment opportunities on site for the duration of the contract, a penalty of 1,5 \* the value of the amount of employment that was not created, calculated at R350-00 per day per person, will be calculated and imposed. This amount will be deducted from the Contractor's payment certificate.

The Contractor is to indicate to the Municipality via a report certified by their auditors indicating the payments made to Local Labour at the end of the Contract before the retention money is released.

**MECHANICAL PROJECT**  
**SPECIFICATION & DATA**  
**SHEETS**

**MPS\_01: Distribution Pump Sets (Option 1)**

1. Scope of Works																																															
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the Distribution Pump Sets and pipe work.																																														
2. Description of the Equipment																																															
2.1	Four pump sets are required. The four pump sets receives water from the suction ring pipe work, supplied from the Rand Water Facility, situated next to the Distribution pump station site. Each of the four pumps can pump individually or together in combination, one, two or three pumps operating. The delivery pipe work allows for different delivery options. The distribution pumps can deliver to the reservoirs, the pressure tower and directly into the distribution network. The existing pump sets must be replaced with new pump and pipe work.																																														
3. General Information																																															
3.1	Medium type; Potable Water.																																														
3.2	Medium SG; 1.0																																														
3.3	Medium pH; 5 - 7.																																														
3.4	Medium Temperature; 10 - 25 °C.																																														
3.5	Location; Distribution Pump Station.																																														
3.6	Reference Drawings;																																														
4. Distribution Pump																																															
	<table><thead><tr><th>SPECIFIED</th><th>OFFERED</th></tr></thead><tbody><tr><td>4.1 Manufacturer;</td><td>-</td></tr><tr><td>4.2 Model;</td><td>-</td></tr><tr><td>4.3 Quantity;</td><td>4</td></tr><tr><td>4.4 Duty point flow, 1x pump, (L/s);</td><td>262.9</td></tr><tr><td>4.5 Duty point head, 1x pump, (m);</td><td>43.5</td></tr><tr><td>4.6 Duty point flow, 2x pump parallel , (L/s);</td><td>N/A</td></tr><tr><td>4.7 Duty point head, 2x pump parallel , (m);</td><td>N/A</td></tr><tr><td>4.8 Pump configuration;</td><td>Four duty</td></tr><tr><td>4.9 Pump type;</td><td>Axially Split Volute Casing</td></tr><tr><td>4.10 Duty point efficiency (%);</td><td>&gt; 95% of BEP</td></tr><tr><td>4.11 Pump min. flow (L/s);</td><td>83.33</td></tr><tr><td>4.12 Pump max. flow (L/s);</td><td>-</td></tr><tr><td>4.13 Discharge diameter (mm);</td><td>-</td></tr><tr><td>4.14 Suction diameter (mm);</td><td>-</td></tr><tr><td>4.15 Solids handling size (mm);</td><td>N/A</td></tr><tr><td>4.16 Speed at duty point (rpm);</td><td>1450</td></tr><tr><td>4.17 Max. speed (rpm);</td><td>-</td></tr><tr><td>4.18 Shut-off head (m);</td><td>-</td></tr><tr><td>4.19 BEP head (m);</td><td>-</td></tr><tr><td>4.20 BEP flow (L/s);</td><td>-</td></tr><tr><td>4.21 BEP efficiency (%);</td><td>-</td></tr><tr><td>4.22 Self-cleaning wear plate;</td><td>N/A</td></tr></tbody></table>	SPECIFIED	OFFERED	4.1 Manufacturer;	-	4.2 Model;	-	4.3 Quantity;	4	4.4 Duty point flow, 1x pump, (L/s);	262.9	4.5 Duty point head, 1x pump, (m);	43.5	4.6 Duty point flow, 2x pump parallel , (L/s);	N/A	4.7 Duty point head, 2x pump parallel , (m);	N/A	4.8 Pump configuration;	Four duty	4.9 Pump type;	Axially Split Volute Casing	4.10 Duty point efficiency (%);	> 95% of BEP	4.11 Pump min. flow (L/s);	83.33	4.12 Pump max. flow (L/s);	-	4.13 Discharge diameter (mm);	-	4.14 Suction diameter (mm);	-	4.15 Solids handling size (mm);	N/A	4.16 Speed at duty point (rpm);	1450	4.17 Max. speed (rpm);	-	4.18 Shut-off head (m);	-	4.19 BEP head (m);	-	4.20 BEP flow (L/s);	-	4.21 BEP efficiency (%);	-	4.22 Self-cleaning wear plate;	N/A
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4.21 BEP efficiency (%);	-																																														
4.22 Self-cleaning wear plate;	N/A																																														

4.23	Seal type;	Mechanical	
4.24	Bearing seal;	-	
4.25	Oil reservoir;	-	
4.26	Shaft sleeve;	Replaceable	
4.27	NPSH required at the duty point (m);	-	
4.28	NPSH available at the duty point (m);	-	
4.29	Suction lift at the duty point (m);	-	
4.30	Volute casing material;	Ductile iron, ASTM A536, 65-45-12	
4.31	Impeller material;	Ductile iron, ASTM A536, 100-70-03	
4.32	Impeller washer material;	N/A	
4.33	Impeller screw material;	N/A	
4.34	Backplate/Bracket material;	N/A	
4.35	Wear plate material;	N/A	
4.36	Bearing frame material;	Ductile iron, ASTM A536, 65-45-12	
4.37	Shaft material;	17-4 PH SS	
4.38	Shaft sleeve material;	SS 304	
4.39	Fastener material;	Grade 5 Steel	
4.40	Mechanical seal material;	Silicon carbide vs. Silicone carbide	
4.41	Pump & Motor Base-Plate material;	MS, hot dipped galvanized	
4.42	Pump Operating Specification;	ISO 9906 class 2B	

5. Drive Equipment			
		SPECIFIED	OFFERED
5.1	Motor Manufacturer;	-	
5.2	Motor Model;	-	
5.3	Motor quantity (no.);	4	
5.4	Motor size (kW);	132	
5.5	Motor Rotation Speed (rpm);	1450	
5.6	Motor type;	AC, induction, 3-phase	
5.7	Motor efficiency class (IE);	IE3	
5.8	Motor insulation class;	F	
5.9	Motor ingress rating (IP);	55	
5.10	Motor full load current (Ampere);	-	
5.11	Motor load factor at duty point (%);	80 (min.)	
5.12	Motor power factor at duty point (%);	-	

5.13	Motor thermal protection;	YES	
5.14	Motor heater;	YES	
5.15			

<b>6.</b>	<b>Drive Coupling</b>		
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		SPECIFIED	OFFERED
6.1	Coupling/Drive Manufacturer;	-	
6.2	Coupling/Drive Type;	Tyre Type Flexible	
6.3	V-Belts per pulley (No.);	N/A	
6.4	Drive end pulley diameter (mm);	N/A	
6.5	Drive end pulley shaft diameter (mm);	N/A	
6.6	Non-drive end pulley diameter (mm);	N/A	
6.7	Non-drive end pulley shaft diameter (mm);	N/A	
6.8	Drive end pulley material;	N/A	
6.9	Non-drive end pulley material (mm);	N/A	
6.10	Drive reduction ratio;	N/A	
6.11	V-Belt model, type;	N/A	
6.12	V-Belt length (mm);	N/A	

<b>6.</b>	<b>Drive Coupling (Continue)</b>		
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		SPECIFIED	OFFERED
6.13	Drive max. torque (Nm);	-	
6.14	Drive max. axial load (N);	-	
6.15	Drive max. bending (Nm);	-	

<b>7.</b>	<b>Pipe Work</b>		
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		SPECIFIED	OFFERED
7.1	Suction, from;	Existing Suction Puddle	
7.2	Suction configuration;	Individual per pump	
7.3	Suction Entrance;	Existing Suction Puddle	
7.4	Suction Isolation valve;	Metal Seat Gate PN16 450NB	
7.5	Suction Leg diameter size (mm);	450NB	
7.6	Suction Pipe supports;	Yes, vertical & horizontal	
7.7	Suction Pipe material;	MS, Epoxy	
7.8	Suction Pipe support material;	MS, Hot Dipped Galvanized	
7.8	Delivery to;	Existing Delivery Puddle	
7.10	Delivery configuration;	Individual per pump	

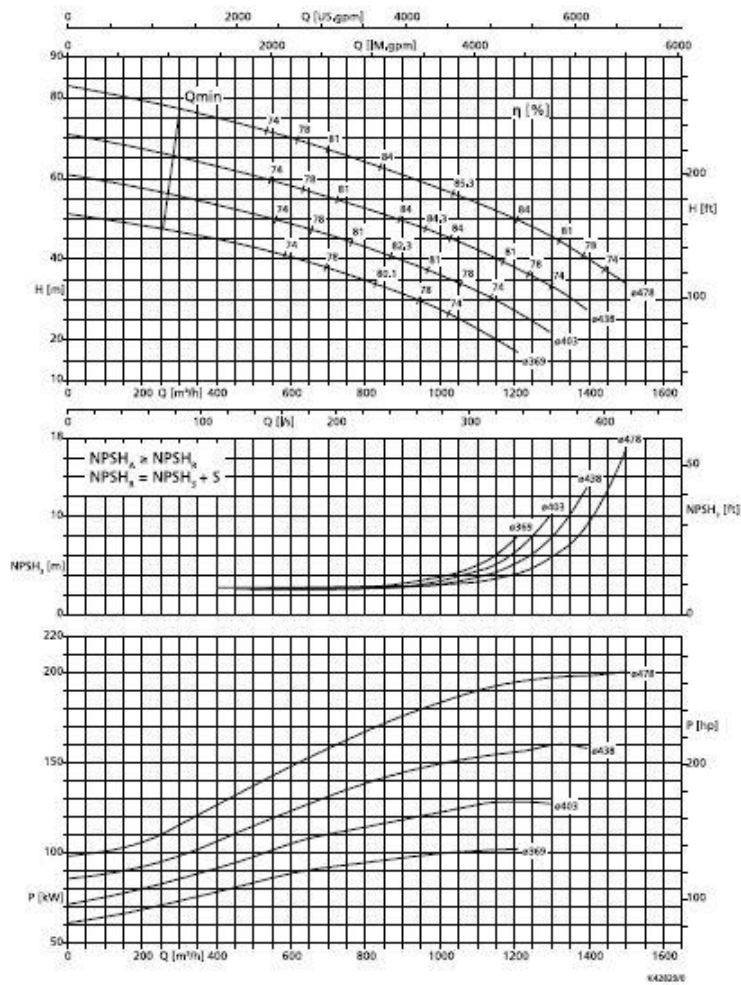
7.11	Delivery Isolation valve;	Metal Seat Gate PN16 250NB	
7.12	Delivery Check valve;	Nozzle Check Multi Stem PN16 250NB	
7.13	Delivery Leg diameter size (mm);	250 to 400NB	
7.14	Delivery Pipe supports;	Yes, horiz. + vert. + elevated	
7.15	Delivery Pipe material;	MS, Epoxy	
7.16	Delivery Pipe supports material;	MS, Hot Dipped Galvanized	
7.17	Pressure gauges;	Yes, suction + delivery, per pump	
7.18	Joint sets;	Yes, bolts/nuts/washers/gaskets	
7.19	Fasteners;	Plain, Hi-Tensile Grade 8.8, Hot Dip Galvanized	
7.20	Anchor bolts;	SS EN 1.4401 Grade	
7.21	Flange Drilling;	SANS 1123 1000/3	
8.	Operation & Control		
8.1	Automatic Operation		
8.1.1	PLC Controlled		
8.2	Manual Operation		
8.2.1	MCC & Field Start/Stop Buttons		
8.3	Instrumentation		
8.3.1	1x Suction Pressure Element & Indicating Transmitter.		
8.3.2	1x Delivery Pressure Element & Indicating Transmitter.		
8.3.3	3x Pump Temperature Element & Indicating Transmitter.		
8.3.4	4x Motor Temperature Element & Indicating Transmitter.		
8.3.5	2x Pump Vibration Element & Indicating Transmitter.		
8.3.6	2x Motor Vibration Element & Indicating Transmitter.		

The following pump curve is corresponding to the specified requirements!



# Water Supply Axially Split Volute Casing Pump

Omega 250-4808, n = 1450 rpm





## MPS\_02: Distribution Pump Sets (Option 2)

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the Distribution Pump Sets and pipe work.		
2.	Description of the Equipment		
2.1	Four pump sets are required. The four pump sets receives water from the suction ring pipe work, supplied from the Rand Water Facility, situated next to the Distribution pump station site. Each of the four pumps can pump individually or together in combination, one, two or three pumps operating. The delivery pipe work allows for different delivery options. The distribution pumps can deliver to the reservoirs, the pressure tower and directly into the distribution network. The existing pump sets must be replaced with new pump and pipe work.		
3.	General Information		
3.1	Medium type; Potable Water.	3.2	Medium SG; 1.0
3.3	Medium pH; 5 - 7.	3.4	Medium Temperature; 10 - 25 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Distribution Pump		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	4	
4.4	Duty point flow, 1x pump, (L/s);	262.9	
4.5	Duty point head, 1x pump, (m);	43.5	
4.6	Duty point flow, 2x pump parallel , (L/s);	N/A	
4.7	Duty point head, 2x pump parallel , (m);	N/A	
4.8	Pump configuration;	Four duty	
4.9	Pump type;	End Suction, Multi-Vane, Centrifugal	
4.10	Duty point efficiency (%);	> 95% of BEP	
4.11	Pump min. flow (L/s);	34.7	
4.12	Pump max. flow (L/s);	-	
4.13	Discharge diameter (mm);	-	
4.14	Suction diameter (mm);	-	
4.15	Solids handling size (mm);	N/A	
4.16	Speed at duty point (rpm);	1450	
4.17	Max. speed (rpm);	-	
4.18	Shut-off head (m);	-	
4.19	BEP head (m);	-	
4.20	BEP flow (L/s);	-	
4.21	BEP efficiency (%);	-	

4.22	Self-cleaning wear plate;	N/A	
4.23	Seal type;	Mechanical	
4.24	Bearing seal;	-	
4.25	Oil reservoir;	-	
4.26	Shaft sleeve;	Replaceable	
4.27	NPSH required at the duty point (m);	-	
4.28	NPSH available at the duty point (m);	-	
4.29	Suction lift at the duty point (m);	-	
4.30	Volute casing material;	Ductile iron, ASTM A536, 65-45-12	
4.31	Impeller material;	Ductile iron, ASTM A536, 100-70-03	
4.32	Impeller washer material;	-	
4.33	Impeller screw material;	-	
4.34	Backplate/Bracket material;	-	
4.35	Wear plate material;	N/A	
4.36	Bearing frame material;	Ductile iron, ASTM A536, 65-45-12	
4.37	Shaft material;	17-4 PH SS	
4.38	Shaft sleeve material;	SS 304	
4.39	Fastener material;	Grade 5 Steel	
4.40	Mechanical seal material;	Silicon carbide vs. Silicone carbide	
4.41	Pump & Motor Base-Plate material;	MS, hot dipped galvanized	
4.42	Pump Operating Specification;	ISO 9906 class 2B	

5. Drive Equipment			
		SPECIFIED	OFFERED
5.1	Motor Manufacturer;	-	
5.2	Motor Model;	-	
5.3	Motor quantity (no.);	4	
5.4	Motor size (kW);	132	
5.5	Motor Rotation Speed (rpm);	1450	
5.6	Motor type;	AC, induction, 3-phase	
5.7	Motor efficiency class (IE);	IE3	
5.8	Motor insulation class;	F	
5.9	Motor ingress rating (IP);	55	
5.10	Motor full load current (Ampere);	-	
5.11	Motor load factor at duty point (%);	80 (min.)	

5.12	Motor power factor at duty point (%)	-	
5.13	Motor thermal protection;	YES	
5.14	Motor heater;	YES	
5.15			

<b>6.</b>	<b>Drive Coupling</b>		
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		SPECIFIED	OFFERED
6.1	Coupling/Drive Manufacturer;	-	
6.2	Coupling/Drive Type;	Tyre Type Flexible	
6.3	V-Belts per pulley (No.);	N/A	
6.4	Drive end pulley diameter (mm);	N/A	
6.5	Drive end pulley shaft diameter (mm);	N/A	
6.6	Non-drive end pulley diameter (mm);	N/A	
6.7	Non-drive end pulley shaft diameter (mm);	N/A	
6.8	Drive end pulley material;	N/A	
6.9	Non-drive end pulley material (mm);	N/A	
6.10	Drive reduction ratio;	N/A	
6.11	V-Belt model, type;	N/A	
6.12	V-Belt length (mm);	N/A	

<b>6.</b>	<b>Drive Coupling (Continue)</b>		
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		SPECIFIED	OFFERED
6.13	Drive max. torque (Nm);	-	
6.14	Drive max. axial load (N);	-	
6.15	Drive max. bending (Nm);	-	

<b>7.</b>	<b>Pipe Work</b>		
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		SPECIFIED	OFFERED
7.1	Suction, from;	Existing Suction Puddle	
7.2	Suction configuration;	Individual per pump	
7.3	Suction Entrance;	Existing Suction Puddle	
7.4	Suction Isolation valve;	Metal Seat Gate PN16 450NB	
7.5	Suction Leg diameter size (mm);	450NB	
7.6	Suction Pipe supports;	Yes, vertical & horizontal	
7.7	Suction Pipe material;	MS, Epoxy	
7.8	Suction Pipe support material;	MS, Hot Dipped Galvanized	
7.8	Delivery to;	Existing Delivery Puddle	

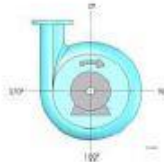
7.10	Delivery configuration;	Individual per pump	
7.11	Delivery Isolation valve;	Metal Seat Gate PN16 250NB	
7.12	Delivery Check valve;	Nozzle Check Multi Stem PN16 250NB	
7.13	Delivery Leg diameter size (mm);	250 to 400NB	
7.14	Delivery Pipe supports;	Yes, horiz. + vert. + elevated	
7.15	Delivery Pipe material;	MS, Epoxy	
7.16	Delivery Pipe supports material;	MS, Hot Dipped Galvanized	
7.17	Pressure gauges;	Yes, suction + delivery, per pump	
7.18	Joint sets;	Yes, bolts/nuts/washers/gaskets	
7.19	Fasteners;	Plain, Hi-Tensile Grade 8.8, Hot Dip Galvanized	
7.20	Anchor bolts;	SS EN 1.4401 Grade	
7.21	Flange Drilling;	SANS 1123 1000/3	
<b>8.</b>	<b>Operation &amp; Control</b>		
8.1	Automatic Operation		
8.1.1	PLC Controlled		
8.2	Manual Operation		
8.2.1	MCC & Field Start/Stop Buttons		
8.3	Instrumentation		
8.3.1	1x Suction Pressure Element & Indicating Transmitter.		
8.3.2	1x Delivery Pressure Element & Indicating Transmitter.		
8.3.3	3x Pump Temperature Element & Indicating Transmitter.		
8.3.4	4x Motor Temperature Element & Indicating Transmitter.		
8.3.5	2x Pump Vibration Element & Indicating Transmitter.		
8.3.6	2x Motor Vibration Element & Indicating Transmitter.		

The following pump curve is corresponding to the specified requirements!

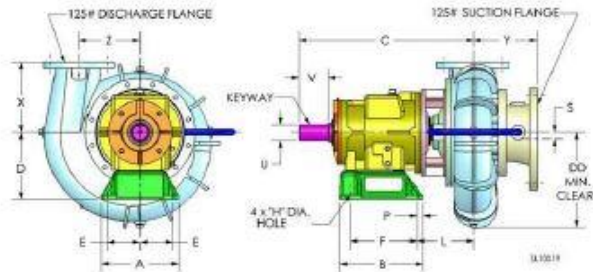


DATA SHEET

# 10RB-F

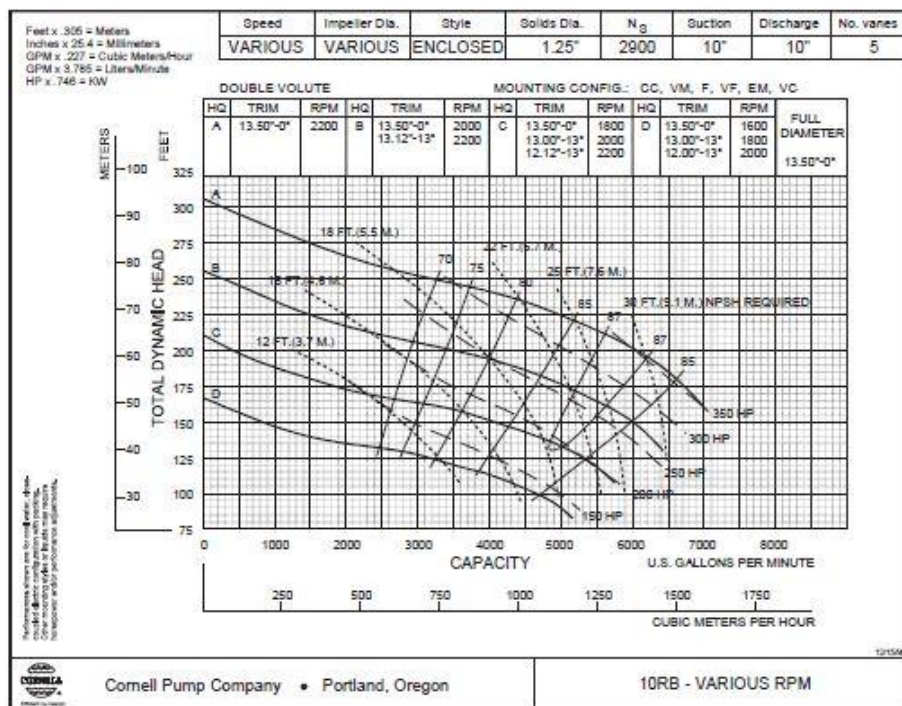


**NOTES:**  
Discharge positions are viewed from the drive end.  
Standard increments of discharge position are shown  
in the chart below (DISCH INCR). Consult factory for  
other discharge positions.



**NOTES:**

PUMP DIMENSIONS																			
MODEL	FRAME	CONNECTION	DISCH. INC.	A	B	C	D	DD	E	F	H	L	P	U	V	X	Y	Z	KEYWAY
10RB	F18	10 10	90°	12	12.88	30.7	10.5	19.12	5.12	10.38	0.81	12.34	0.88	2.5	4.5	14	10.55	12	.62X.31



DS85TL-140826-P

**MPS\_03: Suction Isolation Valve (Actuated).**

1. Scope of Works			
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the suction isolation valve, c/w actuator.		
2. Description of the Equipment			
2.1	Four (4) actuated, metal seat, gate valves will be required. Each of the four new pump sets and pipe work will require a new actuated suction gate valve.		
3. General Information			
3.1	Medium type; Potable Water.		
3.2	Medium SG; 1.0		
3.3	Medium pH; 5 - 7.		
3.4	Medium Temperature; 10 - 25 °C.		
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4. Metal Seat Gate Valve			
	SPECIFIED	OFFERED	
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	4	
4.4	Type;	Metal Seat Gate Valve	
4.5	Size;	450NB	
4.6	Pressure Rating;	PN16	
4.7	Max. Operating Temperature;	70°C	
4.8	Manufacturing Standards;	BS5163 (EN558/3), EN1992	
4.9	Face to Face Standards;	EN588 Table 2, Basic Series 3	
4.10	Face Drilling Standard;	EN1092-2 (ISO7005-2), PN16	
4.11	Corrosion Protection;	Fusion bonded epoxy coating, 250µm	
4.12	Body;	Ductile iron GJS-500-7 (GGG-50)	
4.13	Seat/Face Ring;	Bronze CC491K (LG2)	
4.14	Wedge;	Ductile iron GJS-500-7 (GGG-50)	
4.15	Wedge Nut;	Alu-bronze CC331G (AB1)	
4.16	Stem;	Stainless steel 1.4021 (420)	
4.17	Bolts (Fasteners);	Steel, hot dip galvanized	
4.18	Bonnet Gasket;	EPDM rubber	
4.19	Bonnet;	Ductile iron GJS-500-7 (GGG-50)	
4.20	O-Rings;	EPDM rubber	
4.21	Thrust Collar;	Brass, DZR CZ132	
4.22	Gland;	Ductile iron GJS-500-7 (GGG-50)	
4.23	Bushing;	Polyamide	
4.24	Wiper Ring;	NBR rubber	
4.25	All Fasteners;	Plain, Hi-Tensile Grade 8.8	
4.26	Flange Drilling;	SANS 1123 1000/3	

5. Actuator		SPECIFIED	OFFERED
5.1	Motor Manufacturer;	-	
5.2	Motor Model;	-	
5.3	Motor quantity (no.);	4	
5.4	Motor size (kW);	-	
5.5	Motor Rotation Speed (rpm);	-	
5.6	Motor type;	AC, induction, 3-phase	
5.7	Motor efficiency class (IE);	IE3	
5.8	Motor insulation class;	F	
5.9	Motor ingress rating (IP);	55	
5.10	Motor full load current (Ampere);	-	
5.11	Motor load factor at duty point (%);	80 (min.)	
5.12	Motor power factor at duty point (%);	-	
5.13	Motor thermal protection;	Yes	
5.14	Motor heater;	Yes	
5.15	Gearbox Manufacturer;	-	
5.16	Gearbox Model;	-	
5.17	Gearbox quantity (no.);	4	
5.18	Gearbox type;	-	
5.19	Gearbox reduction ratio;	To Valve Specification	
5.20	Gearbox thermal rating (kW);	-	
5.21	Gearbox service factor;	2.25 (min.)	
5.22	Gearbox max. torque (Nm);	To Valve Specification	
5.23	Gearbox max. axial load (N);	-	
5.24	Gearbox max. bending (Nm);	-	
5.25	Gearbox lubrication type;	-	
5.26			
5.27			
6. Operation & Control			
8.1	Automatic Operation		
8.1.1	PLC Controlled		
8.2	Manual Operation		
8.2.1	MCC & Field Start/Stop Buttons		
8.3	Instrumentation		
8.3.1	Open Position Limit Switch & Indication.		
8.3.2	Close Position Limit Switch & Indication.		

### 8.3.3 4-20 mA feed-back for proportional Open/Close Positioning.

MPS 04: Delivery Isolation Valve (Actuated).

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the delivery isolation valve, c/w actuator.		
2.	Description of the Equipment		
2.1	Four (4) actuated, metal seat, gate valves will be required. Each of the four new pump sets and pipe work will require a new actuated suction gate valve.		
3.	General Information		
3.1	Medium type; Potable Water.	3.2	Medium SG; 1.0
3.3	Medium pH; 5 - 7.	3.4	Medium Temperature; 10 - 25 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Metal Seat Gate Valve		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	4	
4.4	Type;	Metal Seat Gate Valve	
4.5	Size;	450NB	
4.6	Pressure Rating;	PN16	
4.7	Max. Operating Temperature;	70°C	
4.8	Manufacturing Standards;	BS5163 (EN558/3), EN1992	
4.9	Face to Face Standards;	EN588 Table 2, Basic Series 3	
4.10	Face Drilling Standard;	EN1092-2 (ISO7005-2), PN16	
4.11	Corrosion Protection;	Fusion bonded epoxy coating, 250µm	
4.12	Body;	Ductile iron GJS-500-7 (GGG-50)	
4.13	Seat/Face Ring;	Bronze CC491K (LG2)	
4.14	Wedge;	Ductile iron GJS-500-7 (GGG-50)	
4.15	Wedge Nut;	Alu-bronze CC331G (AB1)	
4.16	Stem;	Stainless steel 1.4021 (420)	
4.17	Bolts (Fasteners);	Steel, hot dip galvanized	
4.18	Bonnet Gasket;	EPDM rubber	
4.19	Bonnet;	Ductile iron GJS-500-7 (GGG-50)	
4.20	O-Rings;	EPDM rubber	
4.21	Thrust Collar;	Brass, DZR CZ132	
4.22	Gland;	Ductile iron GJS-500-7 (GGG-50)	
4.23	Bushing;	Polyamide	



4.24	Wiper Ring;	NBR rubber	
4.25	All Fasteners;	Plain, Hi-Tensile Grade 8.8	
4.26	Flange Drilling;	SANS 1123 1000/3	

5.	Actuator	SPECIFIED	OFFERED
5.1	Motor Manufacturer;	-	
5.2	Motor Model;	-	
5.3	Motor quantity (no.);	4	
5.4	Motor size (kW);	-	
5.5	Motor Rotation Speed (rpm);	-	
5.6	Motor type;	AC, induction, 3-phase	
5.7	Motor efficiency class (IE);	IE3	
5.8	Motor insulation class;	F	
5.9	Motor ingress rating (IP);	55	
5.10	Motor full load current (Ampere);	-	
5.11	Motor load factor at duty point (%);	80 (min.)	
5.12	Motor power factor at duty point (%);	-	
5.13	Motor thermal protection;	Yes	
5.14	Motor heater;	Yes	
5.15	Gearbox Manufacturer;	-	
5.16	Gearbox Model;	-	
5.17	Gearbox quantity (no.);	4	
5.18	Gearbox type;	-	
5.19	Gearbox reduction ratio;	To Valve Specification	
5.20	Gearbox thermal rating (kW);	-	
5.21	Gearbox service factor;	2.25 (min.)	
5.22	Gearbox max. torque (Nm);	To Valve Specification	
5.23	Gearbox max. axial load (N);	-	
5.24	Gearbox max. bending (Nm);	-	
5.25	Gearbox lubrication type;	-	
5.26			
5.27			
6.	Operation & Control		
8.1	Automatic Operation		
8.1.1	PLC Controlled		
8.2	Manual Operation		
8.2.1	MCC & Field Start/Stop Buttons		

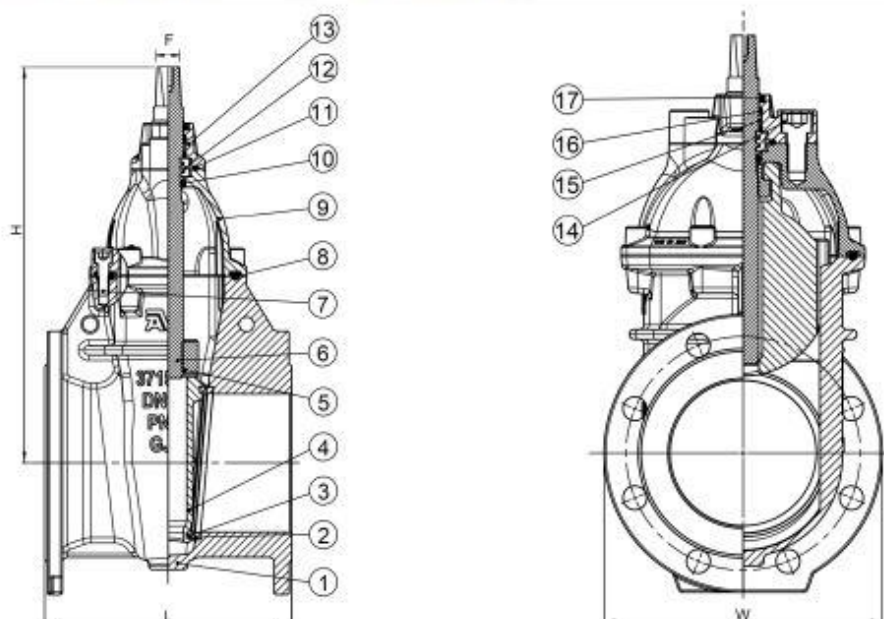
- 8.3 Instrumentation
- 8.3.1 Open Position Limit Switch & Indication.
- 8.3.2 Close Position Limit Switch & Indication.
- 8.3.3 4-20 mA feed-back for proportional Open/Close Positioning.

The following data sheets is corresponding to the specified requirements!

**AVK METAL SEAT GATE VALVE, PN16**

37/50-004

BS5163 (EN558/3), EN1092, galv. 8.8 bolts, alu-bronze wedge nut


**Component list:**

1. Body	Ductile iron GJS-500-7 (GGG-50)	10. Stem seal O-ring	EPDM rubber
2. Seat ring	Bronze CC491K (LG2)	11. O-ring	EPDM rubber
3. Face ring	Bronze CC491K (LG2)	12. Thrust collar	Brass, DZR CZ132
4. Wedge	Ductile iron GJS-500-7 (GGG-50)	13. Gland	Ductile iron GJS-500-7 (GGG-50)
5. Wedge nut	Alu-bronze CC331G (AB1)	14. Bolt	Steel, hot dip galvanized
6. Stem	Stainless steel 1.4021 (A20)	15. Bushing	Polyamide
7. Bonnet bolt	Steel, hot dip galvanized	16. O-ring	EPDM rubber
8. Bonnet gasket	EPDM rubber	17. Wiper ring	NBR rubber
9. Bonnet	Ductile iron GJS-500-7 (GGG-50)		

Components may be substituted with equivalent or higher class materials without prior notification.

**Reference nos. and dimensions:**

AVK ref. no.	DN mm	Theoretical weight / kg
37-080-50-010001	80	21
37-100-50-010001	100	27
37-150-50-010001	150	43
37-200-50-010001	200	76
37-250-50-010001	250	105

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**MPS\_05: Delivery Check Valves.**

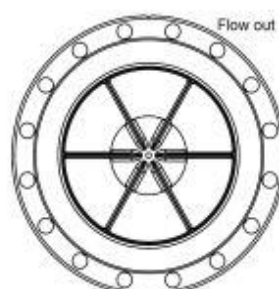
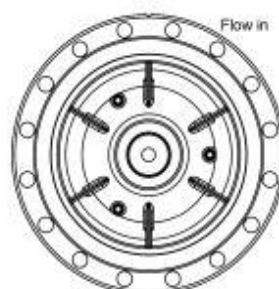
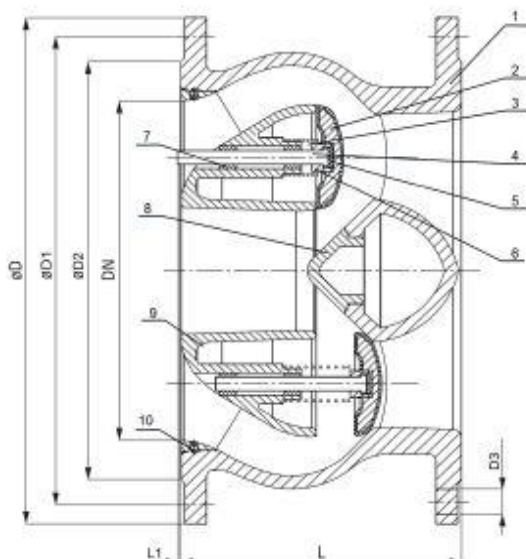
1.		Scope of Works	
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the delivery check valve.		
2.		Description of the Equipment	
2.1	Four (4) nozzle, multi-stem, check valves will be required. Each of the four new pump sets and pipe work will require a new check valve.		
3.		General Information	
3.1	Medium type; Potable Water.	3.2	Medium SG; 1.0
3.3	Medium pH; 5 - 7.	3.4	Medium Temperature; 10 - 25 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.		Metal Seat Gate Valve	
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	4	
4.4	Type;	Nozzle, Multi-Stem, Check	
4.5	Size;	250NB	
4.6	Pressure Rating;	PN16	
4.7	Max. Operating Temperature;	80°C	
4.8	Design Standards;	EN1074-3, EN12266	
4.9	Face to Face Standards;	EN588 Series 14	
4.10	Face Drilling Standard;	EN1092-2, PN10/16	
4.11	Corrosion Protection;	Fusion bonded epoxy coating, 150µm	
4.12	Body;	Ductile iron GJS-500-7 (GGG-50)	
4.13	Disk;	Ductile iron, EPDM encapsulated	
4.14	Spring;	Stainless steel 304	
4.15	Stem;	Stainless steel 1.4021 (420)	
4.16	Ring;	Polyamide	
4.17	Nut;	Stainless steel A2	
4.18	Bushing;	Alu-bronze C61900	
4.19	Plug;	Ductile iron	
4.20	Diffuser Sleeve;	Ductile iron	
4.21	Set Screw;	Stainless steel A2	
4.22	All Fasteners;	Plain, Hi-Tensile Grade 8.8	
4.23	Flange Drilling;	SANS 1123 1000/3	

The following data sheets is corresponding to the specified requirements!

**AVK NOZZLE CHECK VALVE, MULTI STEM, PN10/16**

876/01-001

SS 420 stem, SS 304 spring, alu-bronze bushings, A2 fasteners, FBE coating, EPDM rubber


**Component list:**

1. Body	Ductile Iron	6. Nut	Stainless steel A2
2. Disc	Ductile iron, EPDM encapsulated	7. Bushing	Alu-bronze C61900
3. Spring	Stainless steel 304	8. Plug	Ductile Iron
4. Stem	Stainless steel 420	9. Diffuser sleeve	Ductile Iron
5. Ring	Polymide	10. Set screw	Stainless steel A2

Components may be substituted with equivalent or higher class materials without prior notification.

**Reference nos. and dimensions:**

AVK ref. no.	DN	Flange drilling	D	D1	D2	D3	Number of bolts	L	L1	Theoretical weight/kg
876-0400-01-01102012	400	PN10	565	515	480	28	16	310	-	160
876-0400-01-11102012	400	PN16	580	525	480	31	16	310	-	165
876-0450-01-01102012	450	PN10	615	565	560	28	20	330	7	180
876-0450-01-11102012	450	PN16	640	585	548	31	20	330	7	190
876-0500-01-01102012	500	PN10	670	620	582	28	20	350	-	260
876-0500-01-11102012	500	PN16	715	650	609	34	20	350	-	275
876-0600-01-01102012	600	PN10	780	725	682	31	20	390	15	420
876-0600-01-11102012	600	PN16	840	770	720	37	20	390	15	480

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PS 6: Drainage Pumps & Pipe Work.

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the drainage pumps and pipe work.		
2.	Description of the Equipment		
2.1	Two (2) drainage pumps (one duty, one stand-by), will form part of this contract. The drainage pumps will be installed inside the drainage sump of the Distribution Pump Station.		
3.	General Information		
3.1	Medium type; Drainage water.	3.2	Medium SG; 1.0
3.3	Medium pH; 5 - 7.	3.4	Medium Temperature; 10 - 25 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Featuring Equipment		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	2	
4.4	Duty point flow, 1x pump, (L/s);	8.0	
4.5	Duty point head, 1x pump, (m);	45056.0	
4.6	Pump configuration;	One duty, one standby	
4.7	Pump type;	Submersible, floor, free standing	
4.8	Duty point efficiency (%);	-	
4.9	Pump min. flow (L/s);	-	
4.10	Pump max. flow (L/s);	-	
4.11	Discharge diameter (mm);	-	
4.12	Suction diameter (mm);	-	
4.13	Solids handling size (mm);	-	
4.14	Speed at duty point (rpm);	-	
4.15	Max. speed (rpm);	-	
4.16	Shut-off head (m);	-	
4.17	BEP head (m);	-	
4.18	BEP flow (L/s);	-	
4.19	BEP efficiency (%);	-	
4.20	Seal type;	Mechanical	
4.21	Shaft sleeve;	Replaceable	
4.22	NPSH required at the duty point (m);	-	
4.23	NPSH available at the duty point (m);	-	
4.24	Guide rails + fixing brackets;	N/A	

4.25	Duct-foot;	N/A	
4.26	Volute casing material;	Ductile iron, ASTM A536, 65-45-12	
4.27	Impeller material;	Ductile iron, ASTM A536, 100-70-03	
4.28	Impeller washer material;	SS 416, heat treated	
4.29	Impeller screw material;	SS 304	
4.30	Bearing frame material;	Ductile iron, ASTM A536, 65-45-12	
4.31	Shaft material;	17-4 PH SS	
4.32	Shaft sleeve material;	SS 304	
4.33	Fastener material;	Grade 5 Steel	
4.34	Mechanical seal material;	Silicon carbide vs. Silicone carbide	
4.35	Guide rails + fixing brackets material;	N/A	
4.36	Duct-foot material;	N/A	
4.37			

**5. Drive Equipment**

		SPECIFIED	OFFERED
5.1	Motor Manufacturer;	-	
5.2	Motor Model;	-	
5.3	Motor quantity (no.);	2	
5.4	Motor size (kW);	-	
5.5	Motor Rotation Speed (rpm);	-	
5.6	Motor type;	AC, induction, 3-phase	
5.7	Motor efficiency class (IE);	IE3	
5.8	Motor insulation class:	H	
5.9	Motor ingress rating (IP);	68	
5.10	Motor full load current (Ampere);	-	
5.11	Motor load factor at duty point (%);	80 (min.)	
5.12	Motor power factor at duty point (%);	-	
5.13	Motor thermal protection;	Yes	
5.14	Motor heater;	-	
5.15			

**6. Drive Coupling**

		SPECIFIED	OFFERED
6.1	Coupling/Drive Manufacturer;	-	
6.2	Coupling/Drive Model;	-	
6.3	Coupling/Drive Type;	Direct	

6.4	Drive-end shaft diameter (mm);	-	
6.5	Non-drive end shaft diameter (mm);	-	
6.6	Coupling material;	-	
6.7	Drive max. torque (Nm);	-	
6.8	Drive max. axial load (N);	-	
6.9	Drive max. bending (Nm);	-	
6.10			

<b>7.</b>	<b>Pipe Work</b>		
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		SPECIFIED	OFFERED
7.1	Suction, from;	Drainage sump	
7.2	Suction configuration;	Submersible	
7.3	Suction Entrance;	Pump	
7.4	Suction Isolation valve;	-	
7.5	Suction Pipe diameter size (mm);	-	
7.6	Suction Pipe supports;	-	
7.7	Suction strainer;	-	
7.8	Suction Pipe material;	-	
7.9	Suction Pipe support material;	-	
7.10	Delivery to;	To exit at natural ground level.	
7.11	Delivery configuration;	Single, into 2x manifold	
7.12	Delivery Isolation valve;	Yes, RSV Gate Valve	
7.13	Delivery Check valve;	Yes, Ball Check Valve	
7.14	Delivery Pipe diameter (mm);	80NB (Min.)	
7.15	Delivery Pipe supports;	Yes, horiz. + vert. + elevated	
7.16	Delivery Pipe material;	MS, hot dipped galvanized	
7.17	Delivery Pipe supports material;	MS, hot dipped galvanized	
7.18	Pressure gauges;	Yes, delivery, per pump	
7.19	Joint sets;	Yes, bolts/nuts/washers/gaskets	
7.20	Fasteners;	SS EN 1.4401 Grade	

<b>8.</b>	<b>Operation &amp; Control</b>		
-----------	--------------------------------	--	--

- |     |  |
|-----|--|
| 8.1 | Manual Operation: by means of Start/Stop push button, independent from protection. |
| 8.2 | Automatic Operation: via factory fitted float switch.                              |
| 8.3 | Automatic Operation: Alternate pump after each Start/Stop Cycle.                   |



8.4 Automatic Operation: Pre-set Low delivery-pressure pump protection.

PS\_7: Ventilation.

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the ventilation system for the Distribution Pump Station.		
2.	Description of the Equipment		
2.1	The one ventilation system will be designed, supplied and installed to provide fresh outside air into the dry-well, situated below ground level.		
3.	General Information		
3.1	Medium type; Ambient Air.	3.2	Density; 1.29 g/L @ 0°C
3.3	Medium pH; N/A	3.4	Medium Temperature; -5 to 40 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Featuring Equipment		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	1x System, c/w fans, ducting, louvres, attenuators, supports etc.	
4.4	Building Ventilation Volume;	744.3 m3	
4.5	Air changes;	6 per hour	
4.6	Air Flow;	4465.8 m3/h	
4.7	Max Air flow velocity (Louvres);	1.0 m/s	
4.8	Fan type;	Duct-mounted, direct drive, axial flow.	
4.9	Fan max. speed;	1500 rpm	
4.10	Acoustic Attenuators;	Yes, Up & Down Stream of Fan	
4.11	Louvre Type;	Acoustic Louvres (Trox Type NL)	
4.12	Fan inlet protection;	Storm type weather louvres	
4.13	Inlet Louvres Direction;	180° away from prevailing wind	
4.14	Ducting Design;	Up & Down Stream, by Contractor	
4.15	Ducting max. flow velocity;	2.0 m/s	
4.16	Ducting material;	Mild Steel, Hot Dip Galvanized	
4.17	Louvre material;	Mild Steel, Hot Dip Galvanized	
4.18	Attenuators	Mild Steel, Hot Dip Galvanized	
4.19	Supports;	Mild Steel, Hot Dip Galvanized	
4.20	Fasteners;	SS EN 1.4401 Grade	
5.	Operation & Control		

5.1 Manual Operation: by means of Start/Stop push button, independent from protection.

PS\_8: Lifting Equipment.

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the electrical hoists for the Distribution Pump Station.		
2.	Description of the Equipment		
2.1	There is two electrical hoists required for the two existing lifting beams installed inside the pump[ station.		
3.	General Information		
3.1	Medium type; N/A	3.2	Density; N/A
3.3	Medium pH; N/A	3.4	Medium Temperature; N/A
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Featuring Equipment		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	2	
4.4	Safe Working Load;	5 Ton	
4.5	Hoist type;	Chain	
4.6	Horizontal travel;	Manual, trolley	
4.7	Vertical lift;	Electrical	
4.8	Control;	Field control panel	
4.9	Vertical lift height;	6.0 m	
4.10	Over-Load Protection;	Yes, with alarm	
4.11	Motor size (kW);	-	
4.12	Motor Rotation Speed (rpm);	-	
4.13	Motor type;	400VAC, 50Hz, induction, 3-phase	
4.14	Motor efficiency class (IE);	IE3	
4.15	Motor insulation class:	H	
4.16	Motor ingress rating (IP);	68	
4.17	Motor full load current (Ampere);	-	

5. Operation & Control
- 5.1 Manual Operation: by means of Start/Stop push button, independent from protection.

PS\_9: Inflow Meter.

1.	Scope of Works		
1.1	Manufacture, supply, deliver, store, install, commissioning & up-hold for 12 months, as per the specification, the electromagnetic flow meter for the inflow from the Rand Water supply.		
2.	Description of the Equipment		
2.1	There is one electromagnetic flow meter required for the project. The supplied flow meter must be installed where the existing flow meter is installed, on the inflow Rand Water pipeline. The existing flow meter is installed inline, on a 1050mm Ø pipeline. The contractor must supply and install the specified flow meter.		
3.	General Information		
3.1	Medium type; Potable Water.	3.2	Medium SG; 1.0
3.3	Medium pH; 5 - 7.	3.4	Medium Temperature; 10 - 25 °C.
3.5	Location; Distribution Pump Station.		
3.6	Reference Drawings;		
4.	Featuring Equipment		
		SPECIFIED	OFFERED
4.1	Manufacturer;	-	
4.2	Model;	-	
4.3	Quantity;	1	
4.4	Instrument accuracy;	± 0.2%	
4.5	Instrument type;	Electromagnetic flow meter	
4.6	Pressure Rating;	PN16, ASME CI 300	
4.7	Communication;	4-20mA, HART, Modbus, FF, Profibus-PA/DP, PROFINET	
4.8	Flow measurement;	Bi-directional	
4.9	Turn-down ration;	up to 1000:1	
4.10	Liner;	PP or Hard Rubber, chemical resistant	
4.11	Ingress Rating;	IP68	
4.12	Max.expected flow rate;	2638.3 m3/h	
4.13	Max.expected flow velocity;	0.8 m/s	
4.14	Existing pipeline size;	1050 mm Ø	
5.	Operation & Control		
5.1	Automatic Operation		
5.1.1	Controller is MCC Panel Mounted, 4-20 mA signal to PLC .		

The following data sheets is corresponding to the specified requirements!

OPTIFLUX 2300 | KROHNE SOUTH AFRICA <https://za.krohne.com/en/products/flow-measurement/flowmeters/eie...>

KROHNE South Africa > Products > Flow measurement > Flowmeters > Electromagnetic flowmeters

### OPTIFLUX 2300

Electromagnetic flowmeter for advanced water and wastewater applications

- High accuracy ( $\pm 0.2\%$ ), with CT approvals (OIML R49, MID-001)
- DD/DD installation acc. to MID MI-001 and OIML R49 accuracy class 1
- Flange: DN25...3000 / 1...120", max. PN40 / ASME CI 300
- 3 x 4...20 mA, HART<sup>®</sup>, Modbus, FF, Profibus-PA/DP, PROFINET



OPTIFLUX 2300 C - Compact version

[Overview](#)

[Accessories](#)

[Applications](#)

[Links](#)



The OPTIFLUX 2300 is an electromagnetic flowmeter (EMF) for all demanding applications with water and wastewater. The high-end meter is particularly suitable for applications requiring high accuracy and extensive diagnostics. The EMF has the widest diameter range available in the market (DN25...3000 / 1...120") and complies with requirements for custody transfer (MID MI-001, OIML R49). The flowmeter allows for custody transfer (CT) measurement without inlet/outlet runs (DD/DD) according to OIML R49 accuracy class 1. It has a wide range of approvals for potable water. This makes the OPTIFLUX 2300 an effective alternative to mechanical water meters, not least in CT measurement of potable water.

[Show more](#)

#### Product highlights

- Bi-directional flow measurement over a wide dynamic range (turn down ratio: up to 1000:1)
- No inlet/outlet runs needed for OIML R49 class 1 accuracy
- Widest diameter range available in the market
- Available with patented reference electrode: cost-saving installation without grounding rings
- PP or hard rubber liner: excellent chemical resistance
- Optional for burial installation and constant flooding (IP68)
- Largest custody transfer approved diameter range
- Tamper proof
- Standard measurement accuracy:  $\pm 0.2\%$  or  $\pm 1\text{mm/s}$  of measured value (MV)
- Extensive sensor and process diagnostics (incl. NE 107)
- Meets potable water standards: ACS, DVGW, NSF, TZW, WRAS, KIWA, etc.
- On-site verification of flowmeter with

#### Typical applications

##### General

- All advanced water and wastewater applications
- Custody transfer measurement

##### Water and wastewater industry

- Fiscal metering (custody transfer) of potable water
- Abstraction and irrigation
- Monitoring of distribution networks
- Water treatment plants (raw water, drinking water, treatment chemicals)
- Wastewater networks
- Combined and separate sewage systems
- Storm water overflows (SOWOs)
- Municipal wastewater treatment plants
- Desalination plants (sea water, permeate, brine)

[Show more](#)

**ELECTRICAL PROJECT**  
**SPECIFICATION & DATA**  
**SHEETS**

DISTRIBUTION TRANSFORMER				
Items	Description	Unit	Specified Minimum Requirements	Offered To Be Completed By Contractor
1	Manufacturer		Stipulate	
2	Country of manufacture		Stipulate	
3	Delivery period	Weeks	Stipulate	
4	Number of units required	No	2	
5	Ambient temperature: Min/Max	°C	+5/+50	
6	Rating	kVA	500	
7	Nominal system voltage and rated voltage on principal tapping: MV/LV	kV rms	11/0.4	
8	Type		Outdoor	
9	Tank Type		Sealed	
10	Separate winding or auto-transformer		Separate winding	
11	Number of Phases		3	
12	Connection symbol (vector group) and neutral terminal		Dyn11	
13	Winding tapped		LV	
14	Parallel operation with other transformer matching impedance and tapings under same contract		Not Required	
15	System fault current level	kA	20	
16	Designed Short-circuit current: MV/LV	kA	20	
17	Impedance on principal tapping	%		
18	Tap-changer type (OLTC or OCTS)		OCTS	
19	Number of tapping positions (including transition positions)	No		
20	Lightning impulse insulation level (1,2/50 $\mu$ s full wave) of tap-changer	kV		

21	Zero sequence impedance measurement required		Not Required	
22	Automatic and remote control panels and equipment for the OLTC		Not Required	
23	Tap local/remote switch		Local	
24	Type of tap position indicator		Required	
25	LV outdoor bushing rated for voltage	kV	1	
26	Creepage distance for line terminals (min)	kV/mm	31	
27	Primary connections		185 mm <sup>2</sup> x 3c Cu PILC / XLPE	
28	Secondary connections		2 x 630 mm <sup>2</sup> x 1c Cu PVC	
29	Disconnecting chamber		Not required	
30	Drilling and bolting of flanges to comply with BS 4504 or DIN 2631		Required	
31	Welded main tank cover joint		Required	
32	Earthing connections to earth mat		Required	
33	Brackets for surge arresters		Not Required	
34	Bag in the main tank of the conservator		Not Required	
35	Remote temperature indication		Not Required	
36	Cooling		ONAN	
37	OLTC control to be wired to the marshalling box		Not Required	
38	Cables between the marshalling box and the control room		Not Required	
39	Built- current transformers		Not Required	
40	Winding-temperature thermometer(s)		Not Required	
41	Oil-temperature thermometer		Required	
42	Oil-actuated and gas-actuated relay		Not Required	
43	Pressure-relief device		Required	
44	Buchholz relay		Not Required	
45	Tap-changer protective device		Not Required	
46	Dehydrating breathers		Not Required	
47	Conservator bag		Not Required	
48	Oil filler plug		Required	
49	Oil-level indicators		Not Required	
50	Spares: 1 x MV bushing		Required	
51	Spares: 1 x LV bushing		Required	
52	Spares: 1 x cooling fan motor		Not Required	
53	Spares: 1 x three-phase set of diverter switch contacts		Not Required	
54	Spares: 1 x tap-changer drive motor		Not Required	
55	Spares: 1 x contactor of each type		Not Required	
56	Overall dimensions of tank: Width / Depth / Height	mm	Stipulate	
57	Height over MV bushings	mm	Stipulate	

[illegible]

**Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements**

**Name (Print):** \_\_\_\_\_ **Signature:** \_\_\_\_\_

VARIABLE FREQUENCY CONVERTERS				
	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	GENERAL			
1.1	Manufacturer			
1.2	Model			
1.3	Place of manufacture			
1.4	Expected life (for spares availability)	Years		

<b>2</b>	<b>ELECTRICAL SERVICE CONDITIONS</b>			
2.1	Normal service conditions varied in Project Specification	Yes/No	No	
2.2	Unusual electrical service conditions specified	Yes/No	No	
2.3	Supply network characteristics			
2.3.1	Voltage (nominal)	V	400	
2.3.2	Frequency	Hz	50	
2.3.3	Source impedance ( at minimum fault level) at PCC	Ohms	TBC	
2.3.4	Fault level (maximum) at PCC	MVA	TBC	
2.3.5	Fault level (n-1 contingency/minimum) at PCC	MVA	TBC	
2.3.6	Voltage total harmonic distortion limit at PCC	%	1%	
2.4	VFC input current harmonic limits and actual			
2.4.1	5 <sup>th</sup>	%		
2.4.2	7 <sup>th</sup>	%		
2.4.3	11 <sup>th</sup>	%		
2.4.4	13 <sup>th</sup>	%		
2.4.5	17 <sup>th</sup>	%		
2.4.6	19 <sup>th</sup>	%		
2.4.7	23 <sup>rd</sup>	%		
2.4.8	25 <sup>th</sup>	%		
2.4.9	29 <sup>th</sup>	%		
2.4.10	31 <sup>st</sup>	%		
2.4.11	THD	%		
<b>3</b>	<b>ENVIRONMENTAL SERVICE CONDITIONS</b>			
3.1	Standard climatic conditions varied in Project	Yes/No	No	
3.2	Forced ventilation or air conditioning in VFC room	FV/AC	AC	
3.3	Unusual mechanical installation conditions specified	Yes/No	No	



3.4	Unusual environmental service conditions specified	Yes/No	No	
3.5	Airflow required per VFC	m <sup>3</sup> /s		
<b>4</b>	<b>LOAD DETAILS</b>			
4.1	Type of motor-driven load		Pump	
4.2	Load torque characteristic		Quadratic	
4.3	Number of operation quadrants		1	
4.4	Dynamic braking required		No	
4.5	Operating speed range		As per mechanical specification	
<b>5</b>	<b>CONVERTER TRANSFORMER</b>			
5.1	Type (oil-filled or dry)			
5.2	Number of secondary windings			
5.3	Primary rated voltage	V		
5.4	Secondary rated voltage	V		
5.5	Rated power	kVA		
5.6	Free-standing (FS) or integral (I) to VFC	FS/I		
5.7	No-load losses	W		
5.8	Load losses	W		
<b>6</b>	<b>CONVERTER CONFIGURATION</b>			
6.1	Form of converter (package/chassis/cabinet unit)		Package	
6.2	Rectifier type: diode- or active front end (DFE/AFE)		DFE	
6.3	Rectifier pulse number		6	
6.4	Bypass/redundancy arrangement specified	Yes/No	No	
6.5	Input air circuit-breaker	Yes/No	No	

6.6	Input switch-disconnector	Yes/No	No	
6.7	Input semi-conductor fuses	Yes/No	Yes	
6.8	Input contactor	Yes/No	Yes	
6.9	Input earthing switch	Yes/No	No	
<b>7</b>	<b>CONVERTER FILTERS</b>			
7.1	Line-side reactor	Yes/No	Yes	
7.2	Line-side reactor relative short-circuit voltage	%		
7.3	Line harmonic filters (LHF)	Yes/No		
7.4	LHF free-standing (FS) or integral to VFC (I)	FS/I		
7.5	Motor-side reactor	Yes/No		
7.6	Motor-side dv/dt filter	Yes/No		
7.7	Motor-side sine filter	Yes/No		
7.8	Motor-side common-mode filter	Yes/No		
<b>8</b>	<b>CONVERTER PROTECTION</b>			
8.1	Overcurrent and overload	Yes/No	Yes	
8.2	Undervoltage and overvoltage	Yes/No	Yes	
8.3	Phase loss and unbalance	Yes/No	Yes	
8.4	Earth fault	Yes/No	Yes	
8.5	Over-temperature	Yes/No	Yes	
8.6	DC link overvoltage and overcurrent	Yes/No	Yes	
8.7	Over-temperature of DC link reactor (if installed)	Yes/No	Yes	
<b>9</b>	<b>MOTOR PROTECTION</b>			Indicate if provided by VFC or MPR
9.1	Short-circuit	Yes/No	Yes	
9.2	Start(max starting time)/Stall	Yes/No	Yes	
9.3	Earth fault	Yes/No	Yes	
9.4	Overload	Yes/No	Yes	
9.5	Number of starts	Yes/No	Yes	
9.6	Loss of phase	Yes/No	Yes	
9.7	Unbalance	Yes/No	Yes	

9.8	Loss of load/undercurrent	Yes/No	Yes	
9.9	Thermal by means of motor thermistors/RTDs	Yes/No	Yes	
<b>10</b>	<b>CONVERTER RATINGS</b>			
10.1	Rated system voltage	V	400	
10.2	Line-side rated current	A		
10.3	Input total power factor	pu		
10.4	Line-side displacement power factor	pu		
10.5	Rated continuous output current	A		
10.6	Overload capability and time	A & s		
10.7	Efficiency of complete drive module	%		
10.8	Total losses of complete drive module	W		
<b>11</b>	<b>CONTROL PERFORMANCE REQUIREMENTS</b>			
11.1	Open loop speed control	Yes/No	Yes	
11.2	Steady state deviation band	%	±1 to ±2	
11.3	Closed loop speed control with indirect feedback	Yes/No	No	
11.4	Steady state deviation band	%		
11.5	Closed loop speed control with direct feedback	Yes/No	No	
11.6	Steady state deviation band	%		
<b>12</b>	<b>PROCESS CONTROL INTERFACE</b>			
12.1	Compliant with SANS 61800-7	No/Yes	Yes	
12.2	Communications Interface Quantity	No.		
12.3	Communications Interface Type(s) and Connector(s)	No.		
12.4	Communications Interface Protocol(s)	No.		

12.5	Communications Interface Power Drive System Profile	Process / Drive/ Motion Control	Process	
12.6	Communications Interface Message Structure to SANS 61800-7		Yes	
<b>13</b>	<b>SPECIAL CONTROL FEATURES</b>			
13.1	Automatic restart facility	Yes/No	Yes	
13.2	Flying restart facility	Yes/No	Yes	
13.3	Adjustable ramp times (acceleration/deceleration)	Yes/No	Yes	
13.4	Dip ride-through using load kinetic energy	Yes/No	Yes	
<b>14</b>	<b>TESTING</b>			
	Where indicated the following tests shall be carried out in addition to the specified mandatory tests.			
14.1	Special Tests for Converter			
14.1.1	Overcurrent capability	Yes/No	No	
14.1.2	Measurement of ripple voltage and current	Yes/No	No	
14.1.3	Power factor measurement	Yes/No	No	
14.1.4	Measurement of inherent voltage regulation	Yes/No	No	
14.1.5	Audible noise	Yes/No	No	
14.1.6	Additional tests	Yes/No	No	
14.2	Drive System Site Tests			
14.2.1	Load duty	Yes/No	No	
14.2.2	Allowable full load current versus speed	Yes/No	No	
14.2.3	Temperature rise	Yes/No	No	
14.2.4	Efficiency	Yes/No	No	
14.2.5	Current sharing	Yes/No	No	
14.2.6	Voltage division	Yes/No	No	
14.2.7	Shaft current - bearing insulation	Yes/No	No	
14.2.8	Audible noise	Yes/No	No	

14.2.9	Motor vibration	Yes/No	No	
14.2.10	EMC tests	Yes/No	No	
14.2.11	Harmonic content of CDM output	Yes/No	No	
14.2.12	Current limit and current loop	Yes/No	No	
14.2.13	Speed loop	Yes/No	No	
14.2.14	Torque pulsation	Yes/No	No	
14.2.15	Automatic restart	Yes/No	No	
14.2.16	System full load test	Yes/No	No	
14.2.17	Overall drive system efficiency	Yes/No	No	
14.3	Witnessed factory acceptance test	Yes/No	No	
Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements				
Name (Print):		Signature: .		

<b>PROGRAMMABLE LOGIC CONTROLLERS</b>				
	<b>DESCRIPTION</b>	<b>UNIT</b>	<b>SPECIFIED</b>	<b>OFFERED</b>
<b>1</b>	<b>PROGRAMMABLE LOGIC CONTROLLERS/Programmable RTU</b>			
1.1	Manufacturer			
1.2	Model			
1.3	CPU			
1.4	CPU configuration			
1.5	Digital Inputs	No.		
1.6	Digital Outputs	No.		
1.7	Analogue Inputs	No.		
1.8	Analogue Outputs	No.		
1.9	Spare I/O	%	30%	
1.10	Ports			
1.10.1	Ethernet	No.		
1.10.2	Serial	No.		
1.10.3	Other	No.		
1.11	Software			
1.12	All engineering software included with PLC	Yes / No	Yes	
1.13	Annual Software License renewal required	Yes / No	No, should be on off	

			fee	
1.14	Programming Language		IEC 61131	
<b>2</b>	<b>REMOTE IO</b>			
2.1	Manufacturer			
2.2	Model			
2.3	CPU			
2.4	CPU configuration			
2.5	Digital Inputs	No.		
2.6	Digital Outputs	No.		
2.7	Analogue Inputs	No.		
2.8	Analogue Outputs	No.		
2.9	Spare I/O	%	30%	
2.10	Ports			
2.10.1	Ethernet	No.		
2.10.2	Serial	No.		
2.10.3	Other	No.		
<b>3</b>	<b>PLC, RTU AND RIO PANELS</b>			
3.1	Enclosure Material		as per MCC	
3.2	Enclosure Colour		as per MCC	
3.3	Enclosure Rating	IP	42	
3.4	Enclosure Mounting	Floor Standing /wall mounted	Floor Standing	
3.5	Supply and Control Circuit Voltages	V	24V DC	
3.6	Wire Colours		as per spec	
3.7	Glass door - viewing panel	Yes / No	Yes	
3.8	Termination			
3.9	Glanding			
3.10	Power Supply Unit vendor preferences			
3.11	Uninterruptible Power Supply requirement	Yes / No	Yes	
3.12	Panel light required	Yes / No	Yes, LED	
3.13	Socket outlet required	Yes / No	Yes	
3.14	Physical Spare space	%	30	
<b>4</b>	<b>HUMAN MACHINE INTERFACE (HMI)</b>			
4.1	Manufacturer			
4.2	Model			
4.3	Screen Size	Inches	15"	
4.4	Screen Type		Colour LCD Display, 18 bit	
4.5	Resolution	Pixels		
4.6	Touch Screen	Yes / No	Yes	
4.7	Type of Touch Screen	Capacitive / Resistive		
4.8	Enclosure Rating	IP	65	

		<i>Panel / Flush Fronted / Front</i>	Flush Fronted	
4.9	Position of Installation			
4.10	Software			
4.11	<b>Datasheets included with tender</b>	<b>Yes / No</b>	<b>Yes</b>	
<b>5</b>	<b>UPS</b>			
5.1	Manufacturer			
5.2	Model			
5.3	Place of manufacture			
5.4	Type		Industrial online double conversion with full static bypass	
5.5	Power	W	Load + 30%	
5.6	Backup Time	min	30	
5.7	Output Voltage	V	230V +-5%	
5.8	Nominal Frequency	Hz	50	
5.9	Output Waveform		Pure sine wave	
5.10	Number of Phases	1 or 3	1	
5.11	Communication		Serial/Ethern et	
5.12	Battery Life	Years	Min 10.	
5.13	Battery Type		Sealed, maintenance free, Lead acid contained in UPS	
5.14	Battery Charger			
5.15	<b>Datasheets included with tender</b>	<b>Yes / No</b>	<b>Yes</b>	
<b>6</b>	<b>SUPPLEMENTARY DETAILS</b>			
<p><b>Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements</b></p>				
<p><b>Name (Print):</b> _____ <b>Signature:</b> _____.</p>				

LOW VOLTAGE SOFT STARTERS				
	DESCRIPTION	UNIT	SPECIFIED	OFFERED
<b>1</b>	<b>MAKES AND MODELS</b>			
1.1	Manufacturer			
1.2	Rated power up to 15 Kw	kW		
1.3	Rated power over 15 kW up to 30 Kw	kW		

1.4	Rated power over 30 kW up to 55 kW	kW		
1.5	Rated power over 55 Kw	kW		
<b>2</b>	<b>CHARACTERISTICS OF SOFT STARTERS</b>			
<b>2.1</b>	<b>Type of Equipment</b>			
2.1.1	Two phase control allowed up to 15 kW	Yes/No	Yes	
2.1.2	Controlled phases fully controlled			
2.1.3	In-delta connection allowed	Yes/No	No	
<b>2.2</b>	<b>Ratings</b>			
2.2.1	Rated operational voltage	V	400	
2.2.2	Rated insulation voltage	V		
2.2.3	Rated impulse withstand voltage	kV		
2.2.4	Rated frequency	Hz	50	
<b>2.3</b>	<b>Utilization category</b>		AC-53a	
<b>2.4</b>	<b>Protection Functions</b>			
2.4.1	Overtemperature/thermal protection	Yes/No	Yes	
2.4.2	Electronic motor overload	Yes/No	Yes	
2.4.3	Phase loss	Yes/No	Yes	
2.4.4	Phase unbalance	Yes/No	Yes	
2.4.5	Phase sequence	Yes/No	Yes	
2.4.6	Overcurrent/short-circuit	Yes/No	Motors >55 kW	
2.4.7	Earth fault	Yes/No	Motors >55 kW	
2.4.8	Starts per hour	Yes/No	Motors >55 kW	
2.4.9	Stall (locked rotor under starting conditions)	Yes/No	Motors >55 kW	
2.4.10	Thermistor/RTD input	Yes/No	Motors >55 kW	
2.4.11	Underload (undercurrent)	Yes/No	Yes	
2.4.12	Over- and undervoltage	Yes/No	Yes	
2.4.13	Jam (locked rotor under running conditions)	Yes/No	Yes	
2.4.14	Type 2 co-ordination with upstream SCPD	Yes/No	Yes	
<b>2.5</b>	<b>Control Settings</b>			
2.5.1	Initial start voltage	Yes/No	Yes	
2.5.2	Start ramp time	Yes/No	Yes	
2.5.3	Motor full load current	Yes/No	Yes	
2.5.4	Current limit	Yes/No	Yes	
2.5.5	Kickstart (voltage/current boost)	Yes/No	Yes	
2.5.6	Torque control	Yes/No	Yes	
<b>3</b>	<b>LINE-, BYPASS AND PFC CONTACTORS</b>			
<b>3.1</b>	<b>Line Contactors</b>			
3.1.1	Line contactor required	Yes/No	Yes	
3.1.2	Manufacturer			
3.1.3	Type 2 co-ordination with upstream SCPD	Yes/No	Yes	
3.1.4	Utilization category		AC3	
<b>3.2</b>	<b>Bypass Contactors</b>			



3.2.1	Bypass contactor required	Yes/No	Yes	
3.2.2	Integral or separate			
3.2.3	Manufacturer (if separate)			
3.2.4	Utilization category (with/without line contactor)		AC1/AC3	
<b>3.3</b>	<b>PFC Contactors</b>			
3.3.1	PFC contactor required	Yes/No	Yes	
3.3.2	Manufacturer			
3.3.3	Utilization category		AC6b	
<b>4</b>	<b>OPERATOR AND PROCESS CONTROL INTERFACES</b>			
<b>4.1</b>	<b>Operator Control Interface</b>			
4.1.1	Integral operator control interface		SS >30 kW	
4.1.2	Remote operator control interface in compartment door	Yes/No	Yes	
<b>4.2</b>	<b>Process Control Interface</b>			
4.2.1	Communication link		SS >30 kW	
4.2.2	Communication interfaces and protocols		Fieldbus/Ethernet	
<b>5</b>	<b>TESTING</b>			
8.1	Type tests	Yes/No	Yes	
8.2	Routine tests	Yes/No	Yes	
8.3	Factory acceptance test	Yes/No	No	
8.4	Site acceptance test	Yes/No	Yes	
<p><b>Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements</b></p> <p><b>Name (Print):</b> _____ <b>Signature:</b> _____.</p>				

CABLE SUPPORTS				
	DESCRIPTION	UNIT	SPECIFIED	OFFERED
<b>1</b>	<b>WIRE MESH TRAY</b>			
1.1	Manufacturer			
1.2	Type			
1.3	Material		HDG indoors, Stainless Steel316 Outdoors	
1.4	Duty	Heavy/Medium	Medium	
1.5	Application			
<b>2</b>	<b>CABLE LADDER</b>			
2.1	Manufacturer			
2.2	Type			



***Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements***

**Name (Print):** \_\_\_\_\_ **Signature:** \_\_\_\_\_

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
<b>1</b>	<b>LOW VOLTAGE CABLES</b>			
1.1	Manufacturer			
1.2	Operating Voltage	V	600/1000	
1.3	Number of Cores	No	See Specificati onsand SLDs	
1.4	Size	mm <sup>2</sup>		
1.5	Conductor Type	Cu/Al		
1.6	Cable Type			
1.7	Full Load Current	A		
1.8	Armouring	Yes/No	Yes, SWA or AWA for singlecore	
1.9	Depth of installation	mm (to cable centre)	650	
1.10	Outdoor Cable Markers	Yes/No	No	
<b>2</b>	<b>SUPPLEMENTARY DETAILS</b>			

[illegible]

**Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements**

**Name (Print):** \_\_\_\_\_ **Signature:** \_\_\_\_\_.

## CONTROL, INSTRUMENTATION AND DATA CABLES

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
<b>1</b>	<b>CONTROL CABLES</b>			
1.1	Manufacturer			
1.2	Size	mm <sup>2</sup>	1.5	
1.3	Operating Voltage	V	24VDC/230V AC	
1.4	Number of Cores	No	Refer to Instrumentation and Control cable schedule and drawings.	
1.5	Size	mm <sup>2</sup>		
1.6	Conductor Type	Cu/Al		
1.7	Cable Type			
1.8	Full Load Current	A		
1.9	Armouring	Yes/No	Yes, SWA	
<b>2</b>	<b>INSTRUMENTATION CABLES</b>			
2.1	Manufacturer			
2.2	Operating Voltage	V	24VDC/230V	

			AC	
2.3	Size	<i>mm<sup>2</sup></i>	1.5	
2.4	Cable Type		Twisted Pair	
2.5	Screened		Individually and Overall	
2.6	Armouring	Yes/No	Yes, SWA	
<b>3</b>	<b>FIBRE OPTIC</b>			N/A
3.1	Manufacturer			
3.2	Type		Multimode	
3.3	Armouring	Yes/No	Yes, for outdoor and exposed cables.	
3.4	Armouring Type		Steel Tape Armoured	
3.5	Termination preference type		ST	
3.6	Cores	No	min 12	
3.7	Cable Category		min OM 2	
3.8	Modal Bandwidth	<i>MHz.km</i>	min 500 / 500	
<b>4</b>	<b>ETHERNET CABLES</b>			
4.1	Manufacturer			
4.2	Type		CAT5 STP	
4.3	Armouring	Yes/No	No	
4.4	Termination Type		RJ 45 (Moulded case type)	
<b>5</b>	<b>FIELD BUS CABLE</b>			
5.1	Manufacturer			
5.2	Type		CAT5 STP	
5.3	Armouring	Yes/No	No	
5.4	Termination Type		RJ 45 (Moulded case type)	
<b>6</b>	<b>SUPPLEMENTARY DETAILS</b>			
Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements.				
Name (Print): _____ Signature: _____				

LV ELECTRICAL MOTORS				
	DESCRIPTION	UNIT	SPECIFIED	OFFERED
<b>1</b>	<b>ELECTRICAL OPERATING CONDITIONS</b>			
1.1	Supply voltage (nominal)	V	400	
1.2	Number of phases		3	

1.3	Frequency	Hz	50	
1.4	Voltage and frequency variations	%	As per SANS 1804-2	
1.5	Supply voltage harmonic voltage factor		As per SANS 60034-1	
1.6	Supply voltage negative sequence component	%	2	
1.7	Supply neutral earthed directly/resistively (high/low)		Directly	
<b>2</b>	<b>SITE OPERATING CONDITIONS</b>			
2.1	Altitude a.s.l.	m	As per	
2.2	Maximum ambient temperature	°C	Specification	
2.3	Minimum ambient temperature	°C		
<b>3</b>	<b>MOTOR RATING</b>			
3.1	Rated output	kW	As per Specification	
3.2	Duty type		S1	
3.3	Output margin above load absorbed power	%	15	
3.4	Speed (synchronous)	rpm	1500	
3.5	Speed at rated output, voltage and frequency	rpm		
3.6	Rated voltage	V	400	
3.7	Full load current	A		
3.8	Efficiency class (IE1/2/3)		IE2	
3.9	Rated torque	Nm		
<b>4</b>	<b>ENCLOSURE, CONSTRUCTION &amp; MOUNTING</b>			
4.1	Ingress protection rating		IP55, IP68 for submersible	
4.2	Cooling method		IC411	
4.3	Construction and mounting arrangement		IM B3	
4.4	Terminal box location (R/B/L/T)		as per Contractor's design	
4.5	Cable entry location		Below	
4.6	Cable type and size		As per SLD	
4.7	Corrosion protection (standard/corrosive environment)		Corrosive	
<b>5</b>	<b>WINDINGS TYPE, INSULATION &amp; TEMPERATURE RISE</b>			
5.1	Stator winding type (random/formed diamond coil)		Formed	
5.2	Insulation and impregnation system		VPI	
	<b>DESCRIPTION</b>	<b>UNIT</b>	<b>SPECIFIED</b>	<b>OFFERED</b>
5.3	Insulation thermal class	(F/H)	F	
5.4	Temperature rise class	(B/F)	B	
5.5	Maximum temperature rise at rated output (Zone A supply)	K		
5.6	Maximum temperature rise at rated output (Zone C supply)	K		
5.7	Windings thermal protection (thermistor/PT100)		Yes	

<b>6</b>	<b>GENERAL PERFORMANCE</b>			
6.1	Efficiency at rated output	%		
6.2	Efficiency at rated 75% output	%		
6.3	Efficiency at rated 50% output	%		
6.4	Power factor at rated output	pu		
6.5	Power factor at 75% rated output	pu		
6.6	Power factor at 50% rated output	pu		
6.7	Sound power level at rated load	dBA		
6.8	Silencer required		No	
<b>7</b>	<b>STARTING PERFORMANCE</b>			
7.1	Starting method		As per SLDs	
7.2	Motor moment of inertia	kg.m <sup>2</sup>		
7.3	Number of starts per hour (cold/hot)		6/2	
7.4	Starting current (x full load current)	A		
7.5	Starting torque (x rated torque)	N m		
7.6	Pull-up torque (x rated torque)	N m		
7.7	Breakdown torque (x rated torque)	N m		
7.8	Starting power factor	pu		
7.9	Run up time of driven load (state pu startings current)			
<b>8</b>	<b>DRIVEN LOAD AND COUPLING</b>			
8.1	Load type		Various	
8.2	Load moment of inertia at motor speed	kg.m <sup>2</sup>		
8.3	Coupling method (direct/gearbox/v-belt)			
<b>9</b>	<b>BEARINGS</b>			
9.1	Manufacturer			
9.2	DE bearing type (ball/roller/sleeve)		Ball/roller	
9.3	DE bearing lubrication type (sealed/regreasable)			
9.4	DE bearing life (L10)	h		
9.5	DE bearing regrease interval	h		
9.6	NDE bearing type (ball/roller/sleeve)		Ball/roller	
9.7	NDE bearing lubrication type (sealed/regreasable)			
9.8	NDE bearing life (L10)	h		
9.9	NDE bearing regrease interval	h		
9.10	Bearing thermal protection (thermistor/PT100)			
<b>10</b>	<b>DIMENSIONS AND WEIGHT</b>			
10.1	Motor frame number			
10.2	Motor weight	kg		
<b>11</b>	<b>VARIABLE SPEED APPLICATIONS</b>			
11.1	Operating speed range	rpm	As per load	
11.2	Maximum safe operating speed	rpm		
11.3	Peak voltage withstand level	V		
11.4	Voltage gradient withstand level	V/s		
11.5	Separately-powered cooling fan			

<b>12</b>	<b>OPTIONAL ITEMS</b>			
12.1	Anti-condensation heaters		Yes	
12.2	Slide rails (for v-belt drives)		No	
12.3	Surge protection devices		No	
12.4	Adjusting bolts required		Yes	
<b>13</b>	<b>FACTORY TESTS</b>			
13.1	Routine tests in addition to SANS 1804-2 requirements			
13.1.1	Insulation resistance check		Yes	
13.1.2	Vibration velocity measurement		No	
13.2	Type tests in addition to SANS 1804-2 requirements			
13.2.1	Current vs speed curve		Yes	
13.2.2	Torque vs speed curve		Yes	
<b>14</b>	<b>DRAWINGS / CURVES TO BE PROVIDED WITH TENDER</b>			
14.1	Motor general arrangement with dimensions		Yes	
14.2	Main terminal box with fault rating indicated		Yes	
14.3	Current vs speed curve		Yes for ≥30kW	
14.4	Torque vs speed curve		Yes for ≥30kW	
<p><b>Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements</b></p>				
<p><b>Name (Print):</b> _____ <b>Signature:.</b> _____</p>				

LV SWITCHGEAR AND CONTROLGEAR ASSEMBLIES - MOTOR CONTROL CENTRES				
	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	This data sheet is applicable to the following Motor Control Centres			

<b>1</b>	<b>GENERAL</b>			
1.1	MCC Manufacturer			
1.2	Tested with Stated Deviations to SANS 1973-1	Yes/No	Yes	
1.3	Type Test Certificate Required	Yes / No	Yes	
1.4	Control Voltage	230V/ 24VDC		
1.5	Compartment type	pattern/ withdrawable	Fixed pattern	
<b>2</b>	<b>CONSTRUCTION REQUIREMENTS</b>			
2.1	Steel Work Manufacturer			
2.2	Form of Internal Separation		3b/4a	
2.3	Material of Construction		3CR12	
2.4	Ingress Protection (doors closed)	IP	42	
2.5	Method of Installation		Floor Standing	
2.6	Epoxy Powder Coated	Yes / No	Yes	
2.7	Colour of Assembly		Electric Orange	
2.8	Size of Panel	HxWxD	H <2100	
2.9	Spare Space Required	%	>=20	
2.10	Access	Back / Front/ Side	Front & Rear	
2.11	Cable Entry	Top/ Bottom	Bottom	
2.12	Doors / Removable Panels		Doors	
2.13	Door Locks	Yes / No	Yes	
2.14	Door Locks – Type		Square key	
2.15	Door Locks – Material			
2.16	Incomer Section Required	Yes / No	Yes	
2.17	Corrosion protection		Epoxy coated	
2.18	Gland Plates		Not painted; Alu for single core cables	
<b>3</b>	<b>ELECTRICAL COMPONENTS</b>			
3.1	Busbars			
3.1.1	Material		Copper	
3.1.2	Tinned	Yes / No	Yes	
3.1.3	Current Density	A/mm <sup>2</sup>	<2 as per type test	
3.2	Air Circuit Breakers			
3.2.1	Manufacturer			
3.2.2	Type		Fixed pattern	
3.2.3	Model			
3.2.4	Rated Current	A	As per SLD	
3.2.5	Service short-circuit breaking capacity (Ics)	kA	As per SLD	
3.2.6			Electronic	
3.2.7	Short-circuit release		Electronic	



3.2.8	Motorised	Yes / No	Yes for MCCs With Generator supply	
3.3	Moulded Case Circuit Breakers			
3.3.1	Manufacturer			
3.3.2	Type		Fixed	
3.3.3	Model			
3.3.4	Rated Current	A	As per SLD	
3.3.5	Service short-circuit breaking capacity (Ics)	kA	As per SLD	
3.3.6	Overload release		Thermal/ electronic	
3.3.7	Short-circuit release		Magnetic/ electronic	
3.4	Miniature Circuit Breakers			
3.4.1	Manufacturer			
3.4.2	Type			
3.4.3	Model			
3.4.4	Tripping Curve		C or as per SLD	
3.5	Fuse Switch-Disconnectors			
3.5.1	Manufacturer			
3.5.2	Model			
3.6	High Rupture Capacity (HRC) Fuse Links			
3.6.1	Manufacturer			
3.6.2	Model			
3.7	Surge Arrestors			
3.7.1	Power Circuits – Manufacturer			
3.7.2	Power Circuits – Model			
3.7.3	Power Circuits – Rating	kA		
3.7.4	Remote Indication to PLC	Yes / No	Yes	
3.7.5	Control Circuits – Manufacturer			
3.7.6	Control Circuits – Model			
3.7.7	Remote Indication to PLC	Yes / No		
3.8	Contactors			
3.8.1	Manufacturer			
3.8.2	Model			
3.8.3	Contactor rating		AC3	
3.8.4	Coordination		Type 2	
3.9	Overload Relays			
3.9.1	Manufacturer			
3.9.2	Type			
3.9.3	Model			

3.9.4	Rated Current	A	As per SLD	
3.9.5	Resetable from front of MCC	Yes / No	Yes	
3.9.6	LCD	Yes / No	No	
3.10	Miniature Relays			
3.10.1	Manufacturer			
3.10.2	Model			
3.11	Control switches and pushbuttons			
3.11.1	Manufacturer			
3.11.2	Model			
3.12	Indicating Lamps			
3.12.1	Manufacturer			
3.12.2	Model			
3.12.3	Type		LED	
3.13	Power Meter for Incomer(s)			
3.13.1	Manufacturer			
3.13.2	Model			
3.13.3	Communication Protocol		Modbus/ Ethernet	
3.13.4	Harmonics Measurement	Yes / No	No	
3.13.6	Time of use measurement	Yes / No	No	
3.13.7	Bi-directional	Yes / No	No	
3.13.8	Datasheet provided with tender	Yes / No	Yes	
3.13.9	Data logging functionality	Yes / No	Yes	
3.14	Control-Circuit and auxiliary supply transformer			
3.14.1	Manufacturer			
3.15	Capacitors for Individual Power Factor Correction			
3.15.1	Manufacturer			
<b>4</b>	<b>ACTIVE HARMONIC FILTER (if applicable)</b>			N/A
4.1	Manufacturer			
4.2	Model			
4.3	Type			
4.4	Datasheets included with tender	Yes / No		
<b>5</b>	<b>FIELD E-STOP/START CONTROL STATIONS</b>			
5.1	Method of Installation		Pedestal	
5.2	Material of Construction		HDG	
5.3	Manufacturer			
5.4	Keyswitch Required	Yes / No	No	
5.5	IP rating	IP	65	
<b>6</b>	<b>SUPPLEMENTARY DETAILS</b>			



## **C3.5 MANAGEMENT**

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### **C3.5.1            HEALTH AND SAFETY SPECIFICATIONS**

This part of C3.5 Management contains specifications for Health and Safety matters not covered by C3.4 Construction Specifications.

The number of each clause and each payment item in this specification is prefixed with a G to differentiate these clauses and items.

## **SECTION G1000 : HEALTH AND SAFETY REQUIREMENTS**

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### **G1001            SCOPE**

This health and safety specification establishes the overarching framework within which a contractor is required to satisfy general requirements for occupation health and safety in an engineering and construction works contract.

- Note:** 1) This specification establishes general requirements to enable the employer and the contractor to satisfy the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the Construction Regulations, 2003.
- 2) The Construction Regulations, 2003, require an employer to stop any contractor from executing construction work which is not in accordance with the contractor's health and safety plan for the site or which poses a threat to the health and safety of persons.

### **G1002            DEFINITIONS**

**Act:** the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

**competent person:** any person having the knowledge, training and experience specific to the work or task being performed

**ergonomics:** the application of scientific information concerning humans to the design of objects, systems and the environment for human use in order to optimize human well-being and overall system performance hazard: a source

of or exposure to danger incident: an event or occurrence occurring at work or arising out of or in connection with the activities of persons at work, or in connection with the use of plant or machinery, in which, or in consequence of which-

- a) any person dies, becomes unconscious, suffers the loss of a limb or part of a limb or is otherwise injured or becomes ill to such a degree that he is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or to continue with the activity for which he was employed or is usually employed;
- b) a major incident occurred; or
- c) the health or safety of any person was endangered and where-
  - i) a dangerous substance was spilled;
  - ii) the uncontrolled release of any substance under pressure took place;
  - iii) machinery or any part thereof fractured or failed resulting in flying, falling or uncontrolled moving objects; or machinery ran out of control

**health and safety plan:** a documented plan which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

**health and safety specification:** a documented specification of all health and safety requirements pertaining to the associated works on a construction site, so as to ensure the health and safety of persons

**inspector:** a person designated as such under section 28 of the Act

**major incident:** an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace

**reasonably practicable:** practicable having regard to:

- a) the severity and scope of the hazard or risk concerned;
- b) the state of knowledge reasonably available concerning that hazard or risk and of any means of removing or mitigating that hazard or risk;
- c) the availability and suitability of means to remove or mitigate that hazard or risk; and
- d) the cost of removing or mitigating that hazard or risk in relation to the benefits deriving therefrom;

**risk:** the probability that injury or damage will occur

**safe:** free from any hazard

**scaffold:** any temporary elevated platform and supporting structure used for providing access to and supporting workmen or materials or both

**specification data:** data, provisions and variations that make this specification applicable to a particular contract

**structure**

- a) any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, batching plants, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;
- b) any formwork, false work, scaffold or other structure designed or used to provide support or means of access during construction work; or
- c) any fixed plant in respect of work which includes the installation, commissioning, decommissioning or dismantling and where any such work involves a risk of a person falling two metres or more

**substance:** any solid, liquid, vapour, gas or aerosol, or combination thereof

**suitable:** capable of fulfilling or having fulfilled the intended function or fit for its intended purpose

**G1003 INTERPRETATION**

- G3.1 The Act and its associated regulations shall have precedence in the interpretation of any ambiguity or inconsistency between it and this specification.
- G3.2 Compliance with the requirements of this specification does not necessarily result in compliance with the provisions of the Act.

**G1004 REQUIREMENTS**

**G4.1 General requirement**

- G4.1.1 The contractor shall execute the works in a manner that complies with all the requirements of the Act and all its associated regulations, and in so doing, minimize the risk of incidents occurring.
- G4.1.2 The contractor shall with respect to the site and the engineering and construction works that are contemplated:

- a) identify the hazards and evaluate the risks associated with such work constituting a hazard to the health and safety of such employees and the steps that need to be taken to comply with the Act; and
- b) as far as is reasonably practicable, prevent the exposure of such employees to the hazards concerned or, where prevention is not reasonably practicable, minimize such exposure.

G4.1.3 The contractor shall as far as is reasonably practicable, cause every employee to be made conversant with the hazards to his health and safety attached to any work which he has to perform, any article or substance which he has to produce, process, use, handle, store or transport and any plant or machinery which he is required or permitted to use, as well as with the precautionary measures which should be taken and observed with the respect to those hazards.

G4.1.4 The contractor shall ensure that all employees under his or her control are:

- a) informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment; and
- b) issued with proof of health and safety induction training issued by a competent person and carry proof of such induction when working on site.

G4.1.5 The contractor shall not allow or permit any employee to enter any site, unless such person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

G4.1.6 The contractor shall ensure that each visitor to a construction site, save where such visitor only visits the site office and is not in direct contact with the construction work activities:

- a) undergoes health and safety instruction pertaining to the hazards prevalent on the site; and
- b) is provided with the necessary personal protective

equipment.

G4.1.7 The contractor shall provide suitable on-site signage to alert workers and visitors to health and safety requirements.

G4.1.8 The contractor shall not permit any person who is or who appears to be under the influence of intoxicating liquor or drugs, to enter or remain at a workplace.



## **G4.2 Health and safety representatives**

G4.2.1 The contractor shall appoint in writing one health and safety representative for every 50 employees of the contractor working on the site, whenever there are more than 20 employees on the site; to:

- a) review the effectiveness of health and safety measures;
- b) identify potential hazards and potential major incidents;
- c) in collaboration with his employer, examine the causes of incidents;
- d) investigate complaints by any employee of the contractor relating to that employee's health or safety on the site;
- e) make representations to the contractor on matters arising from a), b), c) or d) or on general matters affecting the health or safety of the employees at the workplace;
- g) inspect the site with a view to the health and safety of employees, at regular intervals;
- h) participate in consultations with inspectors at the workplace and accompany inspectors on inspections of the workplace; and
- i) participate in any internal health or safety audit.

G4.2.2 The contractor shall inform the relevant safety representative:

- a) beforehand of inspections, investigations or formal inquiries of which he has been notified by an inspector; and
- b) as soon as reasonably practicable of the occurrence of an incident on the site.

G4.2.3 The contractor shall convene health and safety meetings whenever more than two health and safety representatives have been appointed for the site. These meetings shall be attended by all health and safety representatives and shall be convened at least once every month to:

- a) make recommendations to the employer regarding any matter affecting the health or safety of persons on the site; and

- b) discuss any incident on the site in which or in consequence of which any person was injured, became ill or died.

G4.2.4 The contractor shall consult with the health and safety committee on the development, monitoring and review of the risk assessment.

#### **G4.3 Appointment of construction supervisor and safety officers**

4.3.1 The contractor shall appoint a full-time competent employee designated in writing as the construction supervisor for the site, with the duty of supervising the performance of the work falling within the scope of the contract and may appoint one or more competent employees to assist the appointed construction supervisor.

1.3.2 A contractor may having considered the size of the project, the degree of dangers likely to be encountered or the accumulation of hazards or risks on the site, appoint a full-time or part-time construction safety officer in writing, who has in the contractor's opinion the necessary competencies and resources, to assist the contractor in the control of all safety related aspects on the site.

1.3.3 The contractor shall ensure that the construction supervisor is in possession of the most recently updated version of the fall protection plan.

G4.3.4 The contractor shall ensure that the following activities, as relevant, are carried out under the supervision of a competent person and that such persons are appointed in writing:

- a) all formwork and support work operations;
- b) excavation work;
- c) demolition work;
- d) scaffolding work operations;
- e) suspended platform work operations;
- f) operation of batch plants; and
- g) the stacking and storage of articles on the site.

#### **G4.4 Risk assessment**

G4.4.1 The contractor performing work falling within the contract shall, before the commencement of any such work and during construction work, cause a risk assessment to be performed by a competent person appointed in writing. Such an assessment shall as a minimum:

- to;
- a) identify the risks and hazards to which persons may be exposed
  - b) analyse and evaluate the identified risks and hazards;
  - c) document a plan of safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;
  - d) provide a monitoring plan; and
  - e) provide a review plan.

**Note:** A risk assessment is an important step in protecting workers as well as complying with the law. It helps you focus on the risks that really matter in a particular workplace – the ones with the potential to cause real harm. Workers and others have a right to be protected from harm caused by a failure to take reasonable control measures. The following four steps are recommended:

Identify the hazards by looking at what could reasonably be expected to cause harm, ask employees or their representatives what they think, obtain advice from trade associations or publications on health and safety, check manufacturer's instructions or data sheets for chemicals and equipment as they can be very helpful in spelling out the hazards and putting them in their true perspective, review accident and ill-health records, think about long-term hazards to health (eg high levels of noise or exposure to harmful substances) as well as safety hazards etc.

Identify who may be harmed and how by identifying how groups of people might be harmed i.e. what type of injury or ill health might occur.

Evaluate the risks and decide on precautions by doing everything 'reasonably practicable' to protect people from harm i.e. by looking at how things are done, what controls are in place and how the work is organised and comparing this against good practice to see if more can be done to bring practices up to standard. Consider if the hazard can be got rid of all together, and if not how can the risks be controlled so that harm is unlikely, e.g. try a less risky option (eg switch to using a less hazardous chemical); prevent

access to the hazard (eg by guarding); organise work to reduce exposure to the hazard (eg put barriers between pedestrians and traffic); issue personal protective equipment (eg clothing, footwear, goggles etc); and provide welfare facilities (eg first aid and washing facilities for removal of contamination).

Record the findings by writing down the findings of the risk assessment.

G4.4.2 The contractor shall ensure that as far as is reasonably practicable, ergonomic related hazards are analysed, evaluated and addressed in the risk assessment.

G4.4.3 The contractor shall require a competent person to prepare a fall protection plan in compliance with the requirements of the Construction Regulations.

G4.4.4 Notwithstanding the provisions of the fall protection plan, the contractor shall ensure that:

- a) all unprotected openings in floors, edges, slabs, hatchways and stairways are adequately guarded, fenced or barricaded or that similar means are used to safeguard any person from falling through such openings;
- b) no person works in an elevated position, unless such work is performed safely as if working from a scaffold or ladder;
- c) notices are conspicuously placed at all openings where the possibility exists that a person might fall through such openings;
- d) fall prevention and fall arrest equipment is:
  - i) suitable and of sufficient strength for the purpose or purposes for which it is being used having regard to the work being carried out and the load, including any person, it is intended to bear; and
  - ii) securely attached to a structure or plant and the means of attachment thereto is suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and any person who is liable to fall;  
fall arrest equipment is only used where it is not reasonably practicable to use fall prevention equipment; and
- f) suitable and sufficient steps are taken to ensure, as far as is reasonably practicable, that in the event of a fall by any person, the fall arrest equipment or the surrounding environment does not cause injury to the person.

G4.4.5 Where roof work is being performed on a construction site, the contractor shall ensure that it is indicated in the fall protection plan that:

the roof work has been properly planned;

the roof erectors are competent to carry out the work;

no employees are permitted to work on roofs during inclement weather conditions or if weather conditions are a hazard to the health and safety of the employees;

prominent warning notices are to be placed where all covers to openings are not of sufficient strength to withstand any imposed loads and where fragile material exists;

the areas mentioned in paragraph (d) are to be barricaded off to prevent persons from entering; suitable and sufficient platforms, coverings or other similar means of support have been provided to be used in such a way that the weight of any person passing across or working on or from fragile material is supported; and there is suitable and sufficient guard-rails or barriers and toe-boards or other similar means of protection to prevent, so far as is reasonably practicable, the fall of any person, material or equipment.

G4.4.6 The contractor shall ensure that:

- a) all reasonably practicable steps are taken to prevent the uncontrolled collapse of any new or existing structure or any part thereof, which may become unstable or is in a temporary state of weakness or instability due to the carrying out of construction work;
- b) no structure or part of a structure is loaded in a manner which would render it unsafe; and
- c) specification data prepared by the designer of the structure is taken into account in the risk assessment;

Note: The specification data provided by the designer should outline known or anticipated dangers or hazards relating to the works and make available all information required for the safe execution of the work. It should provide as relevant, geotechnical information (or make reference to reports provided in the site information), the loading the structure is designed to withstand, the methods and sequence of construction.

#### **G4.5 Health and safety plans**

G4.5.1 The contractor shall prior to commencing the works to which this specification applies, submit to the employer for approval a

suitable and sufficiently documented health and safety plan, based on this specification and the risk assessment that is conducted.

G4.5.2 The health and safety plan shall as a minimum provide:

- a) the information contained in Table 1 in respect of each of the hazards associated with work falling within the scope of the contract (see Figure 1); and

Table 1: Example of the format of a health and safety plan

What are the hazards?	Who might be harmed and how?	What are the safe work procedures for the site?	What further action is necessary (monitoring and review)?	Action by whom	Action by when

- b) an outline of the manner in which the contractor intends complying with the requirements of this specification.

G4.5.3 The contractor shall discuss the submitted health and safety plan with the employer's representative, modify such plan in the light of the discussions and resubmit the modified plan for approval.

G4.5.4 The contractor shall apply the approved health and safety plan from the date of commencement of and for the duration of the works to which this specification applies.

G4.5.5 The contractor shall conduct periodic audits for compliance with the approved health and safety plan at intervals agreed upon with the employer, but at least once every month.

G4.5.6 The contractor shall update the health and safety plan whenever changes to the works are brought about.

## G4.6 Subcontractors

G4.6.1 The contractor may only subcontract work in terms of a written subcontract and shall only appoint a subcontractor should he be reasonably satisfied that such a subcontractor has the necessary competencies and resources to perform the work falling within the scope of the contract safely. Such a subcontract shall require that the subcontractor shall:

- a) co-operate with the contractor as far as is necessary to enable both the contractor and sub-contractor to comply with the provisions of the Act; and

- b) as far as is reasonably practicable, promptly provide the contractor with any information which might affect the health and safety of any person at work carrying out work or any person who might be affected by the work of such a person at work or which might justify a review of the health and safety plan.

G4.6.2 The contractor shall provide any sub-contractor who is submitting a tender or appointed to perform a sub-contract falling within the scope of the contract, with the relevant sections of this specification and associated specification data which might be pertinent to the sub-contract.

G4.6.3 The contractor shall take reasonable steps as are necessary to ensure:

- a) co-operation between all sub-contractors to enable each of those sub-contractors to comply with the requirements of the Act and associated regulations; and
- b) that each sub-contractor's health and safety plan is implemented.

G4.6.4 The contractor shall conduct periodic audits for compliance with the approved health and safety plan of each and every sub-contractor working on the site at intervals agreed upon with such contractors, but at least once per month.

G4.6.5 The contractor shall stop any contractor from executing construction work which is not in accordance with the contractor's or subcontractor's health and safety plan for the site or which poses a threat to the health and safety of persons.

G4.6.6 The contractor shall ensure that where changes to the works occur, sufficient health and safety information and appropriate resources are made available to the subcontractor to execute the work safely.

G4.6.7 The contractor shall ensure that:

- a) every subcontractor is registered and in good standing with the compensation fund or with a licensed compensation insurer prior to work commencing on site;
- b) potential subcontractors submitting tenders have made provision for the cost of health and safety measures during the construction process; and

- c) every subcontractor has in place a documented health and safety plan prior to commencing any work on site which falls within the scope of the contract.

G4.6.8 The contractor shall receive, discuss and approve health and safety plans submitted by subcontractors.

G4.6.9 The contractor shall ensure that all subcontractors are informed regarding any hazard as stipulated in the risk assessment before any work commences, and thereafter at such times as may be determined in the risk assessment.

G4.6.10 The contractor shall reasonably satisfy himself that all employees of subcontractors are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment.

The contractor shall satisfy himself and ensure that all subcontractor employees deployed in the site are:

- a) informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment; and
- b) issued with proof of health and safety induction training issued by a competent person and carry proof such induction when working on site.

G4.7 Reporting of incidents

The contractor shall notify the employer's representative of any incident as soon as possible after it has occurred and report such incidence to an inspector.

#### **G4.8 Administration**

G4.8.1 Notification of intention to commence construction work

The contractor shall notify the Provincial Director of Labour in writing using a form similar to that contained in Annexure A of the Construction Regulations issued in terms of the Act before construction work commences and retain a copy of such notification in the health and safety file where such work:

involves the demolition of a structure exceeding a height of 3m;

involves the use of explosives to perform construction work;



involves the dismantling of fixed plant at a height greater than 3m;

exceeds 30 days or will involve more than 300 person days of construction work; and includes:

- i) excavation work deeper than 1m; or
- ii) working at a height greater than 3 m above ground or a landing.

#### G4.8.2 Health and safety file

G4.8.2.1 The contractor shall maintain on site a health and safety file on site which contains copies of the following, as relevant:

- a) the notification made to the Provincial Director of Labour in terms of 4.4.1;
- b) the letters of appointment of health and safety representatives;
- c) the minutes of all health and safety meetings;
- d) a comprehensive and updated list of all the subcontractors (nominated, selected or domestic) employed on site by the contractor, indicating the type of work being performed by such sub-contractors;
- e) a copy of each and every subcontract agreement;.
- f) the contractor's health and safety plan;
- g) the health and safety plans of all the contractor's subcontractors who are required to provide such plans;
- h) the recommendations made to the contractor by the health and safety committee referred to in 4.2.3
- i) any report made to an inspector by the health and safety committee referred to in 4.2.3; and
- j) the findings of all audit reports made regarding the implementation of the contractor's or a subcontractor's health and safety plan;
- k) proof that the contractor and every subcontractor is registered and in good standing with the compensation fund or with a licensed compensation insurer;

- l) the inputs of the safety officer, if any, into the health and safety plan;
- m) a copy of risk assessments made by competent persons;
- n) details of induction training conducted whenever it is conducted;
- o) proof of all subcontractor's induction training whenever it is conducted;
- p) letters of appointments for competent persons to supervise prescribed activities;
- q) proof of the following where suspended platforms are used:
  - i) a certificate of system design issued by a professional engineer, professional certificated engineer or a professional engineering technologist;
  - ii) proof of competency of erectors;
  - iii) proof of compliance of operational design calculations with requirements of the system design certificate;
  - iv) proof of performance test results;
  - v) sketches indicating the completed system with the operational loading capacity of the platform;
  - vi) procedures for and records of inspections having been carried out;
  - vii) procedures for and records of maintenance work having been carried out;
  - viii) proof that the prescribed documentation has been forwarded to the provincial director;
- r) records of the register of inspections made by a competent person immediately before and during the placement of concrete or any other load on formwork; and
- s) the names of the first aiders on site and copies of the first aid certificates of competency.

G4.8.2.2 The health and safety file shall be made available for inspection by any inspector, subcontractor, employer's representative, employer's agent, health and safety representative or employee of the contractor upon the request of such persons.

G4.8.2.3 The contractor shall hand over the health and safety file to the employer upon completion of the contract together with a record of all drawings, designs, materials used and other similar information concerning the completed structure.

#### **G4.9 First aid, emergency equipment and procedures**

The contractor shall where more than five employees are employed at a workplace, provide a first aid box or boxes at or near the workplace which shall be available and accessible for the treatment of injured persons at that workplace. Such first aid boxes shall contain suitable first aid equipment.

The contractor shall ensure that where there are more than 10 employees employed on the site that for every group of up to 50 employees at that workplace, at least one person is readily available during normal working hours, who is in possession of a valid certificate of competency in first aid.

### **G1005 MEASUREMENT AND PAYMENT**

*Item*

*Unit*

#### **G10.1 Contractor's initial obligations in respect of the Occupational Health and Safety and Construction Regulations Lump Sum**

Payment of the lump sum tendered shall include full compensation for all costs resulting from the Contractor's initial obligations complying with Occupational Health and Safety Act and its Construction Regulations and requirements in terms of health and safety requirements in respect of the contract as specified.

The full amount will be paid in one instalment only once:-

- (a) The contractor has notified the Provincial Director of the Department of Labour in writing of the project.
- (b) The contractor has made the required initial appointments of employees and sub-contractors.
- (c) The client has approved the contractor's Health and Safety Plan.
- (d) The contractor has set up his Health and Safety File.

*Item*

*Unit*

#### **G10.2 Contractor's time related obligations in respect of the Occupational Health and Safety and Construction Regulations Month**

### **Health and Safety Act and Construction Regulations**

The tendered monthly amount shall represent full compensation for that part of the Contractor's general obligations in terms of the Occupational Health and Safety Act and the Construction Regulations which are mainly a function of time. This includes inter alia payment of all costs for the appointment of all staff contemplated in the construction regulations and the transport of employees on site. Payment will be monthly only after payment for Item G10.1 has been made.

The lump sum tendered will be payable monthly instalments in relation to the month under consideration and the total time of the completion of the Works.

### **C3.5.2 ENVIRONMENTAL SPECIFICATIONS**

This part of C3.5 Management contains specifications for Environmental matters not covered by C3.4 Construction Specifications.

The number of each clause and each payment item in this specification is prefixed with an H to differentiate these clauses and items.

### **SECTION H1000 : ENVIRONMENTAL MANAGEMENT**

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#### **H1001 SCOPE**

The Contractor is required to comply with the requirements of the detailed EMP (to be provided upon award of contract) throughout construction.

The following are standardised additional specifications applicable. They are intended to assist the appointed Contractors to fulfill the environmental requirements of the project. The objective of the EMP is to ensure that the potential impacts upon the environment are minimised, and that upon completion of each section of work the area is left in a clean and sustainable condition.

Overall the environmental impacts of the project are considered to be low as long as the listed procedures are followed. These are given in the EMP.

The Contractor is advised that there are cost implications to the EMP and these must be factored into the tendered price.

#### **H1002 ENVIRONMENTAL MANAGEMENT PLAN**

##### **H2.1 Objectives**

The prime objective of the EMP is to minimise or avoid significant environmental impacts by using a pro-active approach and planning procedures.

The second objective is to have a plan in place to rehabilitate areas that have been impacted upon and, thirdly,

To have a plan in place for emergency situations that arise and are detrimental to the environment e.g. fuel or bitumen spills.

The Contractor will be responsible for the day-to-day implementation of the EMP, by himself and all other sub-contractors. During the course of construction regular compliance audits will be undertaken. This environmental auditing will be conducted by qualified environmental practitioners.

## **H2.2 Environmental Control**

The Contractor will oversee the environmental aspects of the construction phase of the project in consultation with the Engineer.

The Contractor will report back to the bi-weekly site meetings with regards to compliance to the environmental specifications.

## **H2.3 Environmental Awareness Programme**

The Engineer will implement an Environmental Awareness Programme for the Contractor, his staff, sub-contractors and all people working on the project. The initial session will be immediately prior to construction commencing.

## **H2.4 Method Statements**

The Contractor shall submit written method statements for activities that are identified by the Engineer, as being potentially harmful to the environment, or for work that is to be undertaken in areas identified as being environmentally sensitive.

Such activities include dewatering of excavations, pumping, working with cement, erection of construction camps and fuel stores, etc.

The Method Statement shall cover applicable details with regard to:

- construction procedures,
- materials and equipment to be used,
- getting the equipment to and from site,
- how the equipment/ material will be moved while on site,
- how and where material will be stored,
- the containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur,
- timing and location of activities,
- compliance/ non-compliance with the Specifications, and
- any other information deemed necessary by the Engineer.

Method statements shall be submitted at least 7 days prior to commencing work on the activity to give the Engineer time to study the method statement and consult with contractor and specialists and to obtain written approval of the method statements. The Contractor shall not commence on that activity until such time as the method statement has been agreed to in writing by the Engineer. This will be done within this 10 day period.

Any changes required to the method statements once construction has commenced must be agreed upon in writing with the Engineer before being instituted.

## H2.5 Working Areas

Regardless of the extent of the work, the following applies to all of these areas:

- All materials must be stockpiled or stored in a designated area (at each site) avoiding sensitive areas.
- No materials must be left on site once work is completed neither may they be dumped at any other place on site.
- Litter bins and containers for waste materials must be provided by the Contractor at each site. Bins should be weatherproof and scavenger proof.
- All waste must be placed in the bins and containers. No waste may be left lying on the site.
- Visible anti-litter signs must be displayed around the waste collection points and all employees must be encouraged to observe site rules pertaining to solid waste management practices. A concerted effort should be made to collect and dispose of materials suitable for recycling, separately from the other solid waste.
- No burning or burial of waste is permitted.
- Any soils contaminated by the contractor must be removed or rehabilitated. If a significant amount of soil has to be removed fresh soil must be imported and the site rehabilitated by grading and planting vegetation.
- All waste must be removed to an authorised landfill site, or taken to a facility for recycling.  
Any excess road building materials must either be:
  - taken to a site for stockpiling and future re-use,
  - (ii) used for localised rehabilitation, or
  - (iii) removed from site by the contractor for disposal.
- The contractor shall provide waste bins for solid waste collection and storage. Such bins should be placed at designated areas within the site. The refuse collected from the site must be removed for landfill disposal at least once a week.
- Vehicles may not park in the road reserve except with the prior permission of the Engineer.
- Every care should be taken to avoid damaging vegetation or land when vehicles are in use.

- Fuel tanks, pumps, and all equipment using oil, diesel, etc. must have drip trays. The drip trays must have sufficient capacity to contain liquids that will spill in the case of failure of the tanks, etc. The waste liquids taken from the trays must be disposed of at a landfill which permits disposing of liquid wastes.
- Only emergency repairs to vehicles and equipment may take place on site. Where emergency repairs take place it is the responsibility of the contractor to ensure that all waste (e.g. spare parts and oils) are removed from site as soon as possible. All other repairs must take place at a yard off-site, where facilities are suitable and waste facilities are appropriate.
- Whenever practical a tarpaulin should be laid down, prior to emergency repairs taking place, to protect the environment from contamination.
- No natural vegetation may be gathered, removed or destroyed in the course of the project, except where agreed to by the landowner.
- No hunting is permitted.
- Fires are prohibited.
- Erosion control measures must be implemented if the need arises.
- Pollution of water courses by any means must be avoided.
- No defacement of any natural or other features will be allowed; this includes markings for road works, unless markings are restricted to the road surface.
- Dust suppression measures should be implemented if and when required.
- Chemical toilets must be provided at all sites and must be within walking distance of the workers. They must be serviced on a regular basis in order to be kept clean and hygienic. The toilets must be placed in a sheltered place and should be locked after working hours if they are outside a camp area. Alternative arrangements to use existing toilets with owners' written consent may be allowed when submitted in writing.
- All waste from toilets must be disposed of at a permitted landfill or waste treatment works.

## **H2.6 On-site Workers Camp**

### **H2.6.1 Site Camp**

The campsite selection should be carried out in consultation with the landowner or relevant authority.

The site must be selected with due regard to the environment. Due care should be taken to avoid areas where sensitive vegetation and habitats occur.



When the site selection process has been completed, the contractor will define the boundaries of the site and erect a fence with a controlled access around it if practical.

All activities associated with the camp must be restricted to the demarcated area.

It is the responsibility of the contractor to ensure the safety of all personnel within the boundaries of the site. The contractor should have an on-site contingency plan detailing measures to be observed in the case of a health, safety or environmental emergency.

The contractor should ensure that all employees, employed by him and/or employed by subcontractors, have a clear understanding of safety regulations and procedures.

### **H2.6.2 Water, wastewater, and stormwater**

Site occupants must have access to safe drinking water.

If water is stored on site a clear distinction should be made between drinking water and multi-purpose water storage facilities.

All water used on site must be taken from a legal source and comply with recognised standards for potable and other uses.

Wastewater that is contaminated with soaps, detergents and other undesirable materials, such as grease and oils, should be collected in conservancy tanks and disposed of safely in a wastewater treatment facility.

It is illegal to discharge water into a public stream if the quality does not conform with required health standards.

In all camps stormwater must be managed to prevent erosion.

Run-off will be diverted to control ponds so that silt may settle and any pollutants are trapped.

Subsequently, any pollutants must be treated, or removed and disposed of at a permitted landfill site or recycling facility.

All materials should be protected from the rain to prevent them being washed into stormwater channels.

### **H2.6.3 Ablution Facilities**

The contractor shall provide proper and adequate sanitary facilities for all site employees.

These facilities shall be maintained in good and working condition at all times. Odours emanating from these facilities should be controlled within acceptable levels.

## **H2.6.4 Fires and Cooking Facilities**

Fires will not be allowed.

The contractor must supply cooking facilities that are suitable for the environment and are not liable to cause the outbreak of fires. Fire fighting equipment must be supplied by the Contractor at suitable locations.

## **H2.7 Plant and Equipment Storage Facility**

### **H2.7.1 Plant**

At the end of the shift all plant should be driven or transported back to the campsite for proper and safe overnight storage.

The contractor should ensure that equipment left elsewhere is stored in a manner that will not impact negatively upon the environment.

The plant should be regularly inspected for fuel and oil leaks that may be harmful to the environment, and/or aquatic life if washed into a stream or river.

### **H2.7.2 Hazardous Materials**

Hazardous materials should be stored under lock and key in designated areas with properly displayed and visible warning signs.

All storage of hazardous materials must comply with legislation and regulations.

## **H1003REHABILITATION**

Upon completion of each section of work the site must be cleared of all equipment, waste and any rehabilitation work must be undertaken. This may include local grading of soils and re-vegetation where sites have been disturbed.

Immediately after the demolition of the campsite, the contractor shall restore the site to its original state, paying particular attention to its appearance relative to the general landscape.

It is imperative that any potential erosion problems are addressed. This may require subsequent site visits to monitor the efficacy of erosion control measures.

## **H1004EMERGENCY PLANS**

The onus is on the contractor to assess the potential risks to the environment as a result of the project. For example, accidental spillage of materials may pollute the soil or any water body.

The contractor must draw up a suitable emergency plan to contain such pollution. The emergency plans and procedures must be taught to all the workers on site, so that everyone is prepared to cope with an emergency.

Appropriate equipment must be available to carry out the emergency plans.

## **H1005ENVIRONMENTAL AUDITING AND PENALTIES**

On a regular basis, a qualified auditor will carry out a site audit to ascertain and verify the contractor's level of compliance with the requirements of the EMP

Transgression will be treated as a contravention of the contractual agreement.

Deviation from these prescribed requirements will be met with penalties that are intended to enforce compliance.

It is a requirement that the contractor keep concise records of mitigatory measures undertaken at each site to minimise environmental impacts.

Any emergency situations that impact upon the environment should be recorded by the contractor together with the action that was taken to rehabilitate and remediate the site.

A copy of all completed environmental audits will be given to the contractor and the employer by the auditor. Any public complaints regarding the environment must be recorded and discussed with the Engineer to determine an appropriate course of action.

The contractor will be responsible for all costs incurred in the rehabilitation of sites.

The contractor will be responsible for all costs incurred where emergency procedures are implemented to deal with accidents that impact upon the environment.

The contractor will be responsible for ensuring that all procedures required to rehabilitate all sites are implemented.

If third parties are called to the site to perform clean up and rehabilitation procedures, the contractor will be responsible for all costs.

Penalties will be imposed for contravention of the EMP, as specified in the EMP:

## **MEASUREMENT AND PAYMENT**

No separate payment items have been scheduled for compliance with the EMP, and all the relevant cost of the Contractor are deemed to be covered in other relevant items in the schedule of quantities.

**MECHANICAL PARTICULAR**  
**SPECIFICATION**  
**(PAM)**

PAM 1      ANCILLARY EQUIPMENT

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant. Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

PAM 2      PUMPS

SCOPE

This section of the Specification includes the manufacture, testing, protection, supply and off- loading of pumps and base-plates used for the pumping of raw or potable water at ambient

temperatures as stated. Pump duties shall be in accordance with the Project Specifications.

Electrical motors does not form part of this section of the Specification. This section of the Specification must be read in conjunction with the Project Specification and Electrical specifications.

INTERPRETATIONS

Abbreviations

For the purposes of this Specification the following abbreviations will apply:

BS	-	British Standards Institution
SABS	-	South African Bureau of Standards
DIN	-	German Standards Institute
ISO	-	International Organization for Standardization
SIS	-	Swedish Standards

## Standards

Pumps shall comply with this Specification and with the current and most recent issues of the following standards where applicable:

BS 970	Wrought steel in the form of blooms, billets, bars and forgings
BS 1400	Copper alloy ingots and copper and copper alloy castings
BS 3100	Specification for steel casting for general engineering purposes
BS 3468	Austenitic cast iron
BS 4360	Specification for weld able structural steel
BS 4675	Mechanical vibration in rotating and reciprocating machinery
BS 4999	General requirements for rotating electrical machines
BS 5316q	Acceptance tests for centrifugal, mixed flow and axial flow pumps
BS 4504	Flanges and bolting for pipes, valves and fittings
SABS 20	Copper alloy ingots and castings
SABS 1123	Steel pipe flanges
SIS 05 59 00	Pictorial surface preparation standards for painting steel surfaces

## MATERIALS

### General

All materials shall possess qualities adequate for purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South Africa or other internationally recognized standard specification.

For each type of equipment, the Manufacturer shall indicate the materials used for each of the proposed sub-assemblies.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws that may be detrimental to their use.

The Tenderer shall indicate in his tender the proposed materials for each component of the assembly.

#### Castings

No repair of cast components will be permitted without the prior approval of the Engineer.

The filling of casting defects shall be carried out by highly qualified welders only, according to the latest welding techniques.

Any cast component requiring filling at any fabrication stage after the first anneal shall be subjected to further annealing treatment unless stipulated otherwise.

Cast components shall not be wrapped or distorted in any way and shall not show any increase in dimensions (beyond that shown on the fabrication drawings) likely to cause interference with other components in the erection of the item of equipment for which they were made.

The structure of cast components shall be homogeneous and free of non-metallic impurity. If, at critical points of a cast component, there is too great a concentration of impurities or alloy, the component shall be rejected.

#### Pump Casings

Pump casing shall be of cast iron or cast steel. The grade of material proposed should be selected appropriate to the quality of water to be pumped as specified in the Project Specification.

#### Impellers

Impellers shall be cast in either phosphor bronze (PBI according to BS 1400 or 1 C according to SABS 200), aluminum bronze (AB1 according to BS1400 or 1E according to SABS 200) or chrome steel (316C11 according to BS 3100, or DIN 1.4313), unless otherwise specified in the Project Specification. Cast iron or leaded gunmetal shall not be permitted.

## Pump shafts

Pump shafts shall be of EN 26 steel to BS 970 or similar

If a Tenderer wishes to propose an alternative material this should be motivated with details of the benefits to be achieved.

## Stainless steel

The stainless steel used shall be of the type easily jointed or fitted by electric welding.

Stainless steel which cannot withstand the effects of welding or associated heat treatment will not be accepted.

## Fasteners

All high tensile bolts and studs used shall bear the letters HTS stamped or engraved on the end. Washers shall be provided under all bolt heads and nuts. The threads of bolts and studs shall be cleaned and coated with a graphite/grease, copper based or other approved compound before assembly. The threads of all bolts and studs used with the equipment supplied shall be to the same standard. The length of bolts should be such that at least two threads protrude beyond the nuts, but not more than four threads. The threaded end of all bolts must point the downstream direction of flow

The Tenderer shall indicate in his tender the materials proposed for each part of assembly.

## PLANT

The Tenderer shall satisfy the Engineer of the sufficiency of the manufacturer's workshops to handle the manufacture, testing and protection of the pumps strictly in accordance with the Specification.

## MANUFACTURE

### General

Preference will be given to Pumps with non-overloading characteristics and a shaft rotational speed not exceeding 1 500 r/min.



Pumps shall be of the highest quality and suitable for continuous operation over long periods with the minimum of maintenance at high sustained efficiency.

End-suction pumps constructed on the back pull-out principle shall be provided with spacer pump motor couplings to enable the pump bearing housing, shaft and impeller to be removed without disturbing the pipe work or alignment.

The proposed layout of the pump station shall be indicated on the drawings accompanying the tender documents. They shall be studied carefully and all alterations to the lay-out, pipe work or buildings required to suit the pump offered, shall be set out clearly in letters and drawings accompanying the tender. The final layout shall be agreed upon by the Contractor and the Engineer prior to the commencement of manufacture of any of the equipment.

All equipment offered as well as all work carried out, shall comply fully with the requirements of the Occupational Health and Safety Act 85/1993 and the Machinery and Operational Safety Act 6/1983.

Taking into consideration specific speed calculations, efficiencies and reliability of the pump sets the proposed pump types shall be justified in the Tender. Double-Suction Axially Casing Split Pumps will be preferred unless otherwise specified in the Project Specification.

Arrangements incorporating multiple pump units coupled in series to achieve the duties specified in the particular specifications will not be favorably considered unless otherwise specified.

The arrangements of impellers shall be such as to reduce the residual axial thrust to a minimum. Designs incorporating a double suction will be preferred.

A design and arrangement of the pump casing which ensures that it is not necessary to disconnect the delivery pipe work for the purpose of removing or replacing the complete rotating element will receive favourable consideration.

Suction and delivery details: The orientation of the suction and delivery pipes shall be such as to facilitate maintenance whilst being designed for minimum losses and no air traps.

#### **Pump Characteristics**

The pump shall have stable, non-overloading characteristics.

The Tenderer shall submit with this Tender for each pump offered the following characteristic curves.

With respect to flow (in  $\text{m}^3/\text{s}$ )

total head; in meters (0% to 120% of duty flow) power absorbed; in kilowatts (50% to 120% of duty flow) efficiency; (0% to 120% of duty flow) net positive suction head (NPSH) requirements: recommended, 0% head drop, and 3% head drop relative to pump shaft center line, in the case of horizontal spindle pumps;

- with respect to speed:

torque requirements rated in absolute units.

The Contractor may be called upon to provide further curves at the request of the Engineer, especially for starting and stopping analysis, in connection with surge analysis in the rising mains.

The efficiency curve shall be flat over a wide range in order to provide efficient working with various pump operating conditions. It shall conform to the requirements of the Project Specification.

Unless specified to the contrary, the proposed pumps shall be able to operate without

perceptible signs of cavitation in the full range of the operating envelope specified, pump sets running singly or in parallel. Throttling shall not be allowed. Should there be any doubts, the Contractor shall be called upon to carry out an inspection of the pumps and carry out NPSH tests to prove the equipment, at the Contractors expense. If the pumps are found to be faulty, the Contractor shall be given a responsible period to remedy the problem. Thereafter if the Contractors is unable to resolve the problem it shall be cause for rejection.

#### Pump Casings

No welding, burning, filling or plugging of defective castings shall be permitted without the Engineer's permission in writing, following an inspection of the defects.

The inspection and testing of castings and test bars shall be in accordance with BS 3100.

The dimension and drillings of the suction and discharge flanges integral with the pump casting shall be to SABS 1123 to design pressures specified.

The pressure rating of the delivery flanges shall be at least equal to the maximum suction static pressure, plus the pump shut-off pressure. The minimum pressure rating of the flanges shall be 1 MPa (10 bar).

All pump casings shall be hydrostatically tested at the Manufacturer's workshop and in the presence of the Engineer or his Representative. The test pressure applied shall be

equivalent to 1,5 times the pump shut off head, or alternatively twice the duty head specified, whichever is the greater.

Suitable lifting rings shall be provided on the casings.

The pumping casings should be fitted with suitable replaceable stationary wear rings. These wear rings should be appropriately heat treated for operation in conjunction with the impeller, or impeller wear ring material selected.

#### Impeller

The casting shall be free of blowholes and other defects. No welding, burning, filling or plugging of defective castings shall be permitted without prior approval being obtained from the Engineer in writing, following an inspection of the defects.

All water passages shall be polished to a smooth finish. Water passages which cannot be machined shall wherever possible be hand ground and filed to template.

Each impeller shall, after final machining and dressing, be independently statically balanced and the completely assembled rotating element with coupling shall be dynamically balanced.

The first critical speed of the rotating element shall be at least 1,3 times running speed.

#### Pump Shaft, Sleeves and Diffusers

Pump shafts shall be of an approved material, and of sufficient dimensions to transmit the power to which they will be subjected without undue torsional or bending stresses and deflection

The shafts shall be stress-relieved after initial machinery, and ground to final size.

The shafts shall be suitably designed for the reception of the impeller which shall be adequately secured to the shaft in such a manner as to be readily removable without damage to either the shaft or the impeller.

The Contractor shall ensure that both the critical speed and torsional oscillation characteristics of the combined pump and motor rotating elements are satisfactory for all possible condition of operation.

The shafts shall be adequately protected with replaceable sleeves of an approved bronze or other similar approved non-corrodible material at all areas where wear and/or corrosion could possibly be expected. The replaceable shaft sleeves exposed to the pumped water shall be manufactured from a material compatible with the impeller material selected. These sleeves shall be readily removable without causing damage to either the shafts or the sleeves.

#### Shaft Coupling

The pump and motor shall be connected by a flexible coupling in such a manner that it shall not uncouple whichever way the impeller may be rotating.

The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. Refer to PT 8.3.

The coupling shall be enclosed in a stationary solid-plate guard to the Engineer satisfaction.

#### Pump Bearing and Lubrication

##### Bearings and Lubrication

If anti-friction bearings are fitted a design life of at least 40 000 operating hours is required.

The bearings in the pump casing together with its lubricating systems shall be suitable for the particular circumstances. The particular type and system offered by the Tenderer shall be fully specified.

The pump rotating element shall be positively located in the axial direction. If specified thrust bearings shall be of the tilting pad-type (Mitchell or similar).

Journal bearings consisting of white metal lined bronze sleeves split on the horizontal centre line and lubricated with an oil ring shall be preferred.

All bearings shall be suitable for shaft rotation in both directions.

Preferably the same type of bearing will be chosen for motor and pump.

If not, the necessary allowance shall be made when aligning pump and motor.

Adequate provision shall be made for the cooling of oil for bearings, particularly as the pumps may run continuously in ambient temperatures of the order of 40°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, clearly marked to indicate the standing and running oil levels.

All internal surfaces in continuous contact with the lubricating oil such as oil reservoirs, piping, etc, shall be thoroughly cleaned either chemically or by shot blasting and protected by a method to be approved by the Engineer until such time as the system is changed with oil. No site welding of oil circulating pipes will be permitted.

The entire lubricating system shall be fail safe with alarms set to indicate automatic change-over to the stand-by unit.

#### Glands and Seals

##### Reliability

Reliability of glands is of prime importance. Pumps incorporating low pressure glands where the pressure at the glands does not exceed the main suction supply pressure will be preferred to pumps with shaft glands exposed to higher pressures.

##### Glands

Low pressure glands of the conventional stuffing box pattern utilizing packing rings one each side of lantern rings will be acceptable for the first stage of the pumps. Lantern rings shall be easily removable. The shaft sleeves shall be ground with a polished finish on the wearing surface, and the gap between the sleeves and the follower shall be such that the packing will not be extruded into the gap. Make and type of packing shall be to the approval of the Engineer.

It will be the responsibility of the Contractor to provide filters if the quality of the water necessitates filtration. The flow of water to or from the glands shall be clearly visible.

If mechanical seals are called for, they shall require no separate water supply and shall be suitable for the water to be pumped. Seal selection shall be done in collaboration with the seal manufacturer and proof that this has been done may be requested.

If, in the opinion of the seal manufacturer, the quality of the water is such that a flush would be required to the seals, Tenderers are required to provide for a suitable system. Such a system shall be self-contained and inclusive of all necessary separators, filters, connections and auxiliary pipe work to provide the required flow to the seals at the

appropriate pressure. The auxiliary pipe work and fittings should be in a suitable grade of stainless steel.

Mechanical seals shall be balanced and provided to be suitable for the water pumped. Spare wearing components shall be supplied and delivered when the pump is installed, the cost being included in the price of the pump.

The Tenderer shall supply with his Tender, full details of all pump seals and glands incorporated showing clearly all proposed materials, finished clearances, etc.

#### Pump Vent and Drain Fittings

Stainless Steel vent cocks be provided and fitted at all local high points on each pump casing. These cocks shall be of adequate size to enable the entrapped air to be released freely. Stainless Steel pipes shall be neatly led from priming cocks, gland and casing drain points to a suitable main tundish. Galvanized drainage pipe works of adequate size shall be provided and installed to collect the wastewater from each pump set and to lead it to the drain leading to the pump house sump.

#### Base-plate

The pump and motor base-plate shall be rigid. The upper face of each base-plate upon which the pump and motor are located, shall be machined flat and smooth to ensure that the pump is supported properly directly to the base-plate, without the use of spacers. Provision must be allowed to align the motor correctly to the pump through the use of suitable shims or spacers, the combined height of which should not exceed 3mm..

For every motor, two jacking bolts at right angles with a lock nut shall be provided at every corner.

#### Monitoring Devices

If specifically stated in the Project Specification, one or more of the following monitoring items shall be required:

Full details of the sensing equipment (thermocouples, etc), and of the associated control and monitoring or indicating equipment shall be submitted with the tender offer. Evidence shall also be submitted that adequate spares and services are readily available in this country.

## Temperature Sensors

Either thermocouples or resistance temperature detectors shall be installed, depending on which is more suitable to the duty and application.

Location of temperature probes:

Separate temperature probes shall be installed at the sleeve and/or rolling bearings of each pump and motor and at the gland housings of the pump to monitor the temperatures at these points.

The probes shall be spring-loaded to ensure positive contact with the bearing shells or gland stuffing boxes.

Each probe shall be clearly identified by means of an engraved marking on the sheath and shall be individually calibrated. Test certificates covering the calibration results of all temperature probes shall be submitted to the Engineer.

Temperature detectors offered, shall be suitable for operation in conjunction with temperature indicating, monitoring, alarm and trip equipment of Conlog or equivalent design.

If grease lubricated bearings are offered, the Tenderer shall indicate if temperature detectors can in fact be used. If temperature detectors are not feasible, the Tenderer shall indicate alternative means of monitoring bearings.

Pockets for standard mercury filled glass thermometers shall be provided adjacent to all pockets serving temperature indicating instruments. Pockets for standard thermometers shall have chained covers to prevent the ingress of dirt when not in use and shall be so arranged as to permit the accurate measurements of the bearing temperature. The pockets shall contain a small amount of oil and shall therefore be orientated within 30° of the vertical, horizontal pockets are not acceptable.

Each pump casing shall be fitted with a thermo switch, Fenwall, or equal approved make to safeguard the pump in the event of inadvertent sustained operation against a closed discharge valve. The thermo switch shall be calibrated to close when the temperature of the water in the pump casing exceeds 40°C.

### Pressure gauges

Each pump set shall be equipped with two 150 mm dial diameter flush mounting pressure gauges . The gauges shall be calibrated in kilopascal and the angle shall suit the particular application. The gauge shall be filled with glycerin, and the bubble shall be out of the range of usual reading. The gauges shall be of a type that is possible to recalibrate (dead-weight method) and reset on Site.

These meters shall indicate water pressure in kilopascal and shall have a range at least 50 % higher than the normal duty point. However, in all cases the gauges must have a range at least 30% higher than the shut off, or maximum, head which the pump is capable of generating with the system conditions taking into consideration the maximum static suction pressure possible.

The meters for the suction side of pumps shall be compound gauges and shall be capable of indicating a negative pressure of up to 100 kPa. However, in all cases the gauges must have a range at least 30% higher than the maximum static suction pressure possible.

All pressure gauges shall be supplied and installed complete with isolating Steel cocks, piping, etc. and fitted with a pulsation snubber in stainless steel.

Due to the quality of the water, those submitting tenders should satisfy themselves of the reliable operation of the gauges. Where necessary they must include for the pressure gauges to be fitted with diaphragms.

### Pump set vibration sensors

Suitable vibration sensors shall be mounted on each pump set to stop it on detection of

Detection of excessive vibration. The sensors shall be situated as close as possible to those bearings where the highest vibration levels are encountered.

The monitoring of vibration shall be made via a suitable timing device in order to avoid tripping when starting the pump set or during other transitory conditions.

The pumps shall comply with the requirements of BS4999.

### Automatic air vents

If an automatic air vent is specified for the pump casing, it shall be fitted with an indicator to show the open and closed positions of the air vent. The air vent shall be suitable for remote operation and the control of the air vent shall be mounted on the control panel inside the pump house.



#### Gland leakage detection

A device to monitor gland leakage shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

#### Wear limit switch

Multistage pumps should be fitted with a wear limit switch to protect the pumps against damage after normal wear of the wearing rings have taken place after a period of operation.

#### Corrosion Protection

##### Internal protection

All traces of rust, slag, silica or other contaminants shall be removed by mechanical wire brushing. Abrasive blast clean all interior surfaces to SA 22 (near white) metal finish to the Swedish Standard SIS 05 59 00. The blast profile shall fall within the limits 40-60 microns.

A thorough vacuuming of the interior surface shall be carried out to remove all traces of the abrasive grit before application of internal surface finish.

Apply by brush, or airless spray, three coats of an approved two part epoxy coating, or equivalent, to give a dry film thickness of between 50 and 70 microns per coat. The intermediate coat shall be a different colour to the first and final coat. The total minimum dry film thickness for the complete system shall not be less than 150 microns.

##### External protection

All sharp edges, laminations and protrusions shall be removed by mechanical grinding, where after all traces of rust, slag, silica or other contaminants shall be removed by mechanical wire brushing. The entire surface shall be degreased using a suitable water emulsifiable degreaser. Surfaces shall be left clean and dry prior to coating.

One coat of zinc phosphate high build primer shall be applied (Plascon Code UC 183 or imilar) by airless spray to a dry film thickness of 75 µm, and left 8 hours to dry.

The primer shall be followed by one coat of universal undercoat, (Plascon Code UC 1 or similar) applied by brush, roller or airless spray to a dry film thickness of 30 µm.

This coat shall be left to dry for 16 hours.

The final coat shall be one coat of universal gloss enamel, (Plascon Code G or similar) applied by brush, roller or airless spray to a dry film thickness of 25µm. This shall be left to dry for 20 hours. Colour will be as directed by the Engineer.

#### Designation and Information Plates

Each pump shall be supplied with an information plate – preferably chromium plates – secured to the pump casing in a visible position indelibly marked with the following details:

Maker's name, pump type and serial number

Year of manufacture

Rated duty of pump in liters per second

Head in meters at rated duty

Pump speed in revs per minute

Impeller diameter

Mass of completely assembled pump in kilogram

Types and sizes of Bearings

Letters and figures shall be engraved, or embossed, not stamped

#### Interchangeability

Where two or more similar pump sets are required, the pumps and motors shall be interchangeable in all respects

#### TOLERANCES

The tolerances as specified in this Specification or the appropriate SABS or BS Standards, shall apply.

## INSPECTION, TESTS AND COMMISSIONING

### General

Contractors shall, if requested make available for inspection, their internal Quality System Manual, their Standard Procedure Manual and their Works Instructions. Preferences shall be given to Contractors who have been audited and found to satisfy the requirements of the ISO 9000 Quality system.

Inspection and tests required of the Contractor include the tests and inspections in the workshops and the inspections and tests at Site.

Depending on the results of the tests and inspections, penalties may be applied and, in certain cases, part or all of the equipment may be rejected, as set out hereinafter.

The cost of all tests and inspections shall be included in the Tender. For instance, the cost of commissioning and testing at Site shall be stipulated in the Price Schedule under the section provided or included as part of the cost of erection. (Except for the cost of power and water consumed.) No claim for traveling expenses or further time required for testing will be allowed.

Tenders shall fully acquaint themselves with the properties of the water to be pumped. Any wear of portions of the pump or ancillary equipment that will affect its operating efficiency during the Period of Maintenance will result in the pump set being rejected.

Sign of cavitation pitting on pump parts will not be acceptable.

Leakage from any oil, water or air circuit will not be acceptable.

Leakage at the glands shall be controlled to the minimum required and drained to the Pump Station sump.

Operation of pumps shall be free from undue vibrations throughout the full range of normal running conditions. Vibration levels should not exceed the limits determined by VDI 2059 for good vibration behaviour.

In no case shall temperature-rise above the ambient temperature reach or exceed 40°C for any mechanical component. For temperature-rise of bearings see Clause PT 5.7.7.

In the case of routine tests concerning standard equipments or material quality control tests, not attended by the Engineer or his Representative, tests reports or certificates in duplicate shall be submitted to Engineer.

The Contractor shall notify the Engineer or his Representative in writing two weeks in advance, of the place and dates at which the equipment may be inspected and tested.

The Engineer or his Representative will inform the Contractor of his intention to attend the test or the inspection and propose a date which suits him. If the date preferred by the Engineer is later than ten days after the first possible date, the Contractor shall be entitled to perform the test or inspection without the presence of the Engineer.

If on any agreed date the equipment to be inspected or tested is not ready and the test or inspection has to be postponed the Contractor shall be held responsible for the traveling and/or living expenses of the Engineer and/or his Representative.

When tests and inspection have met the satisfaction of the Engineer or his Representative a certificate of Workshop Acceptance will be issued by the Engineer. The Contractor shall not pack and dispatch to Site any equipment before receiving the relevant "Certificate of Workshop Acceptance."

The Engineer's acceptance shall in no way relieve the Contractor of any obligation with regards to the Specification.

#### Tests

##### Performance tests

Each pump complete with its driving unit shall be tested at the Manufacturer's works, or other location approved by the Engineer to "Class B" requirements of BS 5316 Part 2, and the efficiency carefully measured. Variations from the actual running conditions of the pumps are allowed as defined in the standard. Unless otherwise explicitly mentioned, cavitation tests are required at work.

The tests shall be witnessed by the Engineer or his Representative and details of the tests and the results obtained, duly signed by the appointed Witness, shall be submitted to the Engineer before dispatch of pumping units from the Manufacturer's workshop.

The rotating elements of the pumps and motors shall preferably be dynamically balanced before assembly. The residual unbalance should be better than ISO 1940 grade G 6.3. The good balance of the whole pump set will be checked by measuring the absolute vibration of pump and motor bearing housings.

Tests shall be performed with the pump set on sound foundations, similar to those expected at Site.

Measurements shall be taken in the three axes at each bearing, i.e. axial and two radial components at right angles to each other.

Performance and vibration tests as described above are to be performed before installation on Site for all pump sets more than 22 kW. If these tests are impractical or impossible at the pump manufacturer's works, Tenderers must state this in their Tender and explain the reasons why it is so. The Engineer may be prepared to consider alternative proposals for testing provided these proposals are submitted with the Tender and are clearly described and defined. If this is not done, the Tenderer will be penalized for the cost necessary to have the tests performed in another workshop.

All pieces of equipment subject to water, oil or air pressure shall be tested at a pressure not less than one and a half times the design pressure.

Each piece shall withstand the hydrostatic test pressure without exhibiting signs of sweating, undue deformation and stressing, or defect of any kind.

Hydrostatic testing shall be done with blank flanges bolted on the flanges of the piece. The use of tie-bolts or other forms of restraint applied across the blank flanges to restrain the bodies from deflecting under the applied test pressure will not be permitted without the Engineer's approval.

The hydrostatic test pressure shall be maintained for a period of at least 10 minutes.

#### Performance Test Results

##### At Works

The overall percentages of efficiency as calculated from the tests should not be less than the appropriate guaranteed figures at the duty points by more than 3%.

b) The measured flow rates should not differ from the guaranteed deliveries at any point other than the duty points on the characteristic curves as supplied by the Tenderer by more than 5%.

c) The NPSH requirement should be met for the specified duty point. Where requested by the Engineer additional tests will be required to demonstrate the pump performance at run out conditions, or where the NSPH available is critical

The Contractor will be allowed a period of eight weeks to carry out any amendments to the plant which he may consider necessary to meet the guaranteed figures. Any period granted for design amendment shall not extend the Contract Period.

Further tests shall then be carried out at the Contractors expense and if the test results in question are still not within the limits specified, the Engineer shall have the right to:

either reject the entire plant and recover all monies already paid to the Contractor, or let the Contractor continue with the installation of the pumps sets which may be subjected to penalties or rejection as defined hereinafter then the performances tests at Site are performed

At Site

At the time of performance tests at Site:

should the test results obtained for either efficiency, flow rate, NPSH or vibration still vary beyond the limits indicated in clause PT 7.3.1 above, the Contractor will again be allowed a further four weeks to make such amendments as may be considered necessary and if after these amendments have been made the test results in question are still not within the figures which have been guaranteed, the Engineer reserves the right, according to circumstances, to reject the plant entirely

any other discrepancies, abnormal wear or malfunctioning of plant which may be observed during the Acceptance Tests shall be corrected by the Contractor without delay.

The date of completion shall be the date on which the Acceptance Tests at site have been satisfactorily completed and the plant is in a fully operational state in accordance with the Specification.

Any period granted for design amendments shall extend the Period of Maintenance by a corresponding amount.

Commissioning

On completion of mechanical and electrical erection and as soon as water is available and other circumstances permit, the Contractor shall arrange for the commissioning of all units of the pumping plant in the presence of the Engineer. The Contractor shall ensure that his equipment is suitably prepared before giving the Engineer fourteen days notice in writing of the date of commissioning.

Before the commissioning, the Contractor shall satisfy himself and subsequently prove to the Engineer that all items on the following checklist have been checked and are functioning correctly.

- Visual check of general appearance of plant.
- Check power supply to motor available.
- Determine the direction of rotation.
- i) Remove coupling
- ii) Correct if necessary

Check if pump is turning freely by hand.

Check axial float of pump

Check thermocouple operation/calibration if required.

Check if pump requires gland packing (Mech. Seal flushing).

Check pumps and motors for correct grade and quantity of bearing lubricants (oil/grease packed).

Alignment of pump and motor.

Suction valve open (bypass open).

Discharge valve closed (bypass open).

Check if discharge line is full of water.

Bleed of air on pump and pipe works.

Cooling water to bearings.

Check balancing water if required.

Monitoring and operating equipment are functioning correctly.

Test run of pump.

- i) Number of recommended start - stop of motor.
- ii) Bearing temperature (motor and pump).
- iii) Pump speed.

Suction pressure.

Discharge pressure.

(Volts) (Amps) (kW).

Quantity pump is pumping.

Vibration levels.

Rundown time of pump and motor.

Simulate an emergency shut-down of pump.

Check pump and pipe work for water tightness.

NOTE: The Contractor to ascertain from the Pump Manufacturer whether the items on the check list are sufficient for the successful commissioning of the pump sets.

- c) The pump sets shall be run without interruptions separately for at least 4 hours or such further time as may be required to reach stable operating conditions (particularly, motor temperatures shall be stable).
- d) If the prescribed duration cannot be achieved, the initial commissioning shall take place at a date to be agreed upon by the Contractor and the Engineer. It is to be borne in mind that the penalties for late delivery shall be linked with the initial commissioning.

After the above commissioning, the plant shall be run under approved supervision for not less than two months before the Acceptance Tests are conducted. The Contractor must satisfy himself that the operators are in a position to operate the plant safely and correctly should he be absent from Site during this period.

Commissioning shall not be considered to be complete until the plant is capable of continuous operation by fully trained operators of the Employer and until two months have elapsed and the plant has passed the Acceptance Tests as specified.

The Acceptance Tests shall be performed only if and when every item of the whole Contract is fulfilled and if and when each piece of equipment, including the monitoring and control devices, is working properly. The Engineer is entitled to postpone the Acceptance Tests if any part of the Contract is not to his satisfaction or if the plant has not been successfully operated for at least 200 hours.

The Certificate of Commissioning for the equipment is issued by the Engineer only when the results of the Acceptance Test, recorded in a report prepared and submitted by the Contractor, are found satisfactory.

Final Operation and Maintenance Manuals shall be made available before the Certificate of Commissioning is issued.

The Period of Maintenance (or Guarantee Period) commences at the date of the Certificate of Commissioning.

During the first 14 days of operation of the scheme, the Contractor shall be on site to rectify any problems with the scheme within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor shall within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.



Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost

After the satisfactory conclusion of the Acceptance Tests on Site and the issue of the Certificate of Commissioning, the Contractor shall guarantee the satisfactory operation and functioning of the entire plant covered by the Certificate of Commissioning for a period of twelve months measured from the date of the Certificate of Commissioning.

The Contractor shall make good, free of all charges, any defects arising during this Period of Maintenance including the replacement of all defective parts and their installation and commissioning. This guarantee shall apply to all defects arising during proper use of the plant, due to faulty design or maintenance instructions, inferior materials or poor workmanship.

Maintenance by the client's personnel during the Period of Maintenance shall be limited to cleaning and lubrication only as instructed by the Contractor. All other maintenance or adjustments shall be carried out by the Contractor

The final Certificate will be issued by the Engineer when the Period of Maintenance has elapsed and all Contractual obligations have been met in accordance with the General Conditions of Contract.

## INSTALLATION OF PUMP SETS

### Couplings

All pumps are to be matched for coupling to their respective motors. Couplings shall impose no restriction on normal end play or expansion and shall be provided with a removable guard, painted red. The direction of rotation shall be indicated with a clear arrow painted on the exterior of the coupling guard. The latter shall be designed thus to render reversed mounting impossible.

### Grouting of Base-Plates

Base-plates shall be grouted after the alignment of pump sets has been approved. The Contractor must provide details of the grouting procedure he intends to utilize. Grouting of base-plates shall be done by the Contractor and he shall ensure full grout penetration between each pump base and relevant base-plate.

## Pump Set Alignment

### General

It is accepted that all new pump sets have been aligned on the base-plates in the factory. A certain amount of base-plate deformation is possible during transit and installation. Therefore, the alignment shall be rechecked on site following a hot run as specified hereafter. Two main checks are to be carried out, viz.

angular alignment and radial alignment of the pump shaft

The checks are to be done on all pump sets.

### Preparation

Before any check, the following preparations shall be completed.

Final grouting to the base-plate shall be completed.

Driving units shall be isolated from the power supply. The Contractor shall ensure that no damage can be caused by turning either unit (driving or driven unit).

Couplings should be fixed to their respective shafts and the segments must be free to move relative to each other. Where the method of coupling is too tight to allow free movement between the two half-couplings the rims should be marked so that readings can be taken when the two marks are in line.

Alignment Checks (See attached Data Sheet)

### Angular Alignment

- i) Clamp two clock gauges diametrically opposite coupling pin holes of the driving or driven half-coupling, the plunger ends resting on the back of the opposite half-coupling.

With one gauge at the top and one at the bottom set both gauges to zero.

Turn both couplings through  $180^\circ$ . If the alignment is correct, the readings on the gauges should be numerically the same, although not necessarily zero.

Adjustment should generally be made on the outboard end of the pump.

Turn both couplings through 90° and set the clock gauges to zero. Repeat step (iii).

Note: This method does not require axial location of either half coupling.

Intersection of Axis (Radial Alignment)

i) Clamp one clock gauge into one of the coupling holes in the driving or driven

half-coupling, the plunger end of the clock gauge seating on the rim of the other coupling.

Rotate the couplings together and note the readings at each quarter turn.

Adjust the position and heights of the units until uniform clock readings are obtained.

Note: Where the operating temperature of a unit has the effect of lifting the centre line of one machine in relation to the other, allowance in the height of the appropriate machine must be made. Height adjustment must be in accordance with the manufacturer's specifications.

Tolerances

- i) Angular Alignment: The angle between two half-couplings shall not be more than 0,01° for speeds up to 1500 rpm. This corresponds to a variation of 0,05 mm and 0,02 between readings on a 300 mm dia coupling.
- ii) Redial Alignment: If readings vary by more than 0,10 mm (i.e. 0,05 mm eccentricity) for 1500 rpm adjustments shall be made.

Grouting of Base Plates

- i) A gap of approximately 25 mm is provided between the base-plate and top of the foundation.

Following approval of initial pump set and pipe work alignment, The Contractor shall erect suitable formwork along the base-plate perimeter and shall grout the entire aforesaid gap, foundation bolt pockets and base-plate volume up to the top surface of the base-plate. Appropriate grout holes shall be provided on the base-plate surface for this purpose. The Contractor shall timeously, prior to erection, submit to the Engineer full details of the grout type required, which should attain a design compressive strength of 30 MPT within 10 days.

Prior to execution of final shaft alignment checks, the grouting operation shall have been completed, the grout adequately cured and all foundation bolts tightened.

Final alignment control checks to be performed in the presence of the Engineer (or his appointed representative), immediately following a hot run.

Alignment Control Sheets will be completed for every unit checked, and will be signed by both the Engineer and the Contractor. The original copy will be kept by the Engineer and a duplicate by the Contractor.

For alignment control sheet, see attached.

#### Installation of Dowel Pins

Following approved alignment of pump sets, suitable dowel pins shall be fitted to facilitate correct re-location of pump sets.

#### Manufacturer's Certificate of Approval

Following wet commissioning of pump sets, the pump manufacturer or his approved supplier shall check the installation and when satisfied shall issue to the Engineer a certificate approving installation in compliance with the manufacturer's specifications.

The Contractor shall furthermore, upon commissioning, perform vibration tests in the horizontal and vertical planes of each and every bearing housing. The results are to be endorsed by the pump and motor manufacturers for acceptability and handed to the

Engineer within 14 days from the commencement of the Defects Liability Period.

It is further required of the Contractor to perform same measurements upon each and every maintenance visit during the Defects Liability Period. The results shall be logged and shall be endorsed by the pump and motor manufacturers for acceptability and handed to the Engineer within 7 days after each maintenance site visit.

#### MEASUREMENT AND PAYMENT

Measurement and payment will be done in accordance with the methods stated below:

##### Supply and Delivery

Pump sets/motor will be measured per unit including the following:

Pumps, motors, couplings, coupling material, base-plates and monitoring items as individually itemized.

Design, manufacture, purchase, protection, supply, handling, transport and profit.

Fixing material required to secure monitoring equipment to pump/motor.

Fixing material required to secure the pump and motor to the base-plate.

Temporary storage and maintenance during storage, should it be required.

The required tests and inspections at the manufacturer's work.

Operating and Maintenance Manuals as well as drawings in accordance with the specification.

Commissioning of each pump set/motor as specified.

#### Individual Performance Checks

Pay – item	Unit
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Performance testing of pumps/motors	
-------------------------------------	--

by independent institutions	
-----------------------------	--

(Provisional item)	No
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Should the Client require performance testing of the pumps or motors by independent institutions such as the South African Bureau of Standards, a separate pay-item will be provided in the Schedule of Quantities. The tendered rate shall include for the transporting to and from the institution, off loading, handling, etc., as well as all fees payable to the institution for each pump/motor unit tested.

## ANCILLARY EQUIPMENT

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

## ALIGNMENT CONTROL SHEET

CLIENT:.....

CONTRACT NO: .....

STATION:.....

MACHINE TYPE: .....

UNIT NO: .....REF NO: .....

ALIGNMENT BETWEEN: .....

FACE TO FACE

PERIPHERAL

METHOD OF ALIGNMENT: Dial indicator

READINGS GIVEN IN: mm

ALIGNMENT OF GEAR FITTED O:.....

MEASUREMENTS TAKEN ON: .....

WICH SHAFT ROTATED: .....

VIEWED FROM: .....

DISTANCE BETWEEN SHAFT ENDS: .....

WHEN SHAFT IN WHICH AXIAL POSITION:.....

REMARKS: Suction / Delivery pipes connected.

All foundation bolts tightened / loose.

Final grouting done / not done.

.....

.....

Date: .....

Time: .....

.....

CONTRACTOR

.....

ENGINEER

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### PAM 3 MANUFACTURE AND SUPPLY OF VALVES

#### SCOPE

The section of the Specification includes the manufacture, testing and supply of valves for the conveyance of raw or potable water at ambient temperatures in pipes under pressure.

#### STANDARDS

The most recent issues of the following standard specifications will apply for the purpose of this Specification.

SABS 144	:	Cast-iron single door reflux valves
SABS 191	:	Cast steel gate valves
SABS 192	:	Cast steel single door reflux valves
SABS 664	:	Cast iron gate valves for waterworks
SABS 665	:	Cast iron gate valves for general purposes
BS 5155	:	Cast iron and carbon steel Butterfly valves
ISO 2441	:	Pipeline flanges for general use – shapes and dimensions of pressure tight surfaces
SABS 1123	:	Steel pipe flanges
SIS 05 5900	:	Pictorial surface preparation standard for painting steel surfaces

#### MATERIALS

##### Sluice Valves

The valve body, bonnet, thrust dome, gate and glands shall be cast iron or cast steel as specified and depending on the required test pressures.

Body and gate sealing rings shall be of bronze, gunmetal or stainless steel. RSV gate shall be nitrile rubber covered, and fully encapsulated. The rubber shall not be removed from the guides of the gate.

Spindles shall be of high grade stainless steel.

An isolating valve must be able to check the specified water pressure from both sides.

#### Butterfly Valves

Valve bodies and discs shall be of high-grade cast-iron or cast steel as specified and depending on the required test pressures.

The disc shaft or stub-shaft shall be of stainless steel located in self-lubricating bearings.

Sealing rings, seal retaining rings, body seat rings and associated screws shall be of stainless steel.

A butterfly valve must be able to check the specified water pressure from both sides.

#### Reflux Valves

Valve bodies shall be of cast iron or cast steel depending on the specification or test pressures.

Valve doors shall be of cast iron or cast steel.

The valve body and doors or disc shall be fitted with replaceable stainless steel body and door seat rings.

#### Air Valves

Valve bodies, covers and shield plates ( large orifice ) shall be of cast iron.

The balls shall be of stainless steel.

#### Manufacture

## General

The design pressure of the valves shall not be less than the pressure specified subject to a minimum of 1000 kPa.

All valves shall be double-flanged with bolt holes drilled off-centre all in accordance with the requirements of SABS 1123 or as otherwise specified.

The Tenderer shall give as a function of the downstream pressure the maximum acceptable discharge of water through the valves without risks of vibration and cavitation. The Tenderer shall also submit the head-loss characteristics of the valves.

The design pressure will be hand stamped on the top edge of the flanges of valves in kPa.

If specified, valves shall be supplied with by-passes to be bolted on to the body of the valve and not to the adjoining pipe work.

Valves shall be fitted with position indicators if specified. Fully closed, fully open and intermediate positions shall be indicated in corrosive proof and robust design indicators.

Arrows shall be cast on all hand wheels together with the wording "TO OPEN" or "TO CLOSE". The closing direction shall be clockwise unless otherwise specified.

In the case of cap top valves, an aluminium disc of at least 100 mm diameter and with the same wording and arrows shall be slipped over the spindle and retained by the cap.

All valves shall be supplied complete including bolts, nuts, washers and gaskets in accordance with the class of valve. Bolts shall be of sufficient length to allow not more than three screw threads to protrude outside units after complete tightening of the assembly.

Gaskets for flanged joints shall be of compressed asbestos fiber to BS 2815 Grade A and full faced with a minimum thickness of 3mm for pressures up to and including 1 600 kPa cloth-inserted rubber may be used.

The following information shall accompany the tender:

Description

Flange Drilling

Maximum working pressure

Maximum unbalanced pressure

Test pressure

Manufacturers number

Material of components

Gearing

Accessories

Sluice Valves

Double-flanged, wedge-gate, internal ( non-rising) spindle sluice valves of the waterworks pattern are required to comply fully with SABS 9191 or SABS 664 where applicable.

Only full-way valves will be accepted ( i.e. the gate must be clear of the waterway in the fully open position ).

The maximum force required to turn the hand wheel at the maximum torque shall not be greater than 100 N per hand at the hand wheel run (Total effort = 200 N) when operating at an unbalanced pressure equal to the rated working pressure of the valve. This may be achieved with the aid of gearing of a suitable ratio.

Where gears are used replaceable shear pins shall be provided to prevent damage to the valve if excessive pressure is used.

Butterfly Valves

Horizontal spindle type butterfly valves complete with gearing, hand wheels and flanged at both ends with separate bolting for joining to the adjacent pipe work is required.

Wafer valves or valves fitted with studs for attachment to the adjacent flanges are not permitted.

Valves shall be drop-tight when closed and metal to metal sealing is not acceptable.

All resilient seals shall be removed and readily replaceable on Site with the valve in position.

Resilient seals shall be retained by corrosion resistant securing elements to prevent corroding in position (e.g. bolts, set screws, etc.)

The valve-water seal shall be of the following types:

a resilient seal fixed to the edge of the disc by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the body.

a resilient seal fixed to the body of the valve by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the edge of the discs.

#### Reflux Valves

Reflux valves shall be double-flanged and comply with SABS 144.

Valve bodies and seals shall be free of pockets that will allow dirt accumulation and prevent the doors from closing fully.

Stops or an approved resilient material shall be fitted into the body to prevent the doors from fluttering under full flow conditions.

Valves shall be designed to allow for rapid but non-slamming closing characteristics.

#### Air Valves

Air valves shall be supplied with double-flanged, wedge gate internal ( non-rising) spindle sluice valves for isolation, which unless otherwise specified shall conform in all respects to this specification.

#### Electric Actuators (Applicable for Valves and Sluices)

When specified, the valves shall be fitted with electric, motor-driven flood proof IP 67 actuators of robust design, capable of closing the valves under all unbalanced pressures.

The Tenderer shall state the maximum torque required to operate the valve in his Tender.

In determining this maximum torque an allowance shall be made for any deterioration that could be expected to occur in the bearings during the life of the valve. The actuator shall be capable of transmitting twice this maximum torque without any of its components suffering permanent damage. This shall be proven to the Engineer's satisfaction by workshop tests.

The actuators shall be capable of restraining the valve in any position under all possible conditions of operation, and shall not, in any circumstances, be capable of becoming self-motorized as a result of the dynamic torque loading on the disc or plunger.

All gearing shall be manufactured in accordance with BS 436 Class C and shall be machine cut. All components requiring lubrication shall be adequately lubricated and totally enclosed flood-proof casing fabricated in cast iron and/or die cast aluminium to suit the service weather proof casing whether the valve is to be installed in the open or under cover. Actuators shall also be fitted with mechanical stops to prevent excessive turning and shall be provided with replaceable shear pins.

Hand wheel shall be fitted to all actuators. The direction of rotation to close the valve shall be clockwise when viewed from above the end of the input shaft and from the position of operation. In addition, they shall be clearly and indelibly marked with an arrow showing the direction of closing and the words "Close" and "Toe".

Whether the valve is actuator driven or manually operated, the maximum force required to turn the hand wheel at the maximum torque defined above shall not be greater than 100 N per hand at the hand wheel rim. (Total effort= 200 N.) For large valves the minimum of complete revolutions of the hand wheel to move the valve gate from fully open to fully closed shall not be less than 100.

All electric actuators shall be provided with reversing contactors: local and remote control shall be provided; a device making the local control non-operative shall also be provided on the relevant remote control panel.

After factory tests, the actuators shall be removed from the valve and delivered to Site in separate boxes to safeguard against damage.

#### Protection

All materials and workmanship to comply with relevant SABS specifications.

#### Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a 2 1/2 of SIS 05 50 00 finish. Successive coat of an approved non-toxic epoxy resin paint suitable for spray application (Cupon EP 2300 or similar) shall then be applied to give a final dry film thickness of 250 µm. Drying times between successive layers shall be strictly in accordance with the requirements of the paint manufacturer

As an alternative to the protection as specified above, the Contractor may be required to use either a solvent less epoxy paint system or a fusion bonded epoxy powder coating as specified in the Project Specification.

### External Protection

External surfaces of valve bodies shall be wire brushed to a 3 of SIS 05 59 00 standard and painted with one layer zinc chromate primer to SABS 679 Type I (dried film thickness 50 µm). This will be followed by two alkyd-based undercoat (each coat 25µm thick) and one alkyd-based enamel finishing coat to SABS 630 Grade 1 (dried film thickness 25 µm). Final colour will be as specified by the Engineer.

Machined flanges will be painted with a protective coating of shellac or similar.

### Tolerances

Tolerances as specified in the appropriate SABS or BS standards shall be apply to this Contract.

### Testing and Inspection

#### Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials confirm to the requirements of the relevant SABS or BS Specification. These test will not necessarily be attended by the Engineer but records must be kept and all test results shall be made available to the Engineer.

#### Testing by Independent Body

The Engineer may appoint an independent recognized body to conduct control tests. Samples required for such tests will be provided by Manufacturer free of charge and sampling will be done by this body in accordance with the relevant SABS or BS Specification.

The cost of such control tests will be borne by the Employer.

#### Inspection

Visual, operational and dimensional inspection of valves as well as inspection of protective coatings will be carried out by the Engineer and/or the Manufacturer in the Manufacturers workshops prior to the dispatch of valves to site.

Inspection by the Engineer shall in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the Specification.

#### Hydrostatic Testing

All hydrostatic tests will be witnessed by the Engineer and the Manufacturer will give at least one week prior notification to the Engineer of the proposed dates for such tests.

Valve bodies will be close end tested to at least 1,5 times the working pressure. Test pressures will be maintained for at least 5 minutes and valve bodies will be watertight in all respects at the test pressure.

Assembled valves will be open-end tested to 1,5 x working pressure for materials strength and soundness. Valves will be drop tight from both directions over the complete range of pressures from 0 to 1,5 x working pressure.

Each valve will be supplied with a test certificate certifying that it complies in all respects with the requirements of this Specification.

#### Measurement and Payment

##### General

Tendered prices shall include for the following unless otherwise specified in the Project Specification.

Protective coating as specified.

Couplings and/or jointing material for each type of valve.

Packing and temporary protection against damage during transport and delivery.

Temporary storage and maintenance if required.

Delivery and storage of material on site or in a store as specified.

Testing and inspections at Manufacturer's works.

Valves will be measured per unit of each type.



## ANCILLARY EQUIPMENT

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.

The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

## PAM 4 MANUFACTURE, SUPPLY AND TESTING OF STEEL PIPES

### SCOPE

This specification covers the manufacture and supply of bare, electric welded low carbon steel pipes and steel pipe special items for the conveyance of water at ambient temperatures and at medium pressures.

### STANDARDS

Pipes and specials shall be manufactured, tested and inspected in accordance with the latest issues of the following standard specifications unless amended in subsequent clauses in this specification.

#### Pipes

SABS 719 : Steel Grades A, B and C

SABS 1431 : Steel Grades 300 WA

API 5L : Steel Grades x46, x56 and x60

## Specials

Specials of 150 mm nominal diameters and smaller to be manufactured with pipe conforming to ASTM Schedule 40.

Specials larger than 150 mm nominal diameter shall be manufactured from pipes complying with this specification.

The radiographic technique, adjudication of radiographs and repair of defects shall be in accordance with API 1104.

## Qualifications of Welders

All manual or semi-automatic welds and repair welds shall only be undertaken by welder's qualified under the tests laid down in accordance with API 1104

### d) Non-destructive Tests and Adjudication

Radiographic inspection : API 1104

Ultrasonic inspection : API 5L

e) In this Specification reference is made to the latest issues of the following specifications.

SABS 719

API 5L

API 1104

ASME Section V

BS 2971

BS 2633

## STRESSES

All pipes shall be hydrostatically tested as described in PLN 6.5 to a pressure such as to produce a circumferential tensile stress in the steel of not less than 90% of the minimum yield stress.

The design stress for pipes subjected to the specified design pressures shall be 60% of minimum yield stress of the steel.

## PROCESS OF MANUFACTURE FOR PIPES

Pipes shall be manufactured by an approved semi automatic submerged-arc welding process or shall be electric resistance welded. Where semi automatic submerged-arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside. The number of longitudinal weld seams shall not exceed:

one seam for pipes up to 1 000 mm nominal diameter two seams for pipes larger than 1 000 mm and up to 2 000 mm nominal diameter Circumferential welds by semi automatic submerged-arc welding method for factory double jointed pipes shall have at least one pass on the inside and at least one pass on the outside.

## Welds

SABS 719, BS 2971 and BS 2633 shall generally apply.

For fusion welded pipes and specials, the internal weld bead shall not protrude more than 1 mm into the bore of the pipe or special.

For electric resistance welded pipes, the height of upset metal and flash on the inner surface shall not exceed 1,0 mm.

For pipes to be jointed by butt welding, the internal weld bead shall be ground flush with the pipe body for a length of 200 mm from ends to be jointed.

For pipes to be coupled by flexible couplings, external weld reinforcement or upset metal and flash shall be ground flush with the pipe body for a length of 200 mm from the end to be coupled.

## DIMENSIONAL REQUIREMENTS

### Pipes

All dimensions will be in accordance with SABS 719 clause 4.

### Specials

The tolerances on specials will be in accordance with BS 534, Section 4.

## TESTING AND INSPECTION AT MANUFACTURER'S WORKS AND AT SITE

### General

Factory and Site inspection, supervision of tests and adjudication of test records shall be carried out by an independent Inspectorate.

Tests and inspections shall be carried out at the manufacturer's work at the expense of the Contractor who shall provide all necessary testing facilities, labor, instruments,

equipment and samples that might be required, free of charge. The Inspectorate shall be afforded every facility during the course of manufacture and testing to enable the inspection to be carried out effectively.

All test samples shall be selected by the appointed Inspectors and all instruments used for testing purposes shall be approved by the Inspectors and if in the opinion of the Inspectors any instrument should require calibration, such instruments shall be calibrated at the expense of the Contractor by the SABS or such other body as may be approved by the Inspectorate.

No mechanical working or straining of pipes and specials shall be allowed after testing and inspection.

### Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L Section 10.7.

### Non-destructive Inspection

### Ultrasonic Inspection

Pipes shall be made by an approved welding process and 100 percent of all longitudinal or spiral welds on straight pipes shall be checked with an approved ultrasonic method capable of continuous and uninterrupted inspection of the weld seam in accordance with API 5L Section 9.10 , 9.11 and 9.12 except that the equipment shall be checked with an applicable reference standard at least twice every working turn.

### Radiographic Inspection

#### Longitudinal Weld Pipe

All electric fusion welded pipes, shall be inspected by radiological methods for a distance of 200 mm from each pipe end.

#### Spiral Weld Pipe

All electric fusion welded pipes shall be inspected by radiological methods for a distance of 100 mm from each end of each length of pipe and of the complete "H" at all scalp and welds including 150 mm of the spiral welds in both directions away from the intersection points with the scalp and welds.

#### Circumferential Butt Welds

100 percent of the length of circumferential butt welds shall be examined provided, when consistently acceptable results are obtained, the number of welds to be so tested may be reduced by mutual agreement between the Engineer, the Inspectorate and the Contractor.

### Specials

100 percent of all manual or semi-automatic welds in specials shall be examined radiographically provided, when consistently acceptable results are obtained, the number of welds to be so tested may be reduced.

Where specials can not be hydrostatically tested, all welds shall be liquid penetrate tested as per ASME Section V.

## Repairs

### Straight Piping :

100 percent of the total length of all repairs shall be examined radiographically provided, that where repairs are made before ultrasonic inspection and such repairs pass ultrasonic inspection, no further radiographic inspection of same is required.

Pipes for Rail, Road and River Crossing 100 percent of the total length of all welds shall be examined radiographically.

### Hydrostatic Testing

a) Each individual straight pipe shall be subjected to a hydrostatic test in accordance with the methods described in API 5L, Section 5. Test pressures shall be such as to produce tensile fiber stresses in the pipe wall of not less than 90% of the minimum specified yield strength of steel or shall be 9 MPa whichever is the lesser. Leaks or sweats shall be considered injurious defects.

b) Should it not be possible to hydrostatically test straight piping and/or specials the through liquid penetrate test as per ASME Section V shall be done on all welds over and above the non-destructive tests specified above. This shall only be applicable with the prior written approval of the Engineer.

### Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or determined by any other means to exceed the limitations in API 5L, Section 10.7 shall be repaired in accordance with API 5L Section 10.8 and 10.9 but subject always to the requirements of this specification.

### Destructive Testing

The following destructive tests shall be performed in accordance with SABS 719 clause 7.2 on the first pipe and thereafter on one pipe every 500 subsequent pipes.

#### Transverse Tensile Test

#### Root Bent Test (Electric Fusion Welds)

Flattening Test (Electric Resistance Welds)

Sampling for Destructive Tests

First Sample

A section long enough to provide all the test specimens and material shall be cut from the selected pipe.

Second Sample

If the test specimens and material from the first selected pipe fail to pass any of the tests, a section long enough to provide the appropriate specimens for the test failed by the first sample shall be cut from two further pipes.

Third Sample

If the test specimen from the second sample fails to pass the test(s) a similar section shall be cut from each of a further ten pipes.

Compliance

The piping shall be considered as complying with the specification if after testing of the first or the second or the third sample no defect is found.

**FLANGES**

Material – shall be steel plates to conform to the requirements of SABS 1123.

Dimensions – shall be in accordance with SABS 1123 unless otherwise specified in the Schedule of Quantities or on the drawings.

Type – all flanges shall be of the steel-plate for welding type and shall have flat joint faces unless otherwise specified in the Schedule or Quantities or on the drawings.

Finish – joint surfaces shall be in accordance with SABS 1123 clause 4.5.

All flanges shall be supplied complete with bolts, nuts and washers of a material to conform to the requirements of SABS 1123 where applicable, otherwise to the requirements of the Engineer.

Gaskets for flanges joint shall be of compressed asbestos fiber to BS 2815 Grade A and full faced, unless otherwise specified in the Project Specification, with a minimum thickness of 3 mm.

#### **FLEXIBLE COUPLING**

Flexible couplings shall be of the Viking Johnson or Klamflex type with center register except where specified to the contrary in the Schedule of Quantities or on the drawings. Couplings must be able to withstand hydrostatic test pressures of 1.5 times the specified design pressures and coupling flanges must be designed to withstand all stresses due to tightening of the bolts. Rubber rings shall generally comply with SABS 974 Class F. The internal face of the sleeve section of each coupling shall be grit blasted to SIS 055900 Grade Sa3 finish with an anchor pattern profile not exceeding 75 micrometers in depth as determined by micrometer gauge or portable microscope fitted with a calibrated focusing knob. Within four hours of grit blasting provided surfaces are kept dry and clean, one coat of an approved epoxy resin, Copon or similar shall be spray applied, followed by further coats to a dry film thickness of not less than 300 micrometers over the average profile peak. All other surfaces of coupling components shall be grit-blasted to the same minimum finish and shall receive one coat of an approved protective paint which shall be compatible with materials to be used for the exterior molding of the coupling in the field. Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

#### **MARKING OF PIPES**

All pipes and specials shall be clearly hand stamped alongside a longitudinal or spiral weld on one end of the pipe with the following.

Grade and thickness of steel

Serial number of the pipe or specials

Nominal diameter

Hydraulic tests pressure

#### **ANCILLARY EQUIPMENT**

Details of spares and special tools are to be listed in the Data Sheet.

The Mechanical Contractor will be responsible for the supply, delivery to site and erection of all ancillary equipment, in the form of holding down bolts, rawl-bolts, pipe clips, small pipes, grease piping etc. to complete the Mechanical Contract.



The Mechanical Contractor will also be responsible to compile a manual in which all the relevant mechanical equipment is described together with the routine maintenance, lubrication schedules etc for proper running of the plant.

## CORROSION PROTECTION

### SCOPE

This section includes the corrosion protection and materials required for this Contract.

### GENERAL

The Contractor shall ensure that he has available the latest edition of all the relevant National Specifications and Codes of Practice and the manufacturer's data sheets for materials to be used.

All paints in a paint system shall be purchased from the same manufacturer.

The Contractor shall submit in the Appendices to the document, details of the paints he intends using and shall only proceed with purchase of the paints upon receipt of written approval from the Engineer. Manufacturer's data sheet or legible copies thereof for each product shall be attached to the Appendices.

Materials and procedures shall comply with the appropriate SABS Specifications and Codes of Practice when relevant.

Strict attention shall be paid to fettling of surfaces by the Fabricator (see Clause PZA 4) prior to coating. Surface preparation requirements, the need for strict cleanliness and adherence to specification requirements especially with regards to over coating times are emphasized.

Areas which are inaccessible after assembly shall be prepared and fully coated with the specified system and to the specified requirements before assembly. The coating shall be fully hard dry before assembly.

Mating surfaces shall be coated with primer of first coat only. The coating shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joint shall be fully coated.

The painting sub-contractor shall provide evidence of his competence to apply the specified materials in the specified manner and to apply the necessary Quality Control procedures. The Engineer, at his discretion, may demand a Quality Audit of the Contractor's facilities by a technically competent and independent organization (See Clause PZA 10).

The Contractor shall provide a Quality Plan to show the stages at which Quality Control will be carried out. Further details are given in Clause PZA 10. The Quality Plan is subjected to approval by the Engineer, who may require it to be revised if considered inadequate.

The Engineer will require a Program of Work so that Quality Surveillance inspection can be planned and executed at the appropriate time according to the Contractor's program (see Clause PZA 10).

The Contractor shall provide to material suppliers descriptions of materials to be used and shall receive from them a written assurance that the materials to be supplied with the requirements specified.

## DESIGN

### General

All items shall be designed to minimize corrosion in exposed environments, under immersion conditions and in interior corrosive situations such as in chlorination rooms. The following notes may be used as guidelines.

### Water Retention Areas

Avoid water retention areas wherever possible. For example, angle or U section steel should be used with the toes pointing downwards. The concrete base of steel columns should be sloped away from the steel and the sloping edge should be painted to avoid water ingress at the steel/concrete interface.

### Crevices

Crevices give rise to accelerated corrosion by forming an oxygen concentration cell. Crevices may be avoided by using; continuous welding, not space welding mastics or sealants to seal unavoidable crevices such as bolted connections insertion rubber or suitable plastic between mating surfaces (See also Clause PZA 2.7).

### Bimetallic Couples

Electrical contact between dissimilar metals gives rise to a corrosion cell when an electrolyte such as water is present. Junctions between dissimilar metals shall be insulated.

### Accessibility

Whenever possible, the surface of corrodible materials such as mild steel shall be accessible for maintenance. The use of back to back angles, partially open box sections or inaccessible stiffeners shall be avoided.

### Differential Aeration

Posts buried in soil are subjected to accelerated corrosion to differential aeration. Additional protection shall be given to that part which is buried and up to at least 100 mm above ground.

### Sharp Edges, Weld Spatter and Weld Slag

The designer shall specify that all sharp edges be ground to a radius not less than 2 mm and that all weld spatter and weld slag shall be removed by the Fabricator (see Clause PZA 5).

### Hot Dip Galvanizing

The design of articles to be galvanized shall be referred to the galvanizer (see Clause PZA 8).

### COATING MATERIALS

No variation in materials tendered and approved by the Engineer shall be permitted without the approval of the Engineer in writing.

Correct material selection shall be confirmed by the material supplier (see Clause PZA 12.1).

All coating materials shall be delivered in the manufacturer's original sealed containers, clearly marked with the following:

Manufacturer's name.

Product Brand and Reference Number.

Batch Number which may incorporate the date of manufacture.

Date of manufacture, unless already incorporated in the batch number.

Abbreviated instructions for storage and use of the material, which shall include mixing ratios of components of multi-component materials, minimum temperature of application and method of application.

The SABS mark where applicable.

All coating materials shall be kept in an approved store, which shall be dry, enclosed and where the temperature is unlikely to exceed 40C or drop below 0 C.

Usage of materials shall be on a first in, first out basis and no materials may be used which have exceeded the shelf life recommended by the manufacturer.

#### FETTLING OR DRESSING BY THE FABRICATOR

Before any surface preparation or painting is commenced, dressing shall be carried out to avoid projections, sharp edges, weld slag and spatter that will interfere with the corrosion protection. This includes the following:

Remove all weld flux and weld spatter. Flux is best removed by washing with clean water whilst weld spatter is normally removed by grinding to a smooth surface.

Sharp edges shall be ground to a radius not less than 2 mm.

Welds shall be continuous and shall have a smooth contour. Rough welds shall be ground where necessary to achieve the required smooth profile. Discontinuous welds shall not be permitted except by written approval of the Engineer. Undercuts are not permitted and shall be re-welded and ground where necessary.

Articles for hot dip galvanizing shall not contain overlap joints. Closed sections shall be suitably vented. See Clause PZA 8 (Hot dipped Galvanizing).

## SURFACE PREPARATION FOR PAINTING

### Mild Steel

Oil and grease contamination, when present, shall be removed by degreasing before blast cleaning.

Mild steel shall be blast cleaned in accordance with Section 4.3 of SABS 064 Code of Practice for “The preparation of steel surfaces for coating”.

An additional requirement is that water soluble salts present in the steel after blast cleaning shall not exceed the value given in Table 1. Should these values be exceeded, the steel shall be cleaned by washing with clean potable water or by water shrouded or water injected blast cleaning until the soluble salts are within the limits specified in Table 1. The steel shall then be allowed to dry, after which it shall be flash blast cleaned to achieve the required degree of cleanliness.

### Cast Iron and Cast Alloys

All cast surfaces shall be blast cleaned with new iron slag, copper slag, or platinum slag abrasives designed for blast cleaning. The abrasive shall not be recycled or re-used. Cast iron shall be blast cleaned until all sand particles, residual burst on sand and casting skin have been completely removed. This blast cleaning shall be carried out by the Foundry prior to dispatch to the galvanizer or painting contractor, when relevant. Conventional cleaning of castings is inadequate for galvanizing.

### Galvanized Steel Surfaces

Galvanized steel surfaces shall be thoroughly degreased prior to painting, using either a water soluble solvent degreaser used in accordance with the manufacturer's instructions, or a mild acid-detergent degreasing solution. In both cases care shall be taken to avoid entrapment of cleaning agent in recesses or other retention areas and in both cases the surfaces shall be thoroughly washed until a “water break free” surface is achieved. If necessary, the process shall be repeated until a “water break free” surface is obtained.

A water break free surface is one which, when wetted all over with potable water, maintains a continuously wet surface and the water does not break up into islands of un-wetted surface.

**TABLE 1 – STANDARDS FOR BLAST CLEANING REQUIRED**

Property	Above Water	Immersed Surface	Tape Wrapping
Cleanliness to SIS 06 5900 (min)	Sa2½	Sa3	Sa2
Residual dust and debris	0,5%	0,3%	1%
Oil grease and perspiration	Nil	Nil	Nil
Surface Profile min (micrometers)	25 50	50 10	50 100
Water soluble iron salts maximum at any point	500 mg/m2	100 mg/m2	500 mg/m2
Average of any 250 cm	100 mg/m2	100 mg/m2	100 mg/m2

After degreasing, the surface shall be lightly abraded by one of the following methods:

On small areas by the use of abrasive paper not coarser than 120 grade, or by using non-metallic abrasive pads.

On large areas by “sweep blast cleaning”, using a nozzle pressure not greater than 300 kPa and a very fine abrasive. Cracking, flaking, or any form of delamination of the zinc coating due to excessive blast cleaning shall not be permitted. Removal of zinc by blast cleaning shall not exceed 10 micrometers.

Finally, all dust and debris shall be removed by vacuum cleaning, or by washing, and the surface shall be allowed to dry before coating.

#### Aluminium

Generally, aluminum surfaces will be anodized, or powder coated and will require no further treatment. Where painting is required, the aluminum surface shall be thoroughly degreased, then rinsed with clean potable water. If the surface is not “water break free”, repeat the degreasing process until a water break free surface is obtained. Allow to dry completely, then apply a thin coat (8 to 13 micrometers dry film thickness) of wash primer complying with SABS 723, mixed and applied in accordance with the manufacturer’s instructions.

NOTE: Wash primer is an adhesion promoter and does not replace the primer specified in the paint system.

#### Stainless Steel

Components fabricated from stainless steel shall not be contaminated with iron or mild steel. Sheared edges, welds or surfaces subjected to any form of heat treatment shall be picked and passivated. Stainless steel surfaces shall not be scratched or stressed.

When it is required to paint stainless steel, the surface shall be blast cleaned with non-metallic abrasive such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast iron is strictly prohibited. Any contamination with iron or mild steel is prohibited.

Where blasting is impractical, the surface shall be cleaned with detergent solution and roughened manually by using non metallic abrasive pads, followed by washing with clean potable water to a "water break free" surface. If a "water break free" surface is not obtained, detergent cleaning shall be repeated until the surface is "water break free". Allow the surface to dry before coating.

#### Painted Surfaces

##### Fully painted surfaces to be repaired

Bare areas shall be cleaned with abrasive paper not coarser than 220 mesh to bright metal surface. The surrounding paint, which must be intact, shall be feathered for a distance of 20 mm beyond the damaged areas. Dust and debris shall be removed by the use of a clean rag dampened with water or clean solvent that will not attack the coating. The damaged area shall be allowed to dry, after which spot repair shall be carried out with all the coats previously applied and shall overlap the undamaged area by 20 mm.

The requirements of the spot repair shall be not less than that specified for the undamaged coating.

When additional coats are required over the whole surface, the whole surface shall be abraded to a uniform matt finish, dust and debris removed, and the surface allowed to dry. All further coats shall then be applied as specified to give a uniform finish. Note that abrasion of the coating is not required for vinyl systems.

##### Fully painted surfaces to be over coated

Where additional coats are required over the whole surface, the surface shall be degreased and abraded to a uniform matt finish. The surface shall be washed to remove all

contamination and then allowed to dry. Further coats shall then be applied as specified to give the required coating thickness and specified finish.

#### Primed surfaces

Shop applied primers shall be thoroughly sanded with fine abrasive paper to achieve a uniform matt surface, then scrubbed with a solution of suitable water-based detergent-degreaser using a bristle brush, followed by clean water rinses to remove all grease and water soluble matter. The surface shall be allowed to dry completely before application of the specified coating system over the whole surface.

#### Plastic Surface such as u-PVC and Polyester GRP

Sand the surface thoroughly with fine abrasive paper to achieve a uniform matt finish. Remove all debris, oil and grease by scrubbing with a solution of a suitable water-based detergent such as Shell Teepol Lensex. Allow to react for 15 to 30 minutes, then rinse off very thoroughly with clean potable water to remove all residues. Allow to dry completely before painting.

### APPLICATION OF PAINTS

#### Environmental Conditions

Paint shall not be applied in dusty conditions, nor when the steel surface temperature is less than 3 C above dew point, or higher than the advised by the paint manufacturer, or when humidity is greater than 85%, nor when the ambient temperature is less than the minimum or greater than the maximum specified by the manufacturer of the coating material.

#### Mixing

All coating materials shall be very thoroughly mixed until completely homogeneous. In the case of two pack materials, each component containing pigments shall be thoroughly mixed. The two components shall then be mixed together in the proportions supplied by the manufacturer until the mixture is completely homogeneous. In the case of solvent based epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period of 20 to 30 minutes before use.

For two pack materials, the use of part of the contents (Split packs) is strictly forbidden.



### Method of Application

Application shall be by brush, roller, spray, airless spray or other suitable equipment as appropriate for the surface to be coated and in accordance with the recommendations of the manufacturer. Application equipment shall be maintained in clean conditions and in good working order. The use of equipment not maintained in good condition may lead to rejection of the coating.

**NOTE:** Zinc silicate primers shall be applied by conventional spray, using a continuously agitated pressure pot, unless otherwise recommended in writing by the manufacturer.

### Over-Coating

Over-coating times shall be not less than the minimum nor greater than the maximum specified by the manufacturer relevant to the ambient temperature. Strict adherence to over-coating times is particularly important for coatings which are subsequently immersed.

The contractor shall be held responsible for blistering of paint coatings on immersion, when shown to be caused by solvent retention.

All costs shall be clean and free from dust, oil, moisture, perspiration before over-coating. Operators handling blast cleaned or partially painted surface shall wear clean gloves to avoid contamination of the surface.

### Manufacturer's Instructions

Recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead, shall be followed. Verbal information by the manufacturer's representative will not be accepted unless confirmed in writing by the company.

### Handling

Coated components shall not be handled earlier than the hard dry time recommended by the manufacturer, relevant to the ambient temperature. Coated components shall be handled with broad band slings and suitable packing to minimize damage to the coating. All damage caused in handling, transportation and erection, shall be repaired to the satisfaction of the Engineer at no extra cost.

## METAL COATING AND CORROSION RESISTANT METALS

### HOT DIP GALVANIZING

#### Design and Fabrication

Components for hot dip galvanizing shall be designed and fabricated in accordance with the recommendations of SABS Code of Practice Project No. 341/50490 (not published at the time of preparation of this specification), except that the use of lead plugs is not permitted.

It is recommended that the manufacturer consults the galvanizer before design and fabrication to ensure that the fabrication will be suitable for galvanizing.

The main requirements are as follows:

Overlap joints shall be avoided wherever possible. If essential, such overlap joints shall be thoroughly degreased before assembly and shall be vented by drilling holes through one or both overlapping materials.

Closed sections shall be suitably vented. If the inside of a closed section is not to be galvanized, a snorkel vent tube of suitable length and bore shall be attached.

Gussets and internal baffles in tanks shall be cropped to allow free flow of zinc and air.

Joints shall be continuously welded, using balanced welding techniques to avoid stresses. Welds shall be free from cavities, undercutting, weld slag and spatter.

Symmetrical design shall be used whenever possible and the use of thin gauge steel adjacent to heavy sections shall be avoided.

Openings and flanges of manholes and bosses shall finish flush on the inside to ensure complete drainage.

Castings shall be designed to be of as uniform section as possible and shall be blast cleaned in accordance with Clause PZA 6.2 before dispatch to the galvanizer.

### The Hot Dip Galvanizing Process

Hot dip galvanizing shall comply with SABS 763 for fabricated articles, SABS 934 for pre-galvanized sheet, or SABS 935 for wire.

Mating surface on fabricated or cast iron components shall be wiped or centrifuged on removal from the galvanizing bath to remove blobs, runs or excess metal that may impair the air/gas/water tightness of the joint.

Bolts, nuts and washers used for fixing shall be hot dip galvanized to SABS 763. Electroplated fasteners will not be accepted unless otherwise agreed by the Engineer in writing.

### Repair of Galvanized Articles

Welding, flame cutting, or other heat processes shall not be carried out on galvanized articles unless permission is granted by the Engineer in writing.

If such permission is given, or if mechanical damage has occurred, repair shall be carried out as follows:

All scale, spatter and flux shall be removed by grinding and washing with clean water. Edges shall be ground to a radius not less than 2 mm.

The preferred repair process is to blast clean the bare steel and apply zinc by the thermal spray process in accordance with SABS 1391 Part 1, Grade Zn 150. On completion of metal spraying, burnish the surface by means of a mechanical wire brush to give a uniform appearance. Such burnishing shall remove not more than 10 micrometers of zinc.

Where small areas are to be repaired, clean the surface thoroughly with fine abrasive paper, remove all debris with a damp cloth and allow to dry. Apply an approved one pack epoxy ester based zinc rich primer containing not less than 90% by mass of zinc in the dry film. A sufficient number of coats (usually 3 or 4) shall be applied such that the repair coating thickness is not less than the average zinc thickness specified in SABS 763, 934 or 935, as appropriate. The repair shall extend not less than 5 mm beyond the damaged area.

On completion of the repair and when the zinc primer is completely dry, one coat of alkyd resin aluminium paint may be applied to obtain a uniform appearance.

NOTE: Repair of galvanized surfaces by application of aluminium paint alone IS NOT PERMITTED.

#### Storage of Galvanized Components

Galvanized components shall be stored to avoid the formation of “white rust” or other forms of storage staining.

Components shall be separated and supported on wooden battens to ensure adequate ventilation of all surfaces and in such a manner to avoid “ponding” by rainwater.

If storage staining does occur, remove the stains by scrubbing with detergent solution and bristle brush or nylon pad. The use of steel wool or other metallic abrasive is not permitted. Rinse thoroughly and allow to dry. If the residual zinc thickness complies with the requirements of the appropriate grade in the relevant specification, no further action is required unless instructed by the Engineer.

If the zinc thickness is below specification, the article shall be re-galvanized or repaired in accordance with Clause PZA 8.3 as instructed by the Engineer.

#### STAINLESS STEEL FABRICATIONS

##### Grade and Welding Techniques

The grade of stainless steel to be used shall be as specified in the appropriate section of the mechanical specification or drawing. Where welding is necessary, the appropriate “L” (low carbon content) shall be used. Plate shall be supplied as No 1 Finish in accordance with BS 1449 Part 4.

Welding procedures shall be only those recommended by the stainless steel manufacturer or by the South African Stainless Steel Development Association. Only welders coded to BS 4870 Part 1 or to ASME IX, 1983 shall be employed.

Welds shall be smooth and free from blowholes, undercuts, sharp projections and similar visual defects.

Fabrication of stainless steel components shall be carried out in clean work places where there is no contamination by mild steel. Grinding and polishing equipment shall be dedicated and shall not be contaminated with iron or mild steel.

Stainless steel shall be suitably handled to avoid scratching the surface.

### Pickling and Passivation

Cut edges, welds and heat treated surfaces shall be pickled and passivated to remove all discoloration. Proprietary pickling and passivating pastes (as supplied by Duva Chemicals (Pty) Ltd., or other approved supplier) shall be used in accordance with the manufacturer's recommendations. Care shall be taken not to exceed the maximum contact time recommended.

The safety precautions given in PZA 10.2 shall be strictly observed.

After passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. The surface shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer or the South African Stainless Steel Development Association. SAFETY PRECAUTIONS as specified in Clause PZA 10.1 (ii) shall be strictly observed.

### CORROSION RESISTANT STEEL 3CR12

#### Welding Techniques

Welds shall be full penetration welds, using 309 austenitic electrodes of filler wire, or as recommended by the manufacturers (Middelburg Steel & Alloys (Pty) Ltd).

Welders shall be suitably coded for welding similar thickness of austenitic stainless steel, in accordance with BS 4870 Part 1 or ASME IX, 1983.

Welding procedures shall comply with the recommendations of the manufacturers of 3CR12 (Middelburg steel & Alloy (Pty) Ltd).

Welds shall be smooth and free from blow holes, undercuts, sharp projections and similar visual defects.

#### Pickling and Passivation

After completion of welding, both weld and heat affected zones shall be cleaned, pickled and passivated. Any heat scale on the steel shall be pickled and passivated.

The procedure shall be as follows:

Not to painted surfaces Grind or wire brush, using dedicated grinders or stainless steel wire brushes to achieve the required smooth profile or remove scale.

Pickle with a thixotropic paste containing 15-20% nitric acid and 1-2% hydrofluoric acid, with a contact time of 15 to 10 minutes.

Rinse thoroughly with clean water until the pH of the washings is the same as that of the wash water.

Repeat the above process, if necessary to remove all discoloration.

Passivate with 10% nitric acid solution, or a proprietary passivating paste, for a contact time of 10-15 minutes, keeping the surface wet during this period.

Rinse thoroughly with clean potable water until washings are the same pH as the wash water.

Operatives shall wear protective aprons, gloves and safety glasses during pickling and passivating operations.

Splashes on the skin shall be thoroughly washed with clean water immediately after contact. A weak solution of sodium bicarbonate shall be kept available for neutralization. Seek medical attention if in doubt.

Disposal of effluent shall be in accordance with the requirements of the local authority in whose area the work is being carried out. Generally, the effluent is stored in drums containing an excess of lime (calcium carbonate).

## ALUMINIUM

### Anodizing

Aluminium components where specified as anodized shall be natural anodized and sealed in accordance with SABS 999 Grade 25. The corrosion resistance of the coating shall be not less than 8 when tested in accordance with 3.6 of specification SABS 999. Anodising shall be carried out after completion of all welding.

### Powder Coating

When specified by the Engineer, aluminium handrails may be coated with polyurethane powder. Such coating shall only be carried out by Contractors with the necessary plant, equipment and experience to pre-treat and power coat aluminium effectively. The coating shall comply with BS6496, 1984.

### Fixing

Whenever aluminium components, such as stop log frames, come into contact with concrete or grout, the surface of the aluminium in contact with concrete shall be coated with two coats of an approved epoxy tar composition.

## QUALITY ASSURANCE REQUIREMENTS

### Contractor Qualification

The Tenderer shall state in the Appendix to his document the name of the painting sub-contractor that he proposes to use to carry out the painting or coating. The Engineer may, at his discretion, require a Quality Audit of the painting sub-contractor to ensure that he has the management, facilities, skilled staff, and quality control facilities and staff to carry out quality control during application of coatings to ensure compliance with the specification.

The contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Engineer or his representative.

The contractor shall obtain confirmation from the material supplier that materials to be used comply with the specification and are suitable for the intended purpose by having the appropriate Appendix completed by the material supplier.

### Quality Control

The contractor shall have the necessary equipment and staff knowledgeable in test procedures to carry out all the quality control required to ensure compliance with the specification. The contractor will be required to produce a quality plan and a program for carrying out the work. The contractor shall maintain quality control records of all stages of the work, batch numbers of materials used, environmental conditions, all as required by the specification. Quality control shall be inclusive in the contractor's tender price.

### Quality Surveillance

Independent surveillance – The Engineer may employ an independent technically of the work on his behalf.

Program – The Contractor shall advise the Engineer timeously, in writing, when and where the following processes will be carried out:

Completion of fettling or dressing prior to leaving the fabricator's works.

Blast cleaning and application of the first or prime coat.

After completion of all coats to be applied at the contractor's works.

At the commencement of repairs to be carried out on site.

Failure of the Contractor to advice the Engineer of his program may result in rejection of the work.

### Access for Surveillance

For the purpose of carrying out quality surveillance, the Engineer or his representative shall be granted access to any part of the Contractor's premises relevant to the work being carried out, at any reasonable time. The Contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

### Samples

The Engineer or his representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the sample will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material.

### Destructive Testing

The Engineer or his representative may carry out reasonable destructive tests to ascertain compliance with the specification. Areas thus damaged shall be repaired by the contractor to the satisfaction of the Engineer at no additional cost.



#### Cost of Quality Surveillance

Cost of Quality Surveillance shall be borne by the Employer, except when surveillance results in rejection of the lot or when notice by the Contractor results in a fruitless strip, in which cases the cost shall be debited against the contractor's account.

#### Quality Control Records

Proper and adequate quality control records shall be maintained by the Contractor for all stages of the work. These records shall be available for inspection by the Engineer or his representative at the time of Quality Surveillance. Incomplete, inaccurate or inadequate records shall be regarded as non-compliance with the specification, and the cost of surveillance will be back charged to the contractor.

#### Data Sheets, Specifications, and Codes of Practice

The contractor shall have available the latest issues of manufacturer's data sheets materials to be used, National specifications and Codes of Practice relevant to the work to be carried out, as well as a copy of his specification, all of which shall be available to the Contractor's Quality Control Manager.

**ELECTRICAL PARTICULAR**  
**SPECIFICATION**

## **GENERAL TECHNICAL REQUIREMENTS FOR THE EXECUTION OF THE ELECTRICAL WORKS.** **(MATERIALS)**

### **1. SCOPE OF WORKS**

The scope of work includes the refurbishment of the entire Distribution Pump Stations, including (but not limited to):

11kV switchgear & protection

11kV / 400V Transformers

400V switchgear

Motor Control Centre

Power cabling

Control cabling

Small power and lighting

Automation & control

Instrumentation

Fire Detection

Intruder Alarm

Telemetry

Scada

Installation of new equipment shall include the removal of the existing equipment, delivery and offloading to the client's centralized stores.

### **2. STANDARDS**

All materials and equipment to be supplied and installed under this contract shall be new and of the best quality available.

All materials and equipment shall comply with the requirements laid down in the latest editions of the BS, SABS and IEC specifications and their amendments (if any) as well as those laid down in this specification. Where items bearing the SABS mark are available for any of the materials and equipment specified, only materials bearing the said mark, will be acceptable.

The following Standard Specifications and drawings shall apply:

SABS 780	-	Distribution Transformers
SABS 555	-	Transformer oil
SABS 833	-	Bushings
SABS 97	-	Medium voltage cables
SABS 763	-	Galvanizing
SABS 0142	-	Code of Practice for the wiring of Premises
BS 923	-	Testing
BS 2631	-	Switch gear
BS 162	-	Switch gear
BS 159	-	Bus bars
SABS 1091	-	Paint colour
S 3938	-	Current Transformers
BS 3941	-	Potential Transformers

BS 89	-	Ammeters
BS 638	-	Welding cables
SABS 1507	-	Electrical cables with extruded solid dielectric insulation for fixed Installations (300/500V to 1900/3300V)
SABS 256	-	Moulded Case Circuit Breakers
SABS 767	-	Earth leakage protection units
SABS 1084	-	Cover plates for wall outlet boxes
SABS 1085	-	Wall boxes for the enclosure of electrical accessories
SABS 1065	-	Metal conduit Part 1
SABS 1065	-	Metal fittings Part 2
SABS 1574	-	Electric cables and flexible cords
SABS 163	-	Wall and appliance switches
SABS 1119	-	Ballasts for fluorescent lamps
SABS 890	-	Fluorescent lamp reference ballasts
SABS 086	-	Interior luminaries for fluorescent lamps
SABS 1029	-	Miniature substation
SABS 1152	-	Metal working chisels for hand use
BS 3939	-	Graphical symbols for electrical power, telecommunication and Electric Diagrams
BS 148	-	Specification for unused mineral insulating oils for transformers and switch Gear.
BS 142	-	Electrical Protection relays
BS 1650	-	Specification for capacitors for connection to power – frequency System.
BS 4504	-	Circular flanges for pipes, valves and fittings (PN Designated)

### **3. SYSTEM AND SITE CONDITIONS**

All materials and equipment supplied under this contract shall be suitable for operation under the following conditions unless specifically specified otherwise elsewhere in this document:

Medium voltage system: 11 000, 50 Hz, 3-phase, 3 wire, alternating current.

Low voltage system: 400/230V, 50 Hz, 3 phase, 4 wire, alternating current with solidly earth neutral.

Atmosphere: dry, dusty, warm and highly corrosive

### **4. LAWS, REGULATIONS AND CODES OF PRACTICE TO BE OBSERVED**

The work shall be carried out strictly in accordance with and all material and equipment supplied shall comply with the following laws and regulations where applicable:

- (a) The latest edition of the "Code of Practice for the Wiring of Premises", SANS 10142, as amended;
- (b) Occupational Health and Safety Act (Act No.85 of 1993);

- (c) The "Electricity Supply By-Laws and Regulations" of the Local Supply Authority;
- (d) The local Fire-Office Regulations;
- (e) The Requirements of the Department of Communications;
- (f) The Acts and Regulations applicable to the use of explosives;
- (g) "The Code of Practice for the Installation and Maintenance of Electrical Equipment used in Explosive Atmospheres" (SABS 086);

The contractor will be responsible for serving all notice and paying all fees due in terms of the above laws & regulations.

## **5. RADIO AND TV INTERFERENCE**

All equipment installed under this Contract shall comply with the Government Notice. R.2246 and any other applicable rules and regulations in respect of radio and TV interferences. Any equipment found producing interference subsequent to commissioning shall be suppressed or replaced to the satisfaction of the Engineer without any additional cost.

## **6. PROTECTION OF EQUIPMENT AGAINST VOLTAGE SURGES AND SPIKES**

Tenderers shall allow in their tender prices for adequate protection of the equipment supplied and installed under this Contract against direct as well as induced voltage surges and spikes which may be experienced on the system.

Surge arrestors shall be provided on each phase as well as neutral on the incoming power supply terminals of each board.

Electronic equipment shall be adequately protected on both the incoming and outgoing terminals as well as on both ends of cables leaving and entering a building by means of suitable arrestors compatible with the relevant equipment.

Arrestors shall be of COPA manufacture (as supplied by Surge Technologies (Pty) Ltd.) or similar.

All arrestors shall be connected to earth along the shortest possible route and only conductors of adequate rating for the discharge currents catered for shall be used for connections to arrestors.

Tenderers shall submit full particulars of the arrestors offered as well as written confirmation that it will provide adequate protection for the relevant equipment against possible voltage surges and spikes on the system.

## **7. DRAWINGS**

Standard Drawing Sizes

The following standard drawing sizes are preferred.

Electrical Single Line Diagrams	A1 or A2
Electrical Schematic Diagrams	A3
Electrical Wiring Diagrams	A3
Electrical Cable Schedule	A3 or A4
Electrical Connection Schedules	A3 or A4
Electrical Panel General Arrangements	A1, A2 or A3
PLC Hardware Configurations	A2, A3 or A4
Electrical Substation Layouts	A1
Electrical Cable Routing and Racking	A1
Lighting Layout Drawings	A1

A0 drawings are to be avoided due to the difficulty in physically handling the drawing. If an A0 drawing is reduced in size when using AutoCAD all scales shall be removed and the drawing designated "Not to Scale".

#### Document Format

The following defines which documents shall be prepared as "drawings" or which are to be prepared as computer generated schedules:

#### Drawings

Electrical Single Line Diagrams  
Electrical Schematic Diagrams  
Electrical Wiring Diagrams  
PLC I/O Schedule  
Electrical Panel General Arrangements  
PLC Hardware Configurations  
Electrical Substation Layouts  
Electrical Cable Routing and Racking  
Lighting Layout Drawings  
Electrical Equipment Lists

#### Schedules

Electrical Cable Schedules  
Electrical Connection Schedules  
PLC I/O Listings (optional as schedule)

Where document is specified as a schedule it shall be prepared as a spread sheet file with field names and lengths as specified.

#### Drawing Sheets

All drawings shall be drawn on the Employer's drawing sheets unless otherwise approved by the Engineer. Contractors may add their own logos, title blocks

and numbers provided that the main title block is the Employer's title block. The requirement shall apply for the following drawings:

- Single line diagrams
- Schematic diagrams
- Equipment schedules

#### Drawing Numbers

All drawings shall bear the Project number as the main number. Contractors may add their number as a secondary number in which case the number shall be clearly identified as the contractor's number. This requirement shall apply for the following drawings:

Single line diagrams  
Schematic diagrams  
Equipment schedules

#### Equipment Numbering

All electrical equipment shall be numbered using an acceptable equipment numbering system.  
Provision shall be made on the drawings to incorporate this number.

#### Electronic format

All drawings, schematic diagrams and schedules shall be handed over to the Engineer on Compact Disk on completion of the project.

## **8. DRAWINGS SYMBOLS AND LETTERING**

#### Drawing Symbols

All electrical symbols shall be drawn as detailed in the South African Rationalized Specification  
NRS 002 – 1990 Graphical Symbols for Electrical Diagrams.

Symbol sizing shall be according to that specified in the NRS. Electrical symbols shall not be reduced in size to fit into a drawing. Attention shall be paid to the layout to allow for future drawing additions.

Where the NRS 002 – 1990 does not propose a suitable symbol reference shall be made to IEC 617, or a purpose made symbol may be developed. In such case the symbol selected from IEC 617, or created, shall be to the approval of the Engineer.

#### Lettering Requirements

The following lettering sizes shall be used (dimensions in mm)

Item	A0	A1	A2	A3 & A4
Drawing Number	7	7	7	5
Mark, Item No. View, Section No.	5	5	5	3,5
Title – in the block	3,5	3,5	3,5	2,5
Title under detailed item, info on sections	5	3,5	3,5	2,5
Letters and Figures (Body of Drawings)	3,5	3,5	2,5	2,5
Exponents, Small Letters in SI Units	3,5	2,5	1,8	1,8

## 9. SPECIFIC REQUIREMENTS FOR SINGLE LINE DIAGRAMS

### General Requirements

Single line diagrams shall be updated regularly during the project to include plant additions as and when they occur.

### Pumping Station Overall Single Line Information Requirements

The plant overall single line diagrams shall not be over simplified for the sake of maximizing the amount of information on a single sheet. If necessary the drawing shall be split into more than one sheet in a logical manner so that information is grouped by plant sections on each of the sheets.

For this purpose the single line diagrams shall include the following information:

- a) Protection scheme details
- b) Cable sizes
- c) Cable lengths
- d) Transformer ratings, ratio, vector group and impedance
- e) Large motor details (typically only MV motors for overall single line diagrams)
- f) Supply authority substation details including transformer size and impedance

### Drawing layout

The overall single line drawing shall be laid out with the power flow from top to bottom or left to right. The drawing layout should avoid unnecessary crossing of lines.

### Individual Switchboard Single Line Diagrams

These drawings shall be comprehensive in detail and shall, along with the requirements listed for overall single line diagrams, show all the feeder and motor circuits connected to the board, with the following information:

- a) Rating of all circuit breakers



- b) Load details including rating and full load current
- c) Normal running load (calculated) of the incomer circuit(s).
- d) On the incomer circuit the source of the power shall be specified
- e) Cross reference to the overall single line diagram on which the specific single line diagram appears.

## 9. SPECIFIC REQUIREMENTS FOR SCHEMATIC DIAGRAMS

### Use of Multiple Drawing Sheets on One Drawing Number

Schematic diagrams for a particular plant item e.g. a motor control centre, M.V. switchgear panels or similar shall be drawn under one drawing number with multiple sheets.

The set shall include a cover sheet (Sheet 1) and an index sheet (sheet 2, 3 etc. as required). The index sheet(s) shall list all drawings in the set and shall include the sheet number, drawing title and latest revision for that sheet.

### Drawing information

The information depicted on a single schematic sheet shall be limited to the equipment within a particular panel cubicle. A panel cubicle may extend over more than one sheet but a sheet may not contain more than one panel cubicle's equipment and wiring schematic.

### Grid System

Schematic diagrams shall be drawn on a grid system, columns numbered from 0 to 9 rows numbered from A. to E. Equipment shall be numbered and cross referenced on this grid system.

All n/o and n/c relay contacts and auxiliary contacts on equipment shall be listed in close proximity to the relevant component with cross reference to the specific sheet where that contact is utilized.

### Schematic Diagram Layout

Schematic diagrams shall be laid out with a minimum spacing of 10mm between vertical lines. Components shall be laid out evenly in the horizontal plane with the requirements that relay type devices are drawn at the bottom of the sheet.

The power circuit section shall be drawn on the left of the schematic diagram.

### Schematic Diagrams – Medium Voltage Switchgear

Each MV circuit shall have the schematics split over a number of sheeting as follows:

1 <sup>st</sup> sheet in sequence metering	ac circuit details including protection and
---	---

2 <sup>nd</sup> sheet in sequence	closing circuits
3 <sup>rd</sup> sheet in sequence	tripping circuits
4 <sup>th</sup> sheet in sequence	indication and interlocking with external devices

The drawing shall cross reference each other.

## 10. OPERATING MAINTENANCE MANUALS

General details

Separately bound operating manuals and maintenance manuals shall be provided.

Final versions of the operating and maintenance manuals shall contain the following sections:

- Equipment maintenance:      Maintenance data  
    Setting and resetting information  
    General technical data including spare parts lists and drawings  
    Fault diagnoses procedures
- Test and Guarantee:      Protection test report  
    Final test report
- Equipment operation:      Operating instructions  
    (Summary version)  
    Start and stop instructions
- Equipment operation:      Operating instruction (detailed version)
- Drawings:                      All relevant drawings
- Electronic version:          Electronic version of all drawings  
    Electronic copy of PLC programming software

Quantities

The following quantities of the above manuals shall be provided:

- Originals:                      3 (with original brochures)

Preparation sequence

The above manuals shall be made available in the following sequence:

- Draft version:                To be submitted to the Engineer for approval before the beginning of erection.
- Preliminary version:        To be submitted when initial commissioning begins.

- Final version: To be submitted when acceptance tests are over.

#### Preliminary operating and maintenance manuals

During the commissioning period the Contractor shall submit two draft copies of each of the following, for all equipment supplied, for the Engineer's approval:

- Operating manuals (including technical data, check lists, procedures etc.)
- Maintenance manuals (with schedules of routine and regular maintenance and routine tests of equipment).
- Technical data manuals (including schematic wiring diagrams, particular technical data, adjustments details, reference lists, local agents for supply and repair, spare lists etc.).

#### Preparation of the final manuals

After the Engineer has approved the draft manuals described above, copies of each manual shall be supplied by the Contractor.

These manuals shall be permanently bound in book form, together with "as installed" drawings where applicable, with hard plastic covers able to withstand prolonged and repeated use.

Manuals shall be properly indexed to facilitate quick reference.

#### Preparation of the final manuals

The abovementioned copies of the final "Operating and Maintenance Instruction Manuals" shall be prepared as follows:

##### a) Binding

The manuals shall be securely bound in A4 size heavy duty hard backed plastic/waterproof 4 ring binders with clear pockets on the spine and front cover for insertion of title slips giving Contract number, scheme, dam and equipment supplied, etc.

##### b) Separate plastic pockets

Drawing larger than A3 size, index and other title pages shall be contained in separate pockets.

##### c) Layout

Each manual shall contain sections separated by subtitle sheets in plastic pockets that are clearly and visibly marked to match the index.

#### Sections of manual

These various sections of each manual shall be arranged as follows:

- Title page
- Index
- Final acceptance certificate relating to tests carried out
- Operating instructions: These should be clear, concise and easy to follow and must include where applicable pre-start, safety and shut down procedures
- Routine maintenance and lubricating schedules
- Fault diagnosis and repair procedures
- Spare parts lists; names of suppliers/agents details
- Drawings: These shall include general arrangements, assembly drawings, parts and materials lists, etc. in A3 size. The names of suppliers/agents, original brochures and instrument literature shall also be included in the manual.

### **11. ROUTE PLANS TO BE SUBMITTED BY THE CONTRACTOR**

On completion of the work, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans as well as electronic copies, indicating cable routes in a satisfactory manner:

- (a) The exact cable routes with reference to fixed points (e.g. buildings);
- (b) The exact length of cable (HT and LT) installed between terminating points and between joints where relevant; and
- (c) The exact positions of cable joints with reference to fixed points (e.g. buildings).

Prints of the various plans for the marking up of the information required will be supplied to the contractor on request.

### **12. INTERCHANGEABILITY**

All equipment must be manufactured to such close tolerance that all similar components and spares must be fully interchangeable without any further alterations or adjustment being necessary.

### **13. WATER AND DEBRIS ACCUMULATION**

All outdoor equipment shall be designed so that water and debris will not readily accumulate to cause deterioration of equipment or an electrical discharge hazard. Where this cannot be avoided, such places shall be easily accessible for cleaning.

### **14. NAME TAGS**

Identification tags shall be attached to all equipment, sub-assemblies, components such as instruments, fuses etc., cable ends etc. The tags shall be screws on with brass or plated steel screws (no self tapping screws will be permitted). Where screws are not possible such as on the cable, other means of attachment must be submitted for approval to the Engineer.

Cables shall be tagged at end, whether the end terminates in a through joint or an end box, and at regular intervals in between as prescribed in the Detail Specification. Outdoor tags shall be of stainless steel or brass.

Tags mounted indoors or protected by an enclosure shall be made of Ivorene or similar sandwich material with black letters on a white background.

All lettering and text shall be approved by the Engineer.

Letter sizes must be compatible with the application, e.g.

For fuses, terminals, relays etc.	3 to 5 mm
For panels or cubicles	12 to 20 mm
For switchboards or MCC board names	about 50 mm

## **15. FASTENERS**

All bolts and studs shall protrude at least one thread but not more than four threads through the nut, with all washers in position.

If any bolts, nuts, screws or other fasteners are placed in a position that are not accessible to conventional tools, then the Contractor shall provide special tools. This also applies where the size or shape of the fastener is not conventional.

## **16. COLOR AND FINISHING**

All metal parts of equipment shall either be finished in baked enamel or powder coating or galvanized (depending on the circumstances) after manufacture and treatment to SABS 064.

Colors of paint to be used shall be confirmed with the Engineer prior to application.

All steel areas subjected to corrosive atmospheres, which cannot be painted and the paint work must be maintained afterwards, or specified to be galvanized must be hot dip galvanized to SABS 763. The galvanizing must be clean, smooth, of uniform thickness and unblemished. The galvanizing must not affect the mechanical properties of the covered metal.

All drilling welding, cutting and bending must be complete and the metal must be cleaned of any machining blemishes, mill scale, rust and lubricants before

galvanizing. If site trimming, drilling and cutting cannot be avoided then all such denuded surfaces must be dressed with cold galvanizing paint.

The Engineer must approve any other proposed corrosion protection before it is applied.

Galvanized areas must be kept free of lubricants.

Wire must be galvanized to SABS 935.

**17. LV CIRCUIT BREAKERS, ISOLATORS & SWITCHES**  
**MOULDED-CASE CIRCUIT BREAKERS**

This section covers single or multi-pole moulded-case circuit-breakers for use in power distribution systems, suitable for panel mounting, for rating up to 1 000 A, 600 V, 50 Hz.

The circuit breakers shall comply with SANS 156:1977.

Only circuit breakers from reputable suppliers will be accepted. The Tenderer shall provide a technical schedule of all circuit breakers with supplier brochures to the Engineer before procuring any circuit breakers.

The continuous current rating, trip rating and rupturing capacity shall be as specified.

The contacts shall be silver alloy and shall close with a high pressure wiping action.

Where specified, the circuit breaker shall be capable of accommodating factory fitted shunt trip or auxiliary contact units or similar equipment.

The operating handle shall provide clear indication of "ON", "OFF" and "TRIP" positions.

The mechanism shall be of the TRIP-FREE type preventing the unit from being held in the ON position under overload conditions.

All moulded-case circuit breakers in a particular installation shall, as far as is practical, be supplied by a single manufacturer.

The incoming terminals of single-pole miniature circuit breakers shall be suitable for connection to a common busbar.

The circuit breaker shall have a rating plate indicating the current rating, voltage rating and breaking capacity.

Extension type operating handles shall be provided for units of 600 A rating and above.

Where circuit breakers are cascaded, The Tenderer will submit proof from the supplier that the specific circuit breakers are suitable for cascading and the Tenderer shall also guarantee the proper functioning of the cascading.

### **EARTH LEAKAGE RELAYS**

Earth leakage relays shall be single or three-phase units with a sensitivity of 30 mA, with associated circuit breaker or on-load switch for use on 220/250 V single phase or 380/433 V three-phase, 50 Hz, supplies.

The units shall be suitable for installation in switchboards in clip-in trays or bolted to the chassis.

The earth leakage relay shall function on the current balance principle and shall comply with SANS 767-1:1982 as amended, and shall bear the SABS mark. Integral test facilities shall be incorporated in the unit.

Circuit-breakers with trip coils used integrally with earth leakage units (two-pole for single-phase units and three-pole for three-phase units) shall comply with SANS 156:1977.

On-load switches used integrally with earth leakage units (two-pole for single-phase units and three-pole for three-phase units) shall comply with SANS 60947-3:2006.

The fault current rating of the unit shall be 2,5 kA or 5 kA as required / specified, when tested in accordance with SANS 156:1977.

### **MIKROGAP SWITCHES**

Microgap switches shall be suitable for ratings up to 400 A at 660 V (triple-pole) and may be used for main and distribution switches in domestic applications, offices, small factories and similar applications.

Double-pole switches shall be suitable for voltages up to 250 V.

The switches shall comply with SANS 60947-3:2006.

Microgap switches may be used on AC circuits only.

Metal-clad and molded casings are acceptable.

Mikrogap switches shall be capable of carrying rated current continuously and making and breaking rated current.

Heavy, fully accessible, brass terminals with two screws each shall be provided to facilitate easy wiring. Contacts shall have large contact surfaces, made from high quality material such as solid silver.

The "ON" and "OFF" positions and the rating of the switch shall be clearly and indelibly marked.

### **TRIPLE-POLE ON-LOAD ISOLATORS**

This section covers switches suitable for panel mounting for use in power distribution systems up to 600 V, 50 Hz. Switches for motor isolation are included.

The switches shall be of the triple-pole, hand operated type complying with SANS 60947-3:2006.

The switches shall have a high speed closing and opening feature.

The switches shall be suitably rated for the continuous carrying, making and breaking of the rated current specified as well as the through-fault current capacity as specified.

To distinguish the switches from circuit breakers the operating handles shall have a distinctive colour and/or the switch shall be clearly and indelibly labelled "ISOLATOR".

### **ROTARY CAM SWITCHES**

This section covers rotary cam switches used for control functions in switchboards, motor control centers, etc. up to 600 V.

The switches shall be equal or similar to "KLOCKNER-MOELLER" type T rotary cam switches and shall comply with BS 4794, IEC 337 and VDE 0133, where applicable.

The switches shall be of the cam actuated type with two breaks per pole. The required number of poles and number of control functions shall be provided by the assembly of switching units on a common spindle.

The spindle shall be operated by a control handle suitable for the method of installation of the switch. The control handle shall be located by a keyway on the spindle.

The switches shall be provided with a suitable faceplate of non-conductive material, indicating the angle of throw and the switch positions. The latching mechanism shall ensure positive positioning in accurate relation to the positions indicated on the faceplate.

The switches shall be suitable for use with the supply voltage level. The contacts shall be silver-plated or gold laminated and shall be suitably rated for the switching function intended.

For normal applications the making capacity of the switch shall be at least three times the normal current rating. For AC4 duties (inching, reversing, plugging) the rated current of the switch shall be at least equal to the stalled rotor current of the motor.

Special contacts, e.g. late-making, early-breaking, etc. shall be inherent in the design and shall not be improvised by loading or bending contacts, etc.

Time-delay units (if required) shall be of the electronic type with an adjustable time delay on energisation from 50 to 600 s. The units shall be suitable for clip-on rail mounting and supply voltage as specified.

### **TIME SWITCHES**

All time switches shall bear the SABS mark. Only reputable manufacturing suppliers will be accepted.



Time switches shall be of single-pole type, suitable for 220/250 V systems, with contacts rated for the duty to be performed with a minimum rating of 15 A. Contacts shall be of high quality material, e.g. silver-plated or solid silver.

The time switch shall be housed in a dust-tight moulded plastic or metal case, consisting of a plastic clip-on front cover and a moulded plastic or metal base. Time switches to be used for surface mounting on walls shall be provided with a suitably positioned 20 mm conduit knock-out.

### 6.1 Analogue

The clock shall be driven by a self-starting, hysteresis synchronous motor, keeping accurate mains time. All clocks shall be controlled by an electrically wound escapement providing the main spring with a minimum of 15 hours reserve in case of a power failure. The main spring shall be kept fully wound without the use of slipping clutch devices that may wear and fall out of adjustment.

The main spring shall have a minimum of 15 hours reserve under full load and if fully discharged, shall be completely rewound within 15 minutes of the restoration of power.

An external manual bypass switch shall be provided to permit the circuit to be switched "ON" or "OFF" manually without affecting the operation of the time switch.

The time switch shall have a 24-hour dial, with day and night indication, that can be set to switch in 30-minute steps. The dial shall be fitted with 48 tappets corresponding to 48 change-over operations in a 24-hour period.

The time switch shall be fitted with a day omission dial comprising a total of 14 tappets, which can be set to switch in 12-hour steps.

### 6.2 Digital

The power supply shall be 240VAC 50Hz and allow for 85% to 110% fluctuation.

Degree of protection shall be IP66.

The timer shall have a display that can display at least 4 digits with an indicator for ON / OFF / AUTO modes.

The timer shall have an EEPROM with at least 8 different programs for both ON and OFF operations. The program memory shall not be erased when external power is lost. Memory to be retained for at least 10 years.

The interval for each program will be at least to 1 minute accuracy.

The timer shall have a battery backup that shall keep the date / time set for a duration of at least 24 hours. The battery shall be of the re-chargeable type.

The timer shall have a master reset button which can clear the EEPROM data.

## **CONTACTORS**

Contactors shall be of the open or totally enclosed, triple- or double-pole, electromechanically operated, air-break type suitable for 380/433 V or 220/250 V supplies and shall comply with SANS 60947-4-3:1999.

Contactors shall have the following characteristics:

- a) Enclosed coil easily replaceable.
- b) A permanent air gap in the magnetic circuit to prevent sticky operation.
- c) Provision for quick and simple inspection of contacts.
- d) Clearly marked main and auxiliary terminals.

All parts shall be accessible from the front.

Contactors, which are not located in switchboards, shall be housed in enclosures, which comply with IP 54 of IEC 144.

The current rating of the contactor shall be as specified for the circuit with a switching duty in accordance with the SANS 60947-4-3:1999 or IEC 158-1, utilisation category AC1 for lighting and power circuits and utilisation category AC3 for motor starting.

In addition to the required current carrying capacity and switching duty of a contactor, the contactor chosen for a particular application shall be rated for the maximum through fault current allowed by the back-up protection devices at the point where the contactor is installed. Careful co-ordination of short circuit devices shall take place.

All laminations of the magnetic system of the contactor shall be tightly clamped. Noisy contactors shall not be accepted.

Non-current-carrying metallic parts shall be solidly interconnected and a common screwed earth terminal shall be provided. The contactor shall be earthed to the switchboard earth bar.

Latched contactors shall be provided with a trip coil and a closing coil. The contactor shall remain closed after de-energising the closing coil and shall only trip on energising the trip coil.

Contactor operating coils shall have a voltage rating as required by the control circuitry and shall have limits on aeration and temperature rise as specified in Clause 7.5 and Table IV of IEC 158-1. Latched contactors shall be capable of being tripped at 50% of the rated coil voltage.

Contactors for normal/standby change-over circuits shall be electrically and mechanically interlocked. Contactors in star-delta starters shall be electrically interlocked.

Contactors with provision to add auxiliary contacts and convert auxiliary contacts on site are preferred. Contactors with permanently fixed auxiliary contacts shall have at least 1 x N/O and 1 x N/C spare auxiliary contacts in addition to the contacts specified

for control purposes and in addition to contacts required for self-holding operations or economy resistances. Where the number of auxiliary contact required is greater than the number of contacts that can be accommodated on the contactor, an auxiliary relay or additional contactor shall be provided to supply the additional contacts.

It shall be possible to replace main contacts without disconnecting wiring.

Auxiliary contacts shall be capable of making, carrying continuously and breaking 6A at 220 V AC, unity power factor for contactors used on 380-433/220-250 V systems.

Auxiliary contact functions required e.g. "lazy" contacts, late-make, late-break, make-before-break, etc. shall be inherent in the contact design. Under no circumstances may these functions be improvised by bending contacts, loading contacts, etc. These functions shall be available in all contactors.

Spare auxiliary contacts shall be wired to numbered terminal strips in the switchboard and shall appear on the switchboard drawings.

All contactors on a specific project shall be from a standard range of one single manufacturer, unless specified to the contrary.

#### **INDOOR SURGE ARRESTORS**

Surge arrestors shall comply with the requirements of SANS 61643-1:2003 or VDE 0675.

Surge arrestors shall be suitable for installation at altitudes of up to 1800m above sea level.

The unit shall be contained within a thermoplastic or cast resin housing and all internal components shall be fully sealed in.

The unit shall be supplied complete with a galvanised steel-mounting bracket for convenient mounting onto the metalwork or tray of a switchboard.

Alternatively, the unit shall be of the type, which can be mounted into the clip-tray of a switchboard.

Surge arrestors shall be provided in all cases where a switchboard is supplied directly from an overhead line.

The surge arrestor shall be of the Class I, II or III as specified complete with fuses and LED indication.

### **18. INSPECTIONS AND TESTS**

All equipment will be inspected and tested both in the factory during manufacturing and on site during installation. The Engineer will prescribe the inspections and tests required elsewhere in this specification. The Engineer will do all inspections accompanied by the Contractor and the Contractor will do all tests with the Engineer as witness.

The Engineer will require seven (7) days notification to avail himself for any test or inspection and the Contractor must arrange for the maximum number of inspections and tests to be done on the same day. The Contractor must provide all testing facilities and instruments, all equipment required for a test or inspection and all safety clothing prescribed by the Engineer.

The instruments must have valid test certificates issued by an accepted testing authority and the results of the test done must be recorded on a test certificate, of which the Engineer must receive two copies. The Engineer reserves the right to call for a calibration test on any instruments used during the test.

The cost of all tests must be included in the tender price.

## **19. PERFORMANCE TESTS**

On completion of erection and installation the Contractor must carry out the following tests, where applicable, in addition to any other tests, which may be specified elsewhere:

Before commissioning

- (a) Cable Insulation test.
- (b) Earth continuity test.
- (c) Test for correct direction of rotation of motors and reverse if necessary.
- (d) Test for correct operation of control gear, setting of overload protection equipment, etc.
- (e) The Contractor must obtain SABS test certificates for samples of insulating oil in HT switchgear and transformers. These certificates must be submitted to the Engineer.

On completion of installation and putting into proper operation all the plant and equipment, the Contractor will be required to make suitable arrangements for the testing of all plant and equipment supplied under his Contract and running the plant for at least one week, during which time he shall also train the operators in the correct running of the plant. He shall also explain the maintenance manuals to the operator during this time.

The entire cost of testing including supply of test equipment, must be borne by the Contractor and an adequate allowance for such tests must be made in the Tendered price.

## **20. DEFECTS LIABILITY PERIOD**

During this period the Contractor must visit the Site at least three times, say 1, 6 and 12 months respectively after the Commissioning Date, to inspect and check all the plant supplied and installed by him for proper operation and to adjust where necessary, and to satisfy himself that the regular maintenance of

the plant is being carried out correctly and in accordance with the written instructions supplied by him. The Contractor shall make sufficient provision in the correct price for these visits.

## **21. SPARES**

Tenderers shall submit on the appropriate Schedule in this document a list of spares and special tools which is recommended and should be kept by the Employer for maintenance of the plant. Spares which the Employer decides to order must be manufactured simultaneously with the rest of the equipment and be subjected to the same tests for dimensions, tolerance, strength, etc. All spares and special tools must be packed separately and the cases appropriately marked. All spares and special tools must be new and unused and where possible should be standard to all sections of the plant.

## **22. INTRUDER ALARM SYSTEM**

The contractor shall be responsible for the supply, installation, commissioning and testing of the Intruder Alarm System.

The detail design and installation of the Intruder Alarm System shall be installation by a reputable Sub Contractor.

The alarm system shall consist of the following basic components:

- a. Control panel complete with integrated rechargeable sealed 12V battery
- b. Remote keypad
- c. Passive Infrared detectors
- d. Sounder / Alarm
- e. Power supply
- f. Interconnecting cabling

All components shall be sourced from reliable manufacturers with a proven record of successful products and acceptable support services.

Control panel shall be housed in a vermin and insect proof enclosure with appropriate cable connections.

The keypad shall activate and de-activate the alarm by a coded numeric key on the keypad and must only be changeable by authorised personnel using a Master Code. The master codes will not be issued for use except in extreme situations where a contractor has failed to perform as contracted or requested by the Client.

Passive Infrared detectors shall have adequate detection distance for its positioning and purpose with high reliability, 40 detection zones in a standard sealed optic lens with digital signal processing and LED indicator for alarm testing which can be switched off or covered. The detectors shall be installed according to the drawings and connected to the alarm controller with pre-agreed zones.

Magnetic proximity devices (reed switches) for hinged doors shall have the magnetic portion of the device secured to top of the door with the reed switch portion secured to the top of the door frame and aligned with the magnetic portion of the device. Roller or tilt type doors will have the devices secured to the bottom of the doors.

The system shall be supplied from the essential power distribution board unless specifically otherwise directed.

The audible siren shall be mounted to the external wall and indicated on the drawing.

All cabling and cabling methods shall be in accordance with recognised best industry practice and regulations. All cables shall be installed in a 20mm conduit or trunking.

All equipment shall be fully compatible, expandable by the addition of modular units and complete with all connections between individual components to ensure correct operation of the completed system.

The equipment shall be suitable for the environment in which it is anticipated to operate. The system shall be designed and installed not to be adversely affected by external environment conditions or influences.

All detectors, control panels, equipment housings shall have factory installed with anti-tamper devices and shall be wired in such a manner that any attempt to compromise the system will give a tamper indication when the system is de-activated and a tamper alarm when the system is activated.

The contractor shall on completion of the Intruder Alarm System installation:

- a. Fully test the system in the presence of the Engineer and Client representative.
- b. Provide training on the effective use of the system to client representatives and keep an attendance register of such training which must be submitted as part of the compliance certification with the As-Built documentation.

The complete system and all equipment shall be in current production and shall carry a minimum 12-month warranty against failure or reduction in technical performance from the date of practical completion.

## **23. DISTRIBUTION TRANSFORMERS**

The transformer shall be designed and manufactured in strict accordance with the latest editions of NRS 054, SANS 780 and SANS 60076 as amended.

The transformer to be supplied shall be 500kVA, 11kV/415V Dyn11, ONAN, OCTS, sealed type.

It is required that the transformer be equipped with the following fittings:

- a. All windings shall be copper conductors
- b. Off circuit tapping switch
- c. Sealed
- d. Skid underbase
- e. Mounting holes
- f. Jacking pads
- g. All bushings (creepage 31mm/kV)
- h. Dial type thermometer
- i. Malthoid gasket

The transformer shall be designed with dimensions to fit into the designated transformer room.

All radiators are to be hot dipped galvanised to SANS 121.

### **Primary and Secondary Bushings**

The Primary and Secondary bushings shall be in strict accordance to the latest edition of SANS 1037. Unless otherwise specified, the bushings shall be of the outdoor type with a creepage of not less than 31mm/kV.

### **Dial Type Thermometer**

Dial type thermometers shall be graduated in °C for registering "top oil" temperatures. The instrument shall indicate the normal operating temperature of the transformer oil and shall furthermore be equipped with a resettable maximum temperature indicator and a pair of adjustable alarm contacts.

### **Sound Level**

During the design and manufacturing stage of all the transformers, care shall be taken to limit transformer noise and vibration to the level at present being attained in good practices. The transformer sound levels set out in Table 6 of SANS 780 may be used as a guideline.

### **Identification Tags**

All data on the identification tags shall be in the SI system and written in English.

### **Transport & Off-Loading**

Transportation, loading and off-loading shall be done by competent personnel and proof of experience shall be submitted for acceptance to the Engineer at least one month prior to planned operations.

### **Tests and Commissioning**

- a. All tests shall be arranged to represent working conditions as closely as possible and shall be carried out strictly in accordance with the standards and specifications and NRS 054, SANS 780 and SANS 60076.
- b. All type and routine tests shall be carried out before dispatch to site at the manufacturer's plant. The test results and certificates must be provided to the Engineer before dispatch.
- c. All test certificates shall be in English.
- d. Routine testing as required by BSS 171 and IEC 76 shall be carried out. The tests conducted at the factory will be witnessed by the Engineer and one other person from the Employer. Where required, provision shall be made in the tender price for return flights, transport and accommodation from Richards Bay.
- e. The Contractor shall certify that all insulating oil supplied in this contract is P.C.B. free.
- f. Original test certificates or certified copies of all tests carried out in the factory and on site shall be provided with the As-built drawings and manuals at handing-over.
- g. All test certificates must be submitted in hard copy and electronically in Adobe Acrobat – PDF format to the Engineer before hand over.
- h. Once the transformer has been electrically connected, a full on site commissioning of the new transformer, new tap change scheme and protection scheme shall be carried out.

## **Earthing**

- a. The transformer shall be connected to the substation earth as per NRS 054 earthing details for power transformers.
- b. Earthing shall be by means of 3 x 50mm flat copper tails.
- c. The neutral point of the 400V winding of the transformers shall be solidly connected by means of two 50 mm x 3 mm copper earthing straps, laid one upon the other, shall not be less than that of the connection provided at the neutral terminal of the transformer.

## **24. MEDIUM VOLTAGE PAPER INSULATED LEAD CABLES (6.6kV – 33kV)**

All medium voltage paper insulated lead sheath (PILC) copper conductor steel wire armour screened cables in the voltage range of 6.6kV to 33kV shall be manufactured in strict accordance to the latest edition of SANS 97 as amended. This shall include the conductors, insulation, screening, impregnation, metal sheaths, bedding under armouring, armouring, marking, serving and oversheath.

Where armouring is specified, three-core cables shall comprise of a single layer of galvanized steel wires. Single-core cables shall be armoured with a single layer of hard drawn aluminium wires or other non-magnetic material complying to SANS 97 as amended.

The voltage rating and size of the cable shall be as per the detail specification and drawings of which the alternating current distribution system frequency shall be 50Hz.

All routine tests as specified by SANS 97 as amended shall be carried out on production runs of the cable. Two test certificates will be provided for each cable drum delivered to site.

Wooden cables drums shall be clearly marked on both sides providing the following information:

- Voltage
- Actual length
- Conductor size
- Number of cores
- Finish
- Drum Number
- Gross Mass
- Nett Mass
- Direction of rotation
- Manufacturers project or job number
- Information required in accordance with SANS.

Both ends of the cable on the wooden drum must be sealed to prevent penetration of moisture. Both ends of the cable shall furthermore be fixed to the flange of the wooden drum to avoid loose coiling and mechanical damage. Cable drums shall be placed on firm, well-drained surfaces.



All cable connections shall be of the hexagonal crimp method using correct size and type of lugs, ferrule and matching crimp head dices.

Cable ducting and trenches shall be in accordance with SANS 2001 PD3.

The successful Tenderer shall provide any technical or additional required information as requested by the Engineer at any given time.

## **25. SPECIFICATION FOR VARIABLE FREQUENCY MOTOR CONTROLLER**

### **GENERAL**

#### **Summary**

The Variable Frequency Drive (VFD) system shall contain all components required to meet the performance, protection, safety and certification criteria of this specification.

#### **References**

- a) SANS 60146-2: Semiconductor converters - Self-commutated converters including direct d.c. converters.
- b) SANS 60204-1: Safety of machinery - Electrical equipment of machines: General requirements.
- c) SANS 61378-1: Converter transformers - Transformers for industrial applications.
- d) SANS 61800-2: Adjustable speed electrical power drive systems - General requirements: Rating specifications for low voltage adjustable frequency a.c. power drive systems.
- e) SANS 61800-5-1: Adjustable speed electrical power drive systems - Safety requirements: Electrical, thermal and energy.
- f) SANS 61800-5-3: Adjustable speed electrical power drive systems - EMC requirements and specific test methods.
- g) SANS 61800-7-1: Adjustable speed electrical power drive systems - Generic interface and use of profiles for power drive systems.

#### **Submittals**

- a) Shop drawings for approval.
  - i. Drawings: Include dimensional information and conduit routing locations
  - ii. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, etc. as required for approval
  - iii. Wiring Diagrams
    - Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, etc. as required for approval
    - Control Diagram: Include disconnect devices, pilot devices, etc
  - iv. Major components list
- b) Product Data Sheets.
  - i. VFD and Operator Interface publications
  - ii. Data sheets and publications on all major components including but not limited to the following:
    - Contactors

- Circuit breaker and fuse (power and control)
- Control power transformers
- Pilot devices
- Relays / Timers

c) Test procedures shall be per the manufacturer's standards.

### **Closeout Submittals (Operation And Maintenance Manuals)**

a) Shop drawings – Final as shipped

- i. Drawings: Include dimensional information and conduit routing locations
- ii. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, etc. as required for approval
- iii. Wiring Diagrams
  - Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, etc. as required for approval
  - Control Diagram: Include disconnect devices, pilot devices, etc
- iv. Major components list

b) Product data sheets

- i. Contactors
- ii. Circuit breaker and fuse (power and control)
- iii. Control power transformers
- iv. Pilot devices
- v. Relays/Timers

c) Test procedures shall be per the manufacturer's standards

d) Operation and Maintenance Data

- i. Service and Contact information
- ii. VFD and Operator Interface User Manuals
- iii. Troubleshooting / Service Manuals

### **Quality Assurance**

a) Qualifications

- i. Manufacturers:
  - The VFD and all associated optional equipment shall be UL listed or recognized.
  - The VFD shall contain a UL label attached on the inside of the enclosure cabinet.
- ii. Suppliers:
  - All inspection and testing procedures shall be developed and controlled under the guidelines of the Supplier's quality system and must be registered to ISO 9001 and regularly reviewed and audited by a third party registrar.
  - The VFD shall be factory pre-wired, assembled and tested as a complete package.

### **Delivery, Storage and Handling**

- a) Contractor shall coordinate the shipping of equipment with the manufacturer.
- b) Contractor shall store the equipment in a clean and dry space at an ambient temperature range of -25 °C to 55 °C.
- c) The contractor shall protect the units from dirt, water, construction debris and traffic.

### **Warranty**

- a) The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
- b) This warranty applies to variable frequency drive systems.

## **PRODUCTS**

### **Manufacturers**

- a) Reputable suppliers with local support

### **Variable Frequency Drive Unit**

- a) Features
  - i. Hardware
    - Utilize diode bridge or SCR bridge on the input rectifier
    - Utilize DC bus inductor on all six-pulse VFDs only
    - Utilize switching logic power supply operating from the DC bus
    - Incorporate phase to phase and phase to ground MOV protection on the AC input line
    - Utilize gold plated plug-in connections on printed circuit boards
    - Microprocessor based inverter logic shall be isolated from power circuits
    - Utilize latest generation IGBT inverter section
    - Inverter section shall not require commutation capacitors
    - Embedded Ethernet port for direct network cable connections
    - Battery receptacle for Lithium battery power to the Real Time Clock
    - Additional DPI port for handheld and remote HIM options
    - Dedicated Digital Input for hardware enable
    - Conformal coated printed circuit boards
    - Optional onboard 24V DC Auxiliary Control Power Supply
  - ii. Control logic
    - Ability to operate with motor disconnected
    - Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit
    - Provide multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking, and Current Limit Stop
    - Provide multiple acceleration and deceleration rates
    - Adjustable output frequency up to 650Hz

- iii. Device logic control
  - Ability to control outputs and manage status information locally within the VFD
  - Ability to function stand-alone or complimentary to supervisory control
  - Ability to speed reaction time by processing in the VFD
  - Ability to provide scaling, selector switches, or other data manipulations not already built into the VFD
  - Ability to read inputs/write outputs and exclusively control the VFD
  - Ability to provide an option for decision making if communication is lost with main controller
  - Ability to control other VFDs via a peer-to-peer EtherNet/IP network
  - Ability to write programs off-line
- iv. Motor Control Modes
  - Selectable Sensorless Vector, Flux Vector, V/Hz, Permanent Magnet Motor, and Adjustable Voltage Control modes selectable through programming
  - The drive shall be supplied with a Start-up and Auto-tune mode
  - The V/Hz mode shall be programmable for fan curve or full custom patterns
  - Capable of Open Loop V/Hz
- v. Current Limit
  - Programmable current limit from 20 to 160% of rated output current
  - Current limit shall be active for all drive states: accelerating, constant speed and decelerating
  - The drive shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit
- vi. Acceleration / Deceleration
  - Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 to 3600 seconds
  - A second set of remotely selectable accel/decel settings shall be accessible through digital inputs
- vii. Speed Profiles
  - Programming capability shall allow the user to produce speed profiles with linear acceleration/deceleration or "S Curve" profiles that provide changing accel/decel rates
  - S Curve profiles shall be adjustable
- viii. Adjustments
  - A digital interface can be used for all set-up, operation and adjustment settings
  - All adjustments shall be stored in nonvolatile memory (EEPROM)
  - No potentiometer adjustments shall be required
  - EEPROM memory for factory default values shall be provided
  - Software must be available for trending and diagnostics, as well as online and offline programming functionality

- ix. Process PID Control
  - The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions
  - The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference
  - Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator
  - Protection shall be provided for a loss of feedback or reference signal
- x. Skip Frequencies
  - Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided
  - The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed
- xi. Fault Reset / Run
  - The drive shall provide up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart
  - The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults
  - The time between restarts shall be adjustable from 0.5 seconds to 30 seconds
- xii. Run on Power Up
  - A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal
- xiii. Fault Memory
  - The last 32 fault codes shall be stored and time stamped in a fault buffer
  - Information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and twenty-seven other status conditions shall be stored
  - A power-up marker shall be provided at each power-up time to aid in analyzing fault data
  - The last 32 alarm codes shall be stored and time stamped for additional troubleshooting reference
- xiv. Overload Protection
  - The drive shall provide internal class 10 adjustable overload protection
  - Overload protection shall be speed sensitive and adjustable
  - A viewable parameter shall store the overload usage

- xv. Auto Economizer
  - An auto economizer feature shall be available to automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage
  - When the load increases, the drive shall automatically return to normal operation
  
- xvi. Terminal Blocks
  - Separate terminal blocks shall be provided for control and power wiring
  - I/O terminal blocks shall be removable with wiring in place
  
- xvii. Flying Start
  - The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default
  
- xviii. Inputs and Outputs
  - The Input / Output option modules shall consist of both analog and digital I/O
  - No jumpers or switches shall be required to configure digital inputs and outputs
  - All digital input and output functions shall be fully programmable
  - The control terminal blocks shall be rated for 115V AC
  - Inputs shall be optically isolated from the drive control logic
  - The control interface card shall provide input terminals for access to fixed drive functions that include start, stop, external fault, speed, and enable
  - The VFD shall be capable of supporting up to 10 analog inputs, 10 analog outputs, 31 digital inputs, 10 relay outputs, 10 transistor outputs, and 5 positive temperature coefficient (PTC) inputs
  - The Input / Output option modules shall have the following features:
    - Analog Inputs:
      - Quantity two (2) differentially isolated,  $\pm 10V$  (bi-polar), 88k ohm input impedance, 11 bit plus sign
      - Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect and square root
    - Analog Outputs:
      - Quantity two (2)  $\pm 10V$  (bi-polar) / 11 bit & sign,  $2k\Omega$  minimum load, 4-20 mA, 11 bit plus sign,  $400\Omega$  maximum load
      - The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power

- Programming shall be available to select either absolute or signed values of these parameters
  - Digital Inputs:
    - Quantity of six (6) digital inputs rated 24V DC/115V AC
    - All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions
  - Digital Outputs:
    - At least one (1) relay output (N.O. or N.C.)
    - For 240V AC or 24V DC, N.O. contact output ratings shall be 2 amp max., general purpose (inductive)/resistive. N.C. contact output ratings shall be 2 amp max., resistive only
    - Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready and PI Excess Error
    - Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state
    - At least one (1) transistor output
    - For 24V DC, transistor output rating shall be 1 amp max, Resistive
- xix. Reference Signals
  - The drive shall be capable of using the following input reference signals:
    - Analog inputs
    - Preset speeds
    - Remote potentiometer
    - Digital MOP
    - Human Interface Module
    - Communication modules
- xx. Loss of Reference
  - The drive shall be capable of sensing reference loss conditions
  - In the event of loss of the reference signal, the drive shall be user programmable to the following:
    - Fault the drive and coast to stop
    - Issue a minor fault - allows the drive to continue running while some types of faults are present
    - Alarm and maintain last reference
  - When using a communications network to control the drive, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:
    - Fault
    - Stop
    - Zero data
    - Hold last data
    - Send fault configuration
- xxi. Metering

- At a minimum, the following parameters shall be accessible through the Human Interface Module:
  - Output Current in Amps
  - Output Voltage in Volts
  - Output Power in kW
  - Elapsed MWh
  - DC Bus Voltage
  - Frequency
  - Heatsink Temperature
  - Last eight (32) faults
  - Elapsed Run Time
  - IGBT Temperature
  
- xxii. Faults
  - At a minimum, the following faults shall be accessible through the Human Interface Module:
    - Power Loss
    - Undervoltage
    - Overvoltage
    - Motor Overload
    - Heat Sink Over-temperature
    - Maximum Retries
    - Phase to Phase and Phase to Ground Faults
  
- xxiii. Predictive Diagnostics
  - At a minimum, the following predictive diagnostic features shall be provided:
    - Relay Output Life Cycles based on load type and amps
    - Hours of Fan Life based on load and ambient temperature
    - Motor Bearing life based on expected hours of use
    - Motor Lubrication schedule based on hours of use
    - Machine Bearing life based on expected hours of use
  
- xxiv. Real-Time Clock
  - Shall be capable of providing time stamped events
  - Shall have the ability to be set locally or via a remote controller
  - Shall provide the ability to be programmable for month, day, year and local time zones in HH:MM:SS

## **VFD Packaged System**

### **a) Features**

- i. Ratings
  - Voltage
    - Capable of accepting nominal plant power of 480V AC at 50Hz
    - The supply input voltage tolerance shall be  $\pm 10\%$  of nominal line voltage
  - Displacement power factor
    - Six-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of



- 0.95 or better at rated load and nominal line voltage, over the entire speed range
    - Eighteen-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.98 or better at rated load and nominal line voltage, over the entire speed range.
  - Efficiency
    - A minimum of 96.5% (+/- 1%) at 100% speed and 100% motor load at nominal line voltage
    - Control power supplies, control circuits, and cooling fans shall be included in all loss calculations
  - Operating ambient temperature range without derating: 0 °C to 40 °C
  - Operating relative humidity range shall be 5% to 95% non-condensing
  - Operating elevation shall be up to 1000 Meters without derating
- ii. Sizing
- Systems rated at Normal Duty loads shall provide 110% overload capability for up to one minute and 150% for up to 3 seconds
  - Systems rated at Heavy Duty loads shall provide 150% overload capability for up to one minute and 180% for up to 3 seconds
- iii. Auto Reset/Run
- For faults other than those caused by a loss of power or any other non-critical fault, the drive system shall provide a means to automatically clear the fault and resume operation
- iv. Ride-through
- The VFD system shall attempt to ride through power dips up to 20% of nominal. The duration of ride-through shall be inversely proportional to load. For outages greater than 20%, the drive shall stop the motor and issue a power loss alarm signal to a process controller, which may be forwarded to an external alarm signaling device
- v. Run on power up
- The VFD system shall provide circuitry to allow for remote restart of equipment after a power outage. Unless indicated in the contact drawings, faults due to power outages shall be remotely resettable. The VFD system shall indicate a loss of power to a process controller, which may be forwarded to an external alarm signaling device. Upon indication of power restoration the process controller will attempt to clear any faults and issue a run command, if desired
- vi. Communications
- VFD shall provide an embedded EtherNet/IP port
  - VFD shall be capable of communicating on multiple networks
  - VFD shall be capable of supporting the following network options:
    - DeviceNet
    - EtherNet/IP
    - ControlNet Coax
    - ControlNet Fiber
    - Interbus

- CANopen
  - Modbus/TCP
  - Modbus RTU
  - Profibus DP
  - RS-485 DF1
  - RS-485 HVAC
  - Remote I/O
- vii. Enclosure Door Mounted Human Interface Module (HIM)
  - VFD shall provide a HIM with integral LCD display, operating keys and programming keys
  - An enclosure door-mounted HIM, rated NEMA/UL Type 1 or NEMA/UL Type 4/12, shall be provided
  - An optional VFD-mounted HIM, rated NEMA/UL Type 1, may be provided and shall be capable of connecting via a separate cable for use as a handheld terminal
  - The HIM shall have the following features:
    - A seven (7) line by twenty-one (21) character backlit LCD display with graphics capability
    - Shall indicate drive operating conditions, adjustments and fault indications
    - Shall be configured to display in the following three distinct zones:
      - The top zone shall display the status of direction, drive condition, fault /alarm conditions and Auto / Manual mode
      - The middle zone shall display drive output frequency
      - The bottom zone shall be configurable as a display for either programming menus / information or as a two-line user display for two additional values utilizing scaled units
    - Shall provide digital speed control
    - The keypad shall include programming keys, drive operating keys (Start, Stop, Direction, Jog and Speed Control), and numeric keys for direct entry
- b) Enclosures
  - i. Shall be rated NEMA/UL Type (1) or (12)
  - ii. Shall be painted per the manufacturer's standard
  - iii. Shall provide entry and exit locations for power cables
  - iv. Shall contain a label for UL508
  - v. The drive system nameplate shall be marked with system Short Circuit Current Rating (SCCR)
- c) Drive enclosures input disconnect
  - i. Provide an enclosure door interlocked disconnect with fusing, or disconnect, or thermal magnet circuit breaker, or motor circuit protector
  - ii. Operator Handles
    - Provide externally operated main disconnect handle
    - Handles shall be lockable with up to three lockout / tagout padlock positions

- d) Branch circuit protection
  - i. Input fusing, motor circuit protector (MCP), or inverse time circuit breaker shall be provided
- e) Bypass
  - i. Manual Bypass Option:
    - Shall provide a means to manually switch a single motor from drive control to bypass (across the line operation)
    - Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked
    - Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation
    - Provide a Class 10 overload for motor protection while operating in the bypass mode
  - ii. Automatic Bypass Option:
    - Shall provide a means to automatically (upon a drive fault) switch a single motor from drive control to bypass (across the line operation)
    - Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked
    - Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation
    - Shall provide a Auto Bypass/Off/On selector switch, mounted on the enclosure door, for selection of Auto Bypass mode of operation
    - Provide a Class 10 overload for motor protection while operating in the bypass mode
  - iii. SMC Flex / Pump Option Bypass:
    - Shall provide a means to switch a single motor from drive control to bypass via a soft start (across the line operation)
    - Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked
    - Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation
    - Provide a Class 20/30 overload for motor protection while operating in the bypass mode
    - Shall provide a door-mounted HIM
    - Shall provide bypass fusing on input of RVSS bypass
- f) Control power transformer
  - i. Provide a control power transformer mounted and wired inside of the drive system enclosure
  - ii. The transformer shall be rated for the VFD power requirements
- g) Harmonic mitigation techniques
  - i. Drive Input Line Reactor
    - Provide a drive input line reactor mounted within the drive system enclosure for drives that are less than 100 horsepower
    - The line reactor shall meet the following specifications:

- The construction shall be iron core with an impedance of 3 or 5 percent
  - The winding shall be copper or aluminum wound
  - The insulation shall be Class H with a 115 °C rise over 50 °C ambient
  - The unit shall be rated for system voltage, ampacity, and frequency
- ii. 18-pulse VFD (greater than 100 horsepower) with Auto Transformer
  - Provide VFD with a single 18-pulse converter
    - The converter bridge shall be a parallel 18-pulse diode bridge assembly with DC snubber (board or assembly). Diodes shall be rated (devices) with a blocking voltage minimum of 1600V
    - The converter shall incorporate 1000V three phase block style MOV protection rated 85 °C
  - The drive system shall incorporate an 18-pulse phase shifting auto transformer with line reactor as an assembly. The 18-pulse assembly shall be wired into the VFD System enclosure where possible. The auto transformer shall have the following minimum features:
    - Rated for input rectifier duty and matched to VFD overload capability
    - Copper or aluminum wound
    - Class 180 or 220 insulation
    - Power factor of 0.98 or better at rated load and nominal line voltage
    - Open core construction
    - One normally closed thermoswitch contact in each coil wired into a VFD control circuit
  - The drive system shall be compliant with IEEE519-1992 standards at the input VFD terminals based upon the input power phase imbalance within 0.5% of nominal line voltage and under full VFD output current ratings
- h) Auxiliary relays
  - i. Provide relays for Drive Alarm, Drive Fault, Drive Run, and System Status Faults (as required)
  - ii. The relays shall be Allen-Bradley 700-HC (2 N.O. & 2 N.C.). The relay contacts shall be rated for 115V AC/30V DC, 5.0 amp resistive, 2.5 amp inductive
- i) Control interface
  - i. The control terminals shall be rated for 115V AC
  - ii. The control interface shall provide input terminals for access to VFD functions that include start, stop, external fault, speed select, and enable, as required
- j) Motor heater control
  - i. The drive system shall provide the drive control circuitry to energize an existing motor heater whenever the motor is not running via remote power

- ii. The heater control shall be interlocked with the drive and/or bypass and shall be energized whenever the motor is not running. The source shall be remotely provided
  - iii. A pilot light with LED shall be mounted on the drive system enclosure door for indication of Motor Heater On
- k) Hand/Off/Auto selector switch
  - i. Provide a "Hand/Off/Auto" selector switch, mounted on the enclosure door
  - ii. The "Hand/Off/Auto" selector switch shall start the drive in the "Hand" mode and stop the drive in the "Off" mode
  - iii. In the "Auto" mode the drive shall be started and stopped from a remote "RUN" contact
  - iv. In all modes, Auxiliary and Enable inputs to the drive control interface board must be present before the drive will start
  - v. When a HIM is present, the stop function shall always be available to stop the drive regardless of the selected mode ("Hand" or "Auto"). The HIM will be non-functional (except for the display and programming) when the switch is in "Off" mode. The HIM shall stop the drive if the switch is in the "Auto" mode with the remote start contact initiated
  - vi. The drive speed reference shall be controlled from the HIM, unless a separate doormounted potentiometer is provided, when in "Hand" mode (factory default setting)
  - vii. The drive speed reference shall be controlled by a remote 4...20 mA input when in "Auto" mode
  - viii. The device shall be mounted on the drive system enclosure door
- l) Drive disable mushroom push button
  - i. Provide a maintained mushroom style push button, mounted on the enclosure door that when pushed, will open the drive enable input
  - ii. The device shall be mounted on the drive system enclosure door
- m) Pilot lights
  - i. Provide LED pilot lights, mounted on the enclosure door, for indication of the following status:
    - Run
    - Drive Fault
    - Control Power On
    - Motor Fault
  - ii. The device shall be mounted on the drive system enclosure door
- n) Motor run time meter
  - i. Provide a digital, non-resettable, door-mounted elapsed time meter
  - ii. The meter shall be electrically interlocked with the Drive Run relay and Bypass contactor to indicate actual motor operating hours

## **EXECUTION**

### **Examination**

- a) Verify that location is ready to receive equipment

- b) Verify that the building environment can be maintained within the service conditions required by the manufacturer of the VFD

### **Installation**

- a) Installation shall be in compliance with all manufacturer requirements, instructions and drawings

### **Start-up service**

- a) At a minimum, the start-up service shall include:
  - i. Perform pre-Power Check
  - ii. Megger Motor Resistances: Phase-to-Phase and Phase-to-Ground
  - iii. Verify system grounding per manufacturer's specifications
  - iv. Verify power and signal grounds
  - v. Check connections
  - vi. Check environment
- b) Drive Power-up and Commissioning:
  - i. Measure Incoming Power Phase-to-Phase and Phase-to-Ground
  - ii. Measure DC Bus Voltage
  - iii. Measure AC Current Unloaded and Loaded
  - iv. Measure Output Voltage Phase-to-Phase and Phase-to-Ground
  - v. Verify input reference signal
- c) All measurements shall be recorded
- d) Drive shall be tuned for system operation
- e) Drive parameter listing shall be provided

### **Training**

- a) Manufacturer to provide on-site instruction
- b) The instruction shall include the operational and maintenance requirements of the variable frequency drive
- c) The basis of the training shall be the variable frequency drive, the engineered drawings and the user manual. At a minimum, the training shall:
  - i. Review the engineered drawings identifying the components shown on the drawings
  - ii. Review starting / stopping and speed control options for the controller
  - iii. Review operation of the Human Interface Module for programming and monitoring of the variable frequency drive
  - iv. Review the maintenance requirements of the variable frequency drive
  - v. Review safety concerns with operating the variable frequency drive

## **26. LOW VOLTAGE ELECTRIC MOTORS**

All electric motors shall fully comply with the following relevant standards:

SABS 1189, SABS 948, BS 4999 and BS 5000 or IEC 34 and IEC 72.

When ordering electric motors for a specific application the Contractor shall ensure that the orientation of the terminal boxes on the motors are suitable for vertical cable entry from below with the motor installed in position and provided with suitable cable entry holes to accommodate the specific cable glands (Holes to be tapped in case of cast boxes).

All three phase low voltage motors shall be of the squirrel cage induction type.

Unless a power rating for a motor is specified, all motors shall be rated for continuous operation (Duty Class S1) at an output of 15% in excess of the maximum power requirements of the associated driven plant when operating at the maximum specified duty at an ambient temperature of 40 °C and an altitude of 1300 m.a.s.l. The minimum class of insulation shall be class F according to SABS 948.

The motors shall be of a recommended standard rating and if the requirements given above fall between two standard ratings, motors of the next higher standard rating must be provided.

The motors shall be either fixed speed, dual speed or speed control units, as required. All motors shall, where possible, be from the same manufacturer to prevent stocking a variety of spares.

The motor speed shall match that of the driven plant but shall not be in excess of 1500 rpm unless otherwise required.

All motors shall be suitable for "direct-on-line" starting unless "star/delta" or other starting methods are prescribed by the supply authority.

The maximum starting current of these motors under locked rotor conditions with specified voltage applied to the motor terminals shall not exceed six times normal full load current.

The motors shall be suitably rated for 15 starts per hour at an ambient temperature of 40 °C and an altitude of 1300 m.a.s.l.

All submersible motors shall be of the IP 68 type and all other motors shall be of the IP 55 IC 01 41 type.

Motors rated at 22kW and above shall each be equipped with three thermostat with a positive temperature coefficient of resistance embedded in the overhang of the stator windings (one per phase) to facilitate the operation of protective devices on overheating of the relevant motor. These thermostat and heaters shall be wired to suitable separate terminal boxes on the outside of the motor.

All submersible motors shall be supplied complete with adequately rated underwater cables factory connected onto the motor, for power supply as well as sensing where applicable. These cables shall be sufficient length to reach the connection points, i.e. the nearest readily accessible dry area, without straining the cable and shall have watertight connections onto the motor. Exact lengths of cable required shall be verified on site before finalizing orders.

Motor selection for frequency converter speed applications shall allow for the following:

- (a) The rated motor power shall be in excess of 35% of the maximum power required by the driven machine and shall have the written consent of the manufacturer that the motor rating will suit the application. Motors shall be suitable for continuous operation over the variable speed range of between 50% and 100% of the specified motor speed.
- (b) The ratio between the maximum torque and the rated torque of the motor must be less than 2.5.
- (c) The method of cooling of the motor shall be efficient for continuous operation over the abovementioned speed range of the motor and shall either be self-ventilated or separately ventilated type of motor.
- (d) The rated speed of the motor shall be as close as possible to the nominal speed of the driven plant.
- (e) Four-pole motors will be preferred but more pole motors will be acceptable if direct-on-line starting will adversely be affected by the four-pole motor.
- (f) Motor winding insulation must be compatible with frequency converter variable speed operation.
- (g) Noise levels of the motor shall not exceed the value given in SABS 948 appropriated to the rated output and speed range of the motor.
- (h) Variation levels of the motor shall not exceed acceptable vibration amplitudes through the speed range when operating in conjunction with frequency converter variable speed applications.

Dual speed motors shall have separate windings each with differing number of poles. Motor ventilation shall be efficient at the required load torque of the driven plant at both speed settings.

Vibration and noise levels shall not exceed values given in SABS 948 appropriated to the rated output and speed of the motor.

Each motor shall be provided with a grade 304 stainless steel or brass nameplate.

**The following information shall be submitted with each Tender** in respect of all the three phase low voltage motors offered:

- (a) Two copies of an outline drawing showing main overall dimensions.
- (b) Guaranteed continuous rating under site conditions.



- (c) Guaranteed number of starts per hour at an ambient temperature of 40 °C.
- (d) Guaranteed maximum starting current under locked rotor conditions with the normal voltage connected to the incoming terminals.
- (e) Guaranteed efficiency of the motor at 50% and 100% normal full load with motor windings connected in delta.
- (f) Guaranteed power factor of the motor at 50% and 100% normal full load with the motor windings connected in delta.
- (g) The mass of each motor.
- (h) Copies of SABS test reports if these motors carry the SABS mark.

The following tests shall be carried out at the Manufacturer's Works on these motors after manufacture:

- (a) If the motor do not carry the SABS mark, performance and efficiency tests shall be carried out to prove the guaranteed information submitted with the successful Tender. These tests must be performed by the South African Bureau of Standards and a certificate of approval must be submitted stating that the motors comply with the requirements of SABS 948.
- (b) All motors shall be subjected to routine tests as prescribed in Appendix D to SABS 948.

The manufacturer **must submit** to the Engineer two certified copies of test certificates reflecting the conditions and results of the tests carried out on each motor.

After installation on Site, but prior to commissioning, the following test shall be carried out:

- (a) Ensure that the bearings are properly lubricated.
- (b) Ensure that all power and earth connections are properly made.
- (c) Check all ventilation openings for obstruction.
- (d) Measure the insulation resistance between phases mutually and between each phase and earth to ensure that the windings are dry.
- (e) Spin the motor by briefly switching the supply on to check the correctness of the direction of rotation. After the motor has been started the following shall be observed:
- (f) Smoothness and period of acceleration up to maximum speed.
- (g) Noise, vibration and temperatures of motor and bearings.

Seal leak detectors for submersible pump and motor sets

All submersible pump motor sets shall be provided complete with humidity sensors to facilitate seal leak detection as well as an underwater cable connection for each detector as specified for submersible motors.

## **27. ELECTRICAL ACTUATORS FOR VALVE CONTROL**

Electrical actuator motors for valve and sluice gate control shall be rated in excess of 50% of the maximum power required to open and close the valve or sluice gate.

The actuators shall be complete with continuous local position indication providing a 4-20mA signal for remote position indication and suitable for remote control by means of a 4-20ma signal if required as indicated in the detail technical specification.

Electric actuators for plug valve control shall be suitable for valve position selection by means of a local as well as remote non-maintainable signal and limit switches built into the actuator to facilitate positive positioning of the plug valve in any of the positions selected. The actuator shall be provided with local valve position indication as well as facilities for remote indication.

NB: Gears of synthetic materials will not be acceptable in these units.

## **28. Programmable Logic Controller**

This Specification defines the requirements for the design, construction, supply, delivery, programming, configuration, testing, installation and commissioning of Programmable Logic Controllers (PLC) as well as their interfaces to equipment and instrumentation such as HMI and Supervisory Control and Data Acquisition (SCADA).

Applicable standards are:

- IEC 61131 (Parts 1-8) Programmable Logic Controllers
- IEC 61499-1 Function blocks
- Occupational Health and Safety Act of 1993

*Hardware: General*

PLC and PCS hardware shall be of a recognised reputable type, approved by the Engineer; from a major international supplier, with a comprehensive and established South African based technical and logistical support operation.

The PLC / PCS shall comprise of the following:

- a) Central Processing Unit (CPU)
- b) dedicated Power Supply Unit (PSU)
- c) digital and analogue hard-wired input / output (I/O) cards
- d) remotely connected digital and analogue I/O cards (if and where specified)
- e) data communications cards and/or ports on the CPU

The PLC / PCS shall interface with other devices and systems as follows:

- a) control circuit components, equipment, instrumentation and plant devices
- b) industrial Ethernet communications to Level 2 visualization and operation equipment
- c) an open fieldbus communications to Level 0 equipment (if and where specified)
- d) other process controllers (e.g. variable speed drives, electronic controllers, dedicated equipment control systems or other PLCs)
- e) remote terminal units (RTUs), and telemetry systems

The hardwired I/O and network communication cards, together with the processor and power supply cards, shall all be housed in racks of one or more chassis units. Where chassis units are provided with spare slots for hardware expansion, these shall be protected by proprietary blanking plates. Any spare communications ports shall likewise be protected with dust covers or plugs.

The processor memory shall be sufficient to operate the as-installed programme with 20% spare capacity, and the installed I/O cards shall be sufficient to operate the as-installed programme plus 10% spare capacity of each I/O type used.

Once the program has been entered into the processor memory, it shall remain resident and unaltered, including under power down conditions, until it is deliberately modified by use of a programming unit. The processor shall contain a readily replaceable memory backup battery and indication of battery status.

The PLC / PCS shall be programmable using a standard portable notebook computer with suitable software as its programming device. The PLC / PCS shall be provided with all interfacing hardware and software; ready loaded and configured, to permit full access to the programme (including re-programming) via the standard serial communications port of a PC.

The processor shall incorporate the following indications as a minimum:

- a) running
- b) processor watchdog healthy
- c) and I/O manipulation status

The processor watchdog signal shall be configured to raise an alarm upon CPU failure which shall be displayed on the associated HMI / SCADA or telemetry (where applicable). The PLC / PCS CPU shall allow programme changes "on the fly". In other words, minor changes to the control logic shall not require the CPU to be reset thereby causing the plant or works to be shut-down.

The PLC range shall offer various CPU memory, capacity, speed and I/O count sizes to suit the plant or works including "hot-standby" / redundant CPU possibilities all as called for in the Project Specification.

#### *Hardware: PLC I/O*

I/O cards shall be provided with voltages and signal loop currents (or voltages) as called for in the Project Specification.

The I/O cards shall be keyed or otherwise configured to prevent maloperation if placed in the wrong position in a PLC / PCS rack, and each I/O card shall be

capable of being individually removed or replaced without disturbing the wiring to adjacent cards.

Each I/O card shall be provided with an individually fused power supply feed, and an I/O card malfunction or power supply failure shall be recognised by the PLC hardware and software and raise an alarm on the CPU, relevant HMI or SCADA.

Conventional PLC I/O cards shall be limited to a maximum of 16 channels per card, and each I/O point shall be provided with an I/O status indicator. The use of 32 channel digital input cards will be subject to the card's cable termination concept and approval of the Engineer.

The I/O wiring shall be segregated between input and output cards, and all I/O (including spare I/O) shall be loomed from the PLC card down to knife-edge ('swinging blade') disconnect type marshalling terminals from where these shall be marshalled to the field wiring. Where available, proprietary "looms" (connector / termination assemblies) shall be used to connect between the I/O card and the marshalling section.

Where it is necessary to maximise plant availability; e.g. with a duty / standby plant configuration, and more than one input card is available, the duty plant inputs shall be assigned to a separate card from the standby plant inputs. The same shall apply to the assignment of outputs to the plant.

Where mission critical applications require redundant IO these shall be accommodated by the choice of the PLC and appropriate CPU, and the circuitry shall be equally segregated as described above.

#### *Hardware: PLC Remote I/O*

Where Remote I/O is called for in the Project Specification the I/O cards shall preferably be of the same type and range as those offered for the main PLC with centralised I/O.

Data communications from the PLC / PCS to Remote I/O shall be via a dedicated data communications medium and protocol specifically design for Remote I/O and the Data Communications medium from the PLC to HMI, SCADA or Field instrumentation may not be used for this purpose.

#### *Hardware: PLC I/O circuits*

Digital input circuits, whether hard-wired to conventional I/O or connected via remote I/O, shall consist of volt-free contacts from control circuit components, equipment, and plant devices. These circuits shall be energised from the PLC end, and shall be "fail safe" in design, i.e. contacts shall open on PLC failure or alarm conditions and normal plant status conditions shall provide normally open contacts.

Digital outputs shall be provided with integral changeover relay contact suitably rated for the required switching duty and shall be provided with suppression devices when switching DC loads. Alternatively, transistor output cards may be used in which case suitably rated interposing relays shall be included for each digital output in the Assembly.

Analogue input and output cards be capable of a minimum analogue to digital conversion resolution of 12 bits and shall include open circuit and short circuit monitoring.

Analogue inputs shall be powered either from the field instrument they connect to (where the instrument is separately powered with 230 V AC or 24 V DC), or from a fused 24 V DC power supply at the PLC side where the instrument is loop powered. Each instrument loop circuit shall be designed for a loop impedance not exceeding 250 ohms.

Analogue outputs shall be powered from a fused 24 V DC supply via the analogue output card, and shall be able to drive into an impedance of up to 750 ohms. Analogue outputs shall provide a direct connection to the load (i.e. the whole primary loop).

Digital Inputs and Outputs shall be galvanically isolated in groups on no more than eight.

Analog Inputs and Outputs shall be individually galvanically isolated.

#### *Software: General*

PLC application software shall be written to meet the requirements of the plant or works Control Philosophy and the PLC processor shall be capable of being programmed using ladder logic, control system flow chart or statement list in accordance with SANS 61131-3. The software shall be laid out in a modular manner and structured in program and function blocks, such that similar tasks are of a similar structure and functionality to facilitate efficiency and ease of programming and maintenance.

Standard software Function Blocks shall be built up using the Client's standard suite of function (when available), or the PLC manufacturer's recommended standard Function Blocks.

Each line of code shall be fully documented and annotated, using mnemonics directly related to the associated item of plant. Function blocks shall be provided with descriptors e.g. analogue handling block, PID block, motor start block, etc. All data areas used shall be documented and a full memory map provided.

The PLC application software and operating data shall be held in appropriate memory locations; secured against power failure and shall be provided with the facility for password protection against unauthorised access.

A sudden interruption of the power supply to the PLC shall result in the programme failing to a safe condition, and the PLC system shall not require manual attendance following a supply failure or restoration. The software control routines shall provide safe power-on and power off sequences to ensure that the process is always in a safe and controlled condition.

Where a PLC forms part of a networked plant control system, it shall have a standalone operating capability such that in the event of a network failure it shall be able to continue monitoring and controlling its associated plant; using any set-points

and parameters available prior to any network failure, including the ability for operators to change duties, monitor alarms, etc. via any associated local operator interface such as an HMI as called for in the Project Specification.

All software necessary to programme, operate, or maintain any equipment or component within the Assembly, including any network connectivity software, shall be provided, and shall be licensed in the Client's name.

#### *Software: PLC software structure*

The PLC application software controlling the plant shall be structured so as to provide, as a minimum requirement, the software routines for each key functional area as detailed below:

##### Plant initiation

This key functional area shall contain routines developed to control plant start-up and restart, plant reset, and phased plant starting, after a power supply re-energisation; including a return to the control mode selected prior to powering down. Plant trips, when reset by the operator, shall reinstate normal automatic operation without the need for further operator intervention.

##### Plant automatic control

This key functional area shall contain all software necessary to provide automatic control of the plant process(es) and shall include alarm generation and exception handling, together with the starting-up and scheduling of any associated standby plant.

##### Plant shutdown

This key functional area shall contain routines developed to control plant shutdown, including under operational, power failure, and unplanned / emergency conditions.

##### Operator and remote interface(s)

This key functional area shall contain all software necessary to provide interfaces to the local HMI, and to SCADA or telemetry (where required). All digital points to / from the HMI, to / from the SCADA system, or to the telemetry system, shall be held within separate integer registers or memory areas, and all analogue points to / from the HMI, to / from the SCADA system, or to the telemetry system, shall be held within separate floating point registers or memory areas.

##### Interlocks

The PLC / PCS programming shall provide for two types of interlocks namely process and safety interlocks.

###### a) Process Interlocks:

- i) These are dictated by the physical flow of material through the plant and are typically programmed between motor, valve, actuator and controller software blocks.
- ii) Equipment being prevented from start-up by a process interlock shall clearly indicate this condition on the SCADA system.

###### b) Safety Interlocks:

- i) These are typically hardwired into the motor, valve or actuators control circuit, latched and reset in the MCC whilst monitored by the PLC and shall indicate as faults on the HMI or SCADA system.

*Software: PLC software control routines*

The development of the PLC application software shall include as a minimum, the routines as detailed below.

For all plant items, the selection of automatic control via the auto-available input signal shall be recognised by the PLC and displayed at the associated HMI, SCADA (and where appropriate, at a remote telemetry SCADA terminal). When an item of plant is selected for hand control, facilities for the rescheduling of any standby plant shall be provided.

Direct operator control via the PLC of each plant item (where that plant item is selected for automatic control) shall be provided from the associated HMI (and where appropriate, at a remote SCADA terminal). The selection of direct control shall leave the plant item state unchanged until a new control command is issued, at which time the rescheduling of any standby plant item shall take place.

Where duty / standby (or assist) plant is provided, the software control regime shall provide scheduling of these plant items through rotation of the duty / standby (or assist) functions. The duty rotation shall be dependent either upon the hours run for that item of plant selected for duty, or upon the issue of a manual duty rotate command. The required duty hours (between zero and 999) shall be entered by the operator at the associated HMI (or where appropriate, at a remote SCADA terminal). An entered value of zero duty hours shall inhibit the duty function within the associated plant item's duty rotation cycle. For those areas of plant where an apportioned wear pattern is required, an operator warning message shall be issued if the duty cycle hours entered for each item does not provide an uneven wear pattern. Where the operation of plant items is determined by upper and lower process limits, the automatic changeover of duty status shall be delayed until an appropriate point within the operating cycle.

*Software: PLC monitoring software*

Monitoring software shall be provided to confirm the running of plant items in response to any start command, and shall use separately configurable time delays for each item of plant. If an item of plant fails to start within its configured time, the item of plant shall be deemed to have failed and an alarm shall be generated. The monitoring software shall also provide the accumulated run hours for all motor driven and proprietary items of plant.

When an item of plant fails, the control system shall automatically reschedule any standby plant item in place of the duty plant, and execute the appropriate shut-down sequence for the failed plant item. The standby plant item shall continue to operate in place of the failed duty plant item, until the plant item failure condition has been reset by the operator. Once the plant item failure condition has been cleared by the operator, the restored duty plant item shall operate and the standby plant item shall return to its standby status.

Monitoring software shall be provided to confirm the position of all valve(s) and penstock(s) in response to any open or close request, and shall use separately configurable time delays for each valve or penstock. If a valve or penstock fails to



achieve the requested position, within its configured time, the valve or penstock shall be deemed to have failed and an alarm shall be generated.

Monitoring software shall be provided for the associated HMI, SCADA (and where appropriate, at a remote telemetry SCADA terminal), to generate operator message prompts where there is a need to manually exercise control over items of plant which remain in a static operating position or dormant state for extended periods of time. Where applicable, such plant will be identified in the Project Specification and / or Control Philosophy.

The PLC application software shall check all analogue input signals for validity. An analogue input signal shall be converted to a digital value at the I/O card, i.e. the current loop signal shall be converted to 0 - 4095 bits. The PLC software shall periodically check for a conversion which indicates under-range or over-range. If either of these two states is set, the software shall initiate an 'out of range' alarm.

In order to prevent the operator being presented with excessive spurious alarm messages, the PLC application software shall include routines, that on the initiation of a specific event alarm, shall prevent cascade alarms from being raised i.e. a 'mains failure' alarm will mask the 'not available' alarms from individual motor starters, valves, etc.

The PLC application software shall generate totalized quantities for individual items of equipment and instrumentation, whereby a pulsed digital signal shall be received and a set amount added to a totalizer register. The set amount used to increment the totalizer shall be adjustable and stored in a register. The totalizer shall be capable of the range 0 to 999999, and the totalizer shall automatically rolling over to zero when the maximum figure has been reached. The totalizer figures shall be displayed on the associated HMI display, SCADA (and where appropriate, at a remote telemetry SCADA terminal).

#### *Functional Specification*

Prior to programming the PLC, the Contractor shall provide the Engineer with a Control System Functional Design Specification describing how the Plant or Works Control Philosophy will be implemented in the Control System Software (PLC).

The Functional Specification shall include at least the following:

- a) Control System Overview
- b) Final Approved plant or works Control Philosophy
- c) Equipment, Motor and Instrumentation Lists
- d) PLC IO lists
- e) List of Interlock signals
- f) List of Alarms
- g) List of all PID control Loops
- h) List of all Sequence and / or Duty/ Standby control
- i) Detail description of PLC configuration and software building blocks (Function Blocks)
- j) Function Block Parameters tables

The Functional Specification shall be issued to the Engineer for approval.



On completion of the contract the Functional Specification shall be converted into a Control System Functional Description and incorporated into the Operations and Maintenance Manuals.

## **29. MULTICORE CABLES AND EARTHWIRES**

### *Low and Medium Voltage Cables*

All multi core-cables used on this contract shall comply with the requirements laid down in SABS 1507 – 1990 as amended to date for PVC PVC SWA PVC cables with copper conductors and insulated for 500/3300 volt grade.

Cables for status and analog signals shall consist of the requisite size and number of copper twisted pairs, individually and overall screened, PVC sheathed, steel wire armored and PVC covered, complying with the requirements of SABS 1507 where applicable.

Cable and earth wires for a specific application shall be selected strictly in accordance with the requirements laid down in SABS 0142 in respect of current rating and voltage drop. Where practicable the earth continuity conductor shall form an integral part of the cable.

### *Fiber Optic Cables*

The cable shall have a GRP centre strengthening member, color coded fibers in gel filled loose tubes, surrounded by interstitial water blocking gel, aramid strengthening member, paper binder, polyethylene bedding sheath, plastic coated corrugated steel type armor and polyethylene water resistant outer sheath.

The steel armor shall be polymer coated and bonded to the sheath.

The fiber shall be manufactured from pure silica cladding, minimally doped with Phosphorous and Fluorine to achieve a matched cladding and a graded Germanium doped silica core. The primary coating shall consist of two layers of UV curable acryline resin.

Attenuation uniformity shall be checked at both 850nm and 1300nm with a pulse width not exceeding 1 micro's. Fibers with points or steps of discontinuity greater than 0,3dB shall be rejected. For fiber lengths in excess of 1km the attenuation coefficient over the length of fiber shall not vary by more than 0,3dB/km.

The fiber shall withstand a mechanical strain of at least 8N for 1 second and shall have an attenuation increase of less than 0.005dB/turn under a bend resistance test using 100 turns around a 75mm diameter mandrel.

## **30. JOINTING OF CABLES**

Joints will only be allowed where more than one full drum length of cable is necessary to complete a specific circuit and must be restricted to the absolute minimum. All joints shall be made to the best practice by competent cable jointers using first class material. The contractor shall maintain the electrical continuity of the armoring in an approved manner at all straight through joints.

#### *Low voltage power and control cables*

Joints shall only be allowed where more than one drum length of cable is necessary to complete a specific circuit.

The jointing kit shall be equal and similar to Raychem heat-shrinkable joints for cables up to 1 kV.

The joints shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

### **31. TERMINATION OF MULTICORE CABLES**

#### *Low voltage multi core power and control cables*

Cables are to be terminated with glands manufactured of bronze and comprising a barrel with sealing washer and bush nut screwed into one end and a compression nipple with wire clamping ring screwed onto the other end. The opposite end of the compression nipple must have a male electrical thread with locknut. The glands shall be suitably sized for the relevant cables, be of the adjustable type complete with armor clamps and with watertight neoprene shrouds.

Cable terminating glands for outdoor use shall be provided with waterproofing inner seals as well as waterproofing seals on nipples. Cable armoring shall be earthed at each end but may not be used as earth continuity conductor.

#### *Fiber Optic Cables*

Fiber optic cables shall be terminated by means of suitable glands, ST connections and bus terminals capable of direct connection to the bus interfaces on the bus stations. These bus stations will be housed in separate panels of various control centers.

### **32. DISTRIBUTION AND MOTOR CONTROL BOARDS**

#### *Indoor floor standing distribution and motor control boards Construction*

The board shall be designed for front access only unless stated otherwise in the schedules.

The boards shall be of the free standing floor mounted cubicle type with IP 55 insert proofed enclosure, constructed of at least 2mm 3CR12 steel or mild steel powder coated on a rigid channel iron or similar frame, and shall be bolted

down in position by means of M16 high tensile stainless steel bolts grouted into the concrete floor.

The bolts shall be inside the board.

The overall height of the board shall not exceed 2,00m and the overall depth shall not be less than 450mm and shall not exceed 0,6m. The construction of the board shall be such that future extension panels may be fitted on both sides and alterations can be done without major changes to the board. (Modular construction will be preferred.)

The board shall be provided with readily removable covers on the side and hinged panels on the front.

All removable covers shall be provided with pre-approved handles or similar approved to facilitate removal. These covers shall be suitable braced and reinforced to ensure rigidity.

All hinged panels shall be reinforced to ensure rigidity and shall be provided with heavy duty rust proof hinges.

These panels shall also be provided with approved knobs or handles.

Each door shall be supplied with completely concealed hinges, each fastened with not less than four (two on each side) brass bolts and nuts. In the case of double doors the first door shall be locked with two slides on the inside, onto the kiosk shell. The second door shall close over a lip on the first one.

The doors shall be provided with a locking system suitable for padlocking. The locking system shall consist of a 3-way locking mechanism locking the door at the top, middle and bottom. The padlock shall be enclosed in a tamper proof enclosure as part of the door construction.

All switch gear, instruments and equipment for the control of any specific motor or other electrical device, shall be mounted flush behind a common hinged panel, with only operating handles, push buttons and instrument faces protruding through neatly machine punched holes in the panel.

The board shall be provided with a readily removable, rigidly supported unpainted 3CR12 or HDG cable end support gland plate along the entire length of the board and at least 230mm above floor level.

Space shall be provided for future switchgear and equipment where specified.

The board shall be suitably sized to accommodate without cramping, all the switchgear and equipment specified.

Screwed-on engraved labels in English shall be provided below all switchgear and equipment on the panels, to facilitate identification.

The board shall be provided with one set of four solid, copper bus bars in the top section and extending over the entire length of the board. Provision shall be made at the end of each bus bar for future extensions.

Bus bars shall comply with the requirements of BSS 1433 and the relevant clauses of BSS 159.

Bus bars shall be rigidly supported at suitable intervals to prevent undue damage resulting under short circuit conditions. Ceramic or other approved bus bar insulators shall be used. The bus bars shall be arranged horizontally with the longer sides of the cross-sections in the vertical plane and one behind the other, in the horizontal plane, at 90 mm centers.

Bus bars shall be clearly and indelibly marked Red, White and Blue for the three phases and Black for Neutral.

Connections to bus bars shall be effected by means of cable lugs and suitable sized cadmium-plated, high tensile steel bolts and nuts with cadmium-plated cup washers or lock washers.

All screws, studs, bolts, nuts and washers used for these boards shall be Grade 304 Stainless Steel. The use of self-tapping screws will not be permissible. A solid copper earth bar shall be provided inside the board at the back and along the entire length, at a height of approximately 0,6m above floor level.

The earth bar shall have a cross-section of 150 mm<sup>2</sup>.

The earth bars shall be drilled and provided with the required number of 6 mm dia and 10 mm dia cadmium plated, high tensile steel bolts and nuts, complete with cadmium-plated washers and cup washers or lock washers, for making the earth connection. The earth positions shall be evenly spaced along the entire length of each bus bar.

#### Paint finishes for electrical materials and equipment

The paint finishes for electrical materials and equipment where applicable shall strictly comply with the quality specification.

#### Internal wiring

The internal wiring of the boards shall consist of colored PVC-installed conductors of adequate copper cross-section, which shall be neatly installed horizontally and vertically installed in PVC trunking. Numbered ferrules of an approved type (clip on type not acceptable), shall be provided on each end of each wire, to facilitate the tracing of circuits.

#### Electronic Equipment

Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

The door must be labeled: "ELECTRONIC EQUIPMENT".

#### Labeling of Switchboards and Motor Control Boards

A screwed on engraved label of the black on white "trefolite" type shall be provided below each item of equipment on the front panel of each board as well as on the chassis in close proximity to the relevant equipment to identify such equipment in the English language in 6 mm high lettering.

Each board shall further be provided with a screwed on reverse engraved yellow Perspex nameplate with black 20 mm high lettering to identify the board in the English language on the outside of the door at the top thereof.

#### Outdoor distribution- and motor control boards

The outdoor motor control boards shall be of the grade 304 stainless steel or mild steel powder coated cubicle type complying with the specification for indoor boards, but shall be not more than 2000 mm high.

Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

This compartment shall consist of a outer and inner shell with at least 10 mm insulation or polystyrene between the inner and outer shell all round to keep the temperature inside the compartment at least 5° C below the temperature surrounding the compartment in summer. If necessary ventilation fans shall be installed.

The doors of this compartment must also be of a double wall construction with insulation or polystyrene between the two walls. The door must be labeled:

"Electronic Equipment"

Sufficient provision for breathing and heat dissipation must be made in this compartment.

#### Control board components

##### Isolators

All isolators shall be of the "Load-breaking" and "fault-making" type and shall comply with the requirements of BS 5419-1977 where applicable. Where relevant, isolators shall be provided with auxiliary contacts for signal purposes.

#### Fused switches

All fused switches shall be of the "load-breaking" and "fault-making" type complying with BS-5419 where applicable and fitted with HRC cartridge fused links to BSS-88. Auxiliary contacts shall be provided where relevant for signal purposes.

#### Moulded case circuit breaker

All molded case circuit breakers shall comply with the requirements of SABS specification No 156-1977 and shall be equal and similar to Heinemann manufacture.

These circuit breakers shall be fitted with copper terminal collector bars where more than one cable tail has to be terminated on the same terminal.

#### 400 Volt air-break contactors

All contactors shall be of the totally enclosed, three pole, double air break per pole, automatic magnetic type complying with the requirements of IEC 158-1 for Class AC3 contactors of Intermittent Duty Class 0, 3.

All contactors shall be provided with arc extinguisher and readily replaceable silver or silver-alloy contacts rated for at least 2-million "on" and "off" switching operations at rated current.

Each contactor shall be provided with a 240 Volt, 50 Hz closing coil suitable for continuous operation and at least 15 closing operations per hour.

An adequate number of auxiliary contacts shall be fitted.

The contactor may not hum or chatter in service and the contacts may not bounce on closing.

#### Current Limiting Circuit Breakers

The current limiting circuit breakers shall be capable of remaining in service and of carrying their normal rated current after having interrupted the maximum rated short circuit current at least three times.

The current limiting circuit breaker shall be equal and similar to the Merlin and Gerin or Unelec type for air circuit breakers and Merlin and Gerin or CBI for molded case circuit breakers.

#### Direct-on-Line starters (400V motors)

These starters shall be of the manually operated (locally and remotely) type and each starter shall be contained in its own separate compartment on the relevant motor control board.

Each of these units shall comprise amongst other the following components:

1 Only mains fused switch connected to the bus bars of the board and interlocked with the door of the compartment to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.

1 Set of HRC control fused links with carriers and basis;

All necessary relays as required;

1 Only mains contactor;

1 Set of START and STOP push buttons;

1 Only mains operated timing device to limit starts to 15 starts per hour; and

1 Only power factor correction capacitor unit for motors of 5 kW and more.

The following protective and indicating devices complete with necessary suitable rated potential fuses, current transformers, test blocks and auxiliary relays;

1 Only motor protection relay (Electronic type equal and similar to Newelec KC) for motors of 11kW or more or as specified;

1 Only motor under current relay (Where specified)

1 Only instantaneous indicating ammeter for motor current;

1 Only ammeter selector switch for motors of 5kW or more;

3 Current transformers for motors of 5 kW or more;

1 Only running hour meter;

1 Only anti-dither circuit;

1 Only anti-cycle timer; and

1 Only thermister relay for motors of 22 kW or more

1 Only blue LED type indicator light to indicate the time delayed starting period

3 Only LED type indicator lights as follows:

Green – 'Supply on'; Amber – 'Motor Running'; and Red – 'Motor Tripped';

It shall further be possible to trip and lock-out the starter by means of a remote stop button to be provided at the relevant motor.

Provision shall also be made for locking the mains fused switch handle in the OFF position.

#### Star/Delta Starters (400V motors)

These starters shall be of the automatic star/delta type and each starter shall be contained in its own separate compartment on the relevant motor control board.

Each of these units shall comprise amongst others provided for direct-on –line starters the following components as:

1 Only Main Isolator connected to the bus bars of the board and interlocked with the door of the compartment to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open;

3 Only HRC fuses rigidly attached to the load side of the abovementioned Mains Isolator and the rating of which shall be carefully selected for back-up protection for the relevant motor;

1 set of HRC control fused links with carriers and bases;

1 only Mains Contactor;

1 only Star Contactor;

1 only Delta Contactor;

1 only Star to Delta timer of the clockwork or electromagnetic type;

1 only Mains operated timing device to limit the starts to 15 starts per hour;

1 set START and STOP pushbuttons;

1 only three phase Factor Correction Capacitator unit for motors of 5kW or more

All necessary relays.

#### Variable Speed Drives

These variable speed drives shall each be contained in its own separate panel, manufactured and equipped to the satisfaction of the variable speed drive manufacturer to suit their own requirements with regard to ventilation of the variable speed drive.

The variable speed drive panel shall be equipped with air filters.



The frequency converter shall make use of flux vector control without encoder or tachogenerator feedback and shall incorporate direct torque control technology so that the overall effectiveness of the drive shall only be limited by the performance of the motor.

Semi-conductor shall be determined by the values of flux and torque and shall not have a predetermined pattern as in conventional pulse width modulation flux vector drives.

Each of these drives shall comprise amongst others the following components:

1 Only main isolator that shall be interlocked with the door of the panel to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.

3 Only ultra rapid fuses rigid connected to the load side of the above mentioned mains isolator and the rating of which shall comply with the manufacturers specifications for the drive.

1 Only direct torque control frequency converter.

1 Only door mounted control panel complete with cable connections.

1 Only Thermister relay for motors of 22 kW or more.

1 Only external EMC line filter.

All equipment necessary for remote emergency stop device.

All equipment necessary for remote speed control via a monitoring and control SCADA system as well as PLC control.

All equipment necessary for remote motor status and speed monitoring.

A hot dipped galvanized gland plate must be provided at least 250mm above floor level for cable connection.

- (a) The control panel shall be the user interface for monitoring, adjusting parameters and controlling the drive operation. It shall be possible to:
  - i) Enter start-up data into the drive.
  - ii) Control the drive with start, stop and reference signals.
  - iii) Display actual values of motor performance.

4. Display information on at least the five most recent faults.

- (b) The drives shall satisfy the following technical requirements.

- i) The static speed control error shall not exceed  $\pm 0,5\%$  of motor nominal speed.
- ii) Fundamental power factor shall be at least 0,97 at nominal load.
- iii) Efficiency shall be at least 98% at nominal power level.
- iv) The drive shall operate satisfactorily under all ambient temperature conditions between  $-5^{\circ}\text{C}$  and  $+ 40^{\circ}\text{C}$  at an altitude of 1260m above sea level and humidity up to saturation point.
- v) The drive shall provide output protection of motor overload, over current, short circuit at start, earth fault, missing motor phase and over frequency.
- vi) The drive shall satisfy the following minimum harmonic voltage limits. Total harmonic distortion of 6%, odd harmonic distortion of 4% and even harmonic distortion of 2%. These harmonic distortion parameters shall be measured by the Contractor after commissioning of the system and if the equipment fail to comply with this requirement, the Contractor will have to rectify the same to the satisfaction of the Engineer.
- vii) The drive shall be equipped with an AC choke for harmonic current reduction and shall be placed on the AC side of the rectifier bridge in order to protect the rectifier semiconductors against power line transients.
- viii) Torque step rise time shall typically be less than 5ms.
- ix) Stringent precautions must be taken in the design of the protection equipment to assure adequate lightning and surge protection.

#### Current transformers

All current transformers shall be of the air insulated type complying in all respects with the requirements laid down in BS 3938: 1973.

The contractor shall carefully select the ratio, burden and accuracy class to suit its application in accordance with the recommendations and requirements of BS 3938.

#### Indicating instruments

All indicating instruments shall comply with the requirements laid down in BS 89: Part 1:

1970 for instruments of a 2, 5 Accuracy Class. All indicating instruments shall have 96 mm square dials.

The maximum demand ammeters shall be of the 6 amp combined maximum demand registering and instantaneous type having MISC movement and thermal demand indication with a integrating time lag of 15 minutes. The ammeter scales shall be direct reading with a full scale deflection corresponding to 120% of the rated primary current of the relevant current transformer. Each ammeter shall be clearly and indelibly marked to indicate the color of the phase to which it is connected.

The ammeter for motor starters shall be 5 amp instantaneous indicating meters with MICSC movement and direct reading scales. The meter shall be able to withstand over currents resulting under starting conditions and the full load current of the relevant motor shall be clearly marked in red on the face of the meter.

Voltmeter shall be of the direct reading moving iron suppressed zero type.

The power factor meters shall indicate from 0,7 lagging to 0,7 leading.

The running hour meters shall have cyclometer dials indicating up to 5 digits and two decimals.

#### Instrument selector switch

A four-position rotary type instrument selector switch shall be mounted directly below the relevant instrument in such a way that only the selector knob and indicator plate are on the panel, and the switch itself is behind the panel.

The selector knob shall consist of bakelite, and shall have an arrow engraved on it, indicating the switch position.

The switch shall have a positively driven switching mechanism.

The indicator plate shall consist of bakelite and shall have the positions of the three phases and "OFF", engraved on it in 5 mm high lettering.

#### Power factor correction capacitors for 400 Volt motors

Each of these capacitors shall be the indoor switchboard mounting 400 Volt 50 cps three phase self-contained type with a dead casing and shall fully comply with the requirements laid down in BS 1650-1971.

Each capacitor unit shall be of carefully selected rating to correct the power factor of its associated motor to 0,95 at full load and should not exceed a value which compensates for 85% of the no-load magnetizing current.

The dielectric shall consist of plastic film and low-loss paper situated between aluminum foil and impregnated with a synthetic liquid agent with scavenger additive.

The capacitor losses shall not exceed 1 Watt/k VAR.

The capacitor units shall have the following admissible overload at an ambient temperature of 40°C and an altitude 1260 m above sea level.

10% excess volts continuously;

50% excess current continuously; and

30% excess kVAr continuously.

Each of these capacitor units shall be provided with discharge resistors and a fuser each winding element that will disconnect the affected element in event of a de-electric breakdown.

*Information to be submitted with Tenders in respect of the 400 Volt distribution boards and motor control boards. The following information shall be submitted with each Tender in respect of all boards offered:*

- (a) Full technical details and descriptive literature regarding all equipment and instruments offered;
- (b) Three paper prints of an outline drawing of each board indicating the main overall dimensions and general lay-out of the boards; and
- (c) Three paper prints of an outline drawing of the front end processor cabinet indicating the main overall dimensions, general layout and type of material employed on the face of the panel.

*Information to be submitted by the successful Tenderer in respect of all boards. The successful Tenderer shall submit three paper prints of each of the following drawings, in respect of each of the boards to the Engineer for approved prior to manufacture:*

- (a) Outline and general arrangement drawings, showing main overall dimensions and construction details;
- (b) A wiring diagram; and
- (c) A single line diagram.
- (d) Plastic transparent prints of the following drawings shall be supplied to the successful Tenderer in respect of each of the final layout of the boards.
  - i) Outline and general arrangement drawing of each board;
  - ii) A wiring diagram of each board and mimic panel;
  - iii) A single line diagram of each board;
  - iv) A paper print of the single line diagram for that specific distribution board, shall be framed and installed behind glass in each of the switch rooms. These drawings shall be furnished on A2 prints; and

- v) A paper print of the single line diagram for each LT starter panel shall be installed behind Perspex inside the door of each starter panel.

#### *Testing of distribution/motor control boards at the manufacturer's works*

Each distribution/motor control board shall be subjected to the following tests in the manufacturer's works after manufacture:

- (a) A thorough inspection shall be carried out to ensure compliance with the specification and approved drawings and wiring diagrams and to ascertain that all connections are properly made.
- (b) A high voltage test on all primary connections to check the insulation between phases manually and between each phase and earth.
- (c) The polarities and ratios of all potential and current transformer shall be checked.
- (d) Primary and secondary injection tests shall be carried out on all switching, protection, metering interlocking and indication circuits.

The manufacturer shall submit three copies of test certificates giving details of conditions and results of tests carried out to the Engineer.

### **33. CONCRETE PLINTH FOR STARTER PANELS AND PEDESTALS**

The plinth shall be cast 150 mm below as well as 150 mm above the ground level. It shall have neatly beveled edges and shall be 75 mm wider than the panels all round.

An opening of sufficient width to allow for cable entry, shall be provided under the starter panels.

The grade 304 stainless steel foundation bolts for mounting of the panels be cast or grouted into the plinth. The plinth shall be in Class 20/19 concrete and shall be suitably reinforced if necessary.

It is recommended that the casting of these foundations must be carried out by the Civil Contractor at the cost of the Contractor under this contract in accordance with his instructions and under his supervision.

### **34. ELECTRONIC LEVEL CONTROL**

The micro based electronic controllers which will be mounted in the starter shall be easy to calibrate and reliable in service.

The power units for all the pumps in a specific pump station shall be installed in a separate compartment of the starter and clearly labeled in accordance with the pumps it controls.

These level controls shall be designed to automatically select the pump sequence to ensure that all the pumps will at random be a duty pump.

Where a controller controls only two pumps and one pump is always a standby pump, the standby pump shall automatically become the next duty pump after each duty cycle, unless one pump is taken down for service. When that occurs, the duty pump shall remain on duty until the normal operation is restored.

When a pump selected for duty fails to respond to the start signal from the control, and then the next duty pump shall automatically start-up after five minutes.

The level control must also stop all the pumps, whether on manual or automatic selection, when the pump has reached a predetermined low level.

The transducers shall be designed to operate in air, been capsulated, of rugged construction and impervious to submergence.

The transducers shall, where possible, be installed at a point 500 mm away from a wall or pipe, which may cause a false signal, and at least 500 mm above maximum water level.

The coaxial cable between the transducer and power unit shall be of sufficient length to avoid any joints in this cable, as no joints will be permissible.

The grade 304 stainless steel brackets must be provided and installed under this contract.

### **35. EMERGENCY STOP PUSH BUTTONS AND WEATHERPROOF ISOLATORS**

Each of these units shall consist of a totally enclosed outdoor type heavy duty "push and turn to lock" stop push button station with a cable gland entry at the bottom to accommodate a 3 core 1,5 mm<sup>2</sup> LT PVC SWA PVC cable.

This push button station and weatherproof isolator shall be mounted on a rigid 1 meter high grade 304 stainless steel pedestal with 2 mm radius rounded edges, designed to be bolted to a concrete floor.  
(Refer to the relevant drawing.)

An emergency stop push button shall be installed where indicated near the coupling between each motor and its associated pump and shall be connected to the relevant starter panel via the specified cable to stop the motor.

The pedestal shall be securely bolted to the floor by means of stainless steel foundation bolts grouted into the concrete and care shall be taken to ensure that it is installed plumb.

### **36. CABLE LADDERS**

Cable ladders shall be of the heavy duty type, equal and similar to O-Line.

Cable ladders shall be hot dipped galvanized or as specified on the drawings the height of the sides shall be 76 mm with the width to suit the number and size of cables to be installed.

The cable ladders shall be secured on suitable lengths, which shall be suspended from the roof slab by means of suitable lengths 8 mm dia threaded hot, dipped galvanized steel rods.

The threaded rods shall be secured to the roof slab with suitable sized hot dipped galvanized steel raw bolts and shall be secured to the channel sections by means of two hot dipped galvanized nuts and washers.

Clamps of the "K" series, suitable for the specific cable shall be employed to secure the cable onto the tray.

The cable trays shall be capable of carrying a distributed load of 140kgm<sup>-2</sup> and a point load of 90kg at the centre of an unsupported span of 2.5m with a maximum deflection of 15mm and without permanent deformation after removal of the design loads. A factor of safety of 2 shall apply. The cable trays shall be slotted to accept cable ties.

Where cable trays pass through any fire barrier or walls, the tray must be filled with 50mmΦ PVC sleeves passing through the wall and protrude min 250mm on either side. The sleeves must be filled with fire resistant foam after cable installation.

The tray and all cables shall be coated for a min length of 600mm on either side with an approved fire retardant similar or equivalent to Prosafe WB with a final coat of Prosafe Topcoat of matching colour to the Engineer's or Architect's approval. All products shall be handled and applied to manufacturer's recommendations.

### **37. LIGHTNING PROTECTION**

#### *Plant*

The lightning protection of the lightning structures, poles and plant of the works, including all the buildings and handrails on the new plant, form part of this contract.

The lightning protection must be a SABS approved scheme and SABS approved drawing of the scheme must be submitted to the Engineer.

#### *Lightning arrestors*

Tenderers shall allow in their Tender prices for adequate protection of the equipment supplied and installed under this contract against direct as well as induced voltage surges and spikes which may be experienced on the system.

Surge arrestors shall be provided on each phase as well as neutral on the incoming power supply terminals of each board.

Electronic equipment shall be adequately protected on both the incoming and outgoing terminals by means of suitable arrestors compatible with the relevant equipment. 4-20mA signal cables shall be protected on both sides of the cable against surges.

Arrestors shall be of DEHN manufacture (as supplied by Surgetech (Pty) Ltd. or equal and similar thereto).

All arrestors shall be connected directly to earth along the shortest possible route and only conductors of adequate rating for the discharge currents catered for shall be used for connections to arrestors.

Tenderers shall submit full particulars of the arrestors offered as well as written confirmation that it will provide adequate protection for the relevant equipment against possible voltage surges and spikes on the system.

### **38. EARTH CLAMPS**

Earth clamps shall consist of 12 mm x 1,5 mm thick copper strap provided with a 25 mm<sup>2</sup> x 3 mm dia, brass bolt, nut and washers. The design of the clamp shall be such that it will fit snugly around the conduit without necessitating any extra packing.

### **39. FIRE DETECTION SYSTEM**

The specialist sub-contractor shall be a registered South African Qualification & Certification Committee (SAQCC) Fire and FDIA (Fire Detection Installers Association) contractor responsible for the detail design, supply, installation, commissioning and testing of the Fire Detection System.

A fully addressable closed circuit fire detection system shall be installed (max 126 units per loop).

The design and installation of the Fire Detection System shall be done in accordance with SANS 322, 10139 20012 and 10400 (as amended) and the installation shall be done by a reputable and approved Sub Contractor.

The Contractor shall be responsible for providing a link to the existing Main Fire panel (where applicable).

The Contractor shall be responsible for providing a link to the nearest Fire Department. The link shall be compatible to communicate with the applicable Fire Department's system. In areas where cellular reception is poor or not available, suitable measures shall be taken to either boost the signal or to revert to VHF technology. The Contractor shall present his proposal to the Engineer for approval before procuring the said system.

The fire and smoke detection system will comprise of various detectors to cover each area. A multi-zone fire detection control panel of the type ZITON, ARITECH, AST or similar approved shall be installed. The panel shall be supplied with back up battery. The panel shall be fed from the Emergency Power distribution board by means of a 10A circuit breaker located in a glass fronted, lockable box positioned next to the distribution board. The



Addressable Call Point Fire Alarm Break Glass shall be surface mounted type ZITON, ARITECH, AST or similar approved with a clear polycarbonate front cover.

The audible and visual siren shall have strobe light and shall be of the ROSHNEE type or similar approved.

Audio and visual alarms for gas suppression systems must conform to the following sequence of operation:

<b>AUDIBLE AND VISUAL WARNINGS FOR GAS PROTECTED AREAS</b>						
	<b>Bell inside</b>	<b>Siren inside</b>	<b>Strobe inside</b>	<b>Siren outside</b>	<b>Strobe outside</b>	
First detector activates		ON	ON	ON	ON	Standard fire alarm
Second detector activates & timer starts	ON (intermittent)	ON	ON	ON	ON	Intermittent sound
Timer expires / Discharge	ON (solid)	ON	ON	ON	ON	Solid sound

The smoke and heat detectors shall be of the APPOLO or ZITON type.

The manual call point shall be of the ZITON, ARITECH, AST type or similar approved.

All fire signal or control cables shall be Halogen-Free fire retardant Polymer with min of 1.0mm<sup>2</sup> PH120 type fire resistant alarm cable installed in galvanised conduit & trunking to comply with SANS 14115 throughout the installation. Type test certificate shall be submitted for cables being tested in accordance with EN 50200 test requirements to ensure cables remain operational in fire conditions for the rated period or longer and complies with SANS 10139.

The cable shall be installed in a 25mm conduit or trunking.

An easy readable layout drawing clearly identifying the various zones shall be laminated and be wall mounted next to the Fire Panel in a suitably sized aluminium clip board.

A step-by-step operating procedure shall be laminated and be wall mounted in in a suitably sized aluminium clip board complete with the Fire Zones simplified drawing next to the Fire Panel.

The Contractor shall on completion of the Fire Detection System installation:

- Fully test the system in the presence of the Engineer, Client representative and Local Fire Department.
- Ensure for the fire condition that all the air handling units (AHU) and HVAC will shut down, all Access Control doors are released and the grounding of all the lifts.
- Provide a laminated A4 size Step-by-Step procedure for operating and effective use of the Fire Panel next to the panel.
- Provide training on the effective use of the Fire Panel to client representatives and keep an attendance register of such training which must

be submitted as part of the compliance certification with the As-Built documentation.

e. Provide a Compliance Certificate.

#### 40. UNINTERRUPTABLE POWER SUPPLY (UPS)

##### Introduction

Tenderer's are to include for the supply, delivery and commissioning of a [6]kVA; [230/400] volt UPS complete with 6 hours autonomy at full load batteries. Others will provide the final connection of input and output cable supplies. The Unit shall be of the floor standing type and the colour shall be Beige.

##### Alarm functions on unit

i)	"Mains off":	Visual, Audible and Mute	.....
ii)	"Battery low":	Visual, Audible and Mute	.....
iii)	"Inverter off":	Visual, Audible and Mute	.....
iv)	"Short circuit":	Visual, Audible and Mute	.....
v)	"Over load":	Visual, Audible and Mute	.....
vi)	"Bypass";	Visual, Audible and Mute	.....
vii)	"Charger off":	Visual, Audible and Mute	.....
viii)	"Battery under voltage":	Visual, Audible and Mute	.....
ix)	"Over temperature":	Visual, Audible and Mute	.....
x)	"No sync":	Visual	.....

##### Remote alarm panel

i)	Normal Operation:	Visual	.....
ii)	Mains Failure:	Visual, Audible and Mute	.....
iii)	UPS Failure:	Visual, Audible and Mute	.....
iv)	Output to PLC:	All Alarms (intelligent)	.....

##### Cabinet

Steel cabinet (preferably neutral beige colour): .....

## General

- i) At commissioning, a discharge test will be done to agitate and equalise the batteries.
- ii) The Tenderer shall perform an on-site full load test of the unit for a standby time duration of at least 80%. The Tenderer shall document the test and the test shall be witnessed and signed-off by the institutional maintenance staff.
- iii) The Tenderer shall provide on-site operator instruction during normal working hours to the Hospital operating personnel.
- iv) The unit shall comply in all respects with the Occupational Health and Safety Act and Regulations 85/1993.
- v) The unit must be guaranteed against faulty workmanship, material and mechanical defects for a period of 12 months.
- vi) Two complete sets of operating manuals shall be supplied with the unit. The manuals shall include both literature and schematic wiring diagrams of the unit.
- vii) After each period of six months operation during the guarantee period the Tenderer shall allow for a complete maintenance service of the unit (i.e. Two services).
- viii) The Tenderer shall allow for the supply, delivery and installation of a By-pass switch arrangement independent of the UPS as per Item Code EC03005P/UPS/DOH
- ix) Deviation from Specification:  
.....  
.....  
.....  
.....  
.....  
.....
- x) Additional Features Not Specified  
.....  
.....  
.....  
.....  
.....
- xi) Delivery Period: .....
- xii) Nearest Service and Spares Centre: .....

### **34. UNDERGROUND CABLE SLEEVES**

All cable sleeves shall be of the Kabelflex type, manufactured and supplied by Nextube (Pty) Ltd.

Unused sleeve ends shall be sealed by means of Nextube Closure Caps.

Cable sleeves to be installed across roads shall extend at least 450 mm beyond the edge of the road on each side. Each run of cable sleeve shall be laid straight and without any projections on the side, which may cause damage to or obstruct the threading through of cables.

### **35. 11 kV SWITCHGEAR**

#### **SCOPE OF WORK**

This portion of the Project Specification provides for the design, supply, delivery, installation, testing, commissioning and training of 11 kV switchgear.

#### **NORMATIVE REFERENCES**

The most recent editions of the national and international standards and specifications listed below are applicable to the Project Specification:

NRS 003:1191, Metal-clad switchgear

NRS 006:1191, Metal enclosed ring main units

NRS 008:1191, Enclosure of cable termination in air

#### **GENERAL REQUIREMENTS**

##### **(a) Conditions**

The switchgear supplied shall be manufactured to comply with the following:

- |       |                         |   |                                   |
|-------|-------------------------|---|-----------------------------------|
| (i)   | Ambient air temperature | - | -5°C to 40°C                      |
|       |                         |   | 24 hour average not exceeding 35° |
| (ii)  | Altitude                | - | 1 800 m                           |
| (iii) | Polluted ambient air    | - | Above normal dust                 |
|       |                         |   | Above normal smoke                |

##### **(b) Factory tests**

The Supply Authority and the Engineer must be present on a final factory inspection and testing before shipment. A notice of at least 14 days is required for this factory test. The equipment may be delivered after the approval of the Engineer and the Supply Authority.

(c) **Drawings for approval**

The Contractor shall submit 2 sets of fully detailed manufacturing drawings before purchasing of material and manufacturing commences for approval. The Contractor shall give the Engineer a maximum of 10 working days for this approval. The Contractor shall make provision for all these times in his programme since no application for a delay shall be considered for the preparing of detailed drawings and approval before manufacturing commences.

(d) **Notices**

The following notices in three official languages, and in accordance with the OHS Act, shall be exhibited at all entrances to the switching substations.

- (i) A notice prohibiting unauthorised persons from entering such premises.
- (ii) A notice prohibiting any unauthorised persons from handling or interfering with electrical apparatus.
- (iii) A notice detailing procedure in case of fire.
- (iv) A notice containing directions for resuscitation of persons suffering from the effects of electric shock.

(e) **Paint specification**

(i) **Finish required**

Metalwork of switchboards, and associated equipment shall be finished with a high quality paint applied according to the best available method. Baked enamel, electrostatically applied powder coating or similar proven methods shall be used.

(ii) **Corrosion Resistance**

Painted metal shall be corrosion resistant for a period of at least 168 hours when tested in accordance with SABS Method 155.

(iii) **Edges**

Care shall be taken to ensure that all edges and corners are properly covered.

(iv) **Surface Preparation**

Surface preparation shall comply with SABS 064. Prior to painting, all metal parts shall be thoroughly cleaned of rust, millscale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting or acid pickling and washing shall be employed for this purpose.

(v) **Baked enamel finish**

- Immediately after cleaning all surfaces shall be covered by a rust inhibiting, tough unbroken metal-phosphate film and then thoroughly dried.
- Within forty eight (48) hours after phosphating, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two coats of high quality alkyd-based baked enamel.
- The enamel finish on metal luminaire components shall comply with SABS 783, Type III.
- Other metal parts e.g. switchboard panels, etc. shall comply with SABS 783, Type IV with a minimum paint thickness after painting of 0,06 mm. In coastal areas, the dry film thickness shall be increased to at least 0.1 mm.
- The paint shall have an impact resistance of 5,65 J on cold-rolled steel plate and a scratch resistance of 2 kg.

(vi) **Powder Coated Finish**

- Immediately after cleaning the metal parts shall be pre-heated and then covered by a microstructured paint powder applied electrostatically.
- The paint shall be baked on and shall harden within 10 minutes at a temperature of 190° C.
- The minimum paint thickness after baking shall be 0,05 mm. The dry film thickness shall be increased in coastal areas. The paint cover shall have an impact resistance of 5, 65 J on cold-rolled steel plate and a scratch resistance of 2 kg.

g) **Touch-up Paint**

In the case of switchboards and larger equipment enclosures, a tin of matching touch-up paint not smaller than 1 litre per substation shall be provided.

h) **Colour**

The colour of the switchgear shall be confirmed by the Engineer.

## GENERAL SPECIFICATIONS

### (a) Standards

All materials and apparatus shall be new and of the best quality and shall comply with the relevant current specifications of the SABS, BSI or IEC and as stated in this document.

The following standards may be used as a guide but must not be regarded as a complete list.

<u>DESCRIPTION</u>	<u>SABS</u>	<u>BSI</u>	<u>IEC</u>
Air & Oil Switches		5463	265-A-C
Busbar & Busbar Connections	1195	159	
Bushings		222	137
Cable Glands & Sealing boxes		542, 2562	
Circuit-breakers		5311	56
Current Transformers		3938	185
Voltage Transformers		3941	186
HV Fuses		2692	282-1
LV Fuses	172	88	269-1
Electrical Power Switchgear		5227	298
Galvanizing	763	729	
Indicating Instruments		89	51
Insulating Oil	555	148	296
Isolators and Earthing Switches		5253	129
Meters		37	43
Protective Relays		142	255
Colours for Specific Purposes	1091		

### (b) Service conditions

Nominal Voltage 3,3 kV

Rupturing Capacity	25 kA
Impulse Level	45 kV
Highest System Voltage	3,6 kV
Rated Short Time Current (3 s.)	26,3 kA
Frequency	50 Hz
Phases	3
Atmospheric Temperature	- 5°C minimum + 40°C maximum

Altitude	0 m minimum 1850 m maximum
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Lightning & Dust Severe

Average Power Factor 0,8

Maximum Humidity 95 %

The system neutrals will be solidly earthed. However, all switchgear and auxiliary equipment shall be designed to withstand the stresses of an unearthed system.

(c) **Switchgear layout**

- The switchboard shall be designed as a continuous assembly in a straight line, capable of being extended at either end.
- The switchboard will be located in a totally enclosed, naturally ventilated chamber and shall be suitable for installation directly on a finished floor.

(d) **Circuit breakers**

(i) General construction

- Circuit breakers may be of the low oil content, bulk oil or vacuum type.
- Circuit breakers shall be of the horizontal draw-out truck mounted type with either vertical or horizontal isolation action.
- Each circuit breaker shall be installed in a freestanding metal clad cubicle and the front of each panel shall be totally enclosed.
- It shall be possible to remove the circuit breakers from the cubicles without moving the cubicle, without removing parts thereof or without



disconnecting any wiring thereto. Secondary wiring may be unplugged.

- Any circuit breaker shall be interchangeable with any other panel of the board of the same rating. It shall not be possible to insert a circuit breaker into a higher rated circuit.
- Contact spouts, bushing, covers, busbar insulators, etc. shall be designed to minimize dust collection.
- Mechanical stops shall be provided to ensure accurate location of the circuit-breaker truck prior to racking into the service position. The breaker carriage shall be locked in position on both sides of the cubicle with a robust mechanical lock that will not distort or jam under fault conditions.
- All openings, joints, etc. in the entire switchboard shall be adequately vermin proofed.
- All components including screws, nuts, bolts, washers, etc. used in the construction of or fixing of components shall be rendered corrosion proof.

(ii) Circuit-breaking features

- The contacts shall ensure rapid and consistent extinction of the arc with a minimum release of arc energy under all loading and fault conditions and a low power factor.
- The arcing contacts shall be tipped or coated with an erosion resistant material, preferably a tungsten alloy.
- The main contacts shall be self-aligning with a high contact pressure and a self-cleaning action.

(iii) Busbar and circuit shutters

- Protective shutters, which automatically cover the contacts or the fixed portion of the switchgear when the circuit breaker or voltage transformer is withdrawn to the isolation position, shall be provided.
- The busbar and voltage transformer orifices shall be provided with automatic separate shutters.
- Facilities shall be provided for padlocking the shutters in the closed position.

- All shutters shall close automatically after being opened by hand and it shall not be possible for the shutters or shutter operating links to be jammed by the circuit breaker.
- Shutters shall be painted and designated as follows:
  - a) Busbar shutters - The word "BUSBAR" in black lettering on a red background.
  - b) Circuit shutters - The word "CABLE" in black lettering on a yellow background.
  - c) Earthing shutters - The word "EARTH" in black lettering on a green background.

Lettering shall be a minimum of 40 mm high.

(iv) Interlocks

The switchgear shall be mechanically interlocked in accordance with BS 5227 and all interlocks shall be robust and shall not distort or jam in the event of a mal-operation. The minimum safety features provided shall prevent the following actions:

- A closed circuit breaker from being withdrawn or inserted into the isolating contacts. The circuit breaker shall not trip if an attempt is made to do so.
- The closing of the circuit-breaker except when it is correctly located and fully racked in the "service" or "earthing" positions or in the fully lowered position. It must, however, be possible to close the circuit breaker when it is fully withdrawn from the cubicle.
- The lowering of the tank of bulk oil circuit breakers unless the circuit breaker is fully withdrawn and the racking-in of the circuit breaker unless the tank is securely bolted in position.
- The circuit breaker from being closed when the secondary circuits are not fully engaged. It shall also not be possible to remove the secondary circuit plugs unless the circuit-breaker contacts are fully open.
- Electrical tripping of the circuit breaker when the circuit breaker is in the earthed position. Padlocking facilities shall also be provided to lock off the mechanical trip lever on the breaker mechanism.

- The integral earthing switch (where applicable) from closing unless the circuit breaker is in the correct earth position. It must not be possible to close the earth switch onto live busbars.

(v) Earthing

- An earth busbar in accordance with the requirements of par. (f)(iii) shall be provided.
- All joints shall be tinned or silver-plated and clamping bolts, nuts, washers and lock washers of cadmium-plated high tensile steel shall be fitted.
- Integral earthing facilities through the circuit breaker are preferred, but separate earthing devices or earthing switches mounted on separate trucks are acceptable.
- Where separate earthing devices or earthing trucks are supplied, the gear shall be suitable for use on all the circuit breakers in a switchboard and shall also be suitable for earthing either the busbar or the cables. A full set of earthing devices or earthing trucks shall be supplied for each switchboard.
- Earthing equipment shall have a making capacity and a 3-s short time current rating equal to the rest of the switchboard.

(vi) Capacities and fault levels

- The complete primary circuit (OCB's, busbars, etc.) shall be capable of withstanding the rated short time current specified in par. 3 above.
- The circuit breakers shall have continuous current ratings as specified in the Detail Technical Specification.
- Circuit-breaker tanks and top plates shall be capable of withstanding, without permanent distortion, a hydraulic pressure of 700 kPa for 1 minute, unless a lower pressure is approved after reference to actual pressures measured during short circuit tests.
- Each circuit breaker shall be clearly and indelibly marked to show the current and voltage ratings and breaker capacities.

(vii) Closing mechanism

- The closing mechanism shall be either of the hand charged, spring or hand operated, spring assisted or motor wound spring charging or

solenoid operated types as specified in the Detail Technical Specification.

- The closing action of the hand operated, spring assisted mechanisms shall ensure that once closing is initiated the action becomes independent of the operator.
- Motor wound spring charging mechanisms shall be provided with hand cranks for emergency use should the electrical closing circuitry become inoperative.
- Slow closing facilities shall be provided on all mechanism types for maintenance purposes and these facilities shall only be accessible with the circuit-breaker in the "withdrawn" position.
- All mechanisms shall be of the trip-free type and it shall not be possible for the mechanism to maintain the circuit breaker in a "closed" position during fault conditions or when the "open" signal has been initiated.
- The electrical closing circuitry shall be open circuited as soon as the closing sequence has been completed to prevent continued electrical loading of the closing circuitry and to deactivate the closing signal until a new sequence is initiated.
- Where auto-reclosing duties are specified, the mechanisms shall be capable of performing a "BREAK-MAKE-BREAK" operation.
- All electrically operated closing devices shall be at least suitable for operation at any voltage between 80% - 120% of the nominal control voltage at the device terminal. The nominal control voltages are specified in the Detail Technical Specification.
- Anti-pumping devices shall be provided on all mechanisms to prevent pumping while the closing circuit remains energized and the circuit-breaker either fails to latch or trip during closing due to the operation of the protection system. The arrangement shall be to the approval of the Department.

(viii) Tripping mechanism

- A manual tripping mechanism shall be provided on each circuit breaker. It shall be clearly marked "MANUAL/HANDBEDIEN".

- Two 2,5 A trip coils (for overload and short circuit protection) and one 1,0 A trip coil (for earth fault protection) shall be provided where current transformer operated direct acting series tripping is specified. The trip coils shall be suitably rated to withstand the secondary saturation current of the current transformers specified.
- Where shunt tripping is specified DC shunt trip coils shall be provided. The rated control voltage shall be 32 V DC unless specified to the contrary in the Detail Technical Specification.
- Shunt trip coils shall be suitable for operation at any voltage between 80% - 120% of the nominal voltage at the device terminals.
- Secondary contacts operated by the circuit-breaker mechanism shall be provided and rated to interrupt the maximum trip coil current after the circuit breaker has opened. These contacts shall close the tripping circuitry before the circuit-breaker closes.

(ix) Racking mechanism

The racking mechanisms for inserting or withdrawing the circuit breaker shall be designed and constructed to provide a positive action throughout the operations.

(x) Indicating devices

- Each circuit breaker shall be equipped with mechanical indicators to indicate the switching positions and the state of the spring mechanisms (if applicable).
- A mechanical indicator shall also be provided to indicate whether the circuit breaker is racked in or out.
- All mechanical indicators shall be clearly visible from the front of the panel.
- In all cases positive indication must be provided.

(xi) Auxiliary contacts

- Circuit breakers shall be provided with sufficient auxiliary contacts to suit the circuits served.
- Auxiliary contacts shall be coupled in such a manner as to follow positively the operation of the switching device concerned.

- At least two spares normally open and two spare normally closed contacts shall be provided and shall be completely wired to an accessible terminal block.

(e) **Automatic oil switches and fused oil switches**

(i) General

Oil switches shall be of the fault-making, load-breaking type with earthing and testing facilities.

Oil switches shall be manufactured and tested in accordance with BS 5463.

(ii) Construction

- The switches shall be totally enclosed, metal-clad, of the bulk or low oil content type.
- The switch units shall be designed for extension with circuit-breaker panels described in this specification and/or similar switch units.
- Each unit shall be installed in a freestanding metal clad cubicle and the front of the cubicle shall be totally enclosed.
- The switch may be either of the horizontal draw-out with vertical or horizontal isolation, or non-withdrawable fixed tank types.

(iii) Busbars and circuit shutters

Busbar and circuit shutters shall be provided on all withdrawable type switches as specified for circuit breakers.

(iv) Interlocks

- The mechanism shall be incapable of moving directly to the "EARTH" position from the "ON" position. A time delay shall be built into the mechanism to prevent immediate opening of the switch after closure. This shall be achieved by means of non-reversible operating handles, mechanical sliding interlocking gates or a non-reversible movement.
- Padlocking facilities shall be provided.
- Access to the testing facilities shall only be possible with the switch in the "EARTH" position. With the testing devices fitted operation to either the "ON" or "OFF" positions shall be prevented.
- Interlocks shall be provided on withdrawable type switches to prevent:

- a) The switch from being withdrawn from or inserted into the isolating contacts.
- b) The closing of the switch except when it is correctly located or fully withdrawn.
- c) The opening of the tank unless the switch is fully withdrawn and the racking-in of the switch unless the tank is securely fitted.

(v) Operating mechanism

- The switch shall have three positions, namely "ON", "OFF" and "EARTH".
- Except for removing the earth, the switch actuating mechanism shall have a positive action and shall be spring assisted to ensure that once the operating is initiated it becomes completely independent on the operator.
- The fused oil switch shall close fully when making onto a fault to ensure full clearance of the fault by the fuses before tripping and opening the switches.
- A blown fuse on any of the three phases shall open all three phases of the switch and shall inhibit the closure of the switch pending fuse replacement.

(vi) Earthing

- Refer to par. (d)(v).
- Integral cable earthing facilities shall be provided for non-withdrawable switch units. For withdrawable switches earthing facilities similar to that of circuit breakers shall be provided.

(vii) Cable test facilities

- Cable test facilities are required and must be easily accessible.
- Refer to par. (e)(iv) regarding interlocking of test facilities.
- In the event of a separate test unit being provided, it shall be easily fitted.

(viii) Ratings

- The fault making capacities, impulse levels and busbar ratings shall be identical to the ratings of the circuit breakers installed in the same switchboards.

- The continuous current rating of an oil switch shall not be less than 400 A and that of a fused oil switch not less than 90 A.
- Each unit shall be clearly marked to show the current and voltage ratings and fault making capacity.

(ix) Indicating devices

- Each switch shall be equipped with positive mechanical indicators to indicate the switching position and the racked mode (where applicable).
- All indicators shall be visible from the front of the panel.
- Neon indicator lights shall be provided on the incoming panel of a switchboard to indicate the status of all three phases of the incoming cable.

(x) Fuses

- Fuses shall comply with BS 2692.
- Fuse links shall be of the striker pin type, hermetically sealed and shall be suitable for use under oil.
- The fuse link carriage shall be suitable to accept either 254 mm or 359 mm long fuses both with a diameter of 64,5 mm. The carriage shall be adjustable for this purpose and shall not necessitate additional parts.
- Automatic shutters shall be provided to safeguard against inadvertent contact with live parts when the fuse carriage is removed.
- The ratings of the fuses shall be as specified.

(f) **Busbars**

(i) Design and rating

- Busbars shall be manufactured of solid drawn high conductivity copper with rectangular cross-section in accordance with BS 159, SABS 1195 and BS 1433, where applicable.
- The busbars shall be rated for the continuous current carrying capacity. The busbars shall be designed to withstand mechanical and temperature stresses for normal and fault conditions taking into account correction factors for different configurations, "proximity and skin" effects, the effect of ferrous enclosures, ventilation, etc. The maximum allowable temperature of busbars carrying full load at the



specified ambient temperature is 80°C. Tables 4 and 5 may be used as a guide to determine the current rating of the busbars.

- In addition to the current rating busbars shall comply with the following fault level rating:

$$A = 8,2 \times I \times (t)^{1/2}$$

A = minimum cross section (mm<sup>2</sup>)

I = prospective fault current (kA)

t = maximum time in seconds required for protection equipment to clear the fault.

(Minimum allowable value for t = 3 s)

- Where a busbar consists of two or more busbars per phase (laminations), the laminations shall be separated by a minimum distance of the thickness of one lamination. The laminations shall be clamped together with copper spacers at intervals not exceeding 450 mm in order to equalize the current distribution in the laminations.
- Busbars shall be able to carry the rated current along their entire length. Tapering is not permitted.
- The manufacturer shall, where requested, provide design calculations of the busbar ratings.
- Busbars shall be as short and straight as possible.
- Busbars shall be adequately ventilated and shall be situated in separate, totally enclosed, dust free, metal enclosures.
- At each end of a switchboard a removable cover shall be fitted to the busbar chamber in order to extend the switchboard in both directions in the future.
- The busbar ends shall be suitably manufactured and drilled for future extensions without modifications to the existing busbars.

(ii) Insulation and joints

All busbars and connections shall be air insulated and shall be shrouded with heat-shrinkable sleeving or shall be epoxy resin encapsulated. PVC taping, insulating compound or oil immersion is not acceptable. The colours shall correspond to the colour of the supply phase:

**DERATING FACTORS FOR LAMINATED BUSBARS**

	<b>No of parallel busbars per phase</b>
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Area of Cross Section (mm <sup>2</sup> )	2	3	4
500	1,78	2,45	3,13
1 000	1,72	2,36	3,00
1 500	1,65	2,24	2,84
2 000	1,60	2,16	2,70
2 500	1,55	2,10	2,60
3 000	1,52	2,02	2,52
3 500	1,48	1,98	2,48
4 000	1,44	1,96	2,45

**Table 1: Derating Factors for Laminated Busbars**

**CURRENT RATING OF SINGLE COPPER BUSBARS (A)**

Width (mm)	Thickness (mm)						
	2,5	3,15	4,0	6,3	10	12,5	16
12,5	155	180					
16	190	220	250				
20	230	265	300				
25	280	320	365	470			
31,5	340	385	440	560			
40	420	475	540	680	870		
50	510	575	650	820	1030	1160	
63			790	990	1240	1370	
80			970	1200	1480	1640	
100			1160	1430	1760	2180	
125				1710	2100	2310	2570
160				2070	2530	2780	3090
200						3290	3660
250						3900	4300
315						4630	5120
400							6230

**Table 2: Current Rating of Single Copper Busbars (A)**

Red	}	
Yellow or White	}	Phases
Blue	}	
Black		Neutral

- Busbar joints and tees shall be encased in a non-hardening compound and taped with PVC tape unless suitable shrouds are provided.
- The complete primary system shall withstand the full power frequency test voltage specified by BS 5311 and the insulation level of all busbars and connections shall be in accordance with the values specified in 4(f).
- Where connections between busbars and any other part of the switchgear consist of bare copper conductors, and no other insulation except air exists between phases or phases and earth, the clearance distance and insulator lengths shall be in accordance with BS 5227 with correction for altitude as required.

(iii) Earth busbar

An earth busbar shall be installed in a convenient position along the entire length of the switchboard. The cross-sectional area of earth busbars shall be calculated in accordance with the following formula in IEC 439 with a minimum cross-section of 6,3 x 20 mm:

$$S = \frac{I}{X} \times \frac{(t)^{1/2}}{(dT)^{1/2}}$$

where S = cross-section (mm<sup>2</sup>)

I = the r.m.s. value of the current (A)

X = 13 for Copper

t = operating time of protective equipment(s)  
(Minimum value for t = 3 s)

dT = temperature rise (°C)  
= 120°C for insulated conductors  
= 180°C for uninsulated conductors

If t is between 2 s and 5 s then dT may be increased in the same formula to:

dT = 145°C for insulated conductors

= 215°C for uninsulated conductors.

In addition the longer side of the earth bar shall be at least twice the diameter of the largest bolt that will be fitted to the busbar.

**(g) Cable end boxes**

- (i) Cable end boxes to accept the cables specified for each panel shall be provided.
- (ii) The boxes shall be of the metal clad type suitable for indoor use. They shall be equipped with armour clamps and brass or gunmetal conical wiping glands for lead covered steel tape or galvanized steel wire armoured, paper-insulated cables.
- (iii) The cable end boxes shall comply with the standard specification for "CABLE END BOXES AND COMPOUND."
- (iv) The cable boxes shall be fitted with insulating pieces to allow for the possible future installation of frame leakage busbar zone protection when specified.
- (v) The lowest point of any cable gland position shall be at least 300 mm above finished floor level.
- (vi) Cable boxes shall be so designed that cable terminal connections can be made below compound level.

**(h) Secondary circuitry**

- (i) Cabling
  - Gland plates suitably drilled to accept the glands for all the external power, control, protection and DC supply cables shall be provided.
  - The internal wiring to be connected to the cabling mentioned above shall be terminated on numbered terminal strips in close proximity to the gland plate in order that the cable cores can be connected directly to the opposite sides of the terminal strips.
  - Where external DC supplies are connected to the switchboard, semiconductor diodes of a suitable power and voltage rating shall be installed in all DC circuits, in both the positive and negative conductors, to prevent reverse polarity connections.
- (ii) Wiring
  - All wiring shall present a neat appearance and shall be suitably braced, placed in wiring channels or clipped and/or laced.

- Connections to equipment mounted on doors shall be arranged to give a twisting motion and not a bending motion to the conductors.
- All panel and equipment terminals, labels, etc shall be completely accessible after the wiring and cabling has been completed.
- Conductors shall be identified at both ends by means of durable closed ring interlocking cable marking ferrules. PVC or other tape is not acceptable. The numbers on the markers shall also be shown on the wiring diagrams.
- Where conductors are terminated on equipment terminals that do not require the use of lugs, the identification ferrules shall be fixed so that they do not fall off when disconnecting a conductor.
- Identification ferrules shall read from the terminal along the wire.
- All wiring terminating on meters, fuse holders and other equipment with screwed terminals, shall be fitted with lugs. The lugs shall be soldered or crimped to the end of the conductor. Conductors connected to terminals complying with the Department's standard specification for "WIRING TERMINALS", Section C9 need not be soldered or ferruled.
- Secondary wiring shall generally consist of insulated stranded copper conductors with a minimum cross-sectional area of 2,5mm<sup>2</sup>. Solid core conductors are not acceptable. Flexible cords not smaller than 1,0mm<sup>2</sup> shall be installed between equipment mounted on doors and the rest of the switchboard. For voltage ratings in excess of 50 V the wiring insulation shall withstand a test voltage of 50 V or less the insulation shall withstand 500 V to earth for one minute.
- All wiring between different panels within the same switchboard shall be installed in wiring channels. Grommets shall be installed in each hole in the metalwork through which conductors pass. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges. All wiring shall be installed away from terminals, clamps or other current carrying parts.
- Conductors may be jointed at equipment terminals or numbered terminal strips only.

- To minimize the effect of electrolysis, DC circuits shall be so arranged that the isolator or N/O operation contacts are connected to the positive pole of the battery.

(iii) Secondary terminals

- All external wiring and connections to auxiliary contacts, all alarm, protection, intertripping, DC supply circuits, etc. shall terminate on numbered terminal strips. All numbers shall appear on the switchboard drawing.
- Terminals of the type where clamping screws are in direct contact with the conductor are not acceptable.
- Where stud type terminals are provided they shall have a minimum size of O B.A.
- Approximately 10% with a minimum of 2 spare terminals shall be provided on each terminal strip.
- Terminal and test blocks or the "CHAMBERLAIN AND HOOKHAM" or equivalent manufacture shall be provided in each panel for the secondary wiring of the current transformers.

(i) **Cubicle construction**

(i) General

- All cubicles shall be of the totally enclosed, floor mounted type and shall be vermin proof and where possible dustproof.
- Cubicles shall be designed so that it is possible to add additional panels to existing switchboards without undue difficulty.

(ii) Segregation of circuits

- Each circuit in a switchboard shall be provided with an individual cubicle so arranged that accidental contact with live metal in adjacent circuit cubicles is impossible.
- It shall be possible to terminate the cables of any circuit without exposure to any live conductors of the same circuit while the busbars are energized.

(iii) Doors

- Where doors are provided on circuit breaker or switch cubicles, the doors shall be fitted with handles consisting of a push-button-and-handle combination with spring loaded latch or a rotary handle-and-

catch combination. The closing mechanism shall be designed to draw the door closed. Flush mounted ring type handles or square key operated latches are not acceptable. Locking latches shall be padlockable.

- Doors shall be suitably braced and stiffened to carry the weight of equipment installed in doors and to prevent warping.
- Control panel doors shall be fitted with handle closing mechanism as described in par. 10.3.1 above. Alternatively, captive knurled bolts designed to be screwed in by hand may be used.
- Doors shall have stops to prevent overswing of the door when opening and to prevent interference with adjacent panels.
- Doors shall be fitted with suitable rubber or synthetic rubber seals.
- All doors shall be bonded to the framework by a braided copper earth strap.

(iv) Earthing

- All metal parts other than those forming part of electrical circuits shall be connected to the cubicle earth bar.
- All non-current carrying conductive parts, including relays, instruments, transformer and contactor cores, etc. shall be effectively connected to the earth bar either by means of their mounting arrangements on the panel or by means of a special earthing conductor fitted with lugs for attaching to the earth bar.

(k) **Current transformers**

(i) General

- Current transformers shall comply with the standard specification for "CURRENT TRANSFORMERS".
- The short time current rating of current transformers shall not be less than that of the associated circuit breaker.
- Current transformers shall be easily replaceable.
- The secondary windings of the current transformers shall be brought out to terminal and test blocks.
- Windings shall be earthed at one point only.
- Current transformers shall be installed and labelled so that the ratio is clearly visible.

(I) **Voltage transformers**

(i) General

- Voltage transformers shall comply with BS 3941 and IEC 186A and IEC 358 where applicable.
- The transformers shall be double wound. The neutral (star point) connection shall be brought out via a neutral link. The secondary voltage shall be 110 V unless specified to the contrary.
- Voltage transformers shall be metal-clad, of the oil-immersed or epoxy resin-encapsulated type. Oil filled types may not be used with air or vacuum circuit breakers.
- The transformer shall be withdrawable and shall be so arranged that the primary fuses are not accessible unless the transformer is in the fully isolated or withdrawn position. The voltage transformer shall be padlockable in both the withdrawn and inserted positions.
- Automatic shutters shall be provided to cover the isolating contact when the transformer is withdrawn. The shutters shall be padlockable.

(ii) Voltage transformer protection

- The primary side of all voltage transformers shall be connected to the circuit through high voltage HRC fuses.
- Secondary HRC fuses shall be provided on the voltage transformer, preferably under a removable cover secured by captive knurled nuts. The fuses shall be located as close as possible to the transformer output terminals.

(iii) Voltage transformer rating and tests

- The voltage transformers shall have an output suitable for the connected load but at least 200 VA per phase at class B accuracy.
- The voltage ratios shall be suitable for the primary busbar and the required output voltages.
- Voltage transformers shall be tested in accordance with BS 3941 and shall withstand an impulse level of 95 kV.

(I) **Protection relays**

- (i) Protection relays shall be contained in dustproof cases, which shall not allow accumulated dust to fall into the relay when opened.



- (ii) All cases shall be of the flush mounted withdrawable type.
- (iii) Relay contacts shall be capable of repeatedly making and, where the circuit renders it necessary, repeatedly breaking the maximum current possible in the circuits they control.
- (iv) Where more than one set of contacts are provided, all contacts shall operate simultaneously.
- (v) Tripping contacts shall not close due to vibration engendered by the normal or the fault condition operation of the associated or adjacent circuit breakers.
- (vi) Hand resetting shall be accomplished without opening the case and these relays shall be accessible to a person standing on the floor.
- (vii) All relays shall be provided with test blocks to permit tests to be carried out without disconnecting any wiring. These test blocks may be either included in the relay cases or separately mounted. If separately mounted, they shall be of the "CHAMBERLAIN AND HOOKHAM" type or equivalent.
- (viii) The ratio of the associated current transformer shall be clearly marked on the relay faceplate.
- (ix) All relays shall be adjusted during manufacture to conform to the limits stipulated in BS 142.

(m) **Instruments**

- (i) Instruments, i.e. ammeters, voltmeters, combined maximum demand and indicating ammeters, kilowatt-hour meters, frequency meters and running-hour meters shall generally comply with the standard specification for 'DIRECT ACTING INDICATING INSTRUMENTS'.
- (ii) Voltmeters and ammeter scales shall have a full scale reading at least 5 % higher than the system voltage or associated current transformer rating with the latter values clearly marked.
- (iii) The instruments shall be suitably rated for the supply voltage, current and frequency.
- (iv) Each voltmeter shall be protected with easily accessible HRC fuses.
- (v) Each circuit breaker shall be equipped with a trip counter with cyclometer dial.

(n) **Auxiliary equipment**

- (i) Control switches

- Circuit breaker closing and tripping control switches shall close the associated circuit breaker when rotated clockwise.
- Control switches may be fitted with one pair of lazy contacts, i.e. contacts which make when the control switch is turned to the closed position, remain closed when the handle returns to the neutral position and only open when the control switch is moved to the trip position.
- The switches shall be provided with a suitable faceplate indicating the angle of throw and the switching positions.
- The switches shall be suitable for the supply voltage and the contact shall be silver-plated or gold laminated and shall be suitably rated for the switching function intended.
- Control switches shall be lockable in the "NEUTRAL" or "OFF" position.

(ii) Fuses

- All fuses for the protection of auxiliary circuits shall be of the high rupturing capacity cartridge type and shall be mounted on insulated draw-out carriers, which shall hold the fuses positively after withdrawal.
- The top terminal shall be the live terminal in all cases.
- HRC fuses shall be provided in the positive leads of all DC circuits.
- Fuses shall be so positioned that they are readily accessible to a person standing on the floor in front of the panel.
- Labels shall be fitted adjacent to fuses stating their use, rating and duty.

(iii) Indicator lamps

- Indicator lamps shall comply with the standard specification for "INDICATOR LIGHTS".

- The following indications shall be provided:

<u>FUNCTION</u>	<u>COLOUR</u>
Circuit breaker closed	Red
Circuit breaker open	Green
Incoming supply available (on incoming panel only)	White
Auto-trip	Amber
Trip circuit healthy	White

- A lamp test pushbutton for all the indicating lights shall be provided on each switchboard.
- The “trip circuit healthy” indication shall normally be off and a pushbutton shall be provided to indicate the status. The purpose of the indication is to ensure that the tripping voltage supply is available on the panel before the circuit breaker is closed. An indicator light with pushbutton is required on each panel and one indication per switchboard is not sufficient. The circuitry shall be arranged to provide an indication with the circuit breaker in both the “OPEN” and “CLOSED” positions.
- The condition indicated shall be designated below each light.

(iv) Pushbutton and pushbutton assemblies

Pushbuttons and pushbutton assemblies shall comply with the standard specification for these items.

(o) **DC Auxiliary supplies**

If specified, a battery derived DC supply shall be provided with the switchboard. The nominal voltage shall be 32 V DC unless specified to the contrary.

(i) Batteries

- The batteries shall be of the nickel-cadmium type and the cells shall be in high impact polystyrene containers with a large reserve of electrolyte.
- The number of cells and capacity shall be determined from the voltage requirements of the circuit-breaker closing and tripping circuitry and the discharge duties required by the switchboard.
- The battery capacity shall be sufficient to perform either of the following functions:
  - (a) Five successive tripping and reclosing operations of all the circuit-breakers on the switchboard

Or

  - (b) A single tripping and reclosing operation of all the circuit breakers on the switchboard plus supplying all the standing loads on the battery for at least 10 hours.
- Note : The alternative requiring the larger battery shall be used.

(ii) Battery charge unit

- A constant voltage type charger with current limiting facilities shall be provided. The output voltage shall be kept within 1 % of the float charge voltage designed for maximum charge conservation and a maximum battery life for variations of  $\pm 10$  % of the input voltage.
- The float charge voltage shall be less than the gassing voltage.
- The ripple content in the output of the charger shall be less than 2 %.
- The charger capacity shall be adequate to supply any standing load on the battery plus a charging current, which will recharge a fully discharged battery within 8 hours.
- A switch operated boost charge control shall be provided.
- An auxiliary winding shall be added to the charger transformer providing a secondary AC output suitable for all the indicating lights on the switchboard. The lights shall be supplied from this winding and not from the batteries.
- The charger shall be suitable for operation on a nominal 230 V, 50 Hz mains supply or from a supply obtained from a voltage transformer.
- The charger shall be complete with all the required controls including the following standard equipment:
  - a) Power supply isolator.
  - b) Ammeter indicating rectifier output.
  - c) Battery voltmeter.
- The following HRC fuses shall be provided:
  - a) Input fuses.
  - b) Rectifier output fuses.
  - c) Voltmeter fuses.
  - d) Fuses in charger transformer auxiliary output.
  - e) A pair of fuses for each DC circuit plus fuses for 3 spare circuits.
- If more than one battery output circuit is specified, each circuit shall be fitted with a pair of fuses.

(iii) Cubicle

- The batteries and charger shall be housed separately from the switchboard in a self-contained cubicle with the same finish and colour as the switchboard.

- The cubicle shall be dustproof and vermin proof.
- An undrilled removable cable gland plate shall be provided for bottom cable entry.

(iii) Finish

- All welds shall be ground smooth and joints wiped with plumber's metal in order to provide a smooth finish.
- All the metalwork shall be painted in accordance with the "STANDARD PAINTING SPECIFICATION".
- The final colour shall be confirmed by the Engineer.

(iv) Labels

- Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions appear in both official languages.
- Panel designation labels shall appear on the front and back of each panel and on the circuit-breaker truck.
- Engraved sandwiched interchangeable plastic or ivory strips shall be used throughout. The strips shall bear white lettering on a black background.
- Labels shall be secured by means of brass bolts, nuts and washers. Where this is not practicable cadmium-plated self-tapping screws may be used. The glueing of labels will not be acceptable. Sufficient fixing screws shall be provided to prevent labels from warping.

(r) **Tests**

(i) Manufacturer's tests

- All component parts of the equipment shall be subject to type tests and routine tests in accordance with the relevant SABS, BSI or IEC standard specifications.
- Oil circuit-breakers shall be subjected to the following tests in accordance with BS 5311, Part 4, adjusted for atmospheric correction:
- Type Tests :     a) Mechanical endurance.  
                          b) Temperature rise.  
                          c) Dielectric strength and impulse voltage  
                          d) Making and breaking capacity and short time current
- Routine Tests :     a) Power frequency voltage

- b) Resistance of the main circuit
  - c) Mechanical operation
- (ii) On site tests
  - The equipment shall be tested on site after erection and prior to commissioning.
  - The following minimum tests shall be performed:
    - a) Pressure tests on the primary and secondary circuits in accordance with BS 5227 or IEC 298.
    - b) Insulating oil tests in accordance with SABS 555.
    - c) Insulation resistance tests.
    - d) Primary injection tests.
    - e) Earth continuity and earth resistance tests.
    - f) Operating tests.
    - g) Any other tests which may be required to ascertain the correct functioning of the equipment.
- (iii) Test certificates
  - Copies of type test certificates shall be submitted together with the tender.
  - Copies of test certificates of all other tests i.e. routine tests and on site tests shall be forwarded to the Engineer on completion of the tests.
- (iv) Test performance and inspection
  - The Engineer shall be notified in writing at least two weeks in advance of any tests to be conducted to allow its representative to be present at such tests.
  - The Engineer shall also be notified timeously of the completion of the equipment in order that an inspection may be carried out prior to delivery.
- (t) **Oil and compound**
  - (i) The first filling of insulating oil for all the circuit breakers, oil switches, voltage transformers, etc. shall be provided by the switchgear supplier.
  - (ii) An adequate quantity of bituminous or cold filling compound shall be provided by the switchgear supplier for all the cable end boxes.
  - (iii) All other oils or compounds which may be required shall be provided by the switchgear supplier.

(u) **Tools and auxiliary equipment**

The following equipment shall be provided with each switchboard and the cost shall be included in the tender price:

- (i) One raising and lowering handle for every three circuit breakers.
- (ii) One complete set of special maintenance tools for all sizes of circuit breakers.
- (iii) A full set of earthing devices or earthing trucks.
- (iv) One wall mounted steel box for the storage of the above loose equipment. The door shall be padlockable.
- (v) At least six spare HRC fuses of each rating for secondary circuits and three voltage transformer, high voltage HRC fuses.
- (vi) At least three spare high voltage HRC fuses of each rating suitable for the fused oil switches.
- (vii) One cable test unit for each size circuit breaker or oil switch housed in a wall-mounted metal box.

(v) **Technical information**

- (i) Tenderers shall submit descriptive literature of the equipment with their tenders.
- (ii) Two copies of erection, operating and maintenance instruction manuals covering each type of equipment shall be provided with each switchboard.

## SPECIFIC REQUIREMENTS

ITEM		DESCRIPTION	PARAMETER	11KV SWITCHING SUBSTATION EXTENSION														
		PANEL NUMBER		1	TBC			TBC										
		PANEL NOMENCLATURE		TBC				TBC										
1.0	FEEDING FROM			S/S	11KV SUBSTATION EXISTING SWITCHGEAR			S/S										
2.0	FEEDING TO			Tr# 1				Tr# 2										
3.0	SYSTEM PARAMETERS																	
3.1	NOMINAL VOLTAGE	kV	11	11														
3.2	FAULT LEVEL (3 PHASE)	MVA	200	200														
3.3	POWER LINE																	
3.4	CABLE	mm²	25 Cu PILC	25 Cu PILC														
3.5	FEEDER LENGTH	m																
3.6	CAPACITY	A																
4.0	EARTHING METHOD																	
5.0	SWITCHGEAR																	
5.1	TYPE		METAL - CLAD INDOOR	METAL - CLAD INDOOR														
5.2	RATING	A	800	800														
5.3	DOUBLE / SINGLE BUSBAR		SINGLE	SINGLE														
5.4	BUSBAR RATING	A	1250	1250														
5.5	INSULATION MEDIUM		Vacuum	Vacuum														
5.6	TRIPPING METHOD		DC SHUNT	DC SHUNT														
5.7	CLOSING MECHANISM		MOT. CHARGED SPRING	MOT. CHARGED SPRING														
5.8	RATED VOLTAGE	kV	12	12														
5.9	IMPULSE WITHSTAND	kV	95	95														
5.10	RATED SHORT CIRCUIT	kA	20	20														
5.11	FINISH																	
5.11.1	MOVING PANEL PART		Match Exist Switchgear	Match Exist Switchgear														
5.11.2	FIXED PANEL PART		Match Exist Switchgear	Match Exist Switchgear														
6.0	PROTECTIVE INSTRUMENTS		TBC	TBC														
6.1	OVER CURRENT		Y	Y														
6.2	EARTH FAULT		Y	Y														
6.3	SENSITIVE EARTH FAULT		Y	Y														
6.4	PILOT WIRE RELAY		Y	Y														
6.5	AUTO RECLOSING		N	N														
7.0	CURRENT TRANSFORMERS (PROTECTION)																	
7.1	OVER CURRENT																	
7.1.1	NUMBER		3	3														
7.1.2	RATIO		400:1	400:1														
7.1.3	BURDEN	VA	15	15														
7.1.4	CLASS		5P10	5P10														
GENERAL NOTES				<div>SCHEDULE OF EQUIPMENT FOR SUBSTATION IN SASOL</div> <table><tr><th colspan="2">DRAWING NUMBER</th><th>DATE</th><th>DRAWN</th><th>CHECKED</th></tr><tr><td>TBC</td><td>PAGE 1 OF 3</td><td>Mar-23</td><td>GA LOTTER</td><td>GA LOTTER</td></tr></table>					DRAWING NUMBER		DATE	DRAWN	CHECKED	TBC	PAGE 1 OF 3	Mar-23	GA LOTTER	GA LOTTER
DRAWING NUMBER		DATE	DRAWN						CHECKED									
TBC	PAGE 1 OF 3	Mar-23	GA LOTTER						GA LOTTER									
1.0	Switchgear to comply to Standards: IEC56 and IEC 298, BS5311 and BS5227																	
	Degree of protection: IEC298, IEC529																	
2.0	Service conditions: 40 Deg C and 1600m above sea level																	
3.0	Electronic OC Relay: RS485 com port, MODBUS protocol																	
	Windows fully compatible including RELAY complete software																	



ITEM	DESCRIPTION	PARAMETER	11KV SWITCHING SUBSTATION EXTENSION														
	PANEL NUMBER		1	TBC			TBC										
	PANEL NOMENCLATURE		TBC				TBC										
7.2	PILOT WIRE			11KV SUBSTATION EXISTING SWITCHGEAR													
7.2.1	NUMBER																
7.2.2	RATIO																
7.2.3	BURDEN	VA															
7.2.4	CLASS																
8.0	CURRENT TRANSFORMERS (METERING)																
8.1	CURRENT																
8.1.1	NUMBER		3					3									
8.1.2	RATIO		400:1					400:1									
8.1.3	BURDEN	VA	15					15									
8.1.4	CLASS		1					1									
8.2	CURRENT SUMMATION																
9.0	ENERGY METER																
9.1	TYPE		ELSTER					ELSTER									
9.2	MODEL		A1700					A1700									
10.0	CURRENT TRANSUCERS (PROTECTION)																
10.1	INPUT																
10.2	OUTPUT																
11.0	CT TEST BLOCKS (GE PK-2 6-POLE OR SIMILAR)																
11.1	PROTECTION		YES					YES									
11.2	METERING		YES					YES									
12.0	VOLTAGE TRANSFORMER																
12.1	NUMBER																
12.2	RATIO																
12.3	CLASS																
12.4	VA																
13.0	VOLTAGE TRANSUCERS																
13.1	INPUT																
13.2	OUTPUT																
14.0	VOLTAGE SELECTION																
15.0	INDICATING LIGHTS																
15.1	C / B CLOSE		YES					YES									
15.2	C / B OPEN		YES					YES									
15.3	C / B TRIP		YES					YES									
16.0	INDICATING INSTRUMENTS																
16.1	AMPS (96mm x 96mm)		ONE - Y Phase					ONE - Y Phase									
16.2	VOLTS (96mm x 96mm)																
GENERAL NOTES			<div>SCHEDULE OF EQUIPMENT FOR SUBSTATION IN SASOL</div> <table><tr><td colspan="2">DRAWING NUMBER</td><td>DATE</td><td>DRAWN</td><td>CHECKED</td></tr><tr><td>TBC</td><td>PAGE 2 OF 3</td><td>Mar-23</td><td>GA LOTTER</td><td>GA LOTTER</td></tr></table>					DRAWING NUMBER		DATE	DRAWN	CHECKED	TBC	PAGE 2 OF 3	Mar-23	GA LOTTER	GA LOTTER
DRAWING NUMBER		DATE						DRAWN	CHECKED								
TBC	PAGE 2 OF 3	Mar-23						GA LOTTER	GA LOTTER								
1.0	Switchgear to comply to Standards: IEC56 and IEC 298, BS5311 and BS5227																
	Degree of protection: IEC298, IEC529																
2.0	Service conditions: 40 Deg C and 1600m above sea level																
3.0	Electronic OC Relay: RS485 com port, MODBUS protocol																
	Windows fully compatible including RELAY complete software																



### **36. NOTICES AND DANGER PLATES**

#### *SCOPE*

This specification deals with the provision of Notices and Danger Plates as required in terms of the Occupational Health and Safety Act No. 85 of 1993, as well as any other notices that may be required by law or by the nature of the finished Works.

The following standard specifications are referred to in this specification:

-

SABS 0140; Parts I to IV: Identification colour marking.

SABS 1186: Symbolic safety signs.

Occupational Health and Safety Act No 85 of 1993.

#### *MATERIALS AND FINISH*

Outdoor signs shall be either of vitreous enameled type or of cast aluminum with raised or embossed letters.

Indoor notices shall be of non-deteriorating plastic, Perspex or fiberglass.

The colors and size of letters and colors of background shall be in accordance with requirements of SABS 0140 and as approved by the Engineer.

Symbolic signs shall conform to the requirements of SABS 1186.

Signs shall be pre-drilled for fixing.

All fixing accessories shall be of non-corrosive material.

#### *INSTALLATION AND ERECTION*

The Contractor shall supply and fix permanently in position the signs and notices required by law for all the relevant working areas of the Works. Positions of signs shall be as prescribed by the relevant Regulations and as agreed by the Engineer.

### **37. ROTATING BRIDGE BRUSH GEAR**

The brush gear to be installed on the kingpost on the bridge at the center of the tank to facilitate connections between the incoming supply cable and the cable from the kingpost to the motor starter via the rotating arm, shall consist of the following:

- (a) A set of **four** 20 mm wide and **three** 8 mm wide **brass** slip rings on an ebonite or equivalent insulating sleeve (i.e. three slip rings or phase connections, one for the earth connection, three slip rings for the control circuit, namely, start, common and stop connections). Connections to these slip rings shall be effected via an approved heavy duty terminal block with stud brass terminals onto which the lugs on the cable tails shall be bolted. This terminal arrangement shall be completely independent of fixing screws for the slip rings.
- (b) A set of four main circuits and three control circuit "Morganite" carbon brushes, or equivalent. Each of these brushes shall be spring-loaded to ensure high contact pressure and the springs shall be rust-proofed.

The abovementioned brush gear shall be installed in a weatherproof IP55 grade 304 stainless steel housing with a weatherproof access door, on the kingpost of the bridge. This brush gear-housing shall be suitably sized to accommodate the relevant equipment without cramping, and shall be insect proofed.

The brush gear housing shall be designed and constructed to prevent the accumulation of gas and the condensation of moisture inside the housing and the pressure of the brushes on the slip rings shall be high enough to obtain a self-cleaning effect during operation.

The driving motor must be provided with a weatherproof emergency stop push button station mounted on the bridge in close proximity to the bridge access ladder. The supply and installation of cables between the motor, emergency push button station, brush gear and kingpost, shall form part of this Contract. The cable shall be installed in a grade 304 stainless steel conduit mounted on the underside of the bridge.

### **3.5.2 GENERAL TECHNICAL REQUIREMENTS FOR THE EXECUTION OF THE ELECTRICAL WORKS. (CONSTRUCTION)**

#### **1. INSTALLATION OF MULTICORE CABLES**

##### *Cable Trenches*

The contractor will be responsible for the excavation, bedding, back-filling, consolidating and making good of all cable trenches along the routes indicated on the drawings, with the exception of those sections of the cable routes where it is specifically on the accompanying drawings that open cable ducts will be provided by others. Where indicated on drawings ducts inside new buildings will be provided by others. The Contractor however will be responsible for the bedding and filling soil in cable ducts where necessary. A sealing screed to cover the cable duct shall be provided by others.

NOTE: Tenderers shall acquaint themselves fully with the nature and formation of the ground in which the cables are to be laid, before submitting a Tender. No subsequent claim for extras due to lack of knowledge in this respect will be entertained by the Employer.

Cable trenches for L.T. power and lighting cables shall be deep enough to facilitate the laying of these cables at a depth of 750 mm below final ground level.

Trenches for H.T. power cables shall be deep enough to facilitate the laying of these cables at a depth of 1 m below ground level. The floors of all cable trenches shall be smooth and free from boulders and sharp rock projections.

Plastic danger tape shall be installed in all cable trenches 300 mm above the cables for cable protection during future excavation.

Each cable shall be laid in a bedding of river sand or sifted soil 75 mm over and 75 mm below the cable-clayey soil will not be accepted as bedding.

No cable trench shall be back-filled before the cable(s) in the trench has been inspected and approved by the Engineer.

##### *Underground Cable Pipes*

Cable pipes will be supplied and installed by others unless indicated otherwise on the drawings.

Each cable pipe shall be sealed by the Contractor under this Contract at both ends by means of bitumen impregnated jute bags or similar material, after the cable have been installed.

### *Crossings with Other Services*

#### General

Where a cable is laid above another service it shall not be less than 750 mm below ground level, and if this is not possible, the cable shall be laid underneath the other service and shall be protected by means of concrete slabs in the manner prescribed. The deeper or shallower positions of the cable shall only apply for a distance of 1 m both directions of the crossing. If not possible to cross underneath the other service the matter shall be referred to the Engineer for a decision.

#### Clearances

The following minimum clearances shall be maintained between electrical cables and other services:

	VERTICAL	HORIZONTAL
Telkom cables	0,3 m	0,3m
Other water pipes	0,3m	0,3m
Sewerage pipes	0,3m	0,8m
Storm water pipes	0,3m	0,6m
Other Electrical cables	150mm	150mm

#### Laying of Cables

Cables must be laid without delay

The cables shall be laid with minimum of delay in order to backfill the trenches as soon as possible.

The Contractor shall, however not backfill the trench until each length of cable has been tested, inspected and approved by the Engineer.

Only one cable shall be laid at a time and the Contractor shall ensure that cables already laid are not damaged.

#### Method

All cables shall be handled with the utmost care and shall be laid in accordance with the best methods observed in good modern practice. All cables shall be run out on rollers in order to prevent abrasion and no cable

shall be dragged along the ground. No cables shall be bent to a radius of less than 12 times its overall diameter.

#### Installation of Multi core Cables:-

##### ( a ) In concrete ducts

Cables shall be laid neat parallel with each other on the floor of the duct with the maximum spacing

##### ( b ) On cable ladders

Cable shall be installed neat and parallel with each other with the maximum spacing. On Horizontal sections the cables shall be secured to the cable ladders with intervals of not more than 2 m. On vertical sections or where the cable ladders are installed at an angle the cables shall be secured to the cable ladders with interval with intervals of not less than 500 m.

Sections of the cable ladders shall be electrically connected and provision shall be made for crimping and expansion of the racks.

##### ( c ) In Trenches

Two or more L.T. cables in the same trench shall be laid in parallel and not less than 75 mm apart, except where otherwise approved.

H.T. cables in the same trench shall be laid parallel and not less than 150 mm apart, except where otherwise approved.

All L.T. power cables shall be laid 750 mm below final ground level and H.T. power cables shall be laid 1 m below final ground level.

The contractor shall provide 3 m slack at each run of power cable and its associated earth wire and bury the same in the ground as near to the relevant end as possible. Where the cables and earth wires are to be installed in open ducts outside buildings, the slack shall be coiled in the ducts.

The separation between any signal cable and the nearest parallel power cable shall not be less than 150 mm.

##### ( d ) Against Walls

Cables and earth wires to be installed on walls, where approved by the Engineer, shall be neatly installed on heavy duty hot dipped galvanized steel cable racks. Cables and earth wires on outside walls shall be installed in a similar manner or in suitably sized hot dipped galvanized conduit from 300 mm below up to 2,4 m above final ground level or as required. These conduits shall be secured to the walls by means of hot dipped galvanized steel bath holders at intervals not exceeding 600 mm. (Hospital Saddles).

Saddles shall be secured by means of round headed hot dipped galvanized screws and plugs of an approved type. (Wood will not be accepted as plugging material.) Plug will not be allowed in joints between bricks.

( e )      On Poles

Cables and earth wires to be installed on poles shall be secured to the poles at intervals not exceeding 600 mm by means of 25 mm x 1,5 mm adjustable Grade 304 Stainless Steel straps. Each cable together with its associated earth wire shall be installed in a suitably sized stainless steel pipe or channel from 300 mm below up to 2,4 m above ground level. This pipe or channel shall be secured to the pole by means of 25 mm x 1,5 mm adjustable stainless steel straps at intervals not exceeding 600 mm. To avoid metallic action between different materials Neoprene rubber strip shall be installed between the pole and the strap.

( f )      Cable Channels on Structures and in Buildings

Where cable channels have been provided on structures and in building these must be backfilled with river sand by the contractor.

*Backfilling of Trenches*

Once the cable has been laid, straightened, inspected, approved and covered with the top layer of bedding soil, the trenches shall be backfilled with soil which does not contain more than 40 % rock or shale and will pass through a sieve with 100 mm diameter holes that has been approved by Engineer.

Back-filling of cable trenches shall be done in layers of 150 mm and shall be compacted and consolidated to 95 % modified AASHTO. Test shall be carried out to ensure the required compaction at the cost of the Contractor.

The closed-up sections of the cable trenches shall be maintained by the Contractor in a proper, safe condition for the duration of the contract.



Where the soil in the trenches subsides it shall be refilled and compacted to the satisfaction of the Engineer.

#### *Jointing and Terminating of Cables*

No joint will be allowed in any run of power cable.

All multi core PVC SWA PVC cables shall be terminated at each end by means of a suitably sized cable gland with armour clamp and Neoprene shroud. The armoring of the cable shall be bonded to earth at each end.

All 11 kV cables shall be terminated in compound filled end boxes.

The termination shall be made to the manufacturer's instructions and with materials stipulated in such instructions and with materials stipulated in such instructions.

Where panels are provided with end boxes, these boxes shall be employed to terminate the cable end boxes and shall be filled with the prescribed mass of compound type Henley list No 57040.

The making off of cable ends shall be done strictly in accordance with the manufacturer's instructions as well as the filling of the boxes.

#### *Testing of Cables*

##### *Low voltage cables*

On each completed section of laid and joined cable, the insulation shall be tested to approval with an approved "Megger"-type instrument of not less than 500 V.

##### *11 kV cables*

On each completed section of laid and jointed high tension cable a high voltage test shall be carried out. The test shall be performed according to SABS 97 of 1991. Alternating or direct current may be used.

#### *Earth wires*

Earth wires shall be installed with L.T. cables as and where indicated on the drawings or specified here in and shall consist of bare hard-drawn copper wire.

These earth wires shall be installed at the same depth as the relevant cables, with at least 75 mm clearance between any earth wire and the nearest cable, unless specifically approved otherwise.

No joint will be allowed in any run of earth wire.

Each earth wire shall be terminated at each end by means of a suitably sized bolted lug either sweated or crimped onto the wire. The lugs shall be bolted onto the relevant earth bars or earthing terminals

#### *Cable Markers*

Cable markers with lead labels cast into the top of the cable markers shall be supplied and installed along the cable routes under this Contract as follows:

Along straight runs of the route, not further than 25 m apart;

At turns - one on each side of the turning point, 900 mm from such turning points;

At each branch, 3 markers – i.e. one on each side of the branch, 900 mm from the branch.

The cable marker shall be installed deep enough to ensure that the top of the marker will protrude 50 mm above final ground level.

#### *Route Plans to be Submitted by the Contractor*

On completion of the works, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans (polyester prints) indicating in a satisfactory manner:

The exact cable routes with reference to fixed points (e.g. buildings);

The exact lengths of cable (H.T and LT) installed between terminating points and between joints where relevant; and

The exact position of cable joints with reference to fixed points (e.g. buildings ).

Prints of the various plans for the marking up of the information required, will be supplied to the contractor on request.

#### *Cable measuring, procurement & payment*

The cable lengths in the BOQ are indicative only. The successful tenderer shall measure all cable routes and verify all cable lengths before procuring any cable. Payment shall be done only for actual lengths installed. Pricing should include for off-cuts.

## **2. PLUGGING OF BRICK WALLS AND CONCRETE**

Only plugging material of an approved type may be used for fixing to brick walls and concrete, wood will not be acceptable. Plugging in joints of brick walls will not be acceptable. Only round headed brass screws shall be used for fixing.

Steel structures may not be drilled without written approval of the Engineer. Where steel structures may not be drilled the electrical contractor shall use suitable Grade 304 Stainless Steel clamps for securing the equipment.

## **3. INSTALLATION OF DISTRIBUTION BOARDS AND MOTOR CONTROL BOARDS**

Each of the relevant distribution boards and motor control boards shall be securely bolted down on the floor or plinth by means of the requisite number of foundation bolts grouted into the floor in the positions indicated on the drawings.

These positions shall be confirmed with the Engineer on site, prior to installation.

*Testing and Commissioning of Distribution/Motor Control Boards After Installation on site.*

After installation on site but prior to commissioning the following inspections and tests shall be performed on each distribution/motor control board.

Check all components to ensure that they are free from dust and protective packing material;

Check operation of all components liable to damage in transit such as meter and protection measured;

The insulation of all primary circuits between phases mutually and between each phase and earth shall be measured;

All fused links shall be checked for electrical continuity; and

All control supplies shall be checked.

All adjustable protection devices shall then be met and the boards commissioned all in consultation with and to the instruction of the Engineer.

#### **4. EARTHING**

The contractor shall do all the bonding and ear thing in accordance with the latest addition of the "Code of Practice for the Wiring of Premises" SABS 0142

The substation and HT switch room ear thing shall consist of a 70 mm<sup>2</sup> bare copper earth wire installed in the same trench as the HT supply cables.

#### **5. BALANCING OF LOAD**

The contractor shall balance the load as evenly as possible over three phases on the main board, as well as on all the motor control boards.

#### **6. NAME PLATES**

Cubicles and pedestals shall be marked with the associated motor number. A list of numbers will be provided by the Engineer. The numbers shall be rear engraved on Perspex or similar material. The number shall be black, 40 mm high, on a yellow background. The height of the plate shall be 50 mm. The number shall be secured, on top of the pedestal, as prescribed for distribution boards.

777 Municipality						
UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION						
Project No. 777						
ELECTRICAL EQUIPMENT SPECIFICATION						
FPS (01) MCC1						
1	Panel Requirements:					
1	1 Type	Free standing, indoor, front bottom & back access with hinged doors, extendable				
1	2 IA Rating	25kA, 400V.				
1	3 Busbar Type	Horizontal and vertical flat busbars.				
1	4 Cable terminations	Crimped connection lugs.				
1	5 Material & Finishing	2.5mm mild steel, electrical orange, baked enamel.				
1	6 Panel designation	SASOL DISTRIBUTION PUMP STATION - MAIN MCC SECTION 1.				
1	7 Panel placement	TBC				
1	8 Power Correction	Power correction, on incoming electrical supply.				
1	9 Earthing	Yes, earth-mat.				
2	Incomer Cubicle:					
2	1 Main switch	Instant, adjustable, overload protection, sensitive earth fault, Digital output to PLC.				
2	2 Rating	Rated for Trf: 800A				
2	3 400V volt meter	3 Phases, analogue with phase selector				
2	4 Ampere meter	3 Phases, analogue, for each phase.				
2	5 Surge protection	3 Phases + Neutral to earth with indication (Typical SURGETEK/DEHN).				
2	6 kWh meter	3 Phase, kW, kVA, PF, Max. demand, kWh, kVAR meter with GSM/Ethernet modem.				
2	7 Voltage protection	Over & Under, with digital output to PLC and lamp indication				
2	8 Phase protection	Failure & Reversal with digital output to PLC and lamp indication				
3	Motor Controls Cubicles:					
	EQUIPMENT	Pump No.1	Pump No.2	Drainage Pump No.1	Ventilation No.1	Lifting Equipment No.1
3	1 Motor Size (kW)	132	132	15	15	15
3	2 Motor FLC (A)	TBA	TBA	TBA	TBA	TBA
3	3 Main					
3	4 Circuit Breaker (CB)	Curve 2	Curve 2	Curve 2	Curve 2	Curve 2
3	5 CB, Door Operated	✓	✓	✓	✓	✓
3	6 Q/L protection	✓	✓	✓	✓	✓
3	7 CT protect/meter	✓	✓	✓	✓	✓
3	8 Motor Starter	VSD	VSD	Soft-start	Soft-start	Soft-start
3	9 Motor Reverse					
3	10 Door Mounted					
3	11 Voltmeter	✓	✓	✓	✓	✓
3	12 Amp meter	✓	✓	✓	✓	✓
3	13 Man/OFF/Auto select	✓	✓	✓	✓	✓
3	14 On/OFF select	✓	✓	✓	✓	✓
3	15 START button	✓	✓	✓	✓	✓
3	16 STOP button	✓	✓	✓	✓	✓
3	17 Alarm Reset button	✓	✓	✓	✓	✓
3	18 Reverse button	✓	✓	✓	✓	✓
3	19 Lamp Test button	✓	✓	✓	✓	✓
3	20 RUN light	✓	✓	✓	✓	✓
3	21 STOP light	✓	✓	✓	✓	✓
3	22 TRIP light	✓	✓	✓	✓	✓
3	23 Reverse light	✓	✓	✓	✓	✓
3	24 Run-hr Meter	✓	✓	✓	✓	✓
3	25 Control/Protect	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer
3	26 Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer
3	27 Alternate	✓	✓	Differential Level	Differential Level	Differential Level
3	28 Start level	✓	✓	Differential Level	Differential Level	Differential Level
3	29 Stop level	✓	✓	Differential Level	Differential Level	Differential Level
3	30 Eng Low	✓	✓			
3	31 Eng High	✓	✓			
3	32 Proportional Flow					
3	33 Pressure					
3	34 Solenoid Valve					
3	35 Motor heater	✓	✓			
3	36 Motor therm.	✓	✓			
3	37 Torque			✓	✓	✓
3	38 No flow	✓	✓			
3	39 Power Surge	✓	✓			
3	40 Earth Leakage					

777 Municipality							
UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION							
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ELECTRICAL EQUIPMENT SPECIFICATION							
EPS 01: MCC1							
1. Panel Requirements:							
1. 1 Type	Free standing, indoor, front bottom & back access with hinged doors, extendable						
1. 2 kA Rating	25kA, 400V.						
1. 3 Busbar Type	Horizontal and vertical flat busbars.						
1. 4 Cable terminations	Crimped connection lugs.						
1. 5 Material & Finishing	2.5mm mild steel, electrical orange, baked enamel.						
1. 6 Panel designation	SASOL DISTRIBUTION PUMP STATION - MAIN MCC SECTION 1.						
1. 7 Panel placement	TBC						
1. 8 Power Correction	Power correction, on incoming electrical supply.						
1. 9 Earthing	Yes, earth-mat.						
2. Incomer Cubicle:							
2. 1 Main switch	Instant, adjustable, overload protection, sensitive earth fault, Digital output to PLC.						
2. 2 Rating	Rated for Trfr: 800A						
2. 3 400V volt meter	3 Phases, analogue with phase selector						
2. 4 Ampere meter	3 Phases, analogue, for each phase.						
2. 5 Surge protection	3 Phases + Neutral to earth with indication (Typical SURGETEK/DEHN).						
2. 6 kWh meter	3 Phase, kW, kVA, PF, Max. demand, kWh, kVAR meter with GSM/Ethernet modem.						
2. 7 Voltage protection	Over & Under, with digital output to PLC and lamp indication						
2. 8 Phase protection	Failure & Reversal with digital output to PLC and lamp indication						
3. Motor Controls Cubicles:							
	EQUIPMENT	Pump No.1	Pump No.2	Drainage Pump No.1	Ventilation No.1	Lifting Equipment No.1	
3. 1 Motor Size (kW)		132	132	15	15	15	
3. 2 Motor FLC (A)		TBA	TBA	TBA	TBA	TBA	
3. 3 Circuit Breaker (CB)		Curve 2	Curve 2	Curve 2	Curve 2	Curve 2	
3. 4 CB, Door Operated		✓	✓	✓	✓	✓	
3. 5 O/L protection		✓	✓	✓	✓	✓	
3. 6 CT protect/meter		✓	✓	✓	✓	✓	
3. 7 Motor Starter		VSD	VSD	Soft-start	Soft-start	Soft-start	
3. 8 Motor Reverse							
3. 9 Voltmeter							
3. 10 Amp meter		✓	✓	✓	✓	✓	
3. 11 Man/OFF/Auto select		✓	✓	✓	✓	✓	
3. 12 On/OFF select							
3. 13 START button		✓	✓	✓	✓	✓	
3. 14 STOP button		✓	✓	✓	✓	✓	
3. 15 Alarm Reset button		✓	✓	✓	✓	✓	
3. 16 Reverse button							
3. 17 Lamp Test button		✓	✓	✓	✓	✓	
3. 18 RUN light		✓	✓	✓	✓	✓	
3. 19 STOP light		✓	✓	✓	✓	✓	
3. 20 TRIP light		✓	✓	✓	✓	✓	
3. 21 Reverse light							
3. 22 Run-hr Meter		✓	✓		✓	✓	
3. 23 Control/Protect		Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	Adjustable Timer	
3. 24 Alternate							
3. 25 Start level		✓	✓	Differential Level	Differential Level	Differential Level	
3. 26 Stop level		✓	✓				
3. 27 Emg Low		✓	✓				
3. 28 Emg High		✓	✓				
3. 29 Proportional Flow							
3. 30 Day/Night							
3. 31 Pressure							
3. 32 Solenoid Valve							
3. 33 Motor heater		✓	✓				
3. 34 Motor therm.		✓	✓				
3. 35 Torque				✓	✓	✓	
3. 36 No flow		✓	✓				
3. 37 Power Surge		✓	✓				
3. 38 Earth Leakage							



777 Municipality																	
UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION																	
Project No. 777																	
ELECTRICAL EQUIPMENT SPECIFICATION																	
EPS 02: MCC2																	
1. Panel Requirements:																	
1.1 Type Free standing, indoor, front bottom & back access with hinged doors, extendable																	
1.2 kA Rating 25kA, 400V.																	
1.3 Busbar Type Horizontal and vertical flat busbars.																	
1.4 Cable terminations Crimped connection lugs.																	
1.5 Material & Finishing 2.5mm mild steel, electrical orange, baked enamel.																	
1.6 Panel designation SASOL DISTRIBUTION PUMP STATION - MAIN MCC SECTION 2.																	
1.7 Panel placement TBC																	
1.8 Power Correction Power correction, on incoming electrical supply.																	
1.9 Earthing Yes, earth-mat.																	
2. Incomer Cubicle:																	
2.1 Main switch Instant, adjustable, overload protection, sensitive earth fault, Digital output to PLC.																	
2.2 Rating Rated for Trfr: 800A																	
2.3 400V volt meter 3 Phases, analogue with phase selector																	
2.4 Ampere meter 3 Phases, analogue, for each phase.																	
2.5 Surge protection 3 Phases + Neutral to earth with indication (Typical SURGETEK/DEHN).																	
2.6 kWh meter 3 Phase, kW, kVA, PF, Max. demand, kWh, kVAR meter with GSM/Ethernet modem.																	
2.7 Voltage protection Over & Under, with digital output to PLC and lamp indication																	
2.8 Phase protection Failure & Reversal with digital output to PLC and lamp indication																	
3. Motor Controls Cubicles:																	
EQUIPMENT Pump No.3 Pump No.4 Drainage Pump No.2 Ventilation No.2 Lifting Equipment No.2 Local DB MV Switch Room Sub-DB Welding Plug 220V Plug PLC Panel SCADA Panel Level Meter Pump Room Lights Control Room Lights Valve Room Lights Area Lighting																	
3.1 Motor Size (kW) 132 132 15 15 15 N/A N/A N/A N/A N/A N/A N/A N/A N/A																	
3.2 Motor FLC (A) TBA TBA TBA TBA TBA 100 60 35 20 10 20 10 10A 10A 10A 10A																	
Main																	
3.3 Circuit Breaker (CB) Adj C2 Adj C2 C2 C2 C2 ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓																	
3.4 CB, Door Operated ✓ ✓ ✓ ✓ ✓																	
3.5 O/L protection ✓ ✓ ✓ ✓ ✓																	
3.6 CT protect/meter ✓ ✓ ✓ ✓ ✓																	
3.7 Motor Starter VSD VSD Soft-start Soft-start Soft-start																	
3.8 Motor Reverse																	
Door Mounted																	
3.9 Voltmeter																	
3.10 Amp meter ✓ ✓ ✓ ✓ ✓																	
3.11 Man/OFF/Auto select ✓ ✓ ✓ ✓ ✓																	
3.12 On/OFF select																	
3.13 START button ✓ ✓ ✓ ✓ ✓																	
3.14 STOP button ✓ ✓ ✓ ✓ ✓																	
3.15 Alarm Reset button ✓ ✓ ✓ ✓ ✓																	
3.16 Reverse button																	
3.17 Lamp Test button ✓ ✓ ✓ ✓ ✓																	
3.18 RUN light ✓ ✓ ✓ ✓ ✓																	
3.19 STOP light ✓ ✓ ✓ ✓ ✓																	
3.20 TRIP light ✓ ✓ ✓ ✓ ✓																	
3.21 Reverse light																	
3.22 Run-hr Meter ✓ ✓ ✓ ✓ ✓																	
Control/Protect																	
Adjustable Timer Adjustable Timer Adjustable Timer Adjustable Timer Adjustable Timer																	
3.23 Timer																	
3.24 Alternate																	
3.25 Start level ✓ ✓ Differential Level Differential Level Differential Level																	
3.26 Stop level ✓ ✓																	
3.27 Emg Low ✓ ✓																	
3.28 Emg High ✓ ✓																	



777 Municipality

UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION

Phase No. 777

ELECTRICAL EQUIPMENT SPECIFICATION

EPS 02: MCC2

1.	<b>Panel Requirements:</b>																
1.1	Type	Free standing, indoor, front bottom & back access with hinged doors, extendable															
1.2	kA Rating	25kA, 400V.															
1.3	Busbar Type	Horizontal and vertical flat busbars.															
1.4	Cable terminations	Crimped connection lugs.															
1.5	Material & Finishing	2.5mm mild steel, electrical orange, baked enamel.															
1.6	Panel designation	SASOL DISTRIBUTION PUMP STATION - MAIN MCC SECTION 2.															
1.7	Panel placement	TBC.															
1.8	Power Correction	Power correction, on incoming electrical supply.															
1.9	Earthing	Yes, earth-mat.															
2.	<b>Incomer Cubicle:</b>																
2.1	Main switch	Instant, adjustable, overload protection, sensitive earth fault, Digital output to PLC.															
2.2	Rating	Rated for Trfr: 800A															
2.3	400V volt meter	3 Phases, analogue with phase selector															
2.4	Ampere meter	3 Phases, analogue, for each phase.															
2.5	Surge protection	3 Phases + Neutral to earth with indication (Typical SURGETEK/DEHN).															
2.6	kWh meter	3 Phase, kW, kVA, PF, Max. demand, kWh, kVAR meter with GSM/Ethernet modem.															
2.7	Voltage protection	Over & Under, with digital output to PLC and lamp indication															
2.8	Phase protection	Failure & Reversal with digital output to PLC and lamp indication															
3.	<b>Motor Controls Cubicles:</b>																
	EQUIPMENT	Pump No.3	Pump No.4	Drainage Pump No.2	Ventilation No.2	Lifting Equipment No.2	Local DB	MV Switch Room Sub-DB	Welding Plug	220V Plug	PLC Panel	SCADA Panel	Level Meter	Pump Room Lights	Control Room Lights	Valve Room Lights	Area Lighting
3.29	Proportional Flow																✓
3.30	Day/Night																
3.31	Pressure																
3.32	Solenoid Valve																
3.33	Motor heater	✓	✓														
3.34	Motor therm.	✓	✓														
3.35	Torque			✓		✓											
3.36	No flow	✓	✓														
3.37	Power Surge	✓	✓								✓	✓	✓				
3.38	Earth Leakage								✓	✓							
3.39	Other																
	Remote Control																
3.40	START																
3.41	STOP (Push/Release)	✓	✓	✓	✓	✓											
3.42	Isolator	✓	✓											✓	✓	✓	✓
4.	<b>Material Requirements:</b>																
4.1	Push Buttons	Siemens, Schneider or similar in performance.															
4.2	Indicating Lights	Siemens, Schneider or similar in performance.															
4.3	Amp meter	Instantaneous 90° movement, 100% over scale, 100mm face, max. Amp indication device.															
4.4	Voltmeter	100mm face.															
4.5	Circuit Breaker	Motor starting suitable (motor curve).															
4.6	Motor Control Components	Telemecanique, Siemens, Schneider or similar in performance.															
	Electrical Motor Type:	All electrical motors, Squirrel Cage, 380V/415V, 3 Phase 50Hz, IE3.															
	Cable Trenching:	Done by Civil contractor.															
	Cable support:	Unistrut and cable tray equipment and accessories, strap at 300mm intervals.															
	Specifications:	SANS 10142, 1473-1:2003, 1765:2003 & 60439-1:2004															
	Instrumentation:	MCC or enclosure mounted.															

??? MUNICIPALITY  
UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION  
Project No. ???  
Date: 25 Feb 2023

**LOAD LIST**

Item No.	Equipment Description	Location	Starter	Sub-mersible	Volt	Phase	Rating	Unit	kVA (running)	kVA (start-up)	Amps	PF	Drive Eff.	Util. Factor	kVA (Util Factor)	Stand-by Power	
Bulk Distribution Pump Station Section 1																	
1	Pump No. 1	5/5	VSD	No	400	3	132	kW	151.724	151.724	230.00	0.87	95.2	1	151.72	YES	
2	Pump No. 2	5/5	VSD	No	400	3	132	kW	151.724	151.724	230.00	0.87	95.2	1	151.72	YES	
5	Drainage Pump no. 1	5/5	DOL	No	400	3	15	kW	18.072	108.434	28.70	0.83	91	1	108.43	YES	
7	Ventilation 1	5/5	RCB	No	230	1	5	kW	5.882	5.882	21.74	0.85	100	1	5.88	YES	
9	Lifting equipment 1	5/5	RCB	No	400	3	5	kW	5.882	5.882	12.50	0.85	100	1	5.88	YES	
									333.29	423.65							423.65
Bulk Distribution Pump Station Section 2																	
3	Pump No. 3	5/5	VSD	No	400	3	132	kW	151.724	151.724	230.00	0.87	95.2	1	151.72	YES	
4	Pump No. 4	5/5	VSD	No	400	3	132	kW	151.724	151.724	230.00	0.87	95.2	1	151.72	YES	
6	Drainage Pump no. 2	5/5	DOL	No	400	3	15	kW	18.072	108.434	28.70	0.83	91	1	108.43	YES	
8	Ventilation 2	5/5	RCB	No	230	1	5	kW	5.882	5.882	21.74	0.85	100	1	5.88	YES	
10	Lifting equipment 2	5/5	RCB	No	400	3	5	kW	5.882	5.882	12.50	0.85	100	1	5.88	YES	
11	Outdoor Lighting	5/5	RCB	No	230	1	1.6	kW	1.882	1.882	6.96	0.85	100	1	1.88	YES	
12	PLC Cabinet	5/5	RCB	No	230	1	10	Amp	2.556	2.556	10.00	0.90	75	1	2.56	YES	
13	Local DB	5/5	RCB	No	400	3	80	Amp	61.584	61.584	80.00	0.90	75	1	61.58	YES	
									399.31	489.67							489.67

CLIENT: XXX MUNICIPALITY	REVISION: 03 - FOR APPROVAL
CONTRACT: UPGRADING OF SASOL BULK DISTRIBUTION PUMP STATION	DATE: 20230225
CONTRACTOR: XXX	
CONSULTANT: WATERSPEC	
NOTES:	
Ambient temp: 30 degrees C	
1) MOTOR EARTH INCLUDED IN MOTOR CABLE 4TH CORE	
2) CABLE CORRECTION FACTOR (CORRECTION FACTOR IS AS INDICATED)	
3) MAX VOLT DROP AS PER TENDER CABLE SCHEDULE BASED ON ESTIMATED CABLE LENGTHS TO BE RE CALCULATED BASED ON ACTUAL LENGTHS	

Distribution Pump Station																								
PANEL SOURCE	CABLE TAG	DRIVE IDENTIFICATION	CABLE SOURCE	CABLE DELIVERY	TYPE OF STARTER	POWER RATING	CR1 (LOAD SETTING)	VOLTS (V)	Nb OF PHASES	CABLE SIZE	Nb OF CORES	CABLE TYPE	Nb OF CABLE GROUPS	Nb OF CABLES PER GROUP	CABLES RUN PER RUN	ESTIMATED RUN LENGTH	VOLT DROP MAX %	VOLT DROP ACTUAL %	INSTALL METHOD	CABLE CURRENT RATING (A)	CF GROUPING (FA)	ACTUAL CURRENT (A)	VOLT DROP MAX A	VOLT DROP ACTUAL A
TRF 1	MCC Sec 1	INCOMING SUPPLY FROM TRF 1		TRF	NA	100.0kW	70.0A	400V	3-PHASE	600.0mm <sup>2</sup>	10	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	NA A	0.75	0.00	0.00	0.00
TRF 2	MCC Sec 2	INCOMING SUPPLY FROM TRF 2			NA	100.0kW	70.0A	400V	3-PHASE	600.0mm <sup>2</sup>	10	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	NA A	0.75	0.00	0.00	0.00
MCC Sec 1	11-MCC-001	Pump No. 1	MCC Sec 1	MOTOR	VSD	100.0kW	200.0A	400V	3-PHASE	10.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	107 A	0.75	0.00	0.00	0.00
	11-MCC-002			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-003			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 1	11-MCC-004	Pump No. 2	MCC Sec 1	MOTOR	VSD	100.0kW	200.0A	400V	3-PHASE	10.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	107 A	0.75	0.00	0.00	0.00
	11-MCC-005			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-006			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 1	11-MCC-007	Drainage pump	MCC Sec 1	MOTOR	VSD	10.0kW	20.0A	400V	3-PHASE	6.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m	2.5%	0.00%	DUCTS	40 A	0.75	0.00	0.00	0.00
	11-MCC-008			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-009			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 1	11-MCC-010	Ventilation 1	MCC Sec 1	MOTOR	VSD	0.5kW	0.75A	400V	3-PHASE	2.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m	2.5%	0.00%	DUCTS	20 A	0.75	0.00	0.00	0.00
	11-MCC-011			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m								
	11-MCC-012			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	20m								
MCC Sec 1	11-MCC-013	Ring equipment 1	MCC Sec 1	MOTOR	VSD	0.5kW	0.75A	400V	3-PHASE	2.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m	2.5%	0.00%	DUCTS	20 A	0.75	0.00	0.00	0.00
	11-MCC-014			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m								
	11-MCC-015			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	20m								
MCC Sec 1	11-MCC-016	Pump No. 3	MCC Sec 2	MOTOR	VSD	100.0kW	200.0A	400V	3-PHASE	10.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	107 A	0.75	0.00	0.00	0.00
	11-MCC-017			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-018			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 1	11-MCC-019	Pump No. 4	MCC Sec 2	MOTOR	VSD	100.0kW	200.0A	400V	3-PHASE	10.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	2	2	50m	2.5%	0.00%	DUCTS	107 A	0.75	0.00	0.00	0.00
	11-MCC-020			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-021			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 2	11-MCC-022	Drainage pump 2	MCC Sec 2	MOTOR	VSD	10.0kW	20.0A	400V	3-PHASE	6.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m	2.5%	0.00%	DUCTS	40 A	0.75	0.00	0.00	0.00
	11-MCC-023			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	50m								
	11-MCC-024			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	50m								
MCC Sec 2	11-MCC-025	Ventilation 2	MCC Sec 2	MOTOR	VSD	0.5kW	0.75A	400V	3-PHASE	2.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m	2.5%	0.00%	DUCTS	20 A	0.75	0.00	0.00	0.00
	11-MCC-026			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m								
	11-MCC-027			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	20m								
MCC Sec 2	11-MCC-028	Ring equipment 2	MCC Sec 2	MOTOR	VSD	0.5kW	0.75A	400V	3-PHASE	2.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m	2.5%	0.00%	DUCTS	20 A	0.75	0.00	0.00	0.00
	11-MCC-029			ELECTROSTART STATION	NA	NA	NA	200V	1-PH	1.5mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	20m								
	11-MCC-030			MOTOR THERMISTOR	NA	NA	NA	NA	NA	2.5mm <sup>2</sup>	30	PVCBIAAPVC Co	1	1	1	20m								
MCC Sec 2	11-MCC-031	Local DB	MCC Sec 2	LOCAL DB	FCR	NA	NA	400V	3-PHASE	25.0mm <sup>2</sup>	40	PVCBIAAPVC Co	1	1	1	10m	2.5%	0.00%	DUCTS	NA A	0.75	0.00	0.00	0.00

# **PART C4**

# **SITE INFORMATION**

## **C4 Site Information**

### **C4.1 Scope of Site Information**

#### **C4.1.1 LOCATION OF THE WORKS**

The pump station is located at the Sasolburg Town.

#### **C4.1.2 DESCRIPTION OF THE SITE AND ACCESS**

Contractor to organise access in consultation with the Municipality.

#### **C4.1.1 GEOLOGICAL AND GEOTECHNICAL ASPECTS**

Contractors must acquaint themselves of the conditions on site.

#### **C4.1.2 EXISTING STRUCTURES**

There is existing infrastructure present on the site.

# **PART C5 ANNEXURES**

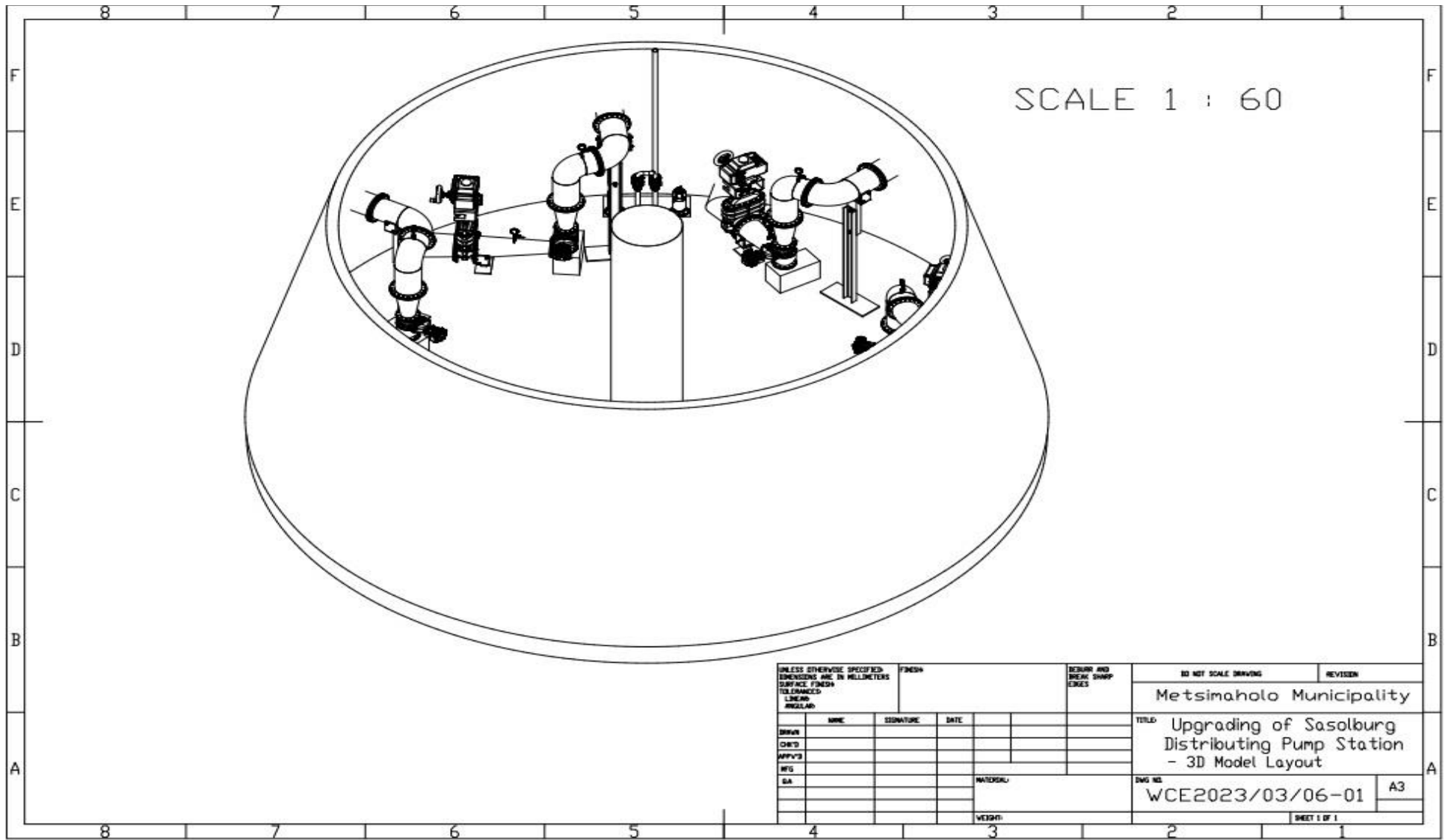
## **TENDER DRAWINGS**

The work shall be carried out in accordance with the following drawings which form part of these contract documents:

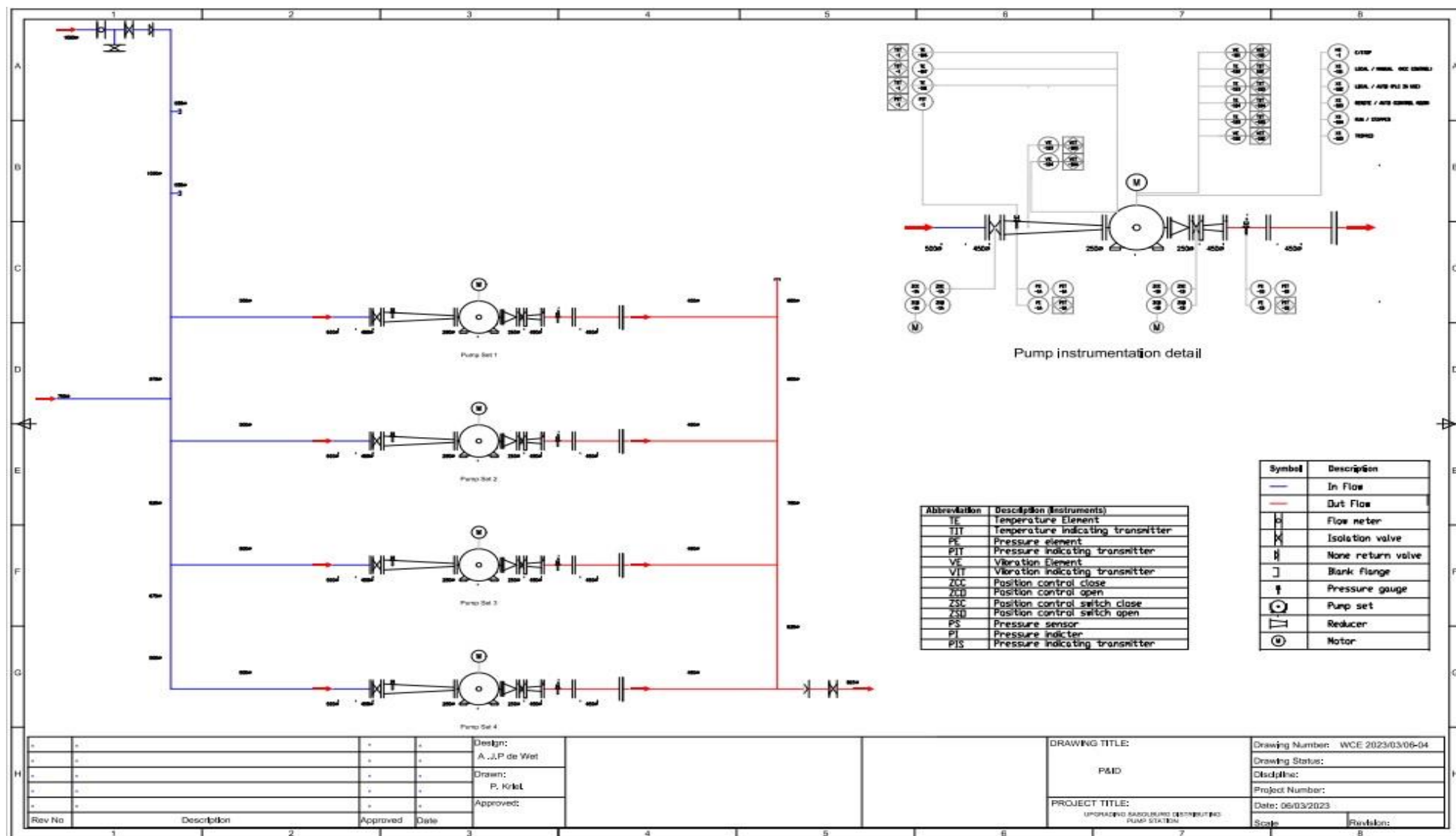
**PLEASE NOTE: THIS DRAWINGS ARE  
FOR TENDER PURPOSE ONLY**

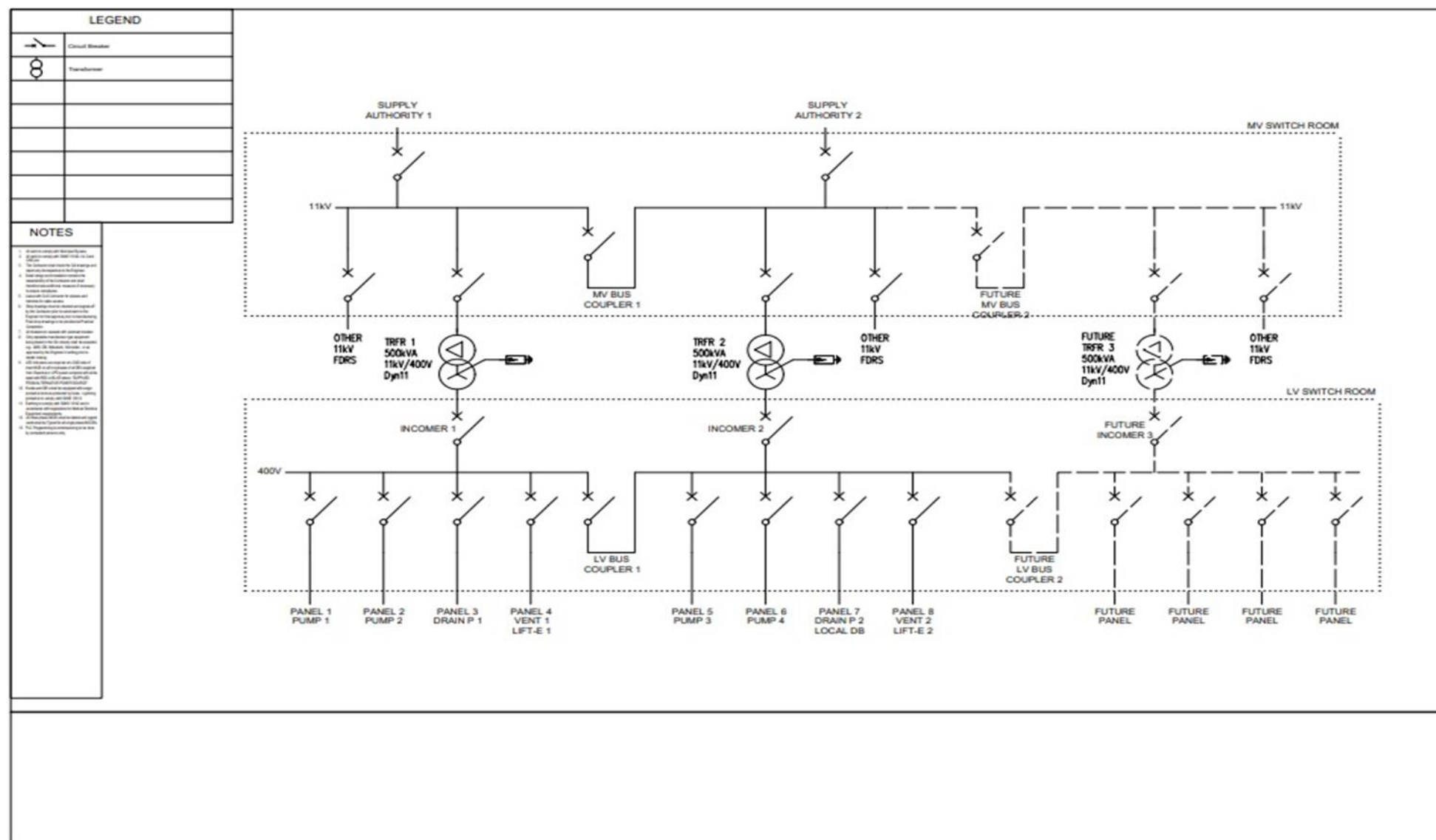














GUARD HOUSE  
FLOORPLAN  
1:100

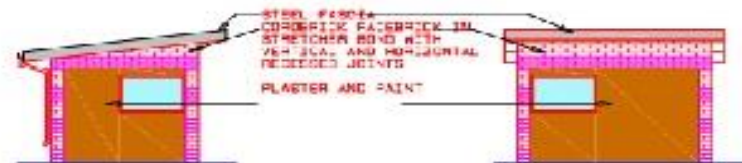


GUARD HOUSE  
SECTION E-B  
1:100



GUARD HOUSE  
NORTH ELEVATION  
1:100

GUARD HOUSE  
WEST ELEVATION  
1:100



GUARD HOUSE  
SOUTH ELEVATION  
1:100

GUARD HOUSE  
EAST ELEVATION  
1:100

No.	Date	By

**Client:**  
HYPERMART LOCAL MUNICIPALITY

**PROJECT:**  
UPGRADING OF BASILIMBO WATER PUMP STATION

**Drawing:**  
GUARD HOUSE

Drawn	By
FEBRUARY 2021	AS SHOWN

**PRELIMINARY DEVELOPMENT CONSULTANTS**



WATERWIS CONSULTANTS (PVT) LTD  
WATERWIS CONSULTANTS (PVT) LTD  
WATERWIS CONSULTANTS (PVT) LTD  
WATERWIS CONSULTANTS (PVT) LTD  
WATERWIS CONSULTANTS (PVT) LTD

Drawn By	PR	
Checked By	SM	
Approved By	PR	

Drawing No. **E-00001**

Project No. **PH000000-02**